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DOE/NASA/0194-1
NASA CR-165257

Catalog of Components for Electric & Hybrid Vehicle Propulsion Systems

(NASA-CR-165257) CATALOG OF COMPONENTS FOR ELECTRIC AND HYBRID VEHICLE PROPULSION SYSTEMS Final Report (Chilton Co.) 930 p HC A99/MF A01 CSCL 13F

N81-29037

Unclas G3/85 26995

H. C. Eissler
Chilton Company
Datalog Division

January 1981

Prepared for
National Aeronautics and Space Administration
Lewis Research Center
Under Contract DEN 3-194

for
U.S. DEPARTMENT OF ENERGY
Conservation and Renewable Energy
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Under Interagency Agreement DE-AI01-77CS51044

HOW TO USE THIS CATALOG

The components listed in this catalog are presented by individual product category. There are fifty product categories and each has it's individual code as part of the page number. These category codes are arranged in alphabetical order.

The product information is indexed in two ways: first, by a product index, starting on the next page; and second, by a manufacturer's index which follows the product index.

The product index lists the components in alphabetical order. Under each component is a list of the applicable manufacturer(s) and the associated page number(s).

The manufacturer's index lists the manufacturers in alphabetical order. Under each manufacturer is a list of the components available from that source and the associated page number(s).

Therefore, whether you are seeking a particular product or a manufacturer with the capability to supply a number of products, simply use the appropriate index to satisfy your needs.

This catalog is part of the Electric and Hybrid Vehicle Program of the U.S. Department of Energy.

The Chilton Company certifies that every effort deemed reasonable has been made to assure that all qualified manufacturers and suppliers were given ample opportunity to provide input to this catalog effort.

Chilton did not knowingly or willingly discriminate for or against any individual manufacturer or supplier in any phase of this contracted catalog development effort.

PRODUCT INDEX

PRODUCT & COMPANY — **PAGE NUMBER**

AC Contactors ..... see Contactors, AC, DC
AC Generators ..... see Alternators
AC Relays ..... see Relays, AC, DC
Adapters ..... see Connectors; Terminations, Electrical
Air Cleaners ..... see Fuel Systems
Air Conditioners
- Harrison Radiator AC-2
- McLean Engineering Midwest ..... AC-3 to 6
- Parker-Hannifin ..... AC-7 to 9
- Proko International AC-10
- Red Dot Corp. ..... AC-11 to 12

Air Coolers ..... see Air Conditioners
Alternators
- American Motors AL-2
- Generac Corp. ..... AL-3 to 6
- Guaranteed Parts Co. AL-7
- Salsbury Industries ..... AL-8 to 9
- Wabash/IPM ..... AL-10 to 11

Axles
- American Motors AX-2
- Dana Corp. ..... AX-3 to 6
- Ford Motor Co. ..... AX-7 to 8
- International Trucks AX-9
- Rockwell International ..... AX-10 to 13

Barrier ..... see Connectors; Terminations, Electrical
Battery Cables ..... see Cables, Electric
Battery Chargers
- Alturdyne ..... BC-2 to 5
- Christie Electric BC-6
- EHV Systems, Inc. ..... BC-7 to 8
- Firing Circuits ..... BC-9 to 12
- Flight Systems BC-13
- Gulf & Western BC-14
- Hobart Brothers ..... BC-15 to 18
- KW Battery ..... BC-19 to 22
- La Marche Mfg. ..... BC-23 to 26
- Lester Equipment Mfg. ..... BC-27 to 30
- Master Control Systems ..... BC-3l to 34
- Motor Appliance Corp. ..... BC-35 to 36
- Schauer Mfg. ..... BC-37 to 39

Battery Condition Indicators ..... see Instrumentation
Battery Fuel Gauges ..... see Instrumentation
Bearings, Wheel and Motor
- Berliss Bearing BR-2
- Fafnir Bearing BR-3
- Hartford Bearing ..... BR-4 to 7
- Keene Corp. ..... BR-8 to 10
- Schatz-Federal ..... BR-11 to 14
- TRW Bearing ..... BR-15 to 18
- The Timken Co. ..... BR-19 to 22
- The Torrington Co. ..... BR-23 to 26

Bearings, Ball ..... see Bearings, Wheel and Motor
Bearings, Cylindrical ..... see Bearings, Wheel and Motor
Bearings, Needle ..... see Bearings, Wheel and Motor
Bearings, Roller ..... see Bearings, Wheel and Motor
Bearings, Taper ..... see Bearings, Wheel and Motor
Bearings, Thrust ..... see Bearings, Wheel and Motor
Belt Drives ..... see Drives, Speed Increasing/Decreasing
Belts
- The B.F. Goodrich Co. ..... BE-2 to 5
- The Goodyear Tire & Rubber Co. ..... BE-6 to 9
- Hi-Lo Mfg. Co. ..... BE-10 to 13
- Uniroyal, Inc. ..... BE-14 to 16

Blocks ..... see Connectors; Terminations, Electrical
Blowers, Cooling
- Kool-O-Matic ..... BL-2 to 5
- McLean Engineering Laboratories ..... BL-6 to 9
- Revcor, Inc. ..... BL-10 to 12

PRODUCT & COMPANY — **PAGE NUMBER**

Brake Pressure Transducer ..... see Transducers, Pressure, Brake
Braking Systems & Components, Regenerative & Non-Regenerative
- Aeroquip, Gustin-Bacon Div. ..... BK-2 to 5
- American Motors Corp. BK-6
- Cableform Inc. ..... BK-7 to 10
- Dico Company, Inc. BK-11
- EIS Div. Parker Hannifin Corp. BK-12
- P.T. Brake Lining Co. Inc. ..... BK-13 to 14
- Rockwell International ..... BK-15 to 17
- Wagner Div. McGraw Edison Co. ..... BK-18 to 19

Breakers ..... see Circuit Breakers
Breakers, Circuit ..... see Circuit Breakers

Cables, Electric
- American Insulated Wire Corp. CA-2
- DLS, Inc. CA-3
- Electrical Conductors, Inc. ..... CA-4 to 7
- Flight Systems CA-8
- Great Valley Industries, Inc. ..... CA-9 to 12
- Guaranteed Parts Co. ..... CA-13 to 16
- Gulf & Western ..... CA-17 to 18
- International Trucks CA-19
- Julian Electric, Inc. ..... CA-20 to 23
- Leviton Mfg. CA-24
- Mercury Electronics ..... CA-25 to 28
- Packard Electric Div. of GM ..... CA-29 to 32
- Rowe Industries ..... CA-33 to 36
- Spectra Strip ..... CA-37 to 38
- Teleflex CA-39

Carburetors ..... see Fuel Systems
Cardon Joint ..... see Universal Joints
Centrifugal Blowers ..... see Blowers, Cooling
Chain Drives ..... see Drives, Speed Increasing/Decreasing
Chargers ..... see Battery Chargers
Circuit Breakers
- GTE Sylvania ..... CB-2 to 4

Circuit Cards ..... see Connectors; Terminations, Electrical
Circuit Protectors ..... see Fuses
Clamps ..... see Connectors; Terminations, Electrical
Clutches
- Lipe Rollway ..... CL-2 to 3
- Salsbury Industries ..... CL-4 to 5
- Spicer Clutch ..... CL-6 to 9
- Twin Disc ..... CL-10 to 11
- Universal Gear, Div. American March Pumps ..... CL-12 to 13

Compound Drives ..... see Drives, Speed Increasing/Decreasing
Connectors, Electrical and Battery Terminal
- Amphenol North America, Div. Bunker Ramo Corp. ..... CN-2 to 3
- Anderson Power Products ..... CN-4 to 7
- Beau Products ..... CN-8 to 11
- Bilfro Corp. CN-12
- Bryant Electric ..... CN-13 to 16
- Cableform Inc. ..... CN-17 to 20
- Crouse-Hinds ..... CN-21 to 22
- Deutsch Industrial Products Div. ..... CN-23 to 26
- Erie Technological Products Div. ..... CN-27 to 30
- Flight Systems CN-31
- Great Valley Industries, Inc. ..... CN-32 to 35
- Guaranteed Parts Co. ..... CN-36 to 39
- Gulf & Western CN-40
- Icore International ..... CN-41 to 44
- K-D Mfg. Co. ..... CN-45 to 47
- Leviton Mfg. CN-48
- Molex, Inc. ..... CN-49 to 50
- Packard Electric, Div. GM ..... CN-51 to 54
- Rowe Industries ..... CN-55 to 58
- Spectra Strip ..... CN-59 to 62
- T & B/Thomas & Betts ..... CN-63 to 66
- Vaco Products Co. ..... CN-67 to 68

Constant Velocity Joints ..... see Universal Joints

PRODUCT & COMPANY	PAGE NUMBER
Contact Bridges	see Contactors, AC & DC
Contactors, AC & DC	
Cableform Inc.	CT-2 to 5
Durakool	CT-6 to 9
Flight Systems	CT-10 to 11
General Electric	CT-12 to 15
GTE Sylvania	CT-16
HB Electrical Mfg.	CT-17 to 20
Vapor Corp.	CT-21 to 24
Ward Leonard	CT-25 to 28
Zenith Controls	CT-29 to 30
Controllers, Motor, Variable Speed, AD & DC	
Cleveland Machine Controls Inc.	CR-2 to 5
EHV Systems, Inc.	CR-6 to 9
Flight Systems	CR-10 to 12
General Electric	CR-13 to 16
Gulf & Western	CR-17
HB Electrical	CR-18 to 21
International Rectifier Corp.	CR-22
Penta Engineering Co.	CR-23
Power Function Engineering, Inc.	CR-24 to 25
PMC Div.	CR-26 to 28
Sevcon	CR-29 to 32
Converter Cords	see DC-DC Converters
Cords	see Cables, Electric
Cores, Heater	see Heaters
Current Controls	see Interlock Devices; Switches
Current Limiters	see Circuit Breakers
Current Transducer	see Transducers, Current
Couplings, Shaft, Flexible	
Flight Systems	CS-2
Lovejoy Inc.	CS-3 to 6
Pennwalt Corp.	CS-7 to 8
Poole Co.	CS-9 to 12
Renold, Inc.	CS-13 to 16
Couplings, Power Transmission, Fluid	
FMC Corp.	CF-2 to 5
Twin Disc, Inc.	CF-6 to 9
DC Contactors	see Contactors, AC & DC
DC -DC Converters	
CEA, Inc.	CV-2 to 4
C-Ran Corp.	CV-5 to 6
General Electric	CV-7
Gulf & Western	CV-8
Hewlett Packard	CV-9 to 12
Klinetics	CV-13
Penta Engineering Co.	CV-14
The Prestolite Co.	CV-15
Tecnetics	CV-16 to 19
DC Generators	see Generators
DC Power Supplies	see DC-DC Converters
DC Relays	see Relays, AC & DC
Decreasing Speed Drives	see Drives, Speed Increasing/Decreasing
Diesel Engines	see Heat Engines
Differentials	
American Motors	DF-2
Spicer Clutch	DF-3
Digital Meters	see Instrumentation
Digital Readouts	see Instrumentation
Discharge Indicators	see Instrumentation
Disconnects	see Disconnects, Emergency
Disconnects, Emergency	
Rowe Industries	DE-2 to 5
T & B/Thomas & Betts Corp.	DE-6 to 7
Disconnect Switches	see Interlock Devices
Drives, Speed Increasing/Decreasing	
Dana Corp.	DS-2 to 5
Hi-Lo Mfg. Co.	DS-6 to 8
Hub City	DS-9 to 10
Livejoy	DS-11
Morse Chain Div. Borg-Warner	DS-12 to 15

PRODUCT & COMPANY	PAGE NUMBER
Electric Current Controls	see Solenoids
Electric Motors	see Motors, Traction
Electric Switches	see Switches
Electrical Cables	see Cables, Electric
Electrical Terminations	see Connectors; Terminations,Electrical
Electrical Wire	see Cables, Electric
Emergency Disconnects	see Disconnects, Emergency
Engines, Heat	see Heat Engines
Exchangers, Heat	see Heat Exchangers
External Combustion Engines	see Heat Engines
Fans	see Blowers, Cooling; Fans, Cooling
Fans, Cooling	
Total Performance Products	FC-2
Flex-a-lite Corp.	FC-3 to 5
Flight Systems	FC-6
Hayden Inc.	FC-7 to 10
McLean Engineering Laboratories	FC-11
Revcor Inc.	FC-12
Filters	see Fuel Systems
Final Drivers	see Axles; Differentials
Fittings	see Couplings, Shaft, Flexible
Fluid Clutches	see Couplings, P.T.,Fluid, Torque Converters
Fluid Connectors, Power	see Couplings, P.T., Fluid
Fluid Couplings	see Couplings, P.T., Fluid
Fluid Drives	see Couplings, P.T., Fluid
Fluid Power Links	see Couplings, P.T., Fluid
Fuel Pumps	see Fuel Systems
Fuel Systems	
Bundy Corp.	FS-2 to 5
Facet Ent. Motor Components Div.	FS-6 to 9
Facet Ent. Fuel Devices Div.	FS-10 to 12
Fleming Metal Fabricators	FS-13 to 15
Guaranteed Parts Co.	FS-16 to 19
Gulf & Western	FS-20
Heimer Industries	FS-21 to 24
Marvel-Schebler/Tillotson	FS-25 to 28
Melben Products Co.	FS-29
Recreational Products Marketing	FS-30
Fuel Tanks	see Fuel Systems
Fuse Holders	see Fuses
Fuse Mountings	see Fuses
Fuses	
Bel Fuse Inc.	FX-2 to 5
International Rectifier	FX-6 to 7
Klinetics, Inc.	FX-8
Leviton Mfg.	FX-9
National Tel-Tronics	FX-10 to 12
Packard Electric Div. of GM	FX-13 to 16
Gasoline Engines	see Heat Engines
Gasoline Systems	see Fuel Systems
Gauges	see Instrumentation
Gear Pumps	see Hydraulic Motors
Generators	
Ag-Tronic International, Inc.	GN-2 to 4
Honeywell Motor Products	GN-5 to 8
Ground Straps	see Cables, Electric
Harness	see Cables, Electric
Heat Engines	
Briggs & Stratton	HE-2 to 5
Ford Motor Co.	HE-6 to 7
Stirling Power Systems	HE-8 to 11
Tecumseh Products Co. (Lauson Power Products Div.)	HE-12 to 15
Heaters	
Harrison Radiator	HT-2
Hunter Mfg. Co.	HT-3 to 5
Red Dot Corp.	HT-6 to 8
Stewart-Warner	HT-9 to 10

PRODUCT & COMPANY	PAGE NUMBER
Heat Exchangers	
Cham-Cal Engineering Co.	HX-2 to 3
G & O Mfg. Co.	HX-4 to 7
Gulf & Western	HX-8
Harrison Radiator	HX-9
Hayden Inc.	HX-10 to 13
Modine Mfg. Co.	HX-14 to 17
Total Performance Products	HX-18
Young Radiator Co.	HX-19 to 20
Heat Generators	see Heaters
Heat Transfer	see Air Conditioners
Heat Transfer Devices	see Heaters, Heat Exchangers
Hydraulic Controls	see Hydraulic Motors
Hydraulic Couplings	see Hydraulic Motors
Hydraulic Drives	see Hydraulic Motors
Hydraulic Fittings	see Hydraulic Motors
Hydraulic Hoses	see Hydraulic Motors
Hydraulic Motors	
Aeroquip Corp.	HM-2 to 5
Bundy Corp.	HM-6 to 9
Cableform Inc.	HM-10 to 11
Dana Corp.	HM-12 to 15
Dico Co. Inc.	HM-16
Fluid Controls, Inc.	HM-17 to 20
Ford Motor Co.	HM-21 to 22
General Electric	HM-23
The B.F. Goodrich Co. Ind. Prod. Div.	HM-24 to 27
Hydura Products	HM-28 to 31
Parker-Hannifin	HM-32 to 35
Permco Inc.	HM-36 to 39
The Roxroth Corp.	HM-40 to 43
Sperry-Vickers	HM-44 to 46
Hydraulic Pressure Transducers	see Transducers, Pressure, Hydraulic
Hydraulic Pumps	see Hydraulic Motors
Hydrostatic Drives	see Hydraulic Motors
Hydrostatic Pumps	see Hydraulic Motors
Hydrostatic Transmissions	see Hydraulic Motors
Increasing Speed Devices	see Drives, Speed Increasing/Decreasing
Indicators	see Instrumentation
Instrumentation	
Anderson Power Products	IN-2 to 5
Cableform Inc.	IN-5 to 9
Datametrics Inc.	IN-10
Thomas G. Faria Corp.	IN-11 to 14
Flight Systems	IN-15 to 18
General Electric	IN-19
Klinetics	IN-20
Nationwide Electronic Systems	IN-21 to 24
Ohio Semitronics Inc.	IN-25 to 26
Omnifac Corp.	IN-27 to 28
Penta Engineering Co.	IN-29 to 30
Rite Autotronics Corp.	IN-31 to 34
Teleflex	IN-35 to 38
Velonex Inc.	IN-39
Instruments	see Instrumentation
Intercoolers	see Heat Exchangers
Interlock Devices	
Anderson Power Products	ID-2 to 5
Flight Systems	ID-6
Leviton Mfg.	ID-8
Omnifac Corp.	ID-8
Internal Combustion Engines	see Heat Engines
Interrupters	see Disconnects, Emergency
Jacks	see Connectors; Terminations, Electrical
Jaw Couplings	see Couplings, Shaft, Flexible
Joints, Universal	see Universal Joints
Journal & Bearing Kits	see Universal Joints
Key Boards	see Switches
Leads	see Cables, Electric

PRODUCT & COMPANY	PAGE NUMBER
Lead Assemblies	see Cables, Electric
Lines, Fuel	see Fuel Systems
LP Gas Systems	see Fuel Systems
Lugs	see Connectors; Terminations, Electrical
Mechanical Connectors, Shaft	see Couplings, Shaft, Flexible
Meters	see Instrumentation
Motor Bearings	see Bearings, Wheel and Motor
Motor Controllers, Variable Speed	see Controllers
Motors, Hydraulic	see Hydraulic Motors
Motors, Traction	
Fidelity Electric Co.	MT-2 to 5
Flight Systems	MT-6
General Electric	MT-7 to 10
Lawnel Corp.	MT-11 to 14
Leroy-Somer, Inc.	MT-15 to 17
Onan Corp.	MT-18 to 21
The Prestolite Co.	MT-22 to 25
Movements	see Instrumentation
Offset Connectors	see Couplings, Shaft, Flexible
Oil Coolers	see Heat Exchangers
Pick-up, Current	see Transducers, Current
Pick-up, Position	see Transducers, Position
Pick-up, Pressure, Brake	see Transducers, Pressure, Brake
Pick-up, Pressure, Hydraulic	see Transducers. Pressure, Hydraulic
Pick-up, Speed	see Transducers, Speed
Pick-up, Temperature	see Transducers, Temperature
Pick-up, Torque	see Transducers, Torque
Pick-up, Voltage	see Transducers, Voltage
Pigtails	see Cables, Electric
Plugs	see Connectors; Terminations, Electrical
Position Solenoids	see Solenoids
Position Transducer	see Transducers, Position
Power Cables	see Cables, Electric
Power Connectors, Mechanical	see Clutches
Power Couplings	see Couplings, P.T., Fluid
Power Drive Pulleys	see Pulleys, Power Drive
Power Links	see Couplings, Shaft, Flexible
Power Relays	see Contactors, AC & DC; Relays, AC & DC
Power Supplies	see DC-DC Converters
Power Transmitters, Mechanical	see Pulleys, Power Drive
Power Transmitters, Fluid	see Torque Converters
Propulsion Motors, Electrical	see Motors, Traction
Pressure Switches	see Switches
Pressure Transducer, Brake	see Transducers, Pressure, Brake
Pressure, Transducer, Hydraulic	see Transducers, Pressure, Hydraulic
Protective Devices, Circuit	see Circuit Breakers; Fuses
Pulley Drives, Variable Speed	see Drives, Speed Increasing/Decreasing
Pulleys, Power Drive	
Climax Metal Products	PU-2 to 3
Hi-Lo Mfg. Co.	PU-4 to 6
Lovejoy Inc.	PU-7
Ohio Mfg. Co.	PU-8 to 11
The Rogers Mfg. Co.	PU-12
Wabash/Ipm	PU-13 to 14
Pump Controllers	see Hydraulic Motors
Pump Drives	see Drives, Speed Increasing/Decreasing
Push Pull Controls	see Switches
Quick Release Devices	see Disconnects, Emergency
Radiators	see Heaters; Heat Exchangers
Receptacles	see Connectors; Terminations, Electrical

PRODUCT & COMPANY	PAGE NUMBER
Refrigeration Equipment (Vehicular)	see Air Conditioners
Regulators, Voltage	see Voltage Regulators
Relays, AC & DC	
Cornell-Dublier	RE-2 to 4
Crouse-Hinds Co.	RE-5 to 7
Cutler-Hammer	RE-8 to 11
Durakool Inc.	RE-12 to 14
Essex Group, United Technologies	RE-15 to 18
Grayhill, Inc.	RE-19
GTE Sylvania	RE-20 to 22
Guardian Electric Mfg. Co.	RE-23 to 26
Gulf & Western	RE-27 to 30
Magnecraft Electric Co.	RE-31 to 34
Midland-Ross Corp.	RE-35 to 38
The Prestolite Co.	RE-39
Relay Service Co.	RE-40 to 42
Struthers-Dunn, Inc.	RE-43 to 46
Vapor Corp.	RE-47 to 50
Ward-Leonard Electric Co.	RE-51 to 54
Zenith Controls, Inc.	RE-55 to 56
Relay Coils	see Relays, AC & DC
Rockers, Control	see Switches
Rotary Solenoids	see Solenoids
Rxeppa Joints	see Universal Joints
Safety Disconnects	see Interlock Devices
Sending Unit, Current	see Transducers, Current
Sending Unit, Position	see Transducers, Position
Sending Unit, Pressure, Brake	see Transducers, Pressure, Brake
Sending Unit, Pressure, Hydraulic	see Transducers, Presssure, Hydraulic
Sending Unit, Speed	see Transducers, Speed
Sending Unit, Temperature	see Transducers, Temperature
Sending Unit, Torque	see Transducers, Torque
Sending Unit, Voltage	see Transducers, Voltage
Sensing Relays	see Relays, AC & DC
Servos	see Solenoids
Shafts	see Axles; Shafts, Drive
Shaft Couplings	see Couplings, Shaft, Flexible
Shafts, Drive	
Dana Corp. Drive Train Service Div.	SD-2 to 5
Ford Motor Co.	SD-6 to 7
Hub City Div. Safeguard	SD-8 to 10
Signal Initiator	see Transducers, Current
Signal Switches	see Transducers, Current
Slo-Blow Fuses	see Fuses
Sockets	see Connectors; Terminations, Electrical
Solenoids	
Century Brass Products	SO-2
Essex Group, United Technologies	SO-3 to 4
Fluid Controls, Inc.	SO-5 to 8
Guaranteed Parts Co.	SO-9
Gulf & Western	SO-10
Ledex Inc.	SO-11
Marvel-Schebler/Tillotson	SO-12 to 15
The Prestolite Co.	SO-16
Speed Changers	see Drives, Speed Increasing/Decreasing
Speed Control	see Contactors, AC & DC; Controllers
Speed Drives, Increasing/Decreasing	see Drives, Speed Increasing/Decreasing
Speed Transducer	see Transducers, Speed
Sprockets	see Pulleys, Power Drive
Stabilizer, Voltage	see Voltage Regulators
Stirling Engines	see Heat Engines
Strain Gage	see Transducers, Torque
Switch Current	see Transducers, Current

PRODUCT & COMPANY	PAGE NUMBER
Switches	
Alto International, LTD	SW-2
Cableform, Inc.	SW-3
Crouse-Hinds, Co.	SW-4 to 6
Cutler-Hammer	SW-7 to 10
Essex Group, United Technologies	SW-11 to 13
Flight Systems	SW-14
General Electric	SW-15 to 18
General Electric	SW-19
Grayhill Inc.	SW-20 to 22
Guaranteed Parts Co.	SW-23 to 26
Gulf & Western	SW-27 to 28
Ledex, Inc.	SW-29 to 30
Leviton Mfg.	SW-31
Marvel-Schebler/Tillotson	SW-32 to 33
Molex Inc.	SW-34 to 36
The Prestolite Co.	SW-37
Rite Autotronics Corp.	SW-38
Stackpole Components Co.	SW-39 to 40
Tech Laboratories Inc.	SW-41 to 42
Teleflex Inc.	SW-43
Transducer Systems, Inc.	SW-44 to 47
Switch, Position	see Transducers, Position
Switch, Pressure, Brake	see Transducers, Pressure, Brake
Switch, Pressure, Hydraulic	see Transducers, Pressure, Hydraulic
Switch, Speed	see Transducers, Speed
Switch, Temperature	see Transducers, Temperature
Switch, Torque	see Transducers, Torque
Switch, Voltage	see Transducers, Voltage
Temperature Transducer	see Transducers, Temperature
Terminals	see Connectors; Terminations, Electrical
Terminal Boards	see Connectors; Terminations, Electrical
Terminal Blocks	see Connectors; Terminations, Electrical
Terminals, Ends	see Connectors; Terminations, Electrical
Terminal Strips	see Connectors; Terminations, Electrical
Terminations, Electrical	
Beau Products Div. of Vernitron	TE-2 to 5
Bilfro Corp.	TE-6
Calex Mfg. Co.	TE-7 to 8
Flight Systems	TE-9
General Electric	TE-10 to 11
Great Valley Industries, Inc.	TE-12 to 15
International Trucks	TE-16
K-D Mfg. Co.	TE-17 to 19
National Tel-Tronics	TE-20 to 23
Packard Electric	TE-24 to 27
Rowe Industries	TE-28 to 31
T & B/Thomas & Betts	TE-32
Ward-Leonard Electric Co.	TE-33 to 35
Time Delay Fuses	see Fuses
Thermocouples	see Transducers, Temperature
Toggle Switches	see Switches
Torque Connectors	see Torque Converters
Torque Converters	
Salsbury Industries	TR-2 to 5
Twin Disc Inc.	TR-6 to 8
Torque Transducer	see Transducers, Torque
Traction Cables	see Cables, Electrical
Traction Motors	see Motors, Traction
Transaxles	see Axles
Transducers, Current	
Essex Group, United Technologies	TC-2
Gulf & Western	TC-3
Ohio Semitronics, Inc.	TC-4
The Prestolite Co.	TC-5
Transducers, Position	
Gulf & Western	TP-2
Marvel-Schebler/Tillotson	TP-3
Teleflex Inc.	TP-4

PRODUCT & COMPANY **PAGE NUMBER**

Transducer Systems, Inc. ..... TP-5 to 8

Transducers, Pressure, Brake
Gulf & Western TB-2
Teleflex Inc. TB-3
Transducer Systems, Inc. ..... TB-4 to 7

Transducers, Pressure, Hydraulic
BEC Controls Corp. ..... TH-2 to 4
Edcliff Instruments ..... TH-5 to 8
Thomas G. Faria Corp. TH-9
GSE Inc. ..... TH-10 to 11
Gulf & Western TH-12
Rite Autotronics Corp. TH-13
Teleflex, Inc. TH-14
Transducer Systems Inc. ..... TH-15 to 17

Transducers, Speed
Century Brass Products TS-2
Gulf & Western TS-3
Teleflex Inc. TS-4
Transducer Systems, Inc. ..... TS-5 to 8

Transducers, Temperature
Analog Devices Inc ..... TT-2 to 4
Thomas G. Faria Corp. TT-5
Guaranteed Parts Co. ..... TT-6 to 7
Gulf & Western TT-8
Marvel-Schebler/Tillotson TT-9
Rite Autotronics Corp. TT-10
Transducer Systems Inc. TT-11

Transducers, Torque
GSE Inc ..... TQ-2 to 3
Gulf & Western TQ-4
Transducer System, Inc. TQ-5

Transducers, Voltage
Calex Mfg. Inc. ..... TV-2 to 3
Gulf & Western TV-4

Transfer Cases ..... see Drives, Speed Increasing/Decreasing

Transmissions, Automatic
American Motors TA-2
Ford Power Products ..... TA-3 to 4

Transmission Coolers ..... see Heat Exchangers

Transmissions, Manual
American Motors TM-2
Borg Warner, Warner Gear ..... TM-3 to 5
Ford Power Products ..... TM-6 to 7

Tubing ..... see Fuel Systems; Hydraulic Motors

U-Joints ..... see Universal Joints

Universal Joints
Dana Corp., Drive Train Service ..... UJ-2 to 3
Dana Corp., Vehicular Group ..... UJ-4 to 7
Hub City Div., Safeguard ..... UJ-8 to 9
Lovejoy Inc. UJ-10
Rockwell International ..... UJ-11 to 14
Twin Disc Inc. ..... UJ-15 to 16
The Zeller Corp. ..... UJ-17 to 20

Vane Pumps ..... see Hydraulic Motors

Variable Pitch Pulleys ..... see Pulleys, Power Drive

Ventilators ..... see Blowers, Cooling

Voltage Regulators
Cableform Inc. ..... VR-2 to 3
Essex Group, United Technologies VR-4
Guaranteed Parts Co. VR-5
Gulf & Western VR-6
The Prestolite Co. VR-7
Wabash/Ipm ..... VR-8 to 11

Voltage Switch ..... see Switches

Voltage Transducer ..... see Transducers, Voltage

Welding Cable ..... see Cables, Electric

Wheel Bearings ..... see Bearings

Wire ..... see Cables, Electric

MANUFACTURER INDEX

MANUFACTURER & COMPONENT — **PAGE NO.**

AEROQUIP CORP.
Industrial Div.
1225 W. Main St.
Van Wert, OH 45891
419-238-1190
- Hydraulic Motors ..... HM-2 to 5

AEROQUIP CORP.
Gustin-Bacon Div.
2901 Lakeview Rd.
Box 927
Lawrence, KS 66044
913-841-4000
- Braking Systems and Components Regenerative and Non-Regenerative ..... BK-2 to 5

AG-TRONIC, INTERNATIONAL INC.
1801 W. B St.
Hastings, NE 68901
402-462-2181
- Generators ..... GN-2 to 4

ALTO INTERNATIONAL, LTD.
11062—118th Place, N.E.
Kirkland, WA 98033
206-827-9606
- Switches SW-2

ALTURDYNE
8050 Armour St.
San Diego, CA 92111
714-565-2131
- Battery Chargers ..... BC-2 to 5

AMERICAN INSULATED WIRE CORP.
Central Ave. & Freeman St.
Pawtucket, RI 02862
401-726-0700
- Cables, Electric CA-2

AMERICAN MARSH PUMPS, INC.
Universal Gear Div.
P.O. Box 23038
722 Porter St.
Lansing, MI 48909
517-489-1471
- Clutches CL-12, 13

AMERICAN MOTORS CORP.
Engine and Component Sales Dept.
27777 Franklin Rd.
Southfield, MI 48034
313-827-3817
- Alternators AL-2
- Axles AX-2
- Braking Systems & Components, Regenerative & Non-Regenerative BK-6
- Differentials DF-2
- Transmissions, Automatic TA-2
- Transmissions, Manual TM-2

ANALOG DEVICES INC.
Route 1 Industrial Park
Norwood, MA 02062
617-329-4700
- Transducers, Control, Temperature ..... TT-2 to 4

ANDERSON POWER PRODUCTS INC.
145 Newton St.
Boston, MA 02135
617-787-5880
- Connectors, Electrical & Battery Terminal ..... CN-4 to 7
- Instrumentation ..... IN-2 to 5
- Interlock Devices ..... ID-2 to 5

BEAU PRODUCTS DIV.
Vernitron Corp.
117 Union Ave.
P.O. Box 10
Laconia, NH 03246
603-524-5101
- Connectors, Electrical & Battery Terminal ..... CN-8 to 11
- Terminations, Electrical ..... TE-2 to 5

BEC CONTROLS CORP.
Box 2510 N.W. Sta.
Davenport, IA 52809
319-391-5220
- Transducers, Control, Pressure, Hydraulic ..... TH-2 to 4

BEL FUSE INC.
198 Van Vorst St.
Jersey City, NJ 07302
201-432-0463
- Fuses ..... FX-2 to 5

BERLISS BEARING CO.
644 West Mt. Pleasant Ave.
Livingston, NJ 07039
201-992-4242
- Bearings, Wheel and Motor BR-2

BILFRO CORP.
33635 Coachman La.
Solon, OH 44139
216-248-0729
- Connectors, Electrical & Battery Terminal CN-12
- Terminations, Electrical TE-6

BRIGGS & STRATTON CORP.
P.O. Box 702
Milwaukee, WI 53201
414-259-5333
- Heat Engines ..... HE-2 to 5

BRYANT ELECTRIC
Div. of Westinghouse
1421 State St.
Bridgeport, CT 06602
203-334-5561
- Connectors, Electrical & Battery Terminal ..... CN-13 to 16

BUNDY CORP.
Bundy Tubing Div.
12345 E. Nine Mile Rd.
Warren, MI 48090
313-758-4511
- Fuel Systems ..... FS-2 to 5
- Hydraulic Motors ..... HM-6 to 9

BUNKER RAMO CORP.
Amphenol North America
2122 York Rd.
Oak Brook, IL 60521
312-986-2300
- Connectors, Electrical & Battery Terminal CN-2, 3

CABLEFORM INC.
Zion Cross Rds.
Troy, VA 22974
804-589-8224
- Braking Systems & Components Regenerative and Non-Regenerative ..... BK-7 to 10
- Connectors, Electrical & Battery Terminal ..... CN-17 to 20
- Contactors, AC & DC ..... CT-2 to 5
- Hydraulic Motors ..... HM-10 to 11

(Cableform Inc. Continued)

Instrumentation ..... IN-6 to 9
Switches SW-3
Voltage Regulators VR-2, 3

CALEX MANUFACTURING CO.
3355 Vincent Rd.
Pleasant Hill, CA 94523
415-932-3911
Terminations, Electrical TE-7, 8
Transducers, Control Voltage TV-2, 3

CEA DIV.
Berkleonics Inc.
1 Aerovista Park
San Luis Obispo, AC 93401
805-544-5454
DC-DC Converters ..... CV-2 to 4

CENTURY BRASS PRODUCTS, INC.
59 Mill St.
Waterbury, Ct 06720
203-574-7700
Solenoids SO-2
Transducers, Control, Speed TS-2

CHAM-CAL ENGINEERING CO.
P.O. Box 972
Garden Grove, CA 92641
213-594-8604
Heat Exchangers HX-2, 3

CHRISTIE ELECTRIC CORP.
20665 Manhattan Place
Torrance, CA 90501
213-320-0808
Battery Chargers BC-6

CLEVELAND MACHINE CONTROLS INC.
7550 Hub Parkway
Cleveland, OH 44125
216-524-8800
Controllers, Motor, Variable Speed AC & DC ..... CR-2 to 5

CLIMAX METAL PRODUCTS CO.
30202 Lakeland Blvd.
Wickliffe, OH 44092
216-585-0300
Pulleys, Power Drive PU-2, 3

CORNELL-DUBILIER ELECTRONICS DIV.
Federal Pacific Electric Co.
118 E. Jones St.
Fuquay-Varina, NC 27526
919-552-2281
Relays, AC & DC ..... RE-2 to 4

C-RAN CORP.
699 4th St. NW
Largo, FL 33540
813-585-3850
DC-DC Converters CV-5, 6

CROUSE-HINDS CO.
Arrow Hart Div.
103 Hawthorn St.
Hartford, CT 06101
203-249-8471
Connectors, Electrical & Battery Terminal CN-21, 22
Relays, AC & DC ..... RE-5 to 7
Switches ..... SW-4 to 6

CUTLER-HAMMER
4201 N. 27th St.
Milwaukee, WI 53216
414-422-7800
Relays, AC & DC ..... RE-8 to 11
Switches ..... SW-7 to 10

DANA CORP.
Hillsdale Plant
411 W. Carleton Rd.
Hillsdale, MI 49242
517-437-4493
Drives, Speed Increasing/Decreasing ..... DS-2 to 5
Hydraulic Motors ..... HM-12 to 15

DANA CORP.
Spicer Clutch Div.
P.O. Box 191
Auburn, IN 46706
219-925-3800
Axles ..... AX-3 to 6

DANA CORP.
Drivetrain Service Div.
P.O. Box 321
Toledo, OH 43691
419-866-1841
Shafts, Drive ..... SD-2 to 5
Universal Joints UJ-2, 3

DANA VEHICULAR GROUP
P.O. Box 8788
Toledo, OH 43623
419-535-5452
Universal Joints ..... UJ-4 to 7

DATAMETRICS INC.
340 Fordham Rd.
Wilmington, MA 01887
617-658-5410
Instrumentation IN-10

DEUTSCH CORP.
Industrial Products Div.
700 S. Hathaway St.
Banning, CA 92220
714-654-0847
Connectors, Electrical & Battery Terminal ..... CN-23 to 26

DICO COMPANY, INC.
Dyneer Corp.
200 SW 16th St.
P.O. Box 1344
Des Moines, IA 50305
515-244-7286
Braking Systems & Components
Regenerative & Non-Regenerative BK-11
Hydraulic Motors HM-16

DLS INC.
222 E. 2nd. Ave.
Bremen, IN 46506
219-546-4717
Cables, Electric CA-3

DURAKOOL INC.
1010 N. Main ST.
Elkhart, IN 46514
219-264-1116
Contactors AC & DC ..... CT-6 to 9
Relays, AC & DC ..... RE-12 to 14

EDCLIFF INSTRUMENTS INC.
1711 15 S. Mountain Ave.
Monrovia, CA 91016
213-358-4571
Transducers, Control, Pressure, Hydraulic ..... TH-5 to 8

MANUFACTURER & COMPONENT — PAGE NO.

EHV SYSTEMS INC.
1699 A Roosevelt Ave.
Bohemia, NY 11716
516-589-2525

Battery Chargers BC-7, 8
Controllers, Motor, Variable Speed, AC & DC ..... CR-6 to 9

ELECTRICAL CONDUCTORS INC.
2500 Commonwealth Ave.
North Chicago, IL 60064
312-689-9090

Cables, Electric ..... CA-4 to 7

ERIE TECHNOLOGICAL PRODUCTS INC.
645 W. 11th St.
Erie, PA 16512
814-453-5611

Connectors, Electrical & Battery Terminal ..... CN-27 to 30

ESSEX GROUP
Electro-Mechanical Div.
Sub. of United Technologies
6233 Concord Ave.
Detroit, MI 48211
313-593-9000

Relays, AC & DC ..... RE-15 to 18
Solenoids SO-3, 4
Switches ..... SW-11 to 13
Voltage Regulators VR-4

ESSEX GROUP
Essex Control Div.
Sub. of United Technologies
131 Godfrey St.
Logansport, IN 46947
219-753-7521

Transducers, Control, Current TC-2

FACET ENTERPRISES, INC.
Motor Components Div.
Elmira, NY 14903
607-737-8350

Fuel Systems ..... FS-6 to 9

FACET ENTERPRISES, INC.
Fuel Devices Div.
696 Hart Ave.
Detroit, MI 48214
313-822-7500

Fuel Systems ..... FS-10 to 12

FAFNIR BEARING DIV. OF TEXTRON, INC.
37 Booth St.
New Britain, CT 06050
203-225-5151

Bearings, Wheel and Motor BR-3

THOMAS G. FARIA CORP.
Faria Lane
Uncasville, CT 06283
203-848-9271

Instrumentation ..... IN-11 to 14
Transducers, Control, Pressure, Hydraulic TH-9
Transducers, Control, Temperature TT-5

FIDELITY ELECTRIC CO. INC.
332 N. Arch ST.
Lancaster, PA 17603
717-397-8231

Motors, Traction ..... MT-2 to 5

MANUFACTURER & COMPONENT — PAGE NO.

FIRING CIRCUITS INC.
Muller Ave.
P.O. Box 2007
Norwalk, CT 06852
203-846-1633

Battery Chargers ..... BC-9 to 12

FLEMING METAL FABRICATORS
2810 S. Tapaner Ave.
Los Angeles, CA 90040
213-723-8203

Fuel Systems ..... FS-13 to 15

FLEX-A-LITE CORP.
5915 Lake Grove Ave., SW
Tacoma, WA 98499
206-584-1336

Fans, Cooling ..... FC-3 to 5

FLIGHT SYSTEMS INC.
Electric Vehicle Components
P.O. Box 25
Mechanicsburg, PA 17055
717-697-0333

Battery Chargers BC-13
Cables, Electric CA-8
Connectors, Electrical & Battery Terminal CN-31
Contactors, AC & DC GT-10, 11
Controllers, Motor, Variable Speed, AC & DC ..... CR-10 to 12
Couplings, Shaft, Flexible CS-2
Fans, Cooling FC-6
Instrumentation ..... IN-15 to 18
Interlock Devices ID-6
Motors, Traction MT-6
Switches SW-14
Terminations, Electrical TE-9

FLUID CONTROLS, INC.
8341 Tyler Blvd.
Mentor, OH 44060
216-255-9711

Hydraulic Motors ..... HM-17 to 20
Solenoids ..... SO-5 to 8

FMC CORP.
Drive Div.
2045 W. Hunting Park Ave.
Philadelphia, PA 19140
215-225-6000

Couplings, Power Transmission, Fluid ..... CF-2 to 5

FORD MOTOR CO.
Parts & Service Div.
Industrial Engine Operations
300 Renaissance Center
P.O. Box 43338
313-568-7435

Axles AX-7, 8
Heat Engines HE-6, 7
Hydraulic Motors HM-21, 22
Shafts, Drive SD-6, 7
Transmissions, Automatic TA-3, 4
Transmissions, Manual TM-6, 7

GENERAC CORP.
Box 8
Waukesha, WI 53187
414-544-4811

Alternators ..... AL-3 to 6

MANUFACTURER & COMPONENT — **PAGE NO.**

GENERAL ELECTRIC CO.
6901 Elmwood Ave.
Philadelphia, Pa. 19142
215-726-2626
- Switches ..... SW-15 to 18
- Terminations, Electrical TE-10, 11

GENERAL ELECTRIC CO.
Industrial Control Dept.
685 W. Rio Road
Charlottesville, VA 22906
804-973-1851
- Contactors, AC & DC ..... CT-12 to 15
- Controllers, Motor, Variable Speed, AC & DC ..... CR-13 to 16
- DC-DC Converters CV-7
- Hydraulic Motors, ... HM-23
- Instrumentation IN-19
- Switches SW-19

GENERAL ELECTRIC CO.
DC Motor and Generator Dept.
Erie, PA 16531
814-455-5466
- Motors, Traction, Electric, AC & DC ..... MT-7 to 10

G & O MANUFACTURING CO.
138 Winchester Avenue
New Haven, CT 06508
203-562-5121
- Heat Exchangers ..... HX-4 to 7

THE BF GOODRICH CO.
Engineered Products Group
500 S. Main St.
Akron, OH 44318
216-379-2144
- Belts ..... BE-2 to 5
- Hydraulic Motors ..... HM-24 to 27

THE GOODYEAR TIRE & RUBBER CO.
Automotive Replacement Products
Lincoln, NE 68501
402-466-8311
- Belts ..... BE-6 to 9

GRAYHILL, INC.
617 Hillgrove Ave.
La Grange, IL 60525
312-354-1040
- Relays, AC & DC RE-19
- Switches ..... SW-20 to 22

GREAT VALLEY INDUSTRIES, INC.
4 Pennsylvania Ave.
Malvern, PA 19355
215-646-7400
- Cables, Electric ..... CA-9 to 12
- Connectors, Electric & Battery Terminal ..... CN-32 to 35
- Terminations, Electrical ..... TE-12 to 15

GSE INC.
23640 Research Drive
Farmington Hills, MI 48024
313-476-7875
- Transducers, Control, Pressure, Hydraulic TH-10, 11
- Transducers, Control, Torque TQ-2, 3

GTE SYLVANIA INC.
One Stamford Forum
Stamford, CT 06904
203-357-2000
- Circuit Breakers ..... CB-2 to 4
- Contactors, AC & DC CT-16
- Relays, AC & DC ..... RE-20 to 22

GUARANTEED PARTS CO., INC.
Auburn Road
Seneca Falls, NY 13148
315-568-5844
- Alternators AL-7
- Cables, Electric ..... CA-13 to 16
- Connectors, Electrical and Battery Terminal ..... CN-36 to 39
- Fuel Systems ..... FS-16 to 19
- Solenoids SO-9
- Switches ..... SW-23 to 26
- Transducers, Control, Temperature TT-6, 7
- Voltage Regulators VR-5

GUARDIAN ELECTRIC MFG. CO. OF CA
4030 W. Spencer St.
Torrance, CA 90503
213-542-8651
- Relays, AC & DC ..... RE-23 to 26

GULF & WESTERN MFG. CO.
26261 Evergreen Rd.
P.O. Box 999
Southfield, MI 48037
319-326-8111
- Battery Chargers BC-14
- Cables, Electric CA-17, 18
- Connectors, Electrical and Battery Terminal CN-40
- Controllers, Motor, Variable speed AC & DC CR-17
- DC-DC Converters CV-8
- Fuel Systems FS-20
- Heat Exchangers HX-8
- Relays, AC & DC ..... RE-27 to 30
- Solenoids SO-10
- Switches SW-27, 28
- Transducers, Control, Current TC-3
- Transducers, Control, Position TP-2
- Transducers, Control, Pressure, Brake TB-2
- Transducers, Control, Pressure, Hydraulic TH-12
- Transducers, Control, Speed TS-3
- Transducers, Control, Temperature TT-8
- Transducers, Control, Torque TO-4
- Transducers, Control, Voltage TV-4
- Voltage Regulators VR-6

HARRISON RADIATOR DIV.
General Motors Corp.
200 Upper Mountain Rd.
Lockport, NY 14094
716-439-2011
- Air Conditioners AC-2
- Heaters HT-2
- Heat Exchangers HX-9

HARTFORD BEARING CO. DIV.
Virginia Industries
951 West St.
Rocky Hill, CT 06067
203-529-7441
- Bearings, Wheel and Motor ..... BR-4 to 7

MANUFACTURER & COMPONENT — PAGE NO.

HAYDEN INC.
1531 Pomona Road
Corona, CA 91720
714-735-4900

Fans, Cooling ..... FC-7 to 10
Heat Exchangers ..... HX-10 to 13

HB ELECTRICAL MFG. CO. INC.
1125 National Parkway
P.O. Box 1466
Mansfield, OH 44901
419-747-2024

Contactors, AC & DC ..... CT-17 to 20
Controllers, Motor, Variable Speed (AC & DC) ..... CR-18 to 21

HEIMER INDUSTRIES
3329 S.W. Military Dr.
San Antonio, TX 78211
512-924-6474

Fuel Systems ..... FS-21 to 24

HEWLETT-PACKARD
1501 Page Mill Rd.
Palo Alto, CA 94304
213-877-1281

DC-DC Converters ..... CV-9 to 12

HI-LO MFG. CO.
1700 G. Freeway Blvd.
Minneapolis, MN 55430
612-566-2510

Belts ..... BE-10 to 13
Drives, Speed Increasing/Decreasing ..... DS-6 to 8
Pulleys, Power Drive ..... PU—4 to 6

HOBART BROTHERS CO.
Power System Div.
Hobart Square
Troy, OH 45373
513-339-6011

Battery Chargers ..... BC-15 to 18

HONEYWELL MOTOR PRODUCTS
P.O. BOX 106
Rockford, IL 61105
815-966-3600

Generators ..... GN-5 to 8

HUB CITY DIV.
Safeguard Power Transmission Co.
P.O. Box 1089
Aberdeen, SD 57401
605-225-0360

Drives, Speed Increasing/Decreasing DS-9, 10
Shafts, Drive ..... SD-8 to 10
Universal Joints UJ-8, 9

HUNTER MFG. CO.
30525 Aurora Rd.
Cleveland, OH 44139
216-248-6111

Heaters ..... HT-3 to 5

HYDURA PRODUCTS
The Oilgear Co.
2304 S. 51st ST.
Milwaukee, WI 53219
414-327-1700

Hydraulic Motors ..... HM-28 to 31

MANUFACTURER & COMPONENT — PAGE NO.

ICORE INTERNATIONAL
180 N. Wolfe Rd.
P.O. Box 8005
Sunnyvale, CA 94088
408-732-5400

Connectors, Electrical & Battery Terminal ..... CN-41 to 44

INTERNATIONAL TRUCKS, OEM SALES
401 N Michigan Ave.
Chicago, IL 60611
312-836-3300

Axles AX-9
Cables, Electric CA-19
Terminations, Electrical TE-16

INTERNATIONAL RECTIFIER CORP.
Semiconductor Div.
233 Kansas St.
El Segundo, CA 90245
213-772-2000

Controllers, Motor, Variable Speed, AC & DC CR-22
Fuses FX-6, 7

JULIAN ELECTRIC INC.
701 Blackhawk Dr.
Westmont, IL 60559
312-920-8950

Cables, Electric ..... CA-20 to 23

KAYDON BEARING DIV.
Keene Corp.
2860 Mc Cracken St.
Muskegon, MI 49443
616-755-3741

Bearings, Wheel and Motor ..... BR-8 to 10

K-D Tools
K-D Manufacturing Co.
3575 Hempland Rd.
Lancaster, PA 17604
717-285-4581

Connectors, Electrical and Battery Terminal ..... CN-45 to 47
Terminations, Electrical ..... TE-17 to 19

KLINETICS, INC.
S & S Div.
9 W.Third St.
Media, PA 19063
215-565-5388

DC-DC Converters CV-13
Fuses FX-8
Instrumentation IN-20

KOOL-O-MATIC CORP.
1831 Terminal Rd.
Niles, MI 49120
616-683-2600

Blowers, Cooling ..... BL-2 to 5

KW BATTERY CO.
3555 Howard St.
Skokie, IL 60076
312-982-8346

Battery Chargers ..... BC-19 to 22

LA MARCHE MFG. CO.
106 Bradrock Dr.
Des Plains, IL 60018
312-299-1188

Battery Chargers ..... BC-23 to 26

LAWNEL CORP.
P.O. Box 206
Bluefield, VA 24605
703-326-1171

Motors, Traction ..... MT-11 to 14

MANUFACTURER & COMPONENT — **PAGE NO.**

LEDEX, INC.
801 Scholz Dr.
P.O. Box 427
Vandalia, OH 45377
513-898-3621

Solenoids SO-11
Switches SW-29, 30

LEROY-SOMER INC.
16 Passaic Ave.
Fairfield, NJ 07006
210-227-9277

Motors, Traction ..... MT-15 to 17

LESTER EQUIPMENT MFG. CO.
2840 Coronado St.
Anaheim, CA 92806
715-630-2260

Battery Chargers ..... BC-27 to 30

LEVITON MANUFACTURING CO.
59-25 Little Neck Parkway
Little Neck, N.Y. 11362
212-229-4040

Cables, Electric CA-24
Connectors, Electrical & Battey Terminal CN-48
Fuses FX-9
Interlock Devices ID-7
Switches SW-31

LIPE-ROLLWAY CORP.
806 Emerson Ave.
Syracuse, NY 13221
315-488-5411

Clutches CL-2, 3

LOVEJOY, INC.
2655 Wisconsin Ave.
Downers Grove, IL 60515
312-852-0500

Couplings, Shaft, Flexible ..... CS-3 to 6
Drives, Speed Increasing/Decreasing DS-11
Pulleys, Power Drive PU-7
Universal Joints UJ-10

MAGNECRAFT ELECTRIC CO.
5575 N. Lynch Ave.
Chicago, IL 60630
312-282-5500

Relays, AC & DC ..... RE-31 to 34

MARVEL-SCHEBLER/TILLOTSON DIV.
Borg-Warner Corp.
2195 S. Elwin Rd.
Decatur, IL 62525
217-428-4631

Fuel Systems ..... FS-25 to 28
Solenoids ..... SO-12 to 15
Switches SW-32, 33
Transducers, Control, Position TP-3
Transducers, Control, Temperature TT-9

MASTER CONTROL SYSTEMS, INC.
910 N. Shore Dr.
Lake Bluff, IL 60044
312-295-1010

Battery Chargers ..... BC-31 to 34

MCLEAN ENGINEERING LABORATORIES
70 Washington Rd.
Princeton Junction, NJ 08550
609-799-0100

MANUFACTURER & COMPONENT — **PAGE NO.**

Air Conditioners ..... AC-3 to 6
Blowers, Cooling ..... BL-6 to 9
Fans, Cooling FC-11

MELBEN PRODUCTS CO. INC.
Production Dr.
Harrison, OH 45030
513-367-4855

Fuel Systems FS-29

MERCURY ELECTRONICS CORP.
339 E. Cottage Place
York, Pa. 17405
717-854-9557

Cables, Electric ..... CA-25 to 28

MIDLAND-ROSS CORP.
Midtex Div.
1650 Tower Blvd.
North Mankato, MN 56001
507-625-6521

Relays, AC & DC ..... RE-35 to 38

MODINE MANUFACTURING CO.
1500 De Koven Ave.
Racine, WI 53401
414-633-2411

Heat Exchangers ..... HX-14 to 17

MOLEX INC.
2222 Wellington Court
Lisle, IL 60532
312-969-4550

Connectors, Electrical & Battery Terminal CN-49, 50
Switches ..... SW-34 to 36

MORSE CHAIN DIV.
Borg-Warner Corp.
South Aurora Street
Ithaca, NY 14850
607-272-7220

Drives, Speed Increasing/Decreasing ..... DS-12 to 15

MOTOR APPLIANCE CORP.
Spirit West Industrial Park
555 Mercury Blvd.
Chesterfield, MO 63017
314-532-3406

Battery Chargers BC-35, 36

NATIONAL TEL-TRONICS
Electro Audio Dynamics, Inc.
State Road Hill
Meadville, PA 16335
814-724-6440

Fuses ..... F-10 to 12
Terminations, Electrical ..... TE-20 to 23

NATIONWIDE ELECTRONIC SYSTEMS INC.
1536 Brandy Parkway
Streamwood, IL 60103
312-289-8820

Instrumentation ..... IN-21 to 24

OHIO MANUFACTURING CO.
P.O. Box 456
Chardon, OH 44024
216-286-9535

Pulleys, Power Drive ..... PU-8 to 11

OHIO SEMITRONICS INC.
1205 Chesapeake Ave.
Columbus, OH 43212
614-486-9561

(Ohio Semitronics Inc. Continued)

Instrumentation IN-25, 26
Transducers, Control, Current TC-4

OMNIFAC CORP.
1700 E. Whipp Rd.
Dayton, OH 45440
513-434-8400

Instrumentation IN-27, 28
Interlock Devices ID-8

ONAN CORPORATION
1400 73rd Ave. NE
Minneapolis, MN 55432
612-574-5000

Motors, Traction ..... MT-18 to 21

PARKARD ELECTRIC DIV.
General Motors Corp.
P.O. Box 431
Warren, OH 44486
216-373-2633

Cables, Electric ..... CA-29 to 32
Connectors, Electrical & Battery Terminal ..... CN-51 to 54
Fuses ..... FX-13 to 16
Terminations, Electrical ..... TE-24 to 27

PARKER HANNIFIN CORP.
Mobile Hydraulic Div.
17325 Euclid Ave.
Cleveland, OH 44112
216-531-3000

Hydraulic Motors ..... HM-32 to 35

PARKER HANNIFIN CORP.
EIS Div.
695 High St.
P.O. Box 701
Middletown, CT 06457
203-346-8624

Braking Systems & Components, Regenerative and Non-Regenerative BK-12

PARKER-HANNIFIN CORP.
Refrigeration & Air
Conditioning Div.
15 Depew Ave.
Lyons, NY 14489
315-599-6085

Air Conditioners ..... AC-7 to 9

PENTA ENGINEERING CO.
615 W. Covina Blvd.
San Dimas, CA 91773
714-599-6085

Controllers, Motor, Variable Speed, AC & DC CR-23
DC-DC Converters CV-14
Instrumentation IN-29, 30

PENNWALT CORP.
S. S. White Industrial Products
151 Old New Brunswick Rd.
Piscataway, NJ 08854
201-752-8300

Couplings, Shaft, Flexible CS-7, 8

PERMCO INC.
1500 Frost Rd.
P.O. Box 68
Streetsboro, OH 44240
216-626-2801

Hydraulic Motors ..... HM-36 to 39

PMC DIVISION
William M. Brobeck & Associates
California Corp.
1235 Tenth St.
Berkeley, CA 94710
415-524-8664

Controllers, Motor, Variable Speed, AC & DC ..... CR-26 to 28

POOLE CO.
1700 Union Ave.
Baltimore, MD 21211
301-235-0800

Couplings, Shaft, Flexible ..... CS-9 to 12

POWER FUNCTIONS ENGINEERING
3831 Cavalier Dr.
Garland, TX 75042
214-278-0996

Controllers, Motor, Variable Speed, AC & DC CR-24, 25

THE PRESTOLITE CO.
Eltra Co.
511 Hamilton St.
Toledo, OH 43694
419-255-4068

DC-DC Converters CV-15
Motors, Traction ..... MT-22 to 25
Relays, AC & DC RE-39
Solenoids SO-16
Switches SW-37
Transducers, Control, Current TC-5
Voltage Regulators VR-7

PROKO INTERNATIONAL
12511 Beatrice St.
Los Angeles, CA 90066
213-391-6391

Air Conditioners AC-10

P T BRAKE LINING CO.
17 Shepard St., Lawrence
Industrial Park
Lawrence, MA 01842
617-686-3861

Braking Systems & Components, Regenerative and Non-Regenerative BK-13, 14

RECREATIONAL PRODUCTS
MARKETING, INC.
P.O. Box 7936
1724 Mary St.
Waco, TX 76710
817-754-5687

Fuel Systems FS-30

RED DOT CORP.
495 Andover Park East
Seattle, WA 98188
206-575-3840

Air Conditioners AC-11, 12
Heaters ..... HT-6 to 8

RELAY SERVICE CO.
1310 N. Pulaski Rd.
Chicago, IL 60651
312-252-2700

Relays, AC & DC ..... RE-40 to 42

MANUFACTURER & COMPONENT — PAGE NO.

RENOLD INC.
P.O. Box A
Westfield, NY 14787
716-326-3121
Couplings, Shaft, Flexible ..... CS-13 to 16

REVCOR INC.
251 Edwards Ave.
Carpentersville, IL 60110
312-428-4411
Blowers, Cooling ..... BL-10 to 12
Fans, Cooling FC-12

REXROTH CORP.
Mobile Hydraulics Div.
Old Mansfield Rd.
Wooster, OH 44691
216-262-2010
Hydraulic Motors ..... HM-40 to 43

RITE AUTOTRONICS CORP.
3485 S. La Cienega Blvd.
Los Angeles, CA 90016
213-836-7900
Instrumentation ..... IN-31 to 34
Switches SW-38
Transducers, Control, Pressure, Hydraulic TH-13
Transducers, Control, Temperature TT-10

ROCKWELL INTERNATIONAL
Automotive Operations
2135 W. Maple Rd.
Troy, MI 48084
313-435-1000
Axles ..... AX-10 to 13
Braking Systems & Components, Regenerative and Non-Regenerative ..... BK-15 to 17
Universal Joints ..... UJ-11 to 14

THE ROGERS MANUFACTURING CO.
275 N. Arlington St.
Akron, OH 44305
216-376-5113
Pulleys, Power Drive PU-12

ROWE INDUSTRIES
6225 Bonore Rd.
Toledo, OH 43612
419-729-9761
Cables, Electric ..... CA-33 to 36
Connectors, Electrical and Battery Terminal ..... CN-55 to 58
Disconnects, Emergency ..... DE-2 to 5
Terminations, Electrical ..... TE-28 to 31

SALSBURY INDUSTRIES
1010 E. 62nd St.
Los Angeles, CA 90001
213-242-6181
Alternators AL-8, 9
Clutches CL-4, 5
Torque Converters ..... TR-2 to 5

SCHATZ-FEDERAL
Fairview Ave.
P.O. Box 1191
Poughkeepsie, NY 12602
914-452-6000
Bearings, Wheel and Motor ..... BR-11 to 14

MANUFACTURER & COMPONENT — PAGE NO.

SCHAUER MFG. CORP.
4500 Alpine Ave.
Cincinnati, OH 45242
513-791-3030
Battery Chargers ..... BC-37 to 39

SEVCON
Div. of Technical Operations Inc.
40 North Ave.
Burlington, MA 01803
617-272-2000
Controllers, Motor, Variable Speed, AC & DC ..... CR-29 to 32

SPECTRA-STRIP
7100 Lampson Ave.
Garden Grove, CA 92642
714-892-3361
Cables, Electric CA-37, 38
Connectors, Electrical and Battery Terminal ..... CN-59 to 62

SPERRY-VICKERS
North American Group
1401 Crooks Rd.
Troy, MI 48084
313-280-2321
Hydraulic Motors ..... HM-44 to 46

SPICER CLUTCH DIV.
Dana Corp.
Fifth and Brandon Sts.
Auburn, IN 46706
219-925-3800
Clutches ..... CL-6 to 9
Differentials DF-3

STACKPOLE COMPONENTS CO.
Dept. EM
P.O. Box M
Farmville, VA 23901
804-392-4111
Switches SW-39, 40

STERLING POWER SYSTEM CORP.
P.O. Box 1187
7101 Jackson Rd.
Ann Arbor, MI 48106
313-665-6767
Heat Engines ..... HE-8 to 11

STEWART WARNER CORP.
South Wind Div.
1514 Dover St.
Indianapolis, IN 46221
317-267-1613
Heaters HT-9, 10

STRUTHERS-DUNN, INC.
Lambs Rd.
Pitman, NJ 08071
609-589-7500
Relays, AC & DC ..... RE-43 to 46

TECH LABORATORIES INC.
Bergen & Edsall Blvds.
Palisades Park, NJ 07650
201-944-2221
Switches SW-41, 42

MANUFACTURER & COMPONENT	PAGE NO.
TECNETICS INC. 1625 Range St. P.O. Box 910 Boulder, CO 80306 303-442-3837	
DC-DC Converters	CV-16 to 19
TECUMSEH PRODUCTS CO. Lauson-Power Products Div. 900 North St. Grafton, WI 53024 414-377-2700	
Heat Engines	HE-12 to 15
TELEFLEX INC. 1816 57th St. Sarasota, FL 33580 605-225-0360	
Cables, Electric	CA-39
Instrumentation	IN-35 to 38
Switches	SW-43
Transducers, Control, Position	TP-1
Transducers, Control, Pressure, Brake	TB-3
Transducers, Control, Pressure, Hydraulic	TH-14
Transducers, Control, Speed	TS-4
THOMAS AND BETTS CORP. 920 Route 202 Raritan, NJ 08869 201-685-1600	
Connectors, Electrical and Battery Terminal	CN-63 to 66
Disconnects, Emergency	DE-6, 7
Terminations, Electrical	TE-32
THE TIMKEN COMPANY P.O. Box 1126 E Wall Street Station New York, NY 10268 800-221-3333	
Bearings, Wheel and Motor	BR-19 to 22
THE TORRINGTON COMPANY Special Products Div. 59 Field St. P.O. Box 1008 Torrington, CT 06790 203-482-9511	
Bearings, Wheel and Motor	BR-23 to 26
TOTAL PERFORMANCE PRODUCTS 830 N. Lake St. Burbank, CA 91502 213-845-1583 213-849-5008	
Fans, Cooling	FC-2
Heat Exchangers	HX-18
TRANSDUCER SYSTEMS, INC. 710 Davisville Rd. Willow Grove, PA 19090 215-657-0800	
Switches	SW-44 to 47
Transducers, Control, Position	TP-5 to 8
Transducers, Control, Pressure, Brake	TB-4 to 7
Transducers, Control Pressure, Hydraulic	TH-15 to 17
Transducers, Control, Speed	TS-5 to 8
Transducers, Control, Temperature	TT-11
Transducers, Control, Torque	TQ-5
TRW BEARINGS DIV. TRW Inc. 402 Chandler St. Jamestown, NY 14701 716-661-2100	
Bearings, Wheel and Motor	BR-15 to 18
TWIN DISC INC. 1340 Racine St. Racine, WI 53403 414-634-1981	
Clutches	CL-10, 11
Couplings, Power Transmission, Fluid	CF-6 to 9
Torque Converters	TR-6 to 8
Universal Joints	UJ-15, 16
UNIROYAL INC. Power Transmission Div. Middlebury, CT 06749 203-573-3717	
Belts	BE-14 to 16
VACO PRODUCTS 1510 Skokie Blvd. Northbrook, IL 60062 312-564-3300	
Connectors, Electrical and Battery Terminal	CN-67, 68
VAPOR CORP. Transportation Systems Div. 6420 W. Howard St. Chicago, IL 60648 312-631-9200	
Contactors, AC & DC	CT-21 to 24
Relays, AC & DC	RE-47 to 50
VELONEX DIV. 560 Robert Ave. Santa Clara, CA 95050 408-727-7370	
Instrumentation	IN-39
WABASH/IPM 200 E. Daniels Rd. Palatine, IL 60067 312-359-4710	
Alternators	AL-10, 11
Pulleys, Power Drive	PU-13, 14
Voltage Regulators	VR-8 to 11
WAGNER DIVISION McGraw Edison Co. 100 Misty Lane Parsippany, NJ 07054 210-386-9300	
Braking Systems & Components, Regenerative & Non-Regenerative	BK-18, 19
WARD LEONARD ELECTRIC CO. INC. 31 South St. Mount Vernon, NY 10550 914-664-1000	

MANUFACTURER & COMPONENT **PAGE NO.**

Ward Leonard Electric Co. Inc. (Continued)

Contactors, AC & DC ..... CT-25 to 28
Relays, AC & DC ..... RE-51 to 54
Terminations, Electrical ..... TE-33 to 35

WARNER GEAR DIV.
Borg-Warner Corp.
P.O. Box 2688
Muncie, IN 47302
317-286-6100

Transmissions, Manual ..... TM-3 to 5

YOUNG RADIATOR CO.
2825 Four Mile Rd.
Racine, WI 53404
414-639-1010

Heat Exchangers HX-19, 20

ZELLER CORP.
P.O. Box 278
Defiance, OH 43512
419-784-2244

Universal Joints ..... UJ-17 to 20

ZENITH CONTROLS INC.
830 W. 40 St.
Chicago, IL 60609
312-247-6400

Contactors, AC & DC CT-29, 30
Relays, AC & DC RE-55, 56

AIR CONDITIONERS

(CODE **AC**)

HARRISON RADIATOR DIVISION
GENERAL MOTORS CORPORATION LOCKPORT, NEW YORK 14094

Harrison Radiator Division, General Motors Corporation
200 Upper Mountain Road
Lockport, New York 14094
Phone: (716) 439-2011

Harrison offers a wide variety of vehicular heat transfer devices including air conditioners, heaters and various heat exchangers. Currently these units are available for prototype, production and service applications.

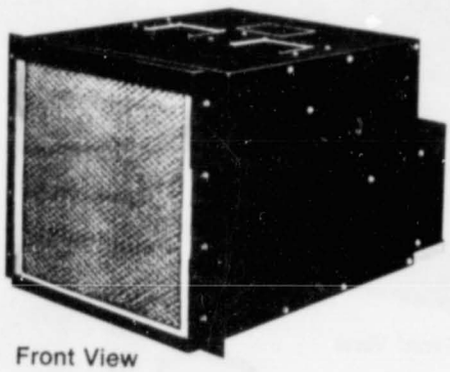
LOBOY® AIR CONDITIONERS

5,000 BTU — 6,000 BTU — 7,000 BTU

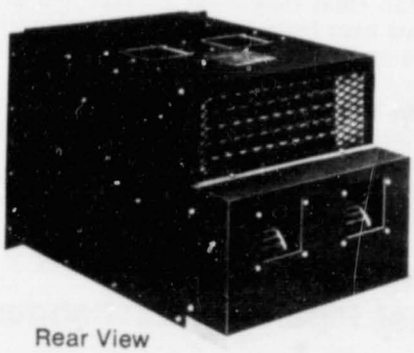
McLean LOBOY® air conditioners are designed specifically to cool electronic enclosures using the CLOSED LOOP SYSTEM approach. Recirculating and cooling the internal air assures constant clean air in contact with electronic components. Centrifugal blowers circulate cool air to provide maximum heat removal and reliable operation.

Highest quality refrigeration and electrical components provide twenty-thousand hours of continuous duty in a wide range of environments and ambient temperatures to 125°F. Constant duty operation reduces high current starting transients, eliminates relay point arcing and extends compressor and motor life.

The 115V/60 cycle, 230V/60 cycle and 230V/50 cycle units are available in door-mounted or rack-mounted versions. Each air conditioner features standard cabinet mounting for quick installation.



Front View



Rear View

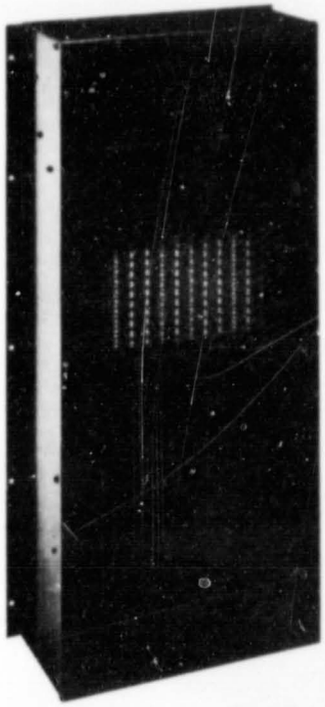
FEATURES

- Large effective area of inlet filter reduces maintenance frequencies.
- Easy LIFT-OUT, cleanable and reusable aluminum inlet filter.
- Dependable pressure-sensing hot gas bypass valve maintains proper load on compressor under low heat dissipation conditions.
- Ready access to refrigeration and electrical components for service and/or maintenance by removing inlet filter.
- LOBOY® BTU ratings have been established at the maximum ambient operating temperatures of 125°F. A substantial improvement in heat removal does occur when operating in ambient temperatures below 125°F.
- LOBOY® air conditioners are readily available in various BTU capacities.
- Cabinet construction is cold-rolled steel, phosphatized and painted semi-gloss black, baked enamel. Alternate colors and/or finishes by special arrangements.
- Special coatings for coils and copper lines available for units required to operate in harsh environments.

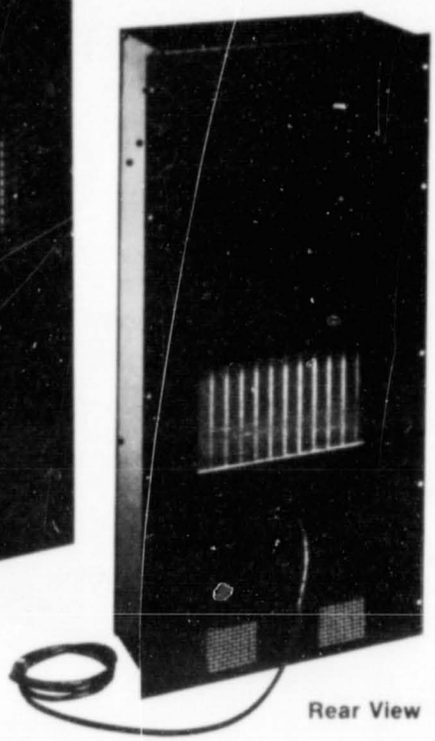
McLEAN ENGINEERING MIDWEST

9560 85TH AVENUE NO. MAPLE GROVE, MINNESOTA 55369 PHONE 612/425-4747

HEAT PIPE/HEAT EXCHANGERS



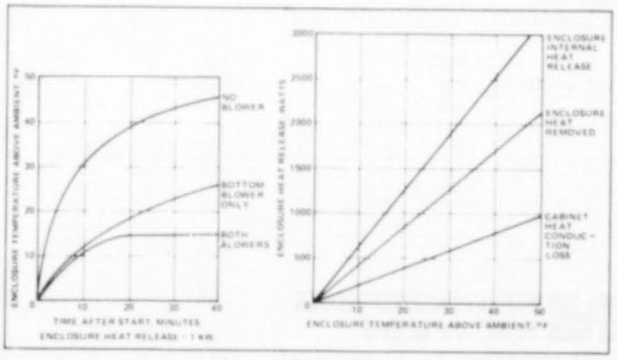
Front View



Rear View

McLean Heat Pipe/Heat Exchangers are designed to remove heat from electronic enclosures with a nominal temperature differential above ambient. (Refer to graph below.) The heat pipes provide an air to air system that utilizes the most advanced method of heat transfer, the heat pipe core, to transfer heat from inside an electronic enclosure to the outside environment. The heat pipe/heat exchanger is a self-contained system, in that no external medium other than air is used.

Performance of McLean Heat Pipe/Heat Exchangers



Model HP-3800

FEATURES

- Small, compact and lightweight—75 pounds.
- One dual centrifugal blower on enclosure side, and transverse (slot) blower on ambient side.
- 38⅛" long × 19" wide × 8" deep.
- Easily mountable on enclosure door, bulkhead or rack rails.
- Gasket mounting kit included.
- Available only in 115v/60hz/1ph configuration.
- Maximum 3 amp. draw.
- 6' service cord.
- Operating temperature range—0° F. to 125° F.
- Cabinet construction is C. R. steel, phosphatized and finished in semigloss black, baked enamel.
- Special coating for heat pipe cores available at extra cost when units are required to operate in hostile environments.

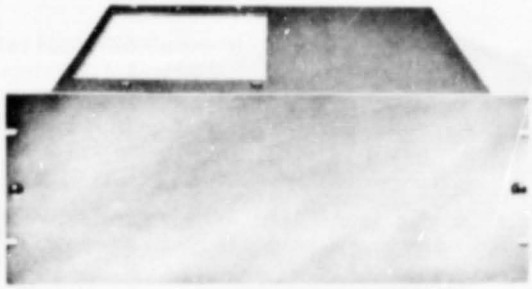
Model HP-3600

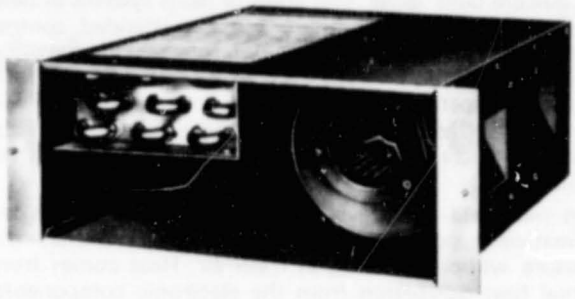
FEATURES

- Small, compact and lightweight—75 pounds.
- 36¾" long × 15" wide × 7" deep.
- Two (2) dual centrifugal blowers.
- Available in either 115v/60hz/1ph, 230v/50hz/1ph or 230v/60hz/1ph power configurations.
- Maximum 4 amp power draw on 115v units.
- 6' service cord.
- Easily mounts on either inside or outside of enclosure door, bulkhead or rack rails. Face mounting is standard. Optional rail mounting is extra.
- Operating temperature range—0° F. to 125° F.
- Cabinet construction is C. R. steel, phosphatized and finished in baked hammertone grey.
- Special coating for heat pipe cores available at extra cost when units are required to operate in hostile environments.

McLEAN ENGINEERING MIDWEST
9560 85TH AVENUE NO. MAPLE GROVE, MINNESOTA 55369 PHONE 612/425-4747

PANEL MOUNTED HEAT EXCHANGER



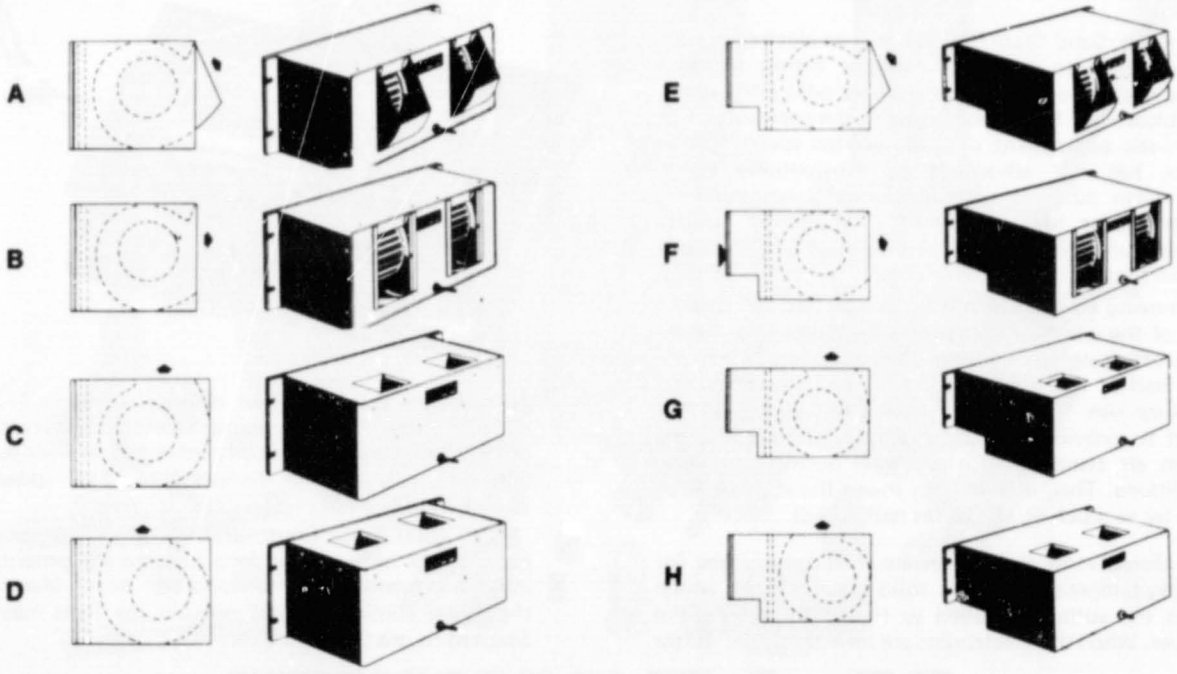


MODEL 2EB412AR44

McLean Heat Exchanger models are designed and manufactured to meet individual specifications and applications. Model 2EB412AR44 is a heat exchanger assembly designed for mounting in the front panel of a standard 19" electronic cabinet, and for removing the heat from the air being recirculated within the cabinet. The system does not use room ambient air, nor does it exhaust warm inside cabinet air into the atmosphere. The model described was designed to maintain an interior cabinet temperature at a maximum of 80°F. with a 1 KW heat dissipation. This is a water cooled heat exchanger model using 66°F to 70°F chilled inlet water. Substantially more cooling may be obtained by using refrigerated water or direct expansion of a refrigerant. Likewise, a higher ambient temperature may be obtained by the use of a warm or hot water circulating system.

EXHAUST VARIATIONS

The flow pattern of McLean packaged blowers may be altered to meet specifications. Various methods of discharge are available. Type A, the most popular, is available in all capacities from stock. Flow direction and geometry of housing is designated by a letter following model number, i.e. Model 2EB408A discharges diagonally upward, while Model 2EB408C discharges vertically from top rear housing. Model 2EB408E indicates a recessed model with air flow diagonally upward and Model 2EB408G is recessed with vertical discharge.



McLEAN ENGINEERING MIDWEST
9560 85TH AVENUE NO. MAPLE GROVE, MINNESOTA 55369 PHONE 612/425-4747

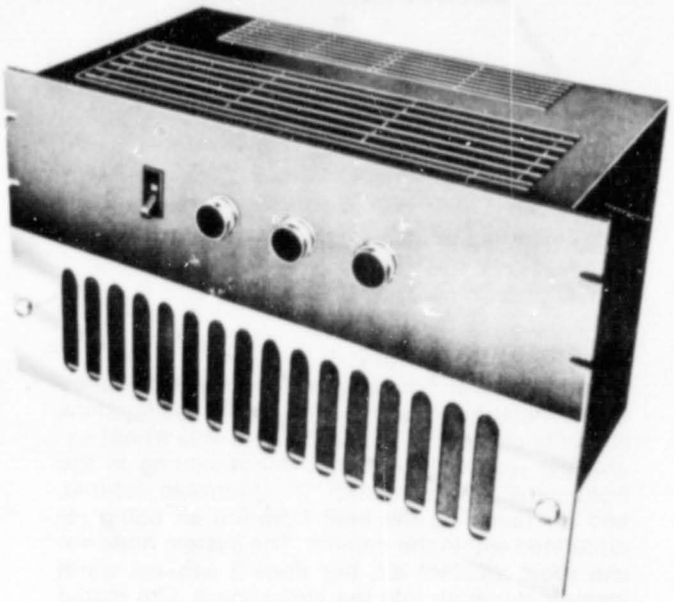
HEATER-COOLER

This custom built mclean unit cools or heats systems in field installations, unheated military huts, unattended control stations and mobile vans. The unit shown is designed to keep an electronic enclosure at an even 65°F with surrounding temperature in still air as low as 10°F. It will also flush and cool with clean filtered air, electronic cabinets when the remote thermostat indicates cooling is required.

When moderate heating is required, internal dampers are automatically positioned to re-circulate air within the enclosure without drawing in fresh air. Heat comes from internal heat dissipation from the electronic components. When substantial heating is required, an internal relay energizes a 1000 watt electric heater to maintain a predetermined temperature.

Front panel contains a circuit breaker to protect heating elements. Three pilot lights indicate "Power On", "Fresh Air" and "Heater On". A terminal strip is provided on the rear for power input and for a 4 wire connection to the 2 step thermostat.

mclean Heater-Cooler units are custom made to meet individual applications and requirements.



SOLID STATE CONTROLLER

The mclean Solid State Controller is an electronic control designed to sense temperature within an electronic enclosure, and to accordingly adjust the speed of a blower or fan providing air to the enclosure. The automatic adjustment of a blower/fan speed by this device has the advantage of substantially lower blower/fan noise at normal operating temperatures, longer motor life, plus control of interior cabinet temperatures to within plus or minus 2°F between certain limits of heat input.

Air moving equipment must often be selected to take care of the worst combination of simultaneous conditions affecting the cooling of electronics. Normally, only half of this air is needed for the allowable temperature rise. The control device lowers blower/fan speed to provide proper air delivery to maintain the design air temperature rise under normal operating conditions. This, in turn, can lower the audible noise level by as much as 15 DB (at half speed).

The closed loop control system includes a probe for sensing temperature, and a solid state control, which varies the voltage supplied to the motor driving the blower. When the electronics are turned on, the motor operates the blower or fan at approximately 1/3 of normal speed, when cabinet temperature reaches 80°F, the voltage is gradually increased to maintain a near constant cabinet temperature. Full speed is attained at 90°F.



mclean Solid State Controllers may be incorporated in all mclean blowers and fans as extra equipment, or may be furnished as a separate item. Many of the mclean cooling devices now in the field may be adapted to use the controller.

McLEAN ENGINEERING MIDWEST
9560 85TH AVENUE NO. MAPLE GROVE, MINNESOTA 55369 PHONE 612/425-4747

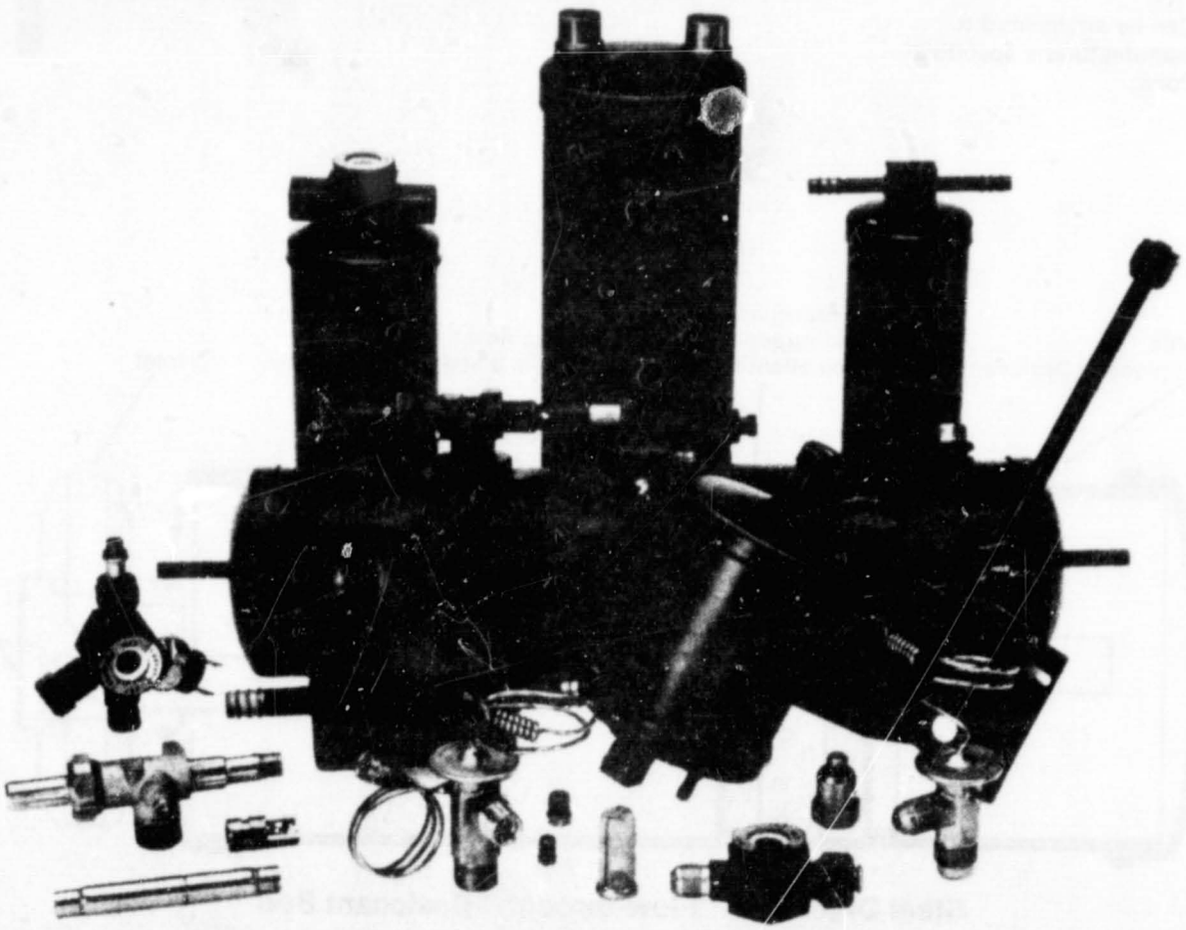
Parker Driers/TXV's

Parker Hannifin Corporation
Refrigeration & Air Conditioning Div.
15 Depew Avenue
Lyons, NY 14489
Phone (315) 946-4891

for mobile air conditioning aftermarket applications

Passenger cars, trucks, agricultural &

off-highway vehicles, recreational vehicles



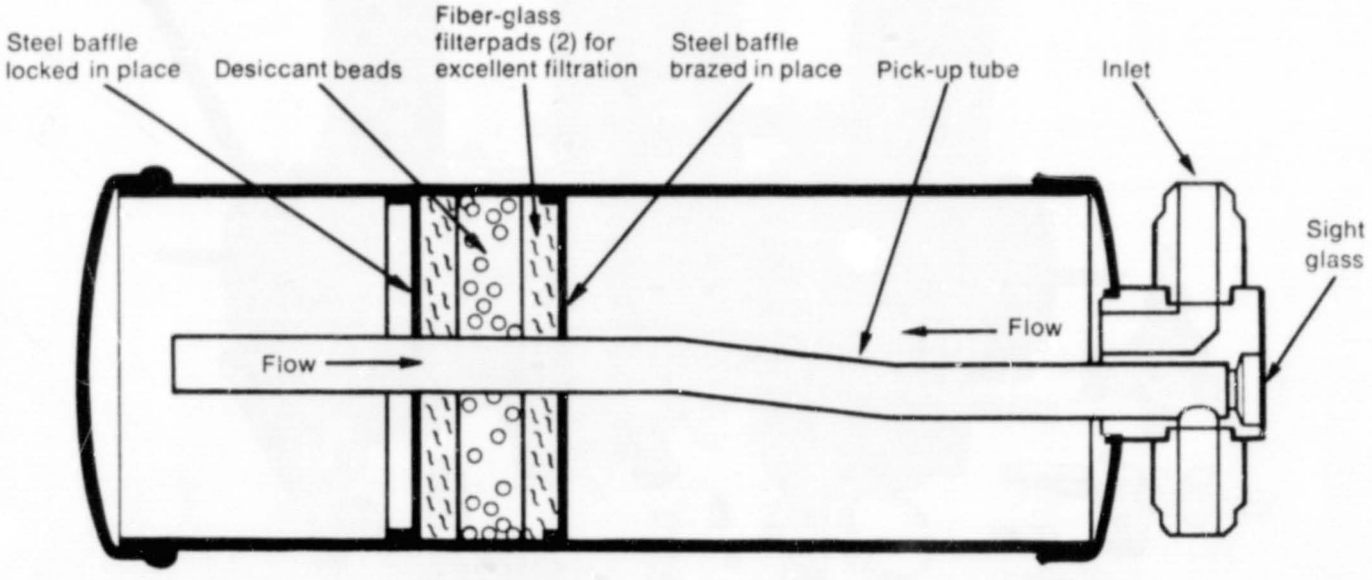
ORIGINAL PAGE IS
OF POOR QUALITY

Automotive Drier Features

Parker Hannifin Corporation
Refrigeration & Air Conditioning Div.
15 Depew Avenue
Lyons, NY 14489
Phone (315) 946-4891

- **Designed for application in trucks, cabs, agricultural, construction, Rec Vehicles, and air conditioning unit manufacturers.**
- **Building-block design permits customer modifications.**
- **Available with flow-through desiccant bed or wool felt bag.**
- **Can be engineered to manufacturer's specifications.**





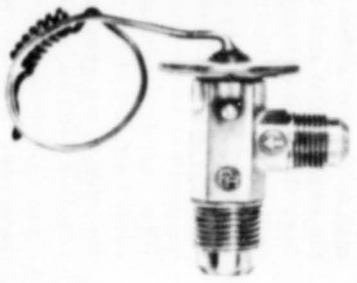
Steel Dryer with "Flow-through" Desiccant Bed

Automotive TXV Features

Parker Hannifin Corporation
Refrigeration & Air Conditioning Div.
15 Depew Avenue
Lyons, NY 14489
Phone (315) 946-4891

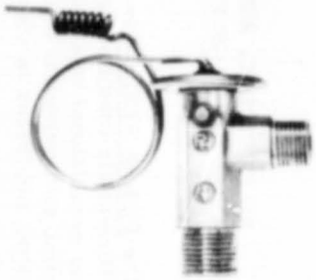
- Available in Internal and Externally Equalized SAE Flare and O-ring
- Balanced Seat Design provides precise control at any system load
- Meets IMACA Std. 301
- Rated for A/C Systems to 3 Tons R-12
- Compact Design

Int. Equalized Flare



030781 Series

Int. Equalized O-ring



031249 Series

Ext. Equalized Flare



031130 Series

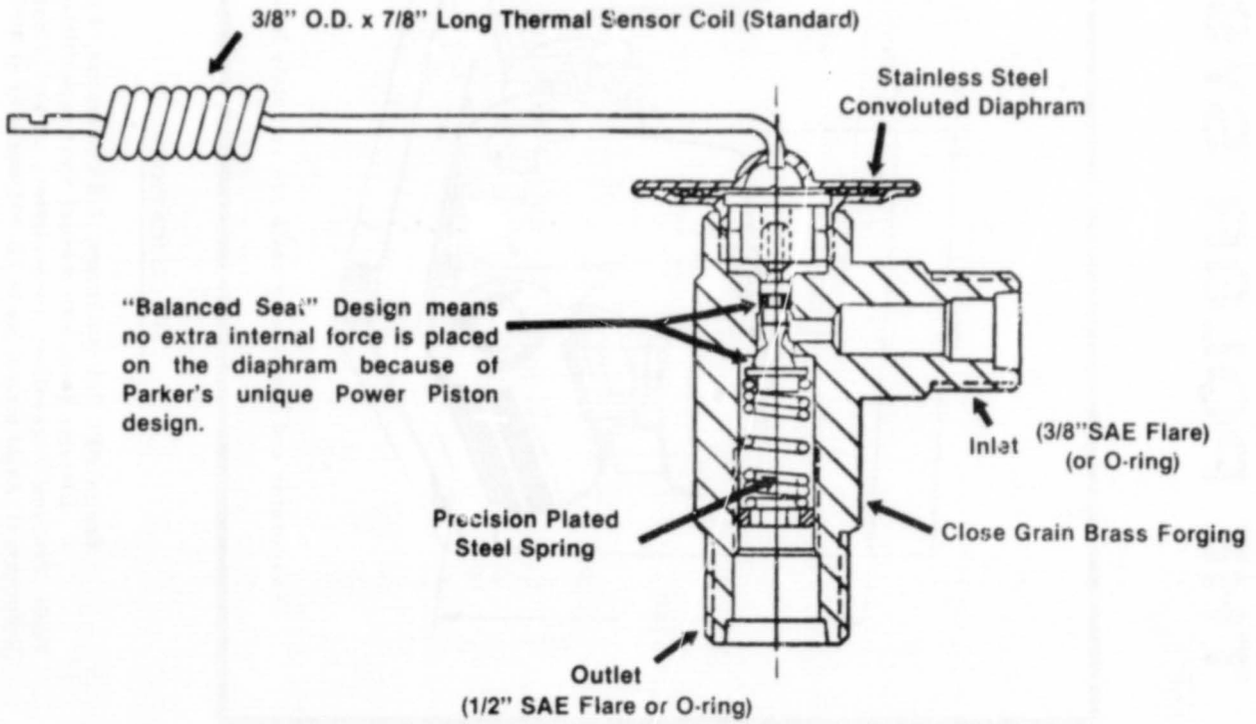
Ext. Equalized O-ring



031131 Series

How To Order:

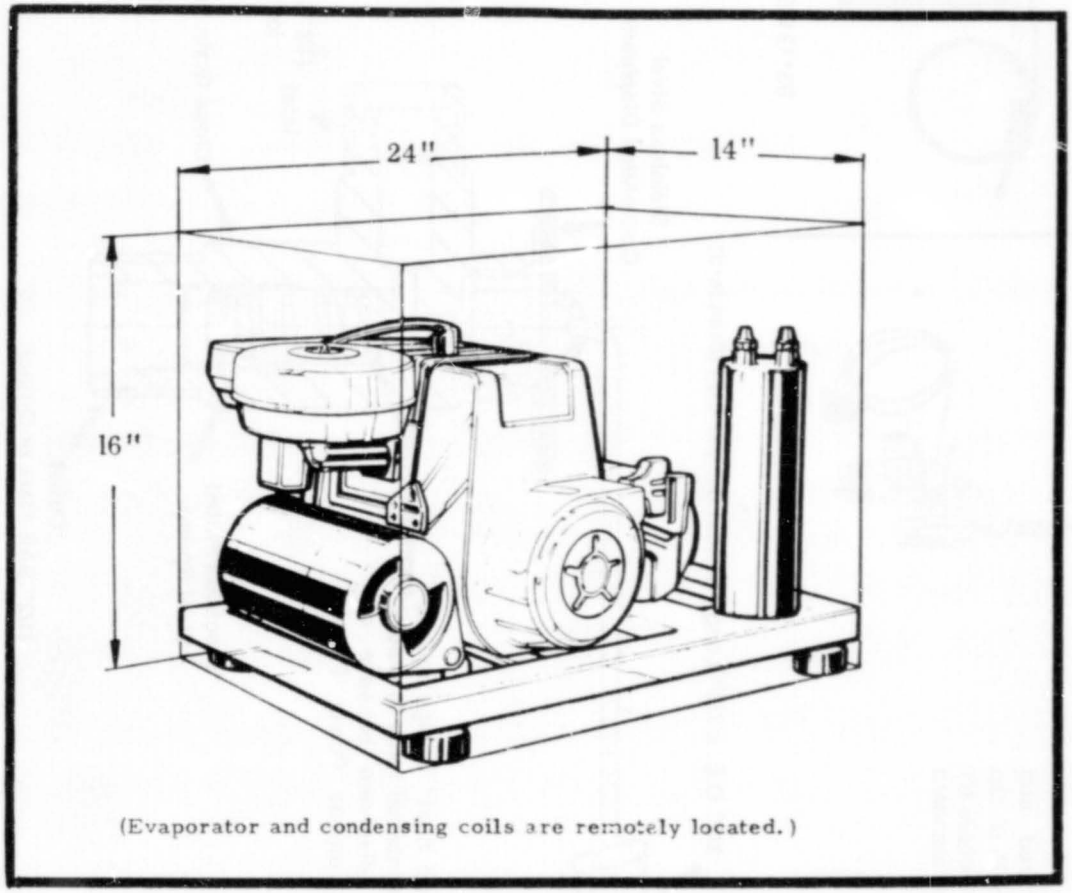
Use series number pictured and specify super heat, mop, length of cap tube and length of external equalizer tube. We will choose closest standard production model available.



Automotive TXV with "Balanced Seat" Design

THE POLAR SYSTEM

: AN EFFICIENT AIR CONDITIONING AND GENERATOR PACKAGE FOR ELECTRIC VEHICLES



(Evaporator and condensing coils are remotely located.)

The POLAR SYSTEM is currently used as an efficient air conditioning and generator package for recreational vehicles and boats. It's use as an environmental control for electric cars, vans, and trucks is ideal.

The POLAR SYSTEM can provide:

** Up to 24,000 Btu's/hr of air conditioning. Interior temperatures can be very accurately maintained for added comfort by adjusting the engine RPM and/or cycling the compressor. Once the desired temperature has been set by the operator, the controls are automatic.

** Up to 1.5 kw battery charging capability. At lower air conditioning loads, the engine's horsepower is diverted to the generator. When the air conditioning compressor has cycled off, all of the engine's horsepower is diverted to the generator. Output voltage is regulated and adjustable.

** Up to 15,000 Btu's/hr of heat is available for passenger comfort, window defrosting, and battery heating. A simple heat exchanger is placed on the engine exhaust. It is more efficient to burn propane or gasoline through the engine to produce heat and electricity than burning fuel through catalytic or other burners for heat only.

PROKO INTERNATIONAL is actively involved with the design and manufacture of an all electric air conditioning system which is powered by DC (without inverters). Compressors are either hermetic or shaft sealed. Typical power consumption is 9.4 Btu's of refrigeration per watt of power input.

For designing, testing and manufacture of environmental controls consult:

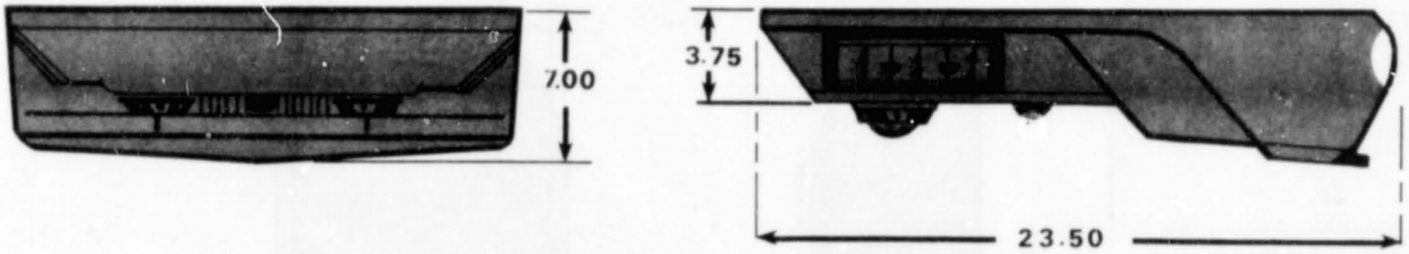
PROKO INTERNATIONAL
12511 Beatrice Street
Los Angeles, California 90066
(213) 391-6391

SPECIFICATIONS

Engine HP: 3.5 maximum, 2.8 continuous, 4 cycle.
Electric start with manual start capabilities.
Fuel: Propane or gasoline; consumption: .6 to 1.2 pounds per hour.
Compressor: Axial piston, up to 24,000 Btu's/hr at 40°F evaporation.
Heat exchanger: Sized according to application and vehicle design.
Weight: 73 pounds.
Size: 24" long, 14" wide, 16" high.

Air Conditioner

DIMENSIONS



SPECIFICATIONS

Capacity: 17,000 BTU per hour at 36° F. refrigerant temp., 80° wet bulb

Air Flow: 235 C.F.M.

Weight: 22 lbs.

Evaporator: 213 cubic inches

Motor: 12 V.D.C. 3 speed

Current draw: 10.5 amps.

FEATURES

- Low Profile
- Reversable Mounting
- "O" Ring Freon Fittings
- Lightweight
- Easy Access to All Components
- Adjustable Louvers
- Dome Lite
- Installation Template Included

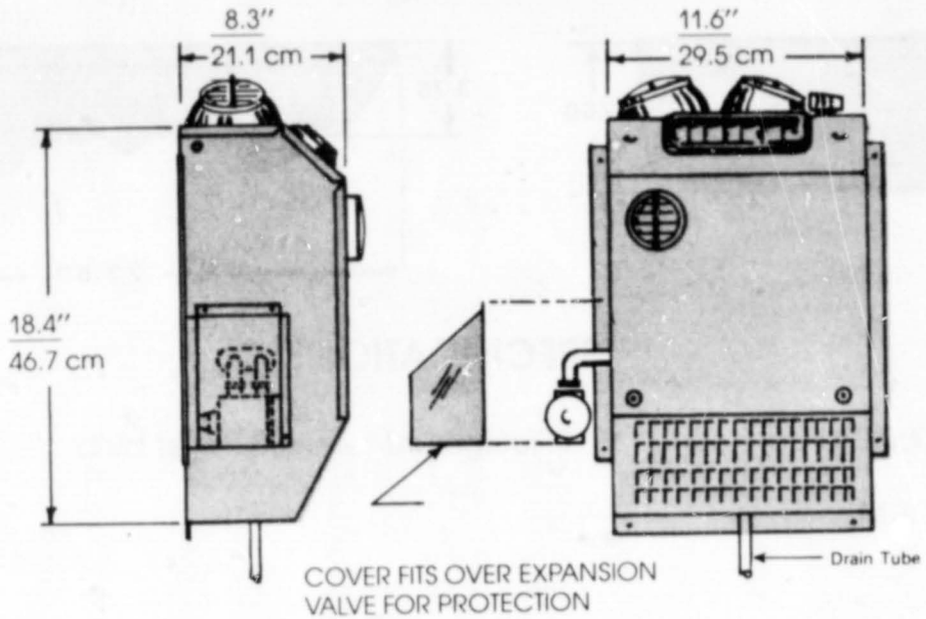
ORDERING INFORMATION

ORDER BY MODEL NUMBER **R-2000-1** (12 VOLT). A GENERAL INSTALLATION KIT IS AVAILABLE WHICH INCLUDES RECEIVER-DRIER AND ALL NECESSARY FREON HOSE AND ALL NECESSARY FITTINGS. ORDER NO. **RD-5-3789-4.**

RED DOT CORPORATION

495 Andover Park East Seattle, WA 98188 (206) 575-3840

Air Conditioner
(General Purpose)
DIMENSIONS



SPECIFICATIONS

Capacity: 19,000 BTU per hour at 36° refrigerant condensing temperature and 80° wet bulb

Air Flow: 240 CFM

Weight: 25 lbs.

Current Draw: 9 Amps at 12 V.D.C.; 4.5 Amps at 24 V.D.C.

Motor: 2 speed with pre-lubricated bearings

Controls: Hi-low motor speed selector; adjustable thermostat; four adjustable louvers

FEATURES

- Removable cover for quick, easy maintenance
- Deck plate provided for easy, thru-deck plumbing
- Block type "o" ring expansion valve
- Simplified mounting saves installation time
- Controls mounted on unit top for accessibility

ORDERING INFORMATION

Order by model number R-7810-0 (12 volt standard)
For 24 Volt application order R-7810-0-24

RED DOT CORPORATION 495 Andover Park East Seattle, WA 98188 (206) 575-3840

ALTERNATORS

(CODE AL)

American Motors Corporation
Engine and Component Sales Department
27777 Franklin Road
Southfield, Michigan 48034
(313) 827-3817

American Motors' products which have potential applications for electric and hybrid vehicles include components used in the manufacture of AMC/Jeep vehicles, such as:

- Alternators
- Axle Assemblies
- Brake Assemblies
- Differentials
- Manual Transmissions
- Automatic Transmissions

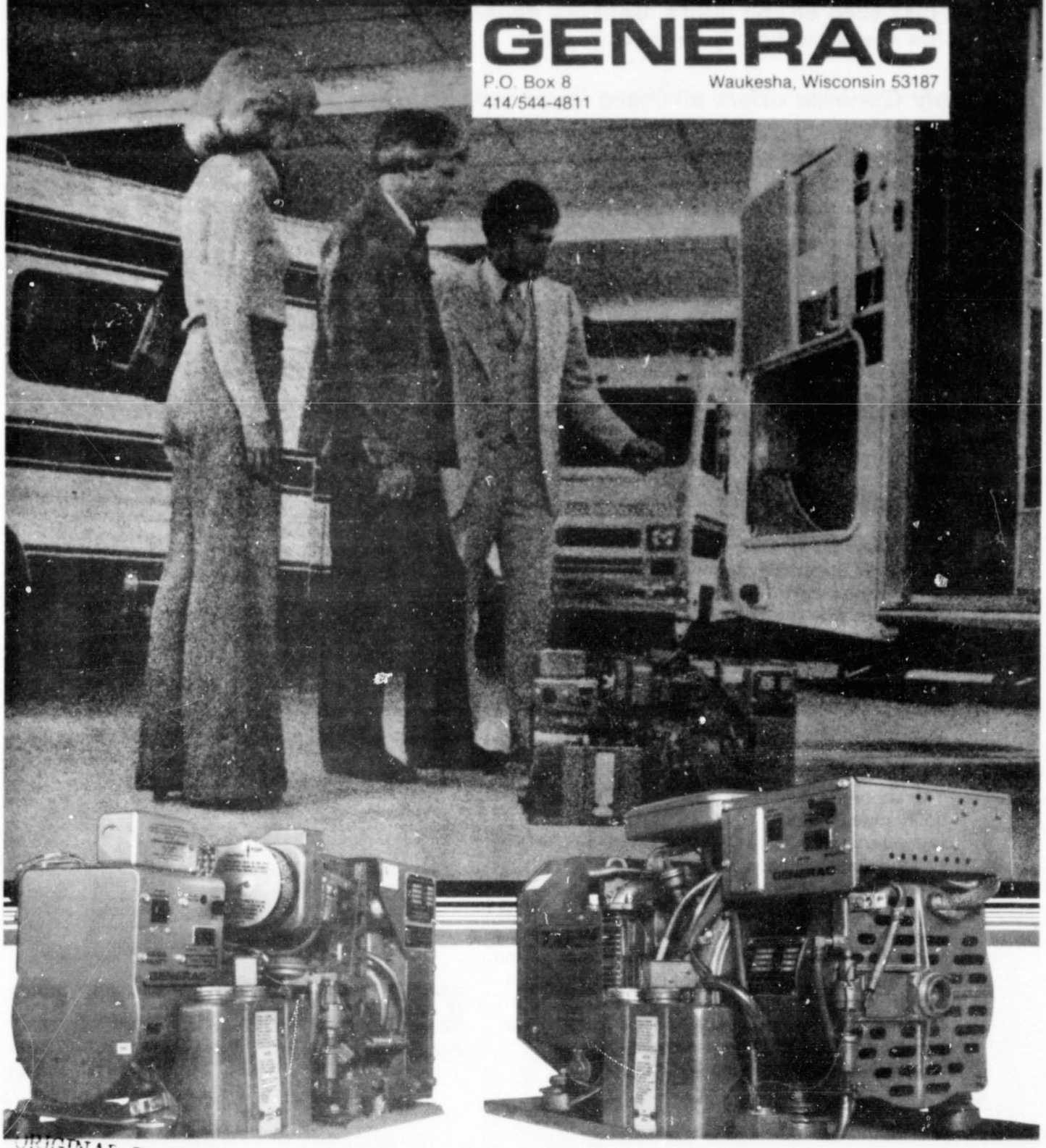
For additional information please contact:

American Motors Corporation
Engine and Component Sales Department
27777 Franklin Road
Southfield, Michigan 48034
(313) 827-3817

GENERAC
RECREATIONAL ELECTRIC POWER

GENERAC

P.O. Box 8 Waukesha, Wisconsin 53187
414/544-4811



ORIGINAL PAGE IS
OF POOR QUALITY

When you travel — take the great indoors with you!

Generac alternators give you the opportunity to enjoy the great indoors no matter where you travel. There is power on demand to keep food refrigerated, do the cooking, run your air conditioning, heat water, or just turn on the lights. Generac dependability helps make every trip more enjoyable.

Only Generac offers all these important features.

- **ALTERNATOR DESIGN SUPERIORITY**
  Generac alternators have no AC sliprings and brushes or DC commutators and brushes...all high replacement parts in ordinary generators.
- **EXCELLENT SURGE CAPACITY**
  Air conditioner starting is assured with a full 25% surge power capacity.
- **RELIABLE STARTING**
  An automotive type electric ring gear starter, automatic electric choke, and solid state ignition give fast, dependable starting in all weather conditions.
- **COOLER OPERATION, MORE "HOT" WATTS**
  Operating temperature, a crucial factor in engine performance and in maintaining rated alternator capacity, is kept at a low level by Generac's exclusive air cooling system. More cooling air volume means you get all the watts you paid for, even on the hottest days.
- **OIL "SAFETY" SYSTEM**
  Generac's completely automatic oil make-up and low oil shut-down system insures the proper oil level for maximum performance, and protects the owner who forgets to check the oil.
- **BIG WEIGHT SAVINGS**
  Advanced alternator design saves from 10% to 43% on weight. when compared to units of equal power ratings. Space savings of up to 55% are also a plus.
- **FUEL SAVINGS UP TO 25%**
  The super efficient alternator design and solid state voltage regulation (±2%) produce big fuel economies.
- ***PLUS, NATIONWIDE SERVICE SUPPORT***
  This includes service center coverage coast-to-coast in the United States and Canada...a computerized field inventory of replacement parts...a thorough factory service training program...and a 24 hour toll free number you can call on the road for the name and location of your nearest Authorized Generac Service Center.

GENERAC

P.O. Box 8 Waukesha, Wisconsin 53187

414/544-4811

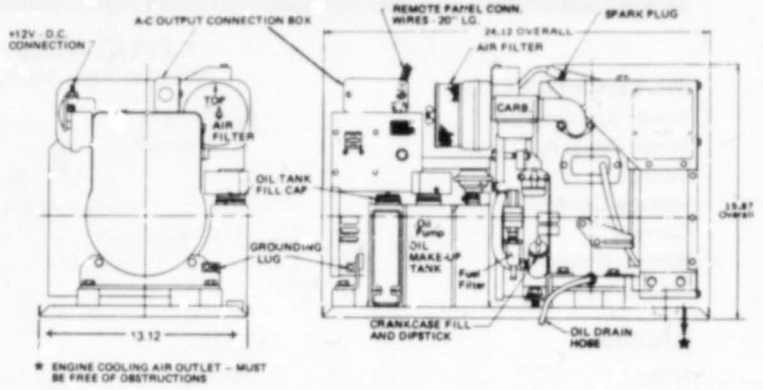
It takes only two models to meet all your needs. GENERAC

P.O. Box 8 Waukesha Wisconsin 53187 414/544-4811

Makes Them Both!

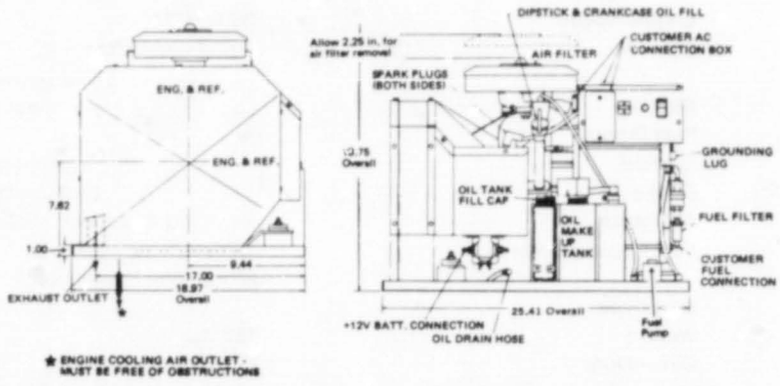
MC-40
4000 Watt Alternator

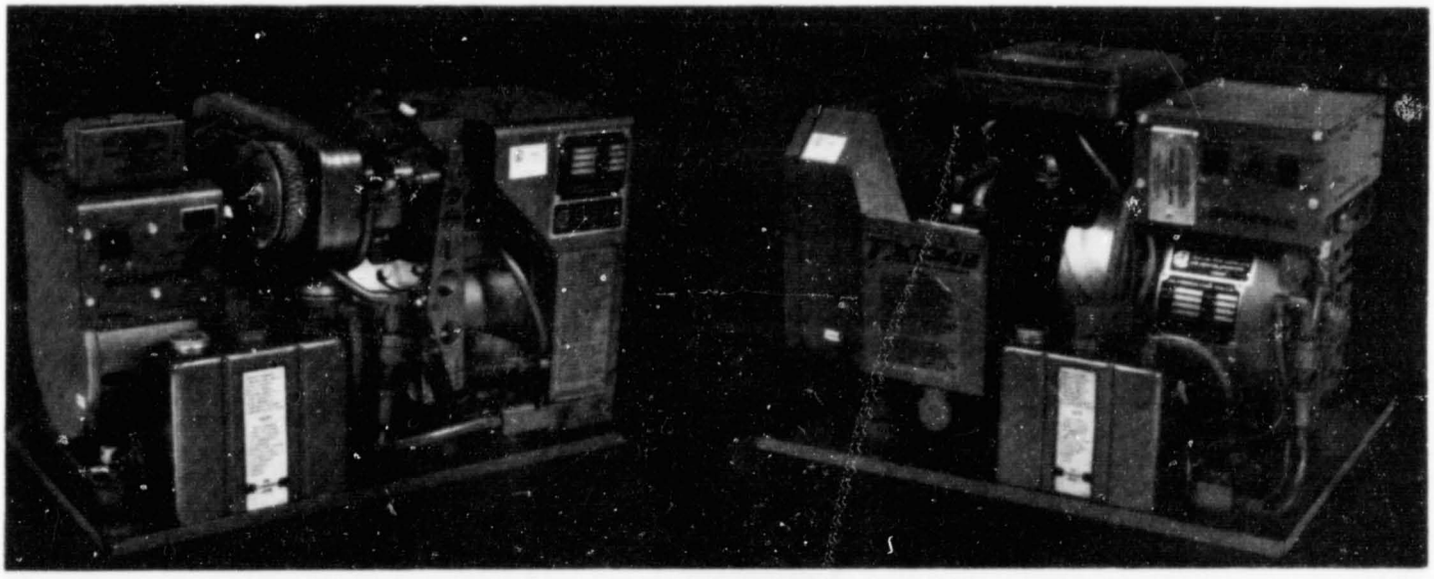
The MC-40 is the most versatile alternator used in the RV industry. Its small cube and light-weight design allow it to be installed in any type of motorhome, trailer or van, yet it delivers a full 4000 watts of power to run a large air conditioner plus all the standard accessories. The MC-40 engine's exclusive internal Anti-Vib mechanism greatly reduces the vibration normally transmitted through the coach. The MC-40 combines all the power and features of larger units, in a small light-weight package that can save you money.



TXP-45
4500 Watt Alternator

The TXP-45 is a twin cylinder, 1800 RPM alternator for the larger RV with a little more compartment space. The TXP's slow speed engine is exceptionally quiet and has a very low vibration level, delivering 4500 watts of power, enough for most Class A motorhomes. It incorporates all the features people expect from the larger, expensive power plants, but its compact design makes it the lightest in its kilowatt class.





The Generac MC-40 and TXP-45 are listed by U.S. Testing Nationwide Consumer Testing Institute (ANSI 198.1-76) (REL No. 71272) and Canadian Standard Association (CSA) (per 946) (LR 20957).

GENERAC

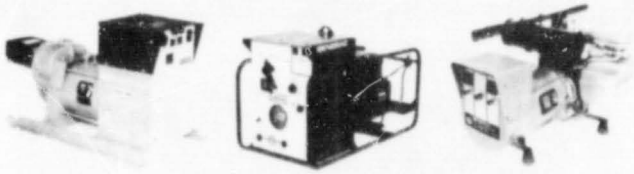
P.O. Box 8 Waukesha, Wisconsin 53187
414/544-4811

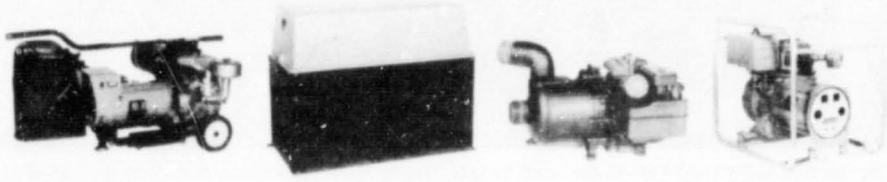
SPECIFICATIONS

	MC-40 Model No. 6897	TXP-45 Model No. 6931
ALTERNATOR		
Power (Continuous)	4000 Watts	4500 Watts
Surge Capacity (Up to)	5000 Watts	5500 Watts
Voltage	120/240 Volts (factory wired for 120 Volts)	
Voltage Control	solid state regulation ±2% proportionate to frequency	
Current	33.3/16.7 Amps	37.5/18.7 Amps
Battery Charge	12 Volts DC at 3 Amps (trickle charge will not boil battery)	
Frequency	60 Hz.	
ENGINE		
Make	Generac 300 CC with "Anti-Vib"	Generac 656 CC
Features	stellite valves, hardened valve seats, forged steel crankshaft & ball bearings, cast iron cylinder sleeve	rotators, chrome plated piston and piston rings
Engine Speed	3600 RPM	1800 RPM
Oil	2 pint engine capacity	3 pint engine capacity
	6 pint reserve tank, automatic low oil shutdown	
Starting	electric (automotive type ring gear)	
Fuel Pump	electric solid state	
Ignition	Generac high-energy solid state	
Choke	Generac automatic electric, time sequencing	
Air Intake	silencing expansion chamber	
Fuel Consumption	.67 gal./hour @ full load intermittent	.75 gal./hour @ full load intermittent
Fuel Type	unleaded recommended	
Weight	135 lbs.	212 lbs.
Dimensions	height — 15 5/8" width — 24 1/8" depth — 13 1/8"	height — 18 3/4" width — 25 1/2" depth — 19"

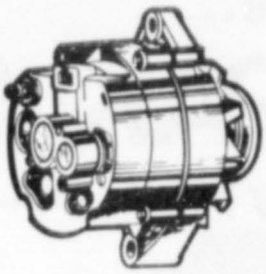
ACCESSORIES

Model 8256, Generac standard muffler with spark arrestor; Model 6815, Generac single chamber silent muffler (Model 6287, spark arrestor may be added to 6815); Model 6136, deluxe remote panel with hour meter; Model 6137, remote panel.



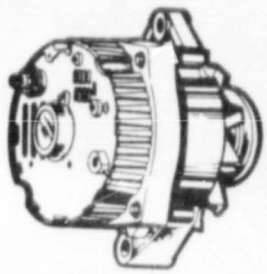


ALTERNATORS



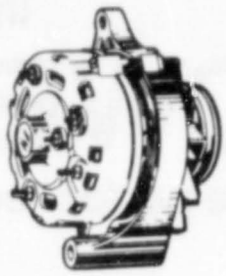


ALT-100
61 Amps.
General Mtrs. (w/o Integral Regulator) 72-62
International Truck (w/o Integral Regulator) 72-63



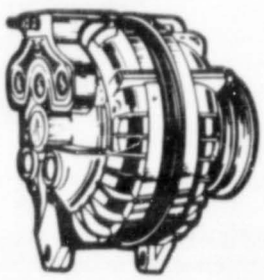


ALT-101
61 Amps.
American Mtrs. (Delco Remy Equipped w/Integral Regulator) 79-76
General Mtrs. (w/Integral Regulator) 79-69
International Truck (w/Integral Regulator) 77-71
Jeep Corp. (Delco Remy Equipped w/Integral Regulator) 79-76



ALT-102
55 Amps.
Ford Motor Co. 76-65

ALT-103
When present stock is exhausted use ALT-104





ALT-104
59 Amps.
Chrysler Corp. 76-60

GP Guaranteed Parts Company - Seneca Falls, New York 13148
TEL: 315-568-5844

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An Instrument Systems Company

introduces...

the POWER-PAK 4000

the perfect accessory power unit.

A new, improved, lightweight, constant-power-output Alternator System... providing 4000 watts of house current delivered automatically at all speeds from your existing engine.



FEATURES

- Mountable on almost any gasoline or diesel engine
- Will develop full rated wattage, frequency & voltage at low engine speed as well as high, unlike any inverter
- Solid state voltage regulator available for overload safety
- Sealed bearings for long-life and dependability
- Aluminum base plate for minimum weight
- Does not draw from battery for excitation under operation
- Emergency D.C. power available
- No separate engine to fuel and maintain
- Complete with magnetic clutch for disengagement when not in use
- Environmental duty construction
- Sine wave frequency transmitted allowing compatibility with all accessories (unlike square wave)
- Complete with circuit breaker
- Output power is true sine wave as opposed to square wave commonly generated by inverters. Some appliances are more efficient with sine wave (microwave ovens, induction motors, etc.)

APPLICATIONS

- Boats (Sail & Power)
- Buses
- Campers
- Emergency vehicles
- Wind generators
- Ideal for use by plumbers, contractors, ranchers, municipalities, public utilities, & many others requiring on-the-spot A.C. power.

SPECIFICATIONS

- 4000 watt rated output
- 33 AMP rated output
- 120 volt A.C. current
- Revolving field, 2 pole, single phase alternator transmitting sine wave 60 HZ frequency with alternator speed at 3600 rpm
- Nominal 6 h.p. required to operate at full capacity wattage (4000 watts)

SALSBURY INDUSTRIES

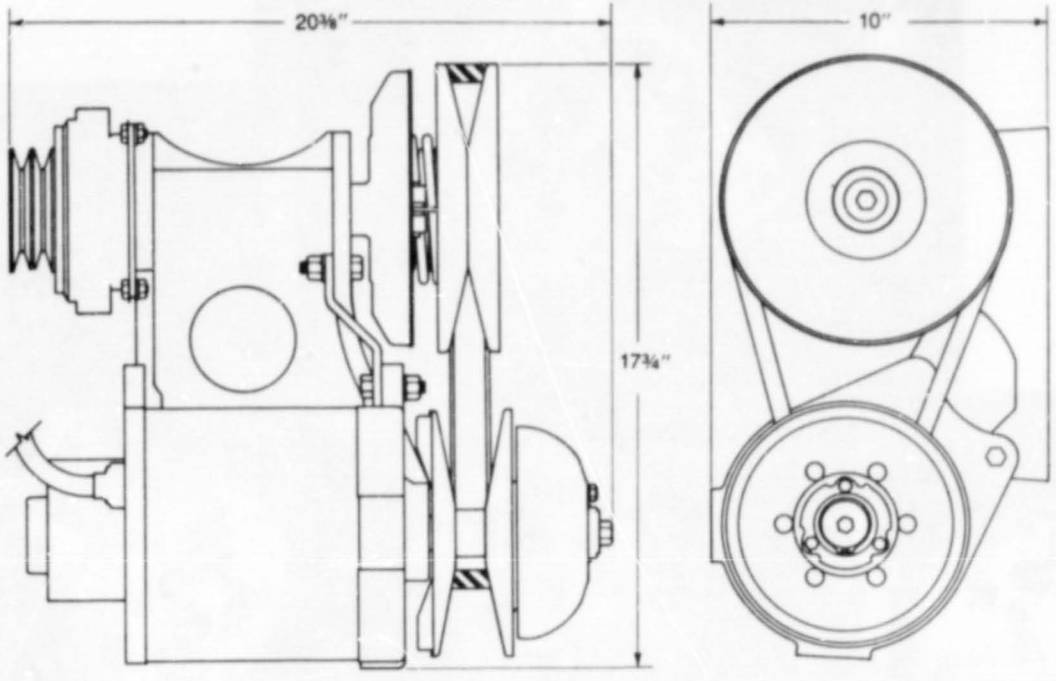
A SUBSIDIARY OF ABG INSTRUMENT SYSTEMS CORPORATION

1010 E. 62nd Street., Los Angeles, Ca. 90001 (213) 242-6181

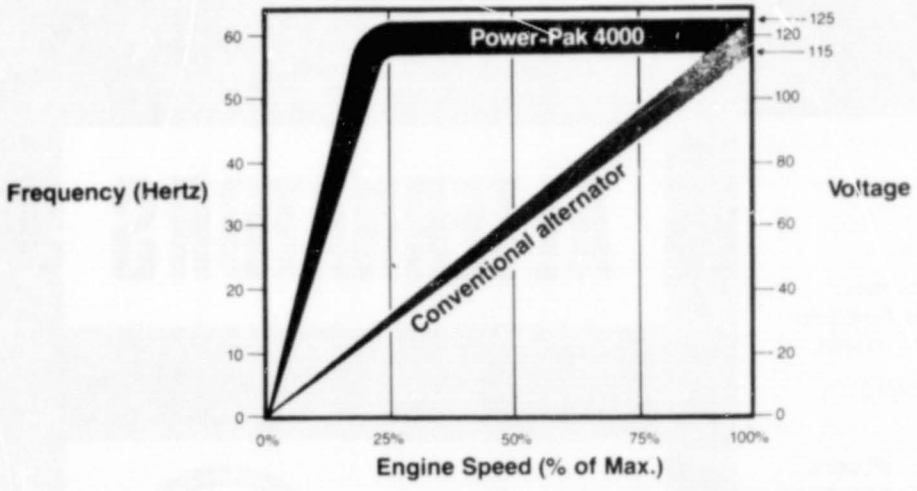
the POWER-PAK 4000

the perfect accessory power unit.

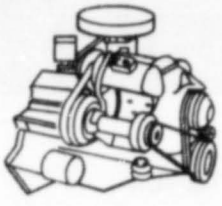
INSTALLATION DIMENSIONS



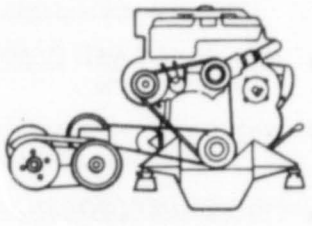
TYPICAL INPUT VS. OUTPUT



TYPICAL ENGINE MOUNT



TYPICAL SIDE MOUNT



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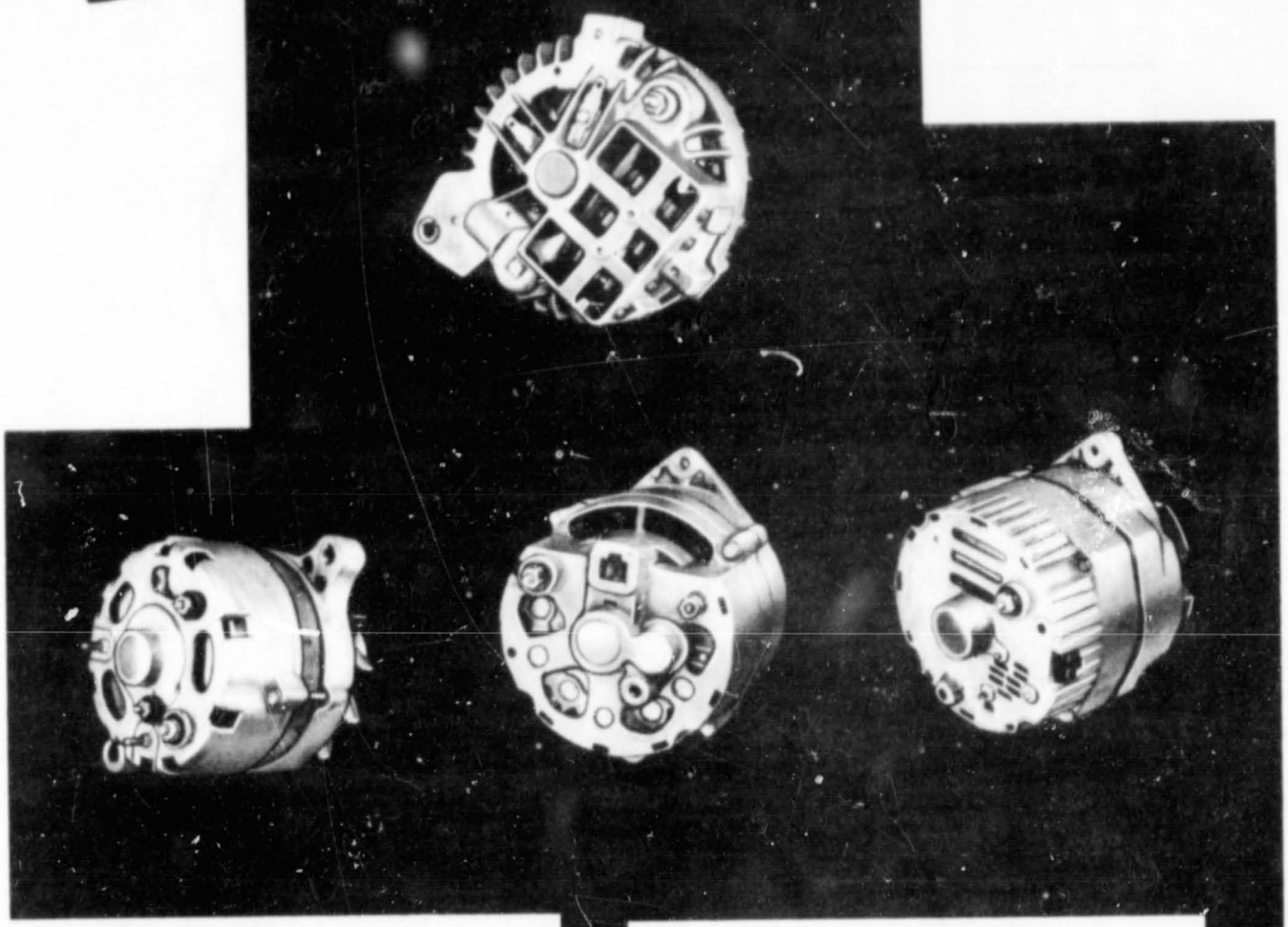
new



ALTERNATORS

FEATURES

- *MAXIMIZED COVERAGE* . . . . these alternators cover 90% of the American passenger car and light truck market.
- *100% BRAND NEW COMPONENTS* . . . . *No rebuilt parts*
- *PROVEN PERFORMANCE* . . . . all units meet or exceed OEM test specifications.
- *PROVEN DEPENDABILITY* . . . : 100% tested by the factory.
- *INCREASED PROFITABILITY* . . . . fewer units to stock means reduced inventory and faster turnover.
- *MADE IN U.S.A.*

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NEW ALTERNATORS

"The *Affordable Difference*"

4 UNITS 90% COVERAGE

FEATURES

100 % NEW – *DURABLE AND RELIABLE*

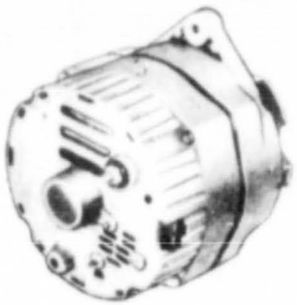
DOUBLE PULLEY – *REPLACES SINGLE PULLEY UNITS*

HIGH AMPERAGE – *REPLACES LOWER AMPERAGE UNITS*

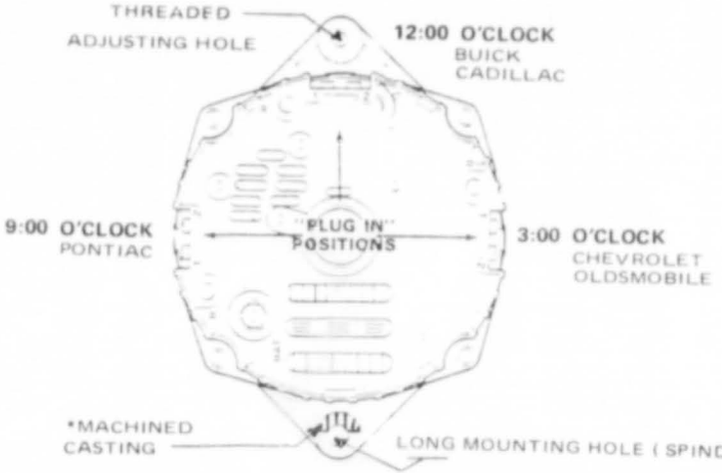
MAXIMUM COVERAGE – *MINIMUM INVENTORY*

TECH TIPS

"Qualify the Battery First!"



*"Special Machined Casting"**
for easy rotation if required.



GM

" Integral"

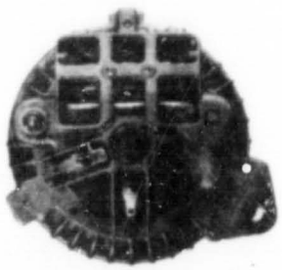
ONE UNIT FOR
ALL
CLOCK POSITIONS

USE THIS FOR THIS*

Chrysler

"Squareback"

ONE UNIT FOR
ALL
APPLICATIONS





* SINGLE FIELD TYPE – USE CONVERSION KIT SUPPLIED

Detailed INSTALLATION INSTRUCTIONS packaged with each unit.

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AXLES

(CODE **AX**)

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American Motors' products which have potential applications for electric and hybrid vehicles include components used in the manufacture of AMC/Jeep vehicles, such as:

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- Axle Assemblies
- Brake Assemblies
- Differentials
- Manual Transmissions
- Automatic Transmissions

For additional information please contact:

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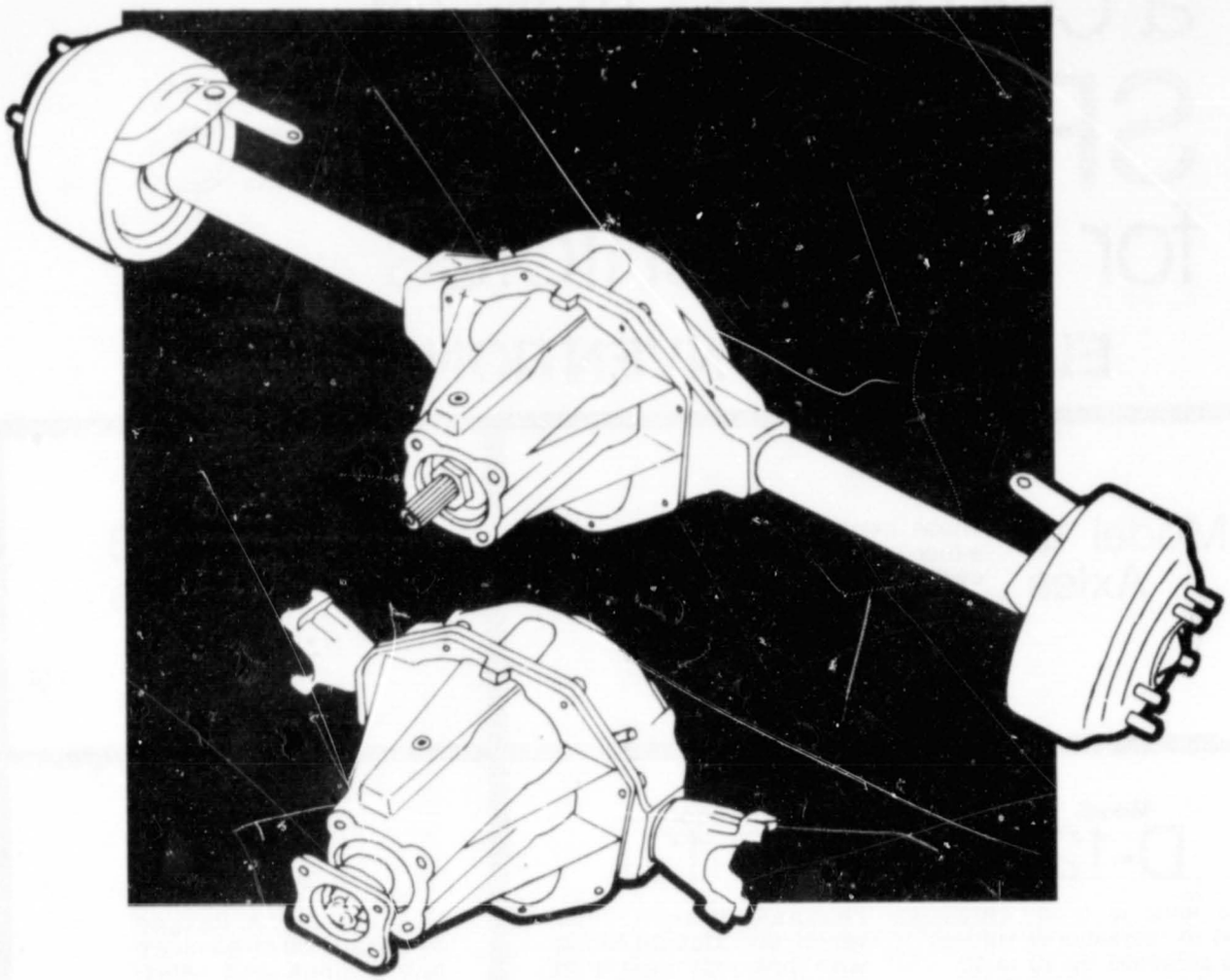
Southfield, Michigan 48034
(313) 827-3817



a complete line of SMALL VEHICLE AXLES from Spicer®

Spicer Clutch Division
Dana Corporation
P.O. Box 191
Auburn, Indiana 46706
Tel. 219-925-3800

DANA

ELECTRIC/CONVENTIONAL • HYDROSTATIC

a complete line of SPICER AXLES for small vehicles

ELECTRIC/CONVENTIONAL

Model 12 Axles

These axles can be powered by either gasoline or electricity. Die-cast aluminum carrier minimizes weight while steel tubes provide maximum load carrying ability.

Model 18 Axles

Model
D-12

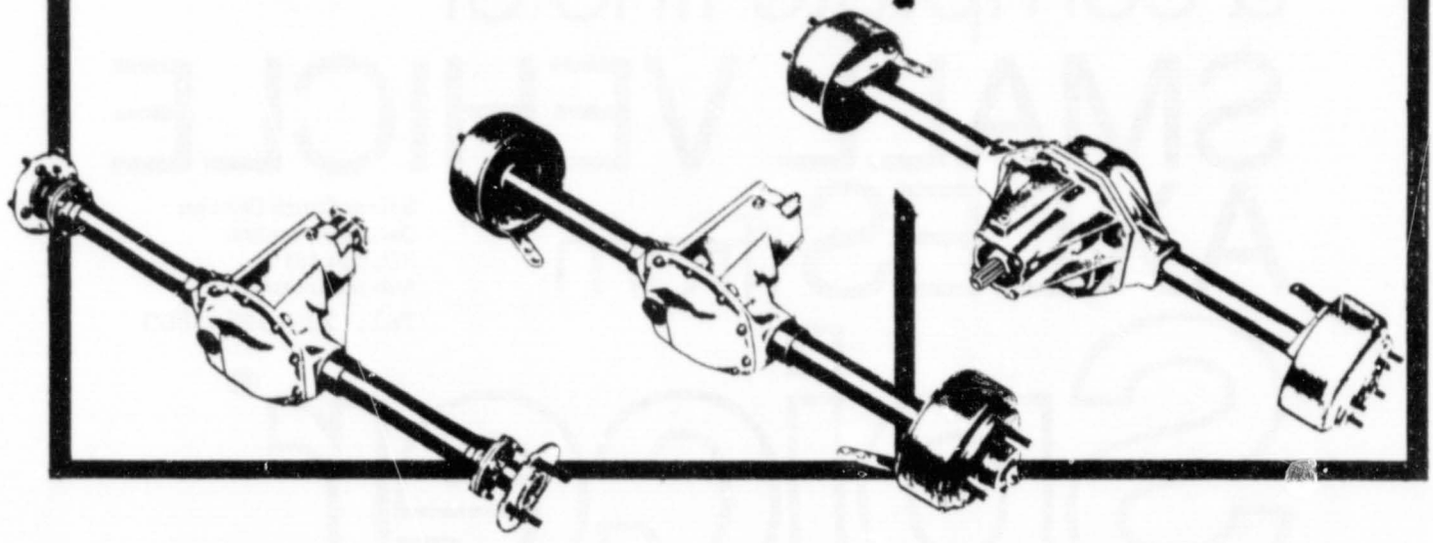
This axle is commonly used in recreational vehicles powered by 10 to 12 h.p. gasoline engines or 1.5 to 2.0 h.p. electric motors. Upset style tube ends are utilized on this design.

Model
S-12

Features straight tube wheel end design along with optional cast iron brake drums. Rated for 10 to 12 h.p. gasoline engines or 1.5 to 2.0 h.p. electric motors.

Model
18

Has one-piece flanged axle shafts which eliminate hub splines and wheel nuts. Wheel bearings are automotive type taper bearings.



For Engineering Assistance, or for Complete Details

WRITE: Sales Department
Spicer Clutch Division
Dana Corporation
P.O. Box 191
Auburn, Indiana 46706
Tel. 219-925-3800

Spicer DANA

Whether you build golf cars, garden tractors, light utility vehicles, or any other type of small electric or gasoline driven vehicle, the ideal axle for your application should be selected from this complete line of Spicer Axles.

Rugged dependability is designed into each axle for maximum economy and service. Automotive type hypoid gear sets give these axles the reputation of being "whisper quiet." Spicer axles are "Customer-ized" through extensive testing and proven use in millions of vehicles used in work and play. Offer a "Customer-ized" axle in your vehicle...Specify Spicer.

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Spicer Clutch Division
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Auburn, Indiana 46706
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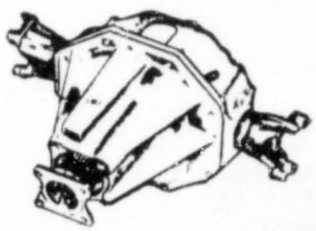
HYDROSTATIC

The newest of the line, the Model 18 Axles provide greater design flexibility by offering both conventional and independent suspension units. They feature die-cast aluminum parts to minimize weight.

Model
IS-18

The most versatile model in the lineup, the IS-18 provides maximum vehicle design flexibility. It can be used as either front or rear drive axle. Supports none of the vehicle's weight.

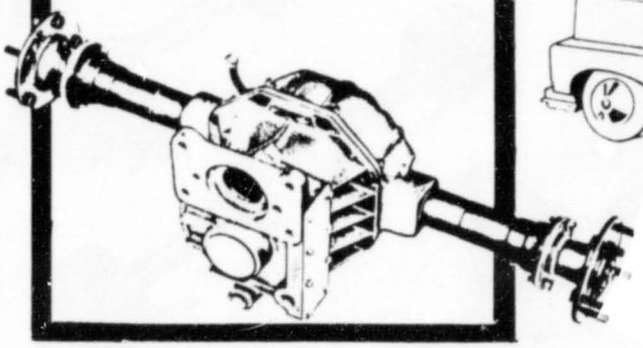


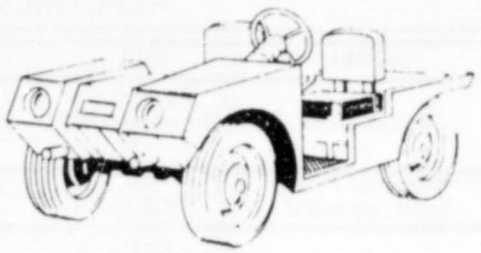
Model GT-20 Axle

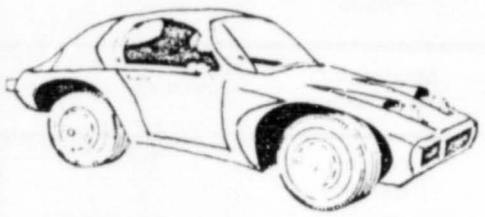
Features a lightweight aluminum carrier which acts as a sump eliminating the need for external reservoir and heat exchanger. Steel tubes are cast into the carrier for maximum load carrying ability.

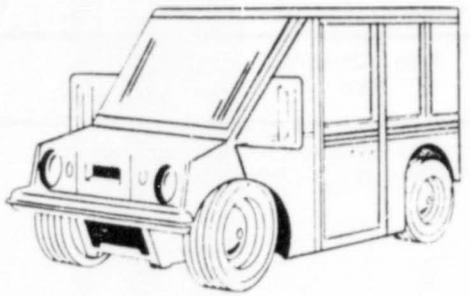
Model
GT-20

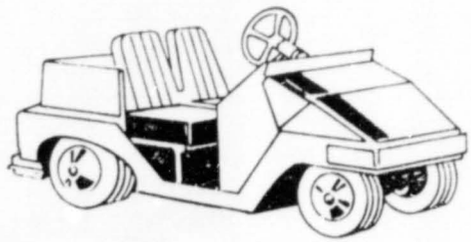
The direct drive feature eliminates belts, pulleys, chains, sprockets, and clashing gears. Taper unit bearings at wheel ends offer greater capacity and longer life. Automotive design ring gear and pinion provide maximum efficiency and quiet operation. Wheel hubs and brakes can be supplied with this axle.





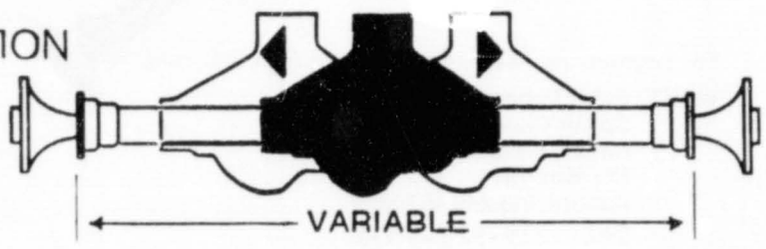






FLEXIBILITY OF CARRIER LOCATION

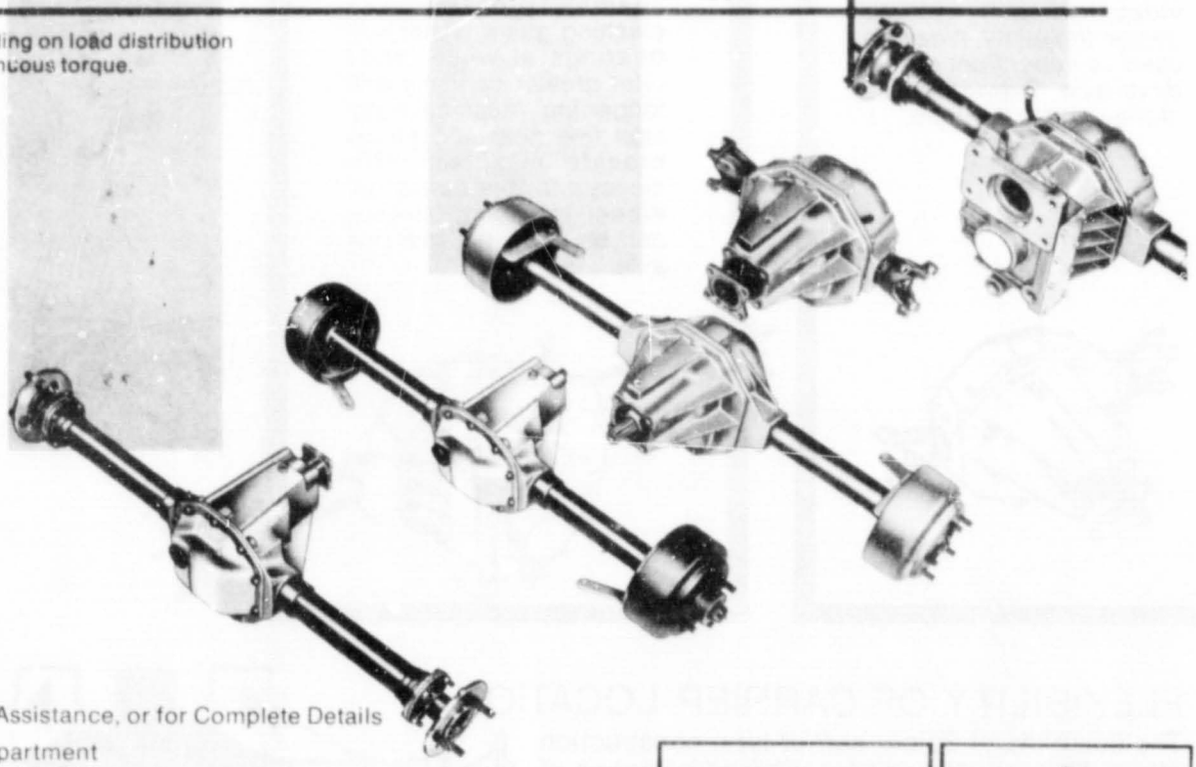
The flexibility of Spicer carrier-type construction offers the product engineer a broad selection of units adaptable to many design specifications at low cost. Carrier offsets and axle tread widths can easily be tailored to suit chassis design.



SPICER® SMALL VEHICLE AXLE specifications

	ELECTRIC/CONVENTIONAL				HYDROSTATIC
MODEL	**D-12**	**S-12**	**18**	**IS-18**	**GT-20**
Type of Drive	Electric/ Conventional	Electric/ Conventional	Conventional Driveshaft	Conventional Driveshaft	In Line Hydrostatic Transmission
Nominal Axle Load Capacity*	1200 lbs.	1200 lbs.	2000 lbs.	N./A.	1800 lbs.
Ratios	5.17:1 12.25:1	5.17:1 12.25:1	5.17:1 7.83:1 12.25:1	5.17:1 7.83:1 12.25:1	20.9:1 30.0:1
Maximum** Input Torque	5.17:1 65 lbs. ft. 12.25:1 45 lbs. ft.	5.17:1 65 lbs. ft. 12.25:1 45 lbs. ft.	5.17:1 170 lbs. ft. 7.83:1 120 lbs. ft. 12.25:1 90 lbs. ft.	5.17:1 170 lbs. ft. 7.83:1 120 lbs. ft. 12.25:1 90 lbs. ft.	20.9:1 23 lbs. ft. 30.0:1 16 lbs. ft.
Weight (Approx.)	60#	73# with brakes and drums	90# with brakes and drums	50# Dry	65# Dry
Axle Lubricant Capacity (Approx.)	Below 1½ Pts. Above 4 Pts.	Below 1½ Pts. Above 4 Pts.	Below 3 Pts. Above 4½ Pts.	Below 3 Pts. Above 4½ Pts.	8 Pts.
Axle Lubricant Type	30-90 Wt. depending on application	30 Wt.	30-90 Wt. depending on application	30-90 Wt. depending on application	Type "F" ATF

*Can be higher depending on load distribution
**Maximum input continuous torque.

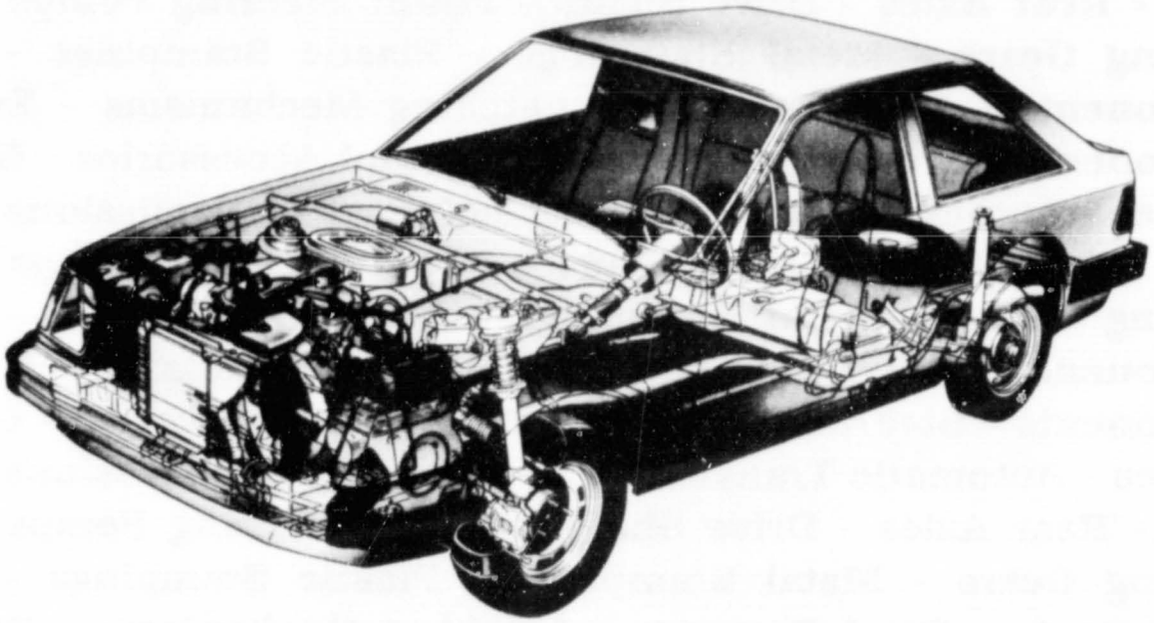


For Engineering Assistance, or for Complete Details

WRITE: Sales Department
Spicer Clutch Division
Dana Corporation
P.O. Box 191
Auburn, Indiana 46706
Tel. 219-925-3800

Spicer DANA

Automotive Components



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300 Renaissance Center, Suite 1800
P.O. Box 43338
Detroit, Michigan 48243
Telephone 313/568-7435

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Proper axle selection is particularly important when considering the more powerful engines, greater loads and higher speeds of today's trucks. And International axles are designed and engineered to meet those demands.

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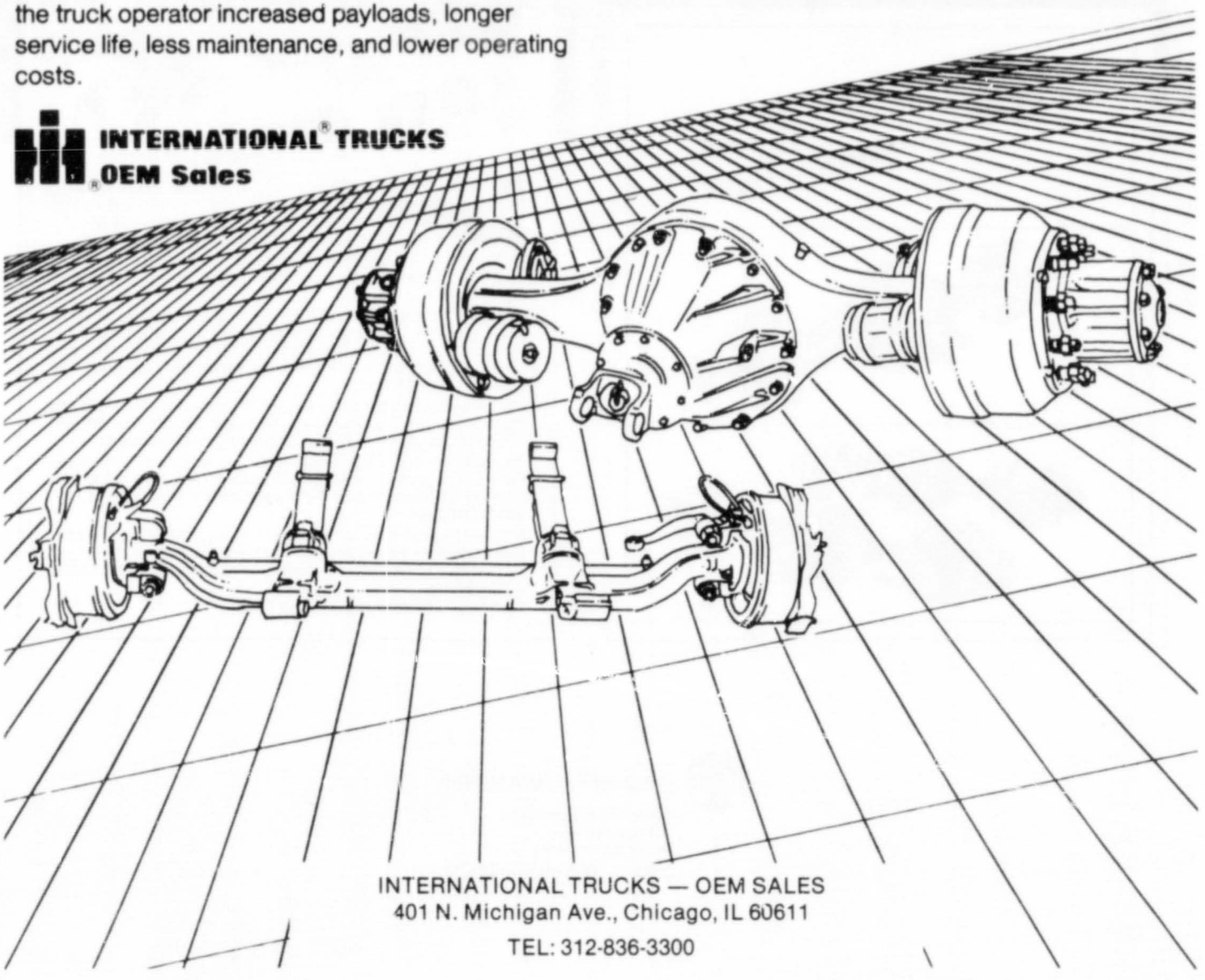

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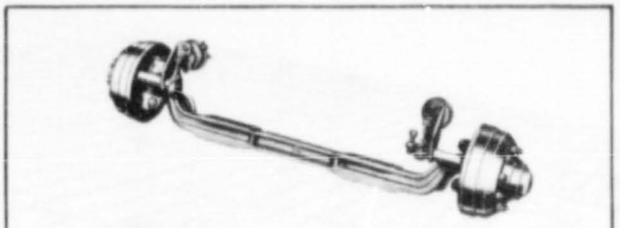
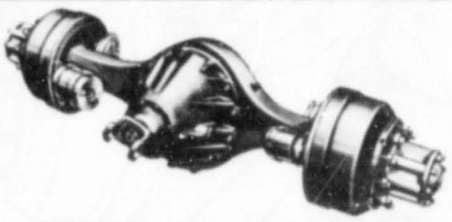
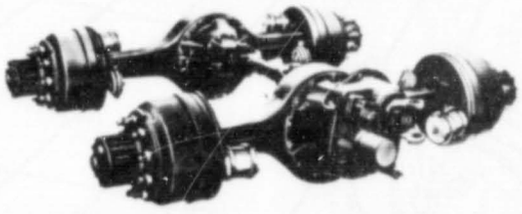
Rockwell

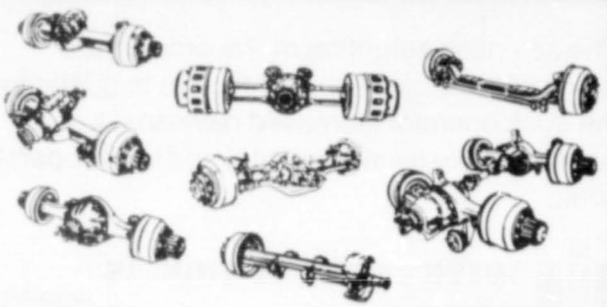
SPECIFICATIONS FOR WORLDWIDE TRUCK & TRACTOR AXLE APPLICATIONS







PRODUCTS YOU CAN TRUST... BACKED UP BY THE MOST EXPERIENCED TEAM OF EXPERTS IN THE INDUSTRY TO ASSURE YOU TOP PRODUCTIVITY AND PERFORMANCE.



The Rockwell line of heavy-duty highway products is backed up by the district teams of experts across the United States and Canada to help you select, specify and maintain all Rockwell components for heavy-duty trucks, tractors and trailers.

Each team of Rockwell international district managers is made up of a Field Relations representative and a Technical Services representative.

All Field Relations personnel are experts and are trained to assist you in the correct selection of axles, brakes, U-Joints, suspension springs and other Rockwell components for all types of heavy-duty trucks, tractors and trailers. They serve the fleet operators and OEM dealers and branches.

The Technical Services personnel are also experts in their field and they are available to advise you in the proper maintenance and service techniques for your Rockwell International Components.

Rockwell Service Parts representatives, serving the Rockwell Parts Distributors are strategically located across the nation and there are Parts Distribution Centers in Florence, Kentucky and Haywood, California.

All of these people are backed by one of the world's most experienced group of automotive engineers and the staff of the largest independent heavy-duty automotive component Technical Center in the country.

Need Help? Talk With The Rockwell Team.

Rockwell International

Automotive Operations

2135 West Maple Road

Troy, Michigan U.S.A. 48084

Tel. 313-435-1000

ROCKWELL FRONT AXLES

AXLE SERIES	RATING(1) POUNDS (Kg)	HUBS AND DRUMS INCHES (mm)	BRAKE(2) TYPE AND SIZES INCHES (mm)
FC-931	8,000 (3629)	10 Stud 11.25" B.C. (10 Stud 285.8 B.C.)	15" x 3.5" "T" (381 x 89 "T") 15" x 3.5" Stopmaster (381 x 89 Stopmaster)
FD-931	9,000 (4082)	10 Stud 11.25" B.C. (10 Stud 285.8 B.C.)	15" x 4" "T" (381 x 102 "T") 15" x 4" Stopmaster (381 x 102 Stopmaster)
FF-971 "Center Point"	12,000 (5443)	10 Stud 11.25" B.C. (10 Stud 285.8 B.C.)	15" x 4" "T" (381 x 102 "T") 15" x 4" Stopmaster (381 x 102 Stopmaster)
FF-931	12,000 (5443)	10 Stud 11.25" B.C. (10 Stud 285.8 B.C.)	15" x 4" "T" (381 x 102 "T") 15" x 4" Stopmaster (381 x 102 Stopmaster) 15" x 5" Stopmaster (381 x 127 Stopmaster) 16.5" x 5" Cam-Master "Q" (419 x 127 Cam-Master "Q")
FF-931-A (Aluminum Beam)	12,000 (5443)	10 Stud 11.25" B.C. (10 Stud 285.8 B.C.)	15" x 4" "T" (381 x 102 "T") 15" x 4" Stopmaster (381 x 102 Stopmaster)
FF-932	13,200 (5987)	10 Stud 11.25" B.C. (10 Stud 285.8 B.C.)	15" x 5" Stopmaster (381 x 127 Stopmaster) 16.5" x 5" Cam-Master "Q" (419 x 127 Cam-Master "Q")
FL-931	16,000—18,000 (7257—8165) and 20,000 (9072)	10 Stud 11.25" B.C. (10 Stud 285.8 B.C.) and 10 Stud 13.19" B.C. (10 Stud 335 B.C.)	15" x 6" Stopmaster (381 x 152 Stopmaster) 16.5" x 6" Cam-Master "Q" (419 x 152 Cam-Master "Q") 17" x 6" Stopmaster (432 x 152 Stopmaster)
FL-951	22,000 (9979)	10 Stud 11.25" B.C. (10 Stud 285.8 B.C.) and 10 Stud 13.19" B.C. (10 Stud 335 B.C.)	17" x 6" Stopmaster (432 x 152 Stopmaster)
FU-910	28,000 (12701)	10 Stud 13.19" B.C. (10 Stud 335 B.C.)	20.25" x 5" Cam-Master (514 x 127 Cam-Master)

ROCKWELL FRONT DRIVING AXLES

AXLE SERIES	CAPACITY POUNDS (Kg)	TRACK INCHES (mm)	BRAKES INCHES (mm)	RATIOS
FDS-75	7,500 (3402)	75.4 (1864.4)	15 x 3 Hyd. (381 x 76)	6.14, 6.83, 7.17
FDS-90	9,000 (4082)	74.2 (1884.7) 76.0 (1930.4)	15 x 4 Stopmaster, Hyd. (381 x 101) 15 x 4 Stopmaster, Air (381 x 101)	6.14, 6.83, 7.17
FDS-1600	16,000 (7258)	79.0 (2006.6)	17.25 x 4 Stopmaster, Air or Hyd. (438 x 101)	6.167, 6.5, 6.8, 7.2, 7.6, 7.8, 8.2
FDS-1800	18,000 (8165)-21,000 (9525)	76.3 (1938.0)	17 x 6 Stopmaster, Air or Hyd. (432 x 152)	**Single Reduction:** 4.11, 5.286, 6.143, 6.833, 7.4 **Double Reduction:** 4.41, 4.77, 5.54, 5.91, 6.28, 6.38, 7.03, 7.09, 7.78, 8.65, 9.76, 11.36, 12.82, 14.53
FDS-2100(3)	21,300 (9525)	76.3 (1938.0)	17 x 6 Stopmaster, Air or Hyd. (432 x 152)	**Single Reduction:** 4.11, 4.33, 4.63, 4.88, 5.25, 6.14, 6.83, 7.4 **Double Reduction:** 5.91, 6.38, 7.03, 7.79, 8.65, 9.76

Contact Rockwell Truck Axle Engineering Department for available tire sizes, track, and steering arms.

(1) Permitted use of axles and components, including capacity ratings where stated, vary with application and service. Installation must be approved by Rockwell Truck Axle Engineering Department.

(2) These are general guidelines; selections vary with application and duty cycle, approval of other ratings, brake sizes . . . etc must be obtained from Rockwell Brake Division Application Dept.

(3) 35° Turning angle.

Rockwell International
Automotive Operations
2135 West Maple Road
Troy, Michigan U.S.A. 48084
Tel. 313-435-1000

ROCKWELL SINGLE REAR AXLES

Basic Axle Series	Rating* Pounds (Kg)	GCW* Pounds (Kg) Highway** Turnpike	Highway** Paved	Description	Housing Size at Spring Seat	Housing Wall Thickness at Spring Seat	Standard Ratios (Others Available)	Brake Types and Sizes*** inches (mm)	Hubs & Drums inches (mm)
D-140	13,000 (5897)	29,000 (13154)	29,000 (13154)	Hypoid Sing. Red.	4.25 x 3.8125 (105 x 96.8)	.31 (7.8)	**5.29, 5.83, 6.2, 6.8, 7.2**		
F-105	15,000 (6804)	35,000 (15876)	34,000 (15876)	Hypoid Sing. Red.	4.25 x 3.8125 (108 x 96.8)	.375 (9.5)	**5.29, 5.83, 6.14, 6.83, 7.17**	15" x 5" Stopmaster (381 x 127 Stopmaster)	
H-172	17,500 (7938)	50,000 (22680)	50,000 (22680)	Hypoid Sing. Red.	5 x 4.25 (127 x 108)	.375 (9.5)	**3.73, 4.62, 4.89, 5.29, 5.83, 6.17, 6.83, 7.17, 7.8, 8.2**	16.5" x 5" Cam-Master (419 x 127 Cam-Master) 16.5" x 6" Cam-Master, 15" x 6" Stopmaster (419 x 152 Cam-Master), (381 x 152 Stopmaster)	10 Stud — 11.25" B.C. (10 Stud — 285.8 B.C.)
L-177	18,500 (8391)	50,000 (22680)	50,000 (22680)	Hypoid Sing. Red.	5 x 4.25 (127 x 108)	.375 (9.5)	**3.73, 4.62, 4.89, 5.29, 5.83, 6.17, 6.83, 7.17, 7.8, 8.2**	16.5" x 7" Cam-Master, 15" x 7" Stopmaster (419 x 178 Cam-Master), (381 x 178 Stopmaster)	10 Stud — 11.25" B.C. (10 Stud — 285.8 B.C.)
Q-145	22,000 (9979)	60,000 (27216)	60,000 (27216)	Hypoid Sing. Red.	5 x 4.25 (127 x 108)	.4375 (11.1)	**4.63, 5.29, 6.17, 7.8**	16.5" x 7" Cam-Master, 15" x 7" Stopmaster (419 x 178 Cam-Master), (381 x 178 Stopmaster)	10 Stud — 11.25" B.C. (10 Stud — 285.8 B.C.)
Y-155	23,000 (10433)	75,000 (34019)	65,000 (29484)	Hypoid Sing. Red.	5.25 x 4.625 (133 x 117)	.50 (12.7)	**4.11, 4.63, 4.89, 5.29, 6.17, 7.83, 7.4**	16.5" x 7" Cam-Master, 15" x 7" Stopmaster (419 x 178 Cam-Master), (381 x 178 Stopmaster)	10 Stud — 11.25" B.C. (10 Stud — 285.8 B.C.)
R-255	23,000 (10433)	85,000 (38555)	85,000 (38555)	Hyp. Hel. Dble. Red.	5.25 x 4.625 (133 x 117)	.50 (12.7)	**5.91, 7.79, 9.76, 10.48, 11.36**	16.5 x 7" Cam-Master, 15" x 7" Stopmaster (419 x 178 Cam-Master), (381 x 178 Stopmaster)	10 Stud — 11.25" B.C. (10 Stud — 285.8 B.C.)
RL-170(2)	20,000 (9072)	110,000 (49895)	85,000 (38555)	Hypoid Sing. Red.	5.25 x 4.625 (133 x 117)	.375 (9.5)	**3.55, 3.7, 3.9, 4.11, 4.33, 4.63, 4.88, 5.29, 5.86, 6.14, 6.83, 7.4**	16.5" x 7" Cam-Master, 15" x 7" Stopmaster (419 x 178 Cam-Master), (381 x 178 Stopmaster)	10 Stud — 11.25" B.C. (10 Stud — 285.8 B.C.)
R-170(2)	23,000 (10433)	110,000 (49895)	85,000 (38555)	Hypoid Sing. Red.	5.25 x 4.625 (133 x 117)	.50 (12.7)	**3.55, 3.7, 3.9, 4.11, 4.33, 4.63, 4.88, 5.29, 5.86, 6.14, 6.83, 7.4**	16.5" x 7" Cam-Master, 15" x 7" Stopmaster (419 x 178 Cam-Master), (381 x 178 Stopmaster)	10 Stud — 11.25" B.C. (10 Stud — 285.8 B.C.)
R-270	23,000 (10433)	110,000 (49895)	90,000 (40824)	Hyp. Hel. Dble. Red.	5.25 x 4.625 (133 x 117)	.50 (12.7)	**5.49, 6.10, 6.43, 6.86, 7.23, 7.84, 9.11, 10.13, 10.97**	16.5" x 7" Cam-Master, 15" x 7" Stopmaster (419 x 178 Cam-Master), (381 x 178 Stopmaster)	10 Stud — 11.25" B.C. (10 Stud — 285.8 B.C.)
S-175	26,000 (11793)	110,000 (49895)	85,000 (38555)	Hypoid Sing. Red.	5.50 x 5.50 (140 x 140)	.56 (14.2)	**3.7, 3.9, 4.11, 4.33, 4.63, 4.88, 5.29, 6.14, 6.83, 7.4**	16.5" x 7" Cam-Master, 18" x 7" Cam-Master (419 x 178 Cam-Master), (457 x 178 Cam-Master)	10 Stud — 11.25" B.C., 10 Stud — 13.19" B.C. (10 Stud — 285.8 B.C.), (10 Stud — 335 B.C.)
U-170	30,000, 36,000(A) (13608, 16329)	110,000 (49895)	85,000 (38555)	Hypoid Sing. Red.	5.50 x 5.50 (140 x 140)	.56 (14.2)	**3.7, 3.9, 4.11, 4.33, 4.63, 4.88, 5.29, 6.14, 6.83, 7.4**	16.5" x 7" Cam-Master, 18" x 7" Cam-Master (419 x 178 Cam-Master), (457 x 178 Cam-Master)	10 Stud — 11.25" B.C., 10 Stud — 13.19" B.C. (10 Stud — 285.8 B.C.), (10 Stud — 335 B.C.)
U-240	25,000, 36,000(A) (13154, 16329)	85,000 (38555)	85,000 (38555)	Hyp. Hel. Dble. Red.	5.50 x 5.50 (140 x 140)	.56 (14.2)	**5.91, 6.38, 7.21, 7.79, 8.86, 9.76, 11.36**	16.5" x 7" Cam-Master, 18" x 7" Cam-Master (419 x 178 Cam-Master), (457 x 178 Cam-Master)	10 Stud — 11.25" B.C., 10 Stud — 13.19" B.C. (10 Stud — 285.8 B.C.), (10 Stud — 335 B.C.)
U-340	29,000, 36,000(A) (13608, 16329)	85,000 (38555)	85,000 (38555)	Hyp. Hel. 2-Speed	5.50 x 5.50 (140 x 140)	.56 (14.2)	**4.78/6.38, 6.25/8.38**	16.5" x 7" Cam-Master, 18" x 7" Cam-Master (419 x 178 Cam-Master), (457 x 178 Cam-Master)	10 Stud — 11.25" B.C., 10 Stud — 13.19" B.C. (10 Stud — 285.8 B.C.), (10 Stud — 335 B.C.)
U-270	30,000, 36,000(A) (13608, 16329)	110,000 (49895)	90,000 (49824)	Hyp. Hel. Dble. Red.	5.50 x 5.50 (140 x 140)	.56 (14.2)	**5.49, 6.10, 6.43, 6.86, 7.23, 7.84, 9.11, 10.13, 10.97**	16.5" x 7" Cam-Master, 18" x 7" Cam-Master (419 x 178 Cam-Master), (457 x 178 Cam-Master)	10 Stud — 11.25" B.C., 10 Stud — 13.19" B.C. (10 Stud — 285.8 B.C.), (10 Stud — 335 B.C.)
W-170	38,000, 42,000(A) (17237, 19051)	110,000 (49895)	85,000 (38555)	Hypoid Sing. Red.	6.50 x 5.50 (165 x 140)	.63 (16.0)	**3.7, 3.9, 4.11, 4.33, 4.63, 4.88, 5.29, 6.14, 6.83, 7.4**	16.5" x 7" Cam-Master, 18" x 7" Cam-Master (419 x 178 Cam-Master), (457 x 178 Cam-Master)	10 Stud — 11.25" B.C., 10 Stud — 13.19" B.C. (10 Stud — 285.8 B.C.), (10 Stud — 335 B.C.)
W-270	38,000, 42,000(A) (17237, 19051)	110,000 (49895)	90,000 (49824)	Hyp. Hel. Dble. Red.	6.50 x 5.50 (165 x 140)	.63 (16.0)	**5.49, 6.10, 6.43, 6.86, 7.23, 7.84, 9.11, 10.13, 10.97**	16.5" x 7" Cam-Master, 18" x 7" Cam-Master (419 x 178 Cam-Master), (457 x 178 Cam-Master)	10 Stud — 11.25" B.C., 10 Stud — 13.19" B.C. (10 Stud — 285.8 B.C.), (10 Stud — 335 B.C.)

ROCKWELL SINGLE REAR AXLES FOOTNOTES:

*Permitted use of axles and components, including capacity ratings where stated, vary with application and service. Installation must be approved by Rockwell Truck Axle Engineering Department.

**Ratings shown are for paved roads for level to rolling terrain.

***These are general guidelines. Selections vary with application and duty cycle. Approval of other rating, brake sizes, etc., must be obtained from Rockwell Brake Division Application Dept.

(A) Airport refueler.

(2) Weight saving aluminum carrier castings available.

Rockwell International
Automotive Operations
2135 West Maple Road
Troy Michigan U.S.A. 48084
Tel. 313-435-1000

ROCKWELL TANDEM AXLES

Basic Axle Series	Rating* Pounds (Kg)	GCW*-Pounds (Kg) Highway: Turnpike	GCW*-Pounds (Kg) Highway: Paved**	Inter-Axle Differential	Housing: Size at Spring Seat	Housing: Wall Thickness at Spring Seat	Standard Ratios (Others Available)	Brake Types and Sizes*** Inches (mm)	Hubs & Drums Inches (mm)
HYPOID SINGLE REDUCTION									
SLHD(2)	34,000 (15422)	110,000 (49895)	85,000 (38555)	Yes	5 x 4.25 (127 x 108)	.375 (9.5)	3.55, 3.7, 3.9, 4.11, 4.33, 4.44, 4.63, 4.88, 5.29, 5.83, 6.17, 6.83, 7.2, 7.8	16.5" x 7" Cam-Master, 15" x 7" Stopmaster (419 x 178 Cam-Master), (381 x 178 Stopmaster)	10 Stud — 11.25" B.C. (10 Stud — 285.8 B.C.)
SQHD(1)(2)	38,000 (17237)	110,000 (49895)	85,000 (38555)	Yes	5 x 4.25 (127 x 108)	.4375 (11.1)	3.55, 3.7, 3.9, 4.11, 4.33, 4.44, 4.63, 4.88, 5.29, 5.83, 6.17, 6.83, 7.2, 7.8	16.5" x 7" Cam-Master, 15" x 7" Stopmaster (419 x 178 Cam-Master), (381 x 178 Stopmaster)	10 Stud — 11.25" B.C. (10 Stud — 285.8 B.C.)
SQHP(2)	40,000 (18144)	143,000 (64864)	110,000 (49895)	Yes	5.25 x 4.625 (133 x 117)	.375 (9.5)	*3.55, 3.7, 3.9, 4.11, 4.33, 4.44, 4.63, 4.88, 5.29, 6.17, 6.83	16.5" x 7" Cam-Master, 15" x 7" Stopmaster (419 x 178 Cam-Master), (381 x 178 Stopmaster)	10 Stud — 11.25" B.C. (10 Stud — 285.8 B.C.)
SSHD(1)	44,000 (19958) 46,000 (20866)(3)	154,000 (69853)	130,000 (58967)	Yes	5.25 x 4.625 (133 x 117)	.50 (12.7)	3.9, 4.11, 4.33, 4.63, 4.89, 5.29, 5.57, 6.17, 6.83, 7.4	16.5" x 7" Cam-Master, 15" x 7" Stopmaster (419 x 178 Cam-Master), (381 x 178 Stopmaster)	10 Stud — 11.25" B.C. (10 Stud — 285.8 B.C.)
SR-170	46,000 (20866)	200,000 (90718)	170,000 (77111)	Yes	5.25 x 4.625 (133 x 117)	.50 (12.7)	3.7, 4.11, 4.33, 4.63, 4.88, 5.29, 6.14, 6.83, 7.4	16.5" x 7" Cam-Master, 15" x 7" Stopmaster (419 x 178 Cam-Master), (381 x 178 Stopmaster)	10 Stud — 11.25" B.C. (10 Stud — 285.8 B.C.)
STHD	50,000 (22680)	154,000 (69864)	130,000 (58967)	Yes	5.50 x 5.50 (140 x 140)	.56 (14.2)	4.11, 4.63, 4.89, 5.29, 5.57, 6.17, 6.83, 7.4	16.5" x 7" Cam-Master, 18" x 7" Cam-Master (419 x 178 Cam-Master), (457 x 178 Cam-Master)	10 Stud — 11.25" B.C. (10 Stud — 285.8 B.C.)
SUHD	58,000 (26308)	154,000 (69864)	130,000 (58967)	Yes	5.50 x 5.50 (140 x 140)	.56 (14.2)	4.11, 4.63, 4.89, 5.29, 5.57, 6.17	16.5" x 7" Cam-Master, 18" x 7" Cam-Master (419 x 178 Cam-Master), (457 x 178 Cam-Master)	10 Stud — 11.25" B.C. 10 Stud — 13.19" B.C. (10 Stud — 285.8 B.C.), (10 Stud — 335 B.C.)
SU-170	58,000 (26308)	200,000 (90718)	170,000 (77111)	Yes	5.50 x 5.50 (140 x 140)	.56 (14.2)	3.7, 4.11, 4.33, 4.63, 4.88, 5.29, 6.14, 6.83, 7.4	16.5 x 7" Cam-Master, 18" x 7" Cam-Master (419 x 178 Cam-Master), (457 x 178 Cam-Master)	10 Stud — 11.25" B.C. 10 Stud — 13.19" B.C. (10 Stud — 285.8 B.C.), (10 Stud — 335 B.C.)
SW-170	70,000 (31751)	200,000 (90718)	170,000 (77111)	Yes	6.50 x 5.50 (165 x 140)	.63 (16.0)	3.7, 4.11, 4.33, 4.63, 4.88, 5.29, 6.14, 6.83, 7.4	16.5" x 7" Cam-Master, 18" x 7" Cam-Master (419 x 178 Cam-Master), (457 x 178 Cam-Master)	10 Stud — 11.25" B.C. 10 Stud — 13.19" B.C. (10 Stud — 285.8 B.C.), (10 Stud — 335 B.C.)
HYPOID-HELICAL DOUBLE REDUCTION									
SRD-DD(1)	44,000 (19958)		100,000 (45359)	Opt	4.875 x 4.875 (124 x 124)	.50 (12.7)	5.78, 6.44, 7.54, 9.21	16.5" x 7" Cam-Master, 15" x 7" Stopmaster (419 x 178 Cam-Master), (381 x 178 Stopmaster)	10 Stud — 11.25" B.C. (10 Stud — 285.8 B.C.)
SR-270	46,000 (20866)	210,000 (95254)	180,000 (81647)	Opt	5.25 x 4.625 (133 x 117)	.50 (12.7)	5.49, 6.10, 6.43, 6.86, 7.23, 7.84, 9.11, 10.13, 10.97	16.5" x 7" Cam-Master, 15" x 7" Stopmaster (419 x 178 Cam-Master), (381 x 178 Stopmaster)	10 Stud — 11.25" B.C. (10 Stud — 285.8 B.C.)
STD-DD	50,000 (22680)		100,000 (45359)	Opt	5.125 x 5.125 (130 x 130)	.625 (15.9)	5.78, 6.44, 6.8, 7.49	16.5" x 7" Cam-Master, 18" x 7" Cam-Master (419 x 178 Cam-Master), (457 x 178 Cam-Master)	10 Stud — 11.25" B.C. 10 Stud — 13.19" B.C. (10 Stud — 285.8 B.C.), (10 Stud — 335 B.C.)
SUD-DD(1)	58,000 (26308)		150,000 (68039)	Opt	5.50 x 5.50 (140 x 140)	.688 (17.4) Top & .50 (12.7) other sides	6.32, 7.24, 7.98, 9.00, 10.14	16.5" x 7" Cam-Master, 18" x 7" Cam-Master (419 x 178 Cam-Master), (457 x 178 Cam-Master)	10 Stud — 11.25" B.C. 10 Stud — 13.19" B.C. (10 Stud — 285.8 B.C.), (10 Stud — 335 B.C.)
SU-270	58,000 (26308)	210,000 (95254)	180,000 (81647)	Yes	5.50 x 5.50 (140 x 140)	.56 (14.2)	5.49, 6.10, 6.43, 6.86, 7.23, 7.84, 9.11, 10.13, 10.97	16.5" x 7" Cam-Master, 18" x 7" Cam-Master (419 x 178 Cam-Master), (457 x 178 Cam-Master)	10 Stud — 11.25" B.C. 10 Stud — 13.19" B.C. (10 Stud — 285.8 B.C.), (10 Stud — 335 B.C.)
SW-270(1)	72,000 (31751)	210,000 (95254)	180,000 (81647)	Yes	6.50 x 5.50 (165 x 140)	.63 (16)	5.49, 6.10, 6.43, 6.86, 7.23, 7.84, 9.11, 10.13, 10.97	16.5" x 7" Cam-Master, 18" x 7" Cam-Master (419 x 178 Cam-Master), (457 x 178 Cam-Master)	10 Stud — 11.25" B.C. 10 Stud — 13.19" B.C. (10 Stud — 285.8 B.C.), (10 Stud — 335 B.C.)
HYPOID SPUR DOUBLE REDUCTION									
SFD-DD-4640(1)	65,000 (29484)		180,000 (81647)	Opt	5.50 x 5.50 (140 x 140)	.750 (19) Top & Bot. .625 (15.9) sides	5.76, 6.58, 7.56, 8.08, 9.03, 10.16	16.5" x 7" Cam-Master, 18" x 7" Cam-Master (419 x 178 Cam-Master), (457 x 178 Cam-Master)	10 Stud — 11.25" B.C. 10 Stud — 13.19" B.C. (10 Stud — 285.8 B.C.), (10 Stud — 335 B.C.)

ORIGINAL PAGE IS
OF POOR QUALITY

ROCKWELL TANDEM AXLES

HYPOID SINGLE REDUCTION

HYPOID-HELICAL DOUBLE REDUCTION

HYPOID SPUR DOUBLE REDUCTION

*Permitted use of axles and components, including capacity ratings where stated, vary with application and service. Installation must be approved by Rockwell Truck Axle Engineering Department.

**Ratings shown are for paved roads for level to rolling terrain.

***These are general guidelines, selections vary with application and duty cycle. Approval of other rating, brake sizes ... etc., must be obtained from Rockwell Brake Division Application Dept.

(1) Wide Track available.

(2) Weight saving aluminum carrier castings available.

(3) Optional bolted-in ring gear.

* 3.55 ratio not available with aluminum carrier casting.

Rockwell International
Automotive Operations
2135 West Maple Road
Troy, Michigan U.S.A. 48084
Tel. 313-435-1000

BATTERY CHARGERS

ON-BOARD and OFF-BOARD

(CODE **BC**)

POWER SYSTEMS

ALTURDYNE

Alturdyne was founded in 1971 to package small gas turbine systems for the commercial and governmental marketplaces. Hundreds of these packages are now in operation nationally and internationally. Since 1971 Alturdyne has expanded its staff to nearly 100 people operating at three San Diego area facilities. Their expertise extends to reciprocating engine systems, sound attenuation and many related packaging and engineering fields for stationary, portable and airborne applications.

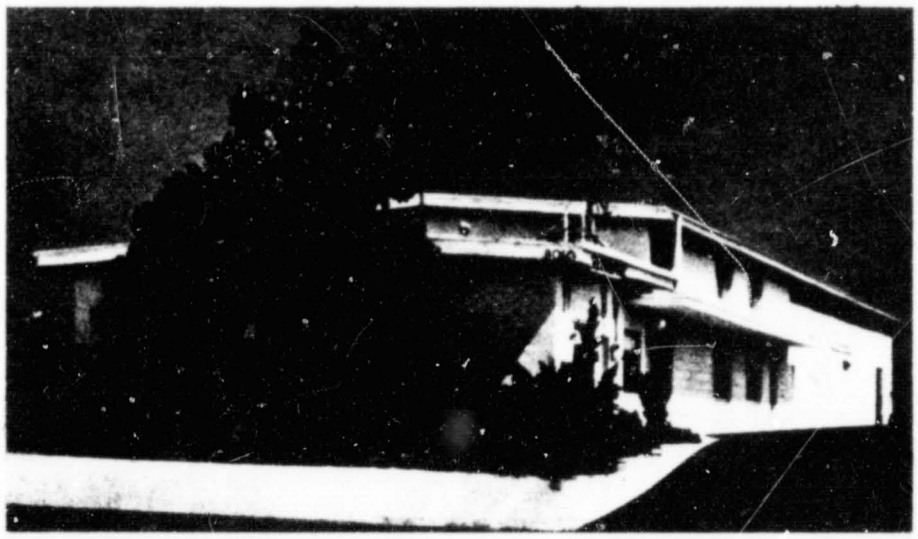
Specializing in custom and engineered systems, Alturdyne has the unique capability to assist its customers in selecting and applying the optimum prime mover for each application.

Alturdyne has the proven capability to package gas turbine, rotary, and reciprocating engines for a wide variety of applications: Generator Sets, Compressors, Hydraulic Start Systems, High-Speed Reduction Drives, Air-Bleed Systems, Fluid Pumpers, Fan Drives, Mechanical Drives, Ground Power Units and Air-Transportable Power Systems.

Alturdyne is committed to the advancement of the state-of-the-art in power systems packaging and application and to making this technology available to new areas of industry and commerce.



FRANK VERBEKE
President

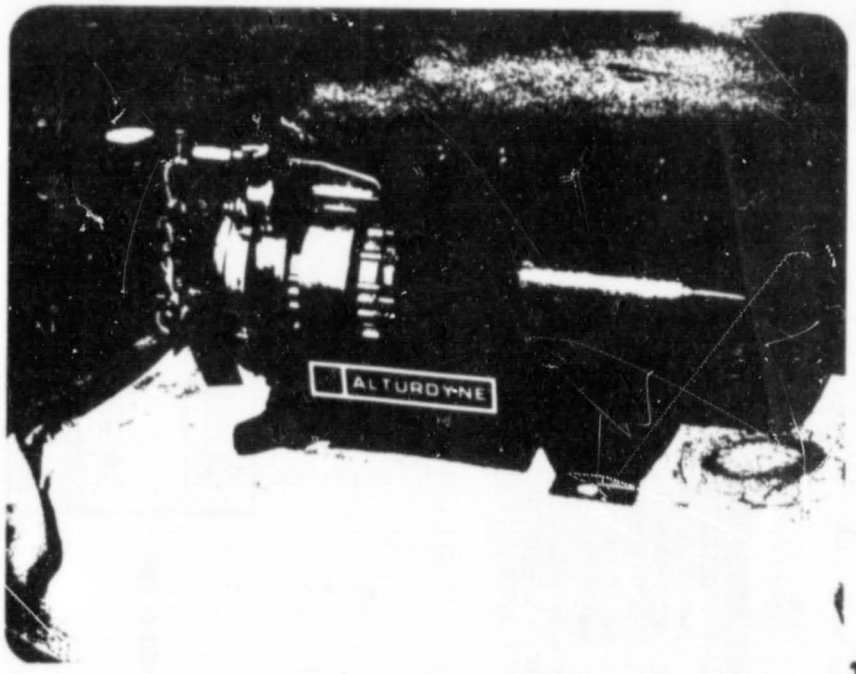


For additional information, write or call:

ALTURDYNE
8050 ARMOUR STREET,
SAN DIEGO, CA. 92111
(714) 565-2131

Branch offices in Los Angeles. San Francisco and Washington, D.C.

SP-440 ROTARY GASOLINE ENGINE



10 KW

Silent
Rugged
Compact
Economic
Light Weight

The SP440 rotary gasoline engine is powerful and reliable. Its exceptional smoothness and low fuel consumption make it an ideal power plant for industrial and agricultural uses such as generators, pumps, compressors, tractors and all terrain vehicles.

SPECIFICATIONS

Max. corrected BHP: 30 BHP @ 5500 RPM (SAE J 607)

Construction: Rotary internal combustion gasoline (Wankel type) engine

Cooling: Air cooling with centrifugal flow blower, oil cooled rotor.

Displacement: 440 cc (26.9 cu. in.).

Compression ratio: 7.6:1

Bearings: Steel-backed aluminium bearings.

Spark plug: One; surface gap M14 x 1.25

Ignition: by flywheel magneto generator of 12 V/100W, with fixed ignition timing.

Fuel feed: By gravity or by pulse pump, or by 12V electric pump.

Carburetor: According to application: Float or diaphragm type.

Air cleaner: Dry air cleaner.

Lubrication: Positive displacement gears, rotor-type oil pump. Full-pressure lubrication to all bearings. Full-flow oil cooling.

Oil Filter: Automotive-type full-flow with internal by-pass valve.

Governor: Centrifugal, constant or variable speed governor for all requirements in 3000-5000 RPM range. Meets specification for both civil and military applications.

Starting system: Electric and/or hand recoil starter.

Power take-off: PTO shaft extension 1-1/8 in dia. x 3.5 in, or 30 mm dia. x 30 mm taper 1:10

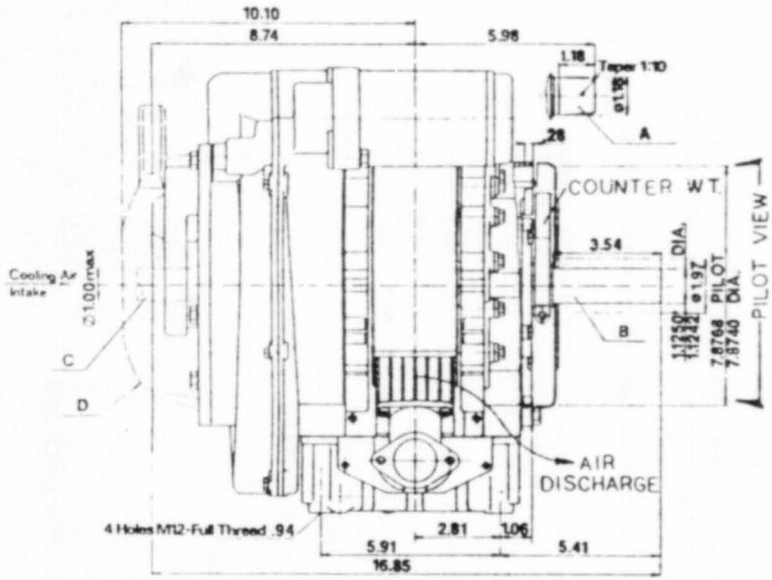
Battery: 12V.

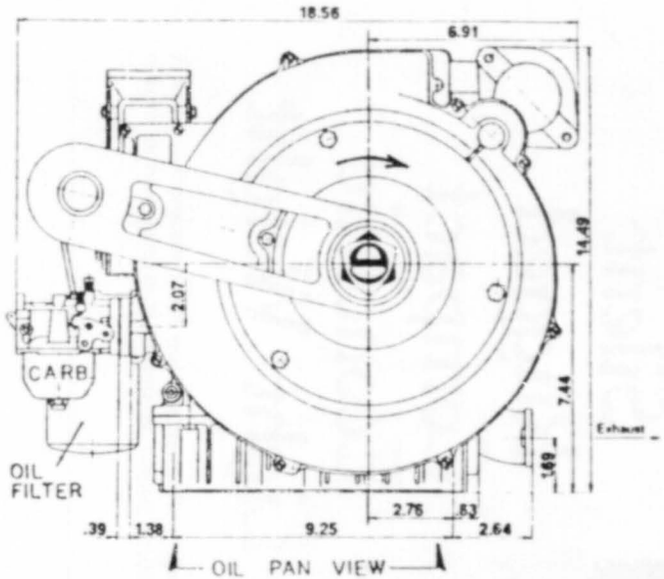
Weight (net dry): 30 kg. (66 lbs.)

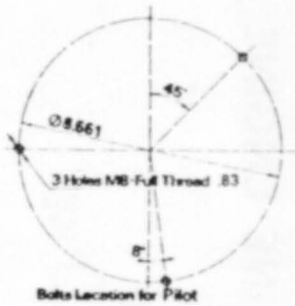
For additional information, write or call:

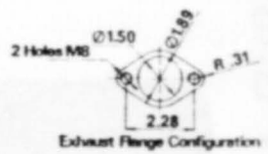
ALTURDYNE
8050 ARMOUR STREET,
SAN DIEGO, CA. 92111
(714) 565-2131

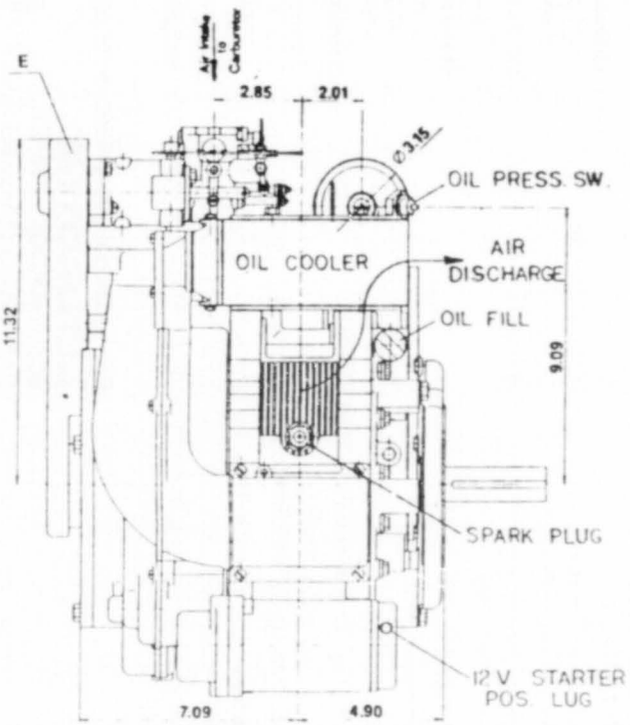
Branch offices in Los Angeles. San Francisco and Washington, D.C.

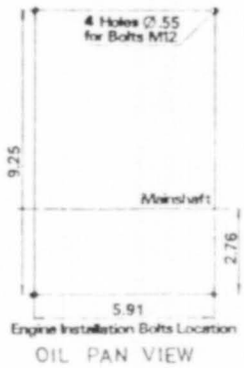












DESIGN PARAMETERS

WEIGHT - 70 LBS. NOMINAL
OIL SUMP - @ 6 PINTS
SFC - .63 LBS/BHPH
MAX. SPEED - 6000 RPM
IDLE SPEED - @ 1200 RPM
MAX. AIRFLOW - 450 CFM
MAX. AIRFLOW RES. - 1" H_2O
CARB. AIRFLOW - 61 CFM
EGT - 1100°F

ACCESSORIES

MUFFLER AND FLEX
2 WHEEL DOLLY
OIL BATH AIR CLEANER
BATTERY, CABLES
LPG SYSTEM
GAUGES AND METERS

Dimensions in inch except the threads.

OPTIONAL CONFIGURATIONS:

A. Mainshaft Extension-Option C11
B. Mainshaft Extension-Option C22
C. Power Take-off Extension (Without Manual Starter)-Option C23
D. Manual Starter-Optional
E. Speed Governor-Optional

For additional information, write or call:

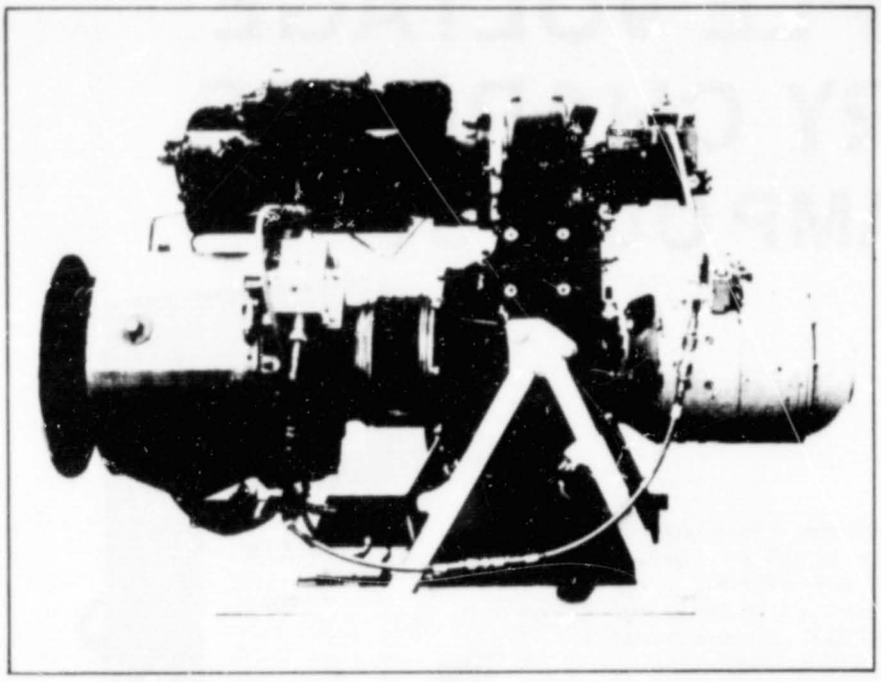
ALTURDYNE
8050 ARMOUR STREET,
SAN DIEGO, CA. 92111
(714) 565-2131

ALTURDYNE SAN DIEGO CALIFORNIA

DRAWING TITLE

SP 440 ROTARY
GASOLINE INDUSTRIAL ENGINE

SIZE	CODE IDENT NO	DRAWING NO.
A	52515	



Typical radial gas turbine engine coupled through a reduction gearbox to a high-speed 28 volt D.C. generator.

GAS TURBINE BATTERY CHARGING UNITS for ELECTRIC VEHICLES

Alturdyne is a custom assembler of diesel-fueled gas turbine-driven generator systems from 10 to 125 KW. Units from 30 KW through 125 KW are assembled using Solar Turbines International's "Titan" series engine. Smaller units are under development and are expected to be available within a year.

Gas turbine engines are unique in many ways. It is possible, for instance, to assemble a single lightweight unit with multiple outputs: A.C. power, D.C. power, hydraulics, bleed and/or compressed air. Other advantages over conventional reciprocating equipment include:

Lighter Weight — Much lighter in weight than reciprocating units. A basic 150-horsepower engine weighs less than 50 pounds.

Smaller Size — Much smaller.

Low Installation Costs — Easy to install!

Low Vibration — No vibration isolation required.

Multiple Fuels — Will operate on many heating oils, diesel fuel, kerosene, etc.

Low Maintenance — Little attention required for maximum reliability. Lube oil consumption is negligible and does not degradate with time.

Atmospheric Pollution — Turbines are clean-burning, emit no visible smoke and meet published anti-pollution requirements.

No Auxiliary Heating — Turbines do not require auxiliary heating for reliable starting in extreme temperatures.

Maximum Reliability — No liquid cooling system.

Easy Starting — Starting is fully automatic and controlled so that the unit may produce power in seconds.

Superior Transient Response — The turbine possesses a higher rotating moment of inertia than reciprocating units so a better dynamic response to load charges is achieved.

Alturdyne can manufacture a gas turbine-driven battery charging generator set to your specifications.

ALTURDYNE

8050 Armour Street • San Diego, California 92111
• 714/565-2131

ORIGINAL PAGE IS
OF POOR QUALITY

MULTIPLE VOLTAGE BATTERY CHARGERS

- 50 AMP OUTPUT-

Ideal for . . .

- **Lift Truck Service**
- **Short Term Rentals**
- **Battery Service**
- **Battery Charger Loan Unit**

These versatile chargers are capable of charging a wide range of battery voltages and battery capacities up to 850 AH. Controls include a battery voltage selector switch, a rate adjustment switch with 6 charging rate steps within each battery voltage setting and a timer to terminate the charge at any time up to 24 hours. Charging current will taper approximately 50% from the original setting on a discharged battery. This increases the charging capacity of the chargers but requires attention to prevent overcharging. For this reason, the chargers should be operated by qualified personnel and used only for short term service on any one battery.



Dimensions
15" W x 22" H x 14" D

Model	Battery Cells (lead-acid)*	Output D-C Amp	A-C Input 1 phase	Wt.
Universal 1850	6, 12, 15, 16, 18	50	115 V, 60 Hz, 20 A	100
Universal 2450	6, 12, 15, 16, 18, 24	50	230 V, 60 Hz, 16 A	140

MOBILE STYLE
Add Suffix "M" to Model



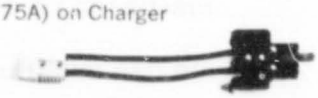
Specifications

- Battery Voltage Selector Switch—adjustment for number of cells to be charged
- Rate Adjustment Switch—6 charging rate steps within each cell group
- 24 Hr Timer—terminates charge after preset time
- Ammeter—indicates charging rate
- Pilot Light—indicates power on
- Transformer—isolation type for safety
- Rectifier—long-life silicon diodes
- Convection Cooling—no fan
- Circuit Protection—input and output fuses
- Cables—8 ft. a-c cable and 10 ft. d-c cables with SB-2 (175A)

Optional Extras

JUMPER SET
(Includes SB (175A) on Charger

SB (175A) to YC



SB (175A) to SB (350A)



SB (175A) to EC



SINCE 1928
CHRISTIE ELECTRIC CORP.

20665 MANHATTAN PLACE, TORRANCE, CALIFORNIA 90501 • (213) 320-0808

EHV Systems, inc.

1699 A Roosevelt Avenue • Bohemia, New York 11716 • Tel.: (516) 589-2525

MODEL CK-1 BATTERY CHARGER

RATINGS:

INPUT VOLTAGE:	108 to 125 VAC, 50-60 HZ, single phase
INPUT CURRENT	17.5 Amps RMS (typical)
CHARGING CURRENT	20 Amps DC (typical, with 96 volt battery)
BATTERY VOLTAGE	48 to 120 VDC (specify)

TECHNICAL CHARACTERISTICS:

- Battery current tapers as battery charges
- Battery current at safe level when battery begins to gas
- Convection cooled (no blower required)

PHYSICAL DESCRIPTION:

SIZE: 8.0 x 12.0 x 6.0

WEIGHT: 24 pounds

EXTERNAL CONNECTIONS:

AC input (3 wire)

Battery (2 wires)

EHV Systems, inc.

1699 A Roosevelt Avenue • Bohemia, New York 11716 • Tel.: (516) 589-2525

MODEL CK-2 BATTERY CHARGER

RATINGS:

INPUT VOLTAGE	-108 to 250 VAC, 1Ø , 50-60 HZ	
INPUT CURRENT (typical)	-SELECTABLE- 20 AMPS RMS (for 20 AMP line)	
	15 AMPS RMS (for 15 AMP line)	
CHARGING CURRENT (typical)	-16 AMPS WITH 117 VAC INPUT	(with 108 volt battery)
	-30 AMPS WITH 234 VAC INPUT	
BATTERY VOLTAGES	72 to 120 VOLTS (others available)	

TECHNICAL CHARACTERISTICS:

- CHARGES AT MAXIMUM CURRENT TO GASSING POINT
- FINISH CHARGES TO FINAL VOLTAGE AT REDUCED CURRENT
- SHUTS DOWN AT FULL CHARGE VOLTAGE
- SWITCH SELECTABLE EQUALIZATION MODE (TIMED)
- TEMPERATURE SHUTDOWN FOR HIGH AMBIENT TEMPERATURES
- LINE CURRENT LIMIT MODE FOR OPERATING FROM 15 AMP LINES
- BATTERY COMPARTMENT BLOWER SUPPLY
- EFFICIENT TRANSISTOR CHOPPER DESIGN(near unity power factor)

PHYSICAL DESCRIPTION:

SIZE - 12.5 x 13.0 x 6.5

WEIGHT- 22 lbs

EXTERNAL CONNECTIONS

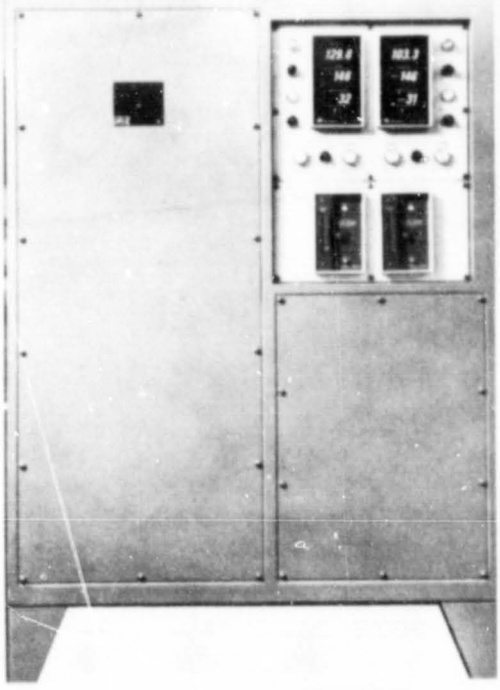
CONTROL INTERLOCKS PREVENT:

- CHARGING WITHOUT BLOWER AIR FLOW
- CHARGING WHILE CAR IS RUNNING
- DRIVING AWAY WHILE CAR IS PLUGGED IN

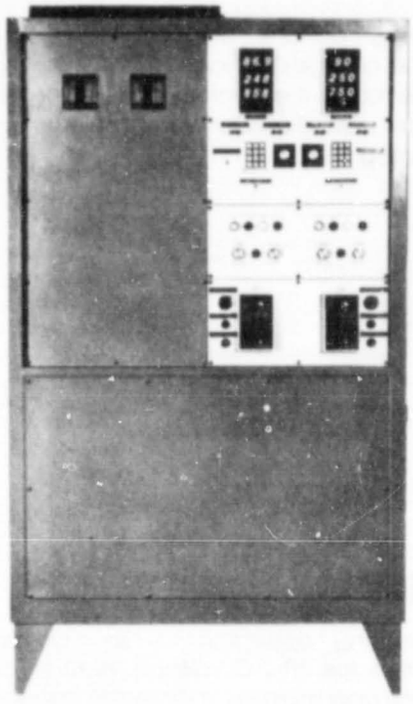
firing circuits inc.

SOLID STATE BATTERY CHARGERS

FORMATION CHARGING OF INDUSTRIAL BATTERIES



TIC 150 WITH OPIONAL
CARD PROGRAMMING CONTROLS



TIC 600 WITH OPTIONAL
AMPERE HOUR CONTROLS and
CARD PROGRAMING

TC & TIC SERIES

TC SERIES FORMATION CHARGING SYSTEMS

Firing Circuits TC Formation Charging Systems, Models TC150, TC300, TC600, TC800, are medium to high current charging systems, designed for use with tank or container processes.

TIC SERIES FORMATION CHARGING SYSTEMS

Firing Circuits Formation Charging Systems, Models TIC150, TIC300, TIC600, TIC800 provide charge-discharge functions for stationary and traction cells. A unique feature of the discharge operation is the ability of the TIC System to reverse the flow of battery power back to the AC power source in order to conserve power that would ordinarily be wasted.

MULLER AVENUE • P.O. BOX 2007 • NORWALK, CONNECTICUT 06852 TELEPHONE (203) 846-1633

General Information TC and TIC Systems

All models in Firing Circuits TC and TIC Systems utilize modular construction for ease of accessibility. The result is a nearly maintenance-free operation that virtually eliminates downtime.

Depending on the model, each TC or TIC charging system has one or two (see chart – back cover) charging circuits. Each circuit can charge from 6 to 40 cells. All models include push button operator's controls and digital meters for monitoring battery circuit voltage, current and accumulated ampere hours.

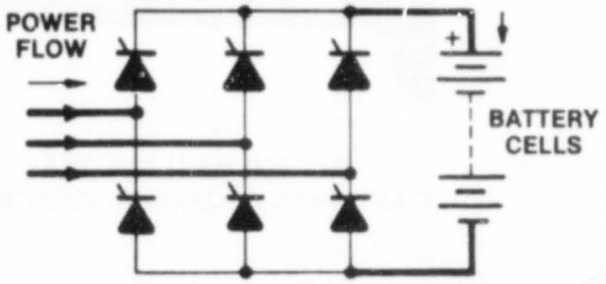
Programming options are available to completely automate the charge-discharge functions. Programming of the TIC series makes it especially useful for testing of traction and stationary cells. (For a list of options available, see Firing Circuits Catalog 8550).



TC and TIC Series Charging Operation

During charging operation, a 3Ø full-wave converter bridge rectifies the 3Ø AC voltage input to controlled DC output. When operating as a constant current system, the voltage output increases or decreases, depending on battery conditions, to maintain the current output constant.

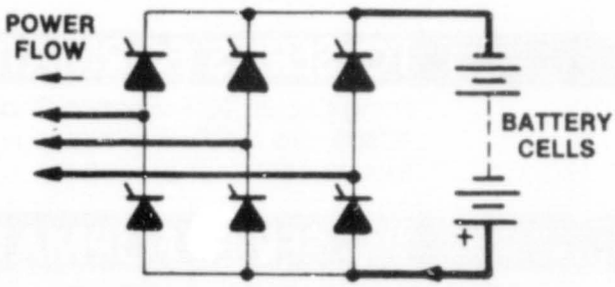
If constant voltage output is selected, the output voltage holds constant for a given setting until the output current reaches the system rating. At rated current output, the charging system operates in a constant current mode and voltage output decreases as load is increased.



CHARGE OPERATION

Discharge Operation of the TIC Series

During discharge operation, current flows at a set rate from the cells being formed back to the power source. The converter that normally rectifies AC power to DC for charging is also used to convert DC power to AC, allowing battery current to flow back to the power source. The inverted power is conditioned to produce very little harmonic influence on the AC power source. If power fails during discharge, the system automatically shuts off, preventing further power flow into the AC power source.



DISCHARGE OPERATION

firing circuits inc.

LEADERSHIP THROUGH EXPERIENCE

MULLER AVENUE • P.O. BOX 2007 • NORWALK, CONNECTICUT 06852

TELEPHONE (203) 846-1633

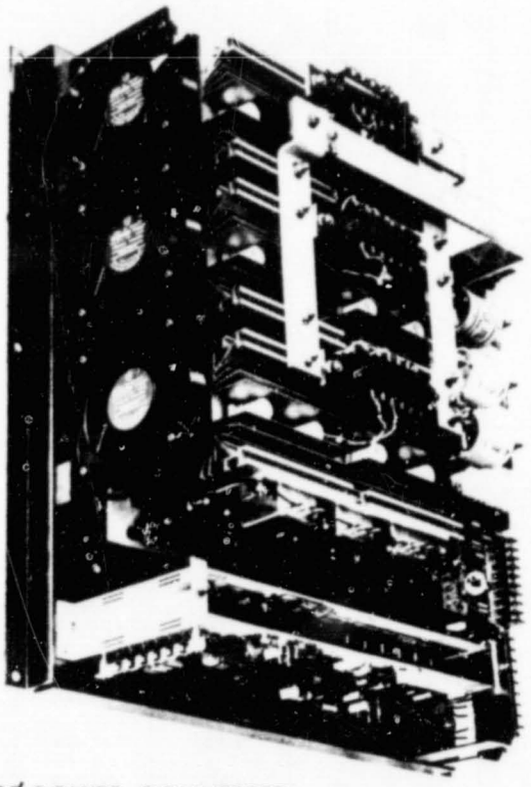
Electrical Features

Power Input — 480 volts ± 10%, 60 Hz ± 3 Hz, 3 Phase
Or — 380/415 volt ± 10% 50 Hz ± 3 Hz, 3 Phase

- Input circuit breaker included.
- Charging circuits fused at their input and output.
- Circuit protection for battery reversal.
- Circuit protection for short circuited output without nuisance fuse blowing.
- Current regulation ± 1% with ± 10% change in A.C. input or 90% change in battery voltage.
- Charging circuits operate with 6 to 40 cells (120 volt output)
- Efficiency minimum 94% at rated output.
- Contactor isolation for each charging circuit.
- Oil tight push buttons and digital meters used on operators controls.
- Operation to 50° C ambient temperature.
- Wide selection of programming and timing options available (see catalog sheet 8455)

Mechanical Features

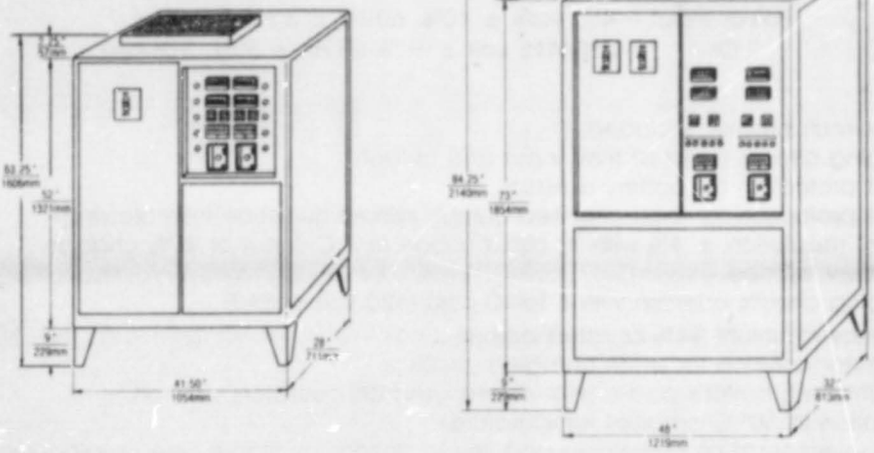
- Construction designed for side by side installation.
- JIC Standards apply to all control and distribution wiring.
- Easy accessibility to input and output connections and internal components.
- Forced air cooling.



3Ø POWER CONVERTER

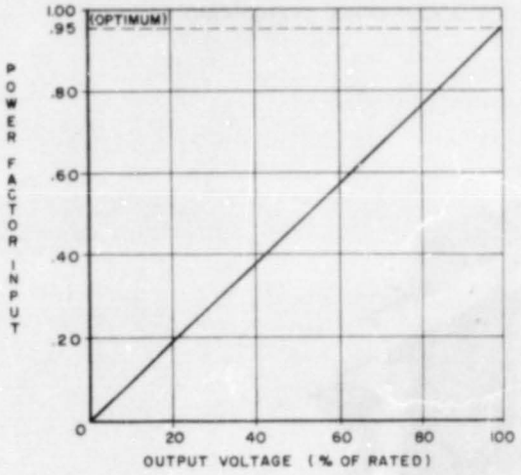
firing circuits inc.
LEADERSHIP THROUGH EXPERIENCE
MULLER AVENUE • P.O. BOX 2007 • NORWALK, CONNECTICUT 06852
TELEPHONE (203) 846-1633

Outline Dimensions

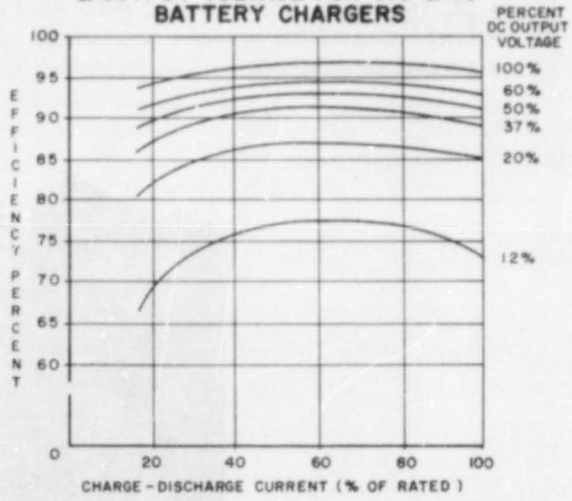


Performance Data

INPUT POWER FACTOR VS OUTPUT VOLTAGE FOR ALL TIC & TC BATTERY CHARGERS



EFFICIENCY VS OUTPUT CURRENT & OUTPUT VOLTAGE FOR TIC & TC BATTERY CHARGERS



Technical Data

CHARGER MODEL	MAX. CHARGE CURRENT (AMPERES) PER CIRCUIT	TOTAL CURRENT RANGE (AMPERES)	REGULATED CONTROL RANGE	MIN.–MAX. 2 VOLT CELLS PER CIRCUIT	MAX. DC OUTPUT VOLTAGE	MAXIMUM INPUT POWER	NUMBER OF CHARGING CIRCUITS	MAX. SERIES CELLS PER SYSTEM	APPROXIMATED WEIGHTS	
									(NET) UNCRATED	(GROSS) CRATED
TC150	150	5 - 150	10 - 150	6 - 40	130	45KVA	2	80	1200LBS 544KG	1450LBS 658KG
TC300	300	15 - 300	25 - 300	6 - 40	130	89KVA	2	80	1900LBS 862KG	2100LBS 953KG
TC600	600	30 - 600	50 - 600	6 - 40	130	178KVA	2	80	2800LBS 1270KG	3000LBS 1361 KG
TC800	800	40 - 800	80 - 800	6 - 40	130	118KVA	1	40	2200LBS 1000KG	2400LBS 1089KG
TIC150	150	5 - 150	10 - 150	6 - 40	130	45KVA	2	80	1300LBS 590KG	1500LBS 680KG
TIC300	300	15 - 300	25 - 300	6 - 40	130	89KVA	2	80	2000LBS 910KG	2200LBS 1000KG
TIC600	600	30 - 600	50 - 600	6 - 40	130	178KVA	2	80	3000LBS 1361KG	3200LBS 1451KG
TIC800	800	40 - 800	80 - 800	6 - 40	130	118KVA	1	40	2700LBS 1227KG	3080LBS 1363KG

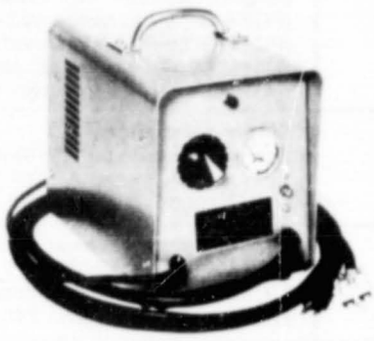
firing circuits inc.

LEADERSHIP THROUGH EXPERIENCE

MULLER AVENUE • P.O. BOX 2007 • NORWALK, CONNECTICUT 06852 • TELEPHONE (203) 846-1633 • TWX 710-468-3334

KEEP THEM CHARGED

These rugged chargers provide the current necessary to recharge a bank of EV batteries in 8 hours, yet they can operate on 120 or 240 volts AC current without drawing more than 15 amps. We have models to charge 36, 48, and 72 volt EV systems, complete with a SB175 connector on the output cable. Allow 6 to 8 weeks for delivery.



OTHER VOLTAGES AVAILABLE ON SPECIAL ORDER

Part No.	Description	Output DC Volts	Output DC Amps	Input AC Volts	Input AC Amps
17-EV3601-250	36 Volt Battery Charger	36	23	120	10.5
17-EV3632-250	36 Volt Battery Charger	36	30	240	7.2
17-EV4821-250	48 Volt Battery Charger	48	20	120	12.0
17-EV4822-250	48 Volt Battery Charger	48	20	240	6.0
17-EV7211-250	72 Volt Battery Charger	72	10	120	9.0
17-EV7221-250	72 Volt Battery Charger	72	20	240	10.2

ELECTRIC VEHICLE COMPONENTS
FLIGHT SYSTEMS
HEADQUARTERS
P.O. BOX 25, MECHANICSBURG, PA 17055
PHONE (717) 697-0333

Gulf+Western Manufacturing Company

Collyer Insulated Wire Division

100 Higginson Ave.
Lincoln, RI 02865
Telephone: 401/723-7800

Control Cables	THERMOSET: Collyer C-150, C-151 — XLP insul. — PVC or Neoprene jacket 600V. Collyer C-148 — XLP XHHW FR-1 conductors, Type T.C. U.L. Listed. Collyer C-191 — EPR/HYPALON conductors — Neoprene or PVC jacket U.L. Listed Type T.C. Collyer C-190 — EPR insul. — Hypalon jacketed extra — flame resistant for nuclear station use. C-140, C-143, C-153, C-150, C-151, C-148, C-190 meet IPCEA — NEMA requirements. C-154, C-148, C-190 meet U.L. Type T.C. requirements.
Machine Tool Wire	**Single conductor** Collyer P-400 U.L. Type THHN/THWN when supplied with 19 wire or more stranding, non compressed, has U.L. Listing as MTW 90°C dry and 60°C in oil. Must be specially ordered.
Motor Lead Cables	**Single conductor — Flexible** IPCEA S-19-81, NEMA WC-3 — RUB. insul., neoprene jacket, 600V 75°C. IPCEA S-68-516, NEMA WC-8 — EPR insul., neoprene or hypalon jkt. 600V, 1000V, 2000V, 90°C. AAR581.3 — Rub. insul., Neop. jkt. diesel locomotive cable — 600V. AAR589 — Hypalon insul., 600V. — Also 1000V non AAR spec.
Traction Cable	**Single conductor** Collyer "Track Star", EPR insulated, Neoprene jacketed, 1000 volt. Also XLP insulated & EPR Insulated manufactured to any Transit company's specifications. 600V., 1000V, 2000V.
Tray Cable	**Multi-conductor power and control — U.L. Listed Type TC per NEC article 340** C-148 — XLP, XHHW FR-1 conductors, PVC jacket, 600V. C-154 — THWN/THHN conductors, PVC jacket, 600V. C-191 — EPR/Hypalon FR-1 conductors — Neop., or PVC jacket, 600V.

Eagle Signal Corporation

8004 Cameron Road
Austin, Texas 78753
Telephone: 512/837-8300

Battery Charger	In conjunction with the G+W zinc chloride battery program, Eagle Signal is currently developing a battery charger. Basic specifications are given below. Custom chargers or adaptations of the basic charger will be considered. Basic Specifications: AC Input Voltage — 230 VAC single phase 60Hz DC Rating — 140VDC 85 amperes continuous Control Range — From 10% voltage and current to 100% voltage and current Cooling — Convection Transformer — Class H insulation, Class B temperature rise Circuit Configuration — Single phase full wave thyristor bridge on secondary side of rectifier transformer Off Board Design
Controllers, Motor, Variable Speed	DC traction motor controller now under development. Custom manufacture.
DC-DC Converters (on board)	Under development. Custom manufacture.

Eagle Signal Industrial Controls Division

736 Federal St.
Davenport, IA 52803
Telephone: 319/326-8111

Control Relays

For very competitive specifications and prices contact EAGLE SIGNAL, 925 Lake Street, Baraboo, Wisconsin 53913, Telephone (608) 356-8321.

DESCRIPTION	CONFIGURATION	POLES	AMPERES
GENERAL PURPOSE			
6/12/24/120/240 VAC	Open Type, solder lug	1, 2, 3	5, 10
6/12/24/48/110 VDC	Open Type, quick disconnect	1, 2, 3	5, 10
	Open Type, printed circuit	1, 2, 3	5, 10
	Enclosed, Plug-in Octal Base	1, 2, 3	5, 10
	Enclosed, Plug-in, Octal base w/light	1, 2, 3	5, 10



HOBART

is totally committed to growing with the electric vehicle industry

Our battery chargers are flexible to meet your battery requirements...

Because the electric vehicle industry is developing so rapidly, there is little or no standardization of batteries. For this reason, Hobart Brothers has designed flexibility into our family of battery chargers to give you the kind of recharge you need. We have been in the battery charging business since 1912 and have years of experience developing industrial battery chargers for the material handling industry and float chargers for the utility and telecommunications industries.



Electric vehicle battery chargers

TYPES—In general, electric vehicle battery chargers are of two types: Onboard and Offboard. Onboard chargers allow the vehicle batteries to be recharged at any convenient 120 or 240 VAC outlet. Some onboard chargers may operate from either voltage, with a faster charge usually possible from the higher input voltage. Offboard chargers are usually larger in size and charge faster than onboard chargers, and are intended for stationary installation where heavier AC service (single or three phase) can be provided.

CONTROL CIRCUITRY—Falls into two categories: Manual or Automatic.

Manual Controls are of two types: Time Control and Voltage/Time.

- *Time controlled chargers* are manually started by turning the timer on and they stop when the timer times out and returns to off.
- *Voltage/time controlled chargers* are manually started by turning the timer on. The timer does not start until the battery reaches a pre-determined state of recharge after which it times out and shuts off the charger. Manual chargers must be turned off before disconnecting to prevent connector arcing and burning.

Automatic Chargers start when a battery is connected. They are equipped with automatic timing or battery monitoring features or both to turn the charger off when the battery is fully charged. Some chargers must be turned off to prevent arcing of the connector if the battery is disconnected while it is charging. Other automatic chargers are equipped with a special connector and safety circuit which allows the charging battery to be disconnected without arcing.

OTHER CONTROL FEATURES

- 24 hour timer can be programmed to allow charging only during periods of off-peak electrical rates.
- Supervisory equipment to monitor the battery or charger circuit or both and indicate faults by pilot lights.

POWER CONVERSION CIRCUITRY converts the AC electrical power to DC recharging power and controls its flow into the battery. Although several types of power conversion circuitry are in use today, the most common is the ferroresonant/rectifier type. Ferroresonant/rectifiers consist of three elements:
1) Ferroresonant power transformer, 2) capacitors, and 3) silicon diode rectifiers.

ORIGINAL PAGE IS
OF POOR QUALITY

HOBART can offer you any of the following battery charging features

- Automatic starting when battery is connected or when 24 hour programmable timer reaches preset turn-on time.
- Automatic line and load regulation will hold charging rate within ±1 percent with AC line voltage fluctuations of up to ±10 percent. (No tap changing is necessary.)
- Pilot light to indicate charger is operable. Independent charging circuits, ammeters, and pilot lights for propulsion battery and control battery.
- Internally adjustable charge control turns chargers off when battery reaches full charged voltage.
- Charger automatically turns off after nine hours of charging if cycle is not terminated earlier by charge control.
- Optional internally adjustable automatic-reset timer to control amount of equalized charge given during each recharge cycle.
- Optional 12 volt, 10 amp. independent charging circuit for control battery.

Below are examples of four HOBART chargers designed for specific recharging requirements

Model 1EV48-30
Input: 208/240/480 volts, 24/22/11 amps, 1 phase, 60 Hz
Output: 96 volts, 30 amps for propulsion battery
Output: 12 volts, 10 amps for control battery
Recharge Time: 9 hours or less.

Model 1EV42-30
Input: 208/240/480 volts, 22/20/10 amps, 1 phase, 60 Hz
Output: 84 volts, 30 amps for 42 cell lead-acid EV type propulsion battery
Optional Output: 12 volt, 10 amp for control battery
Recharge Time: 9 hours or less.

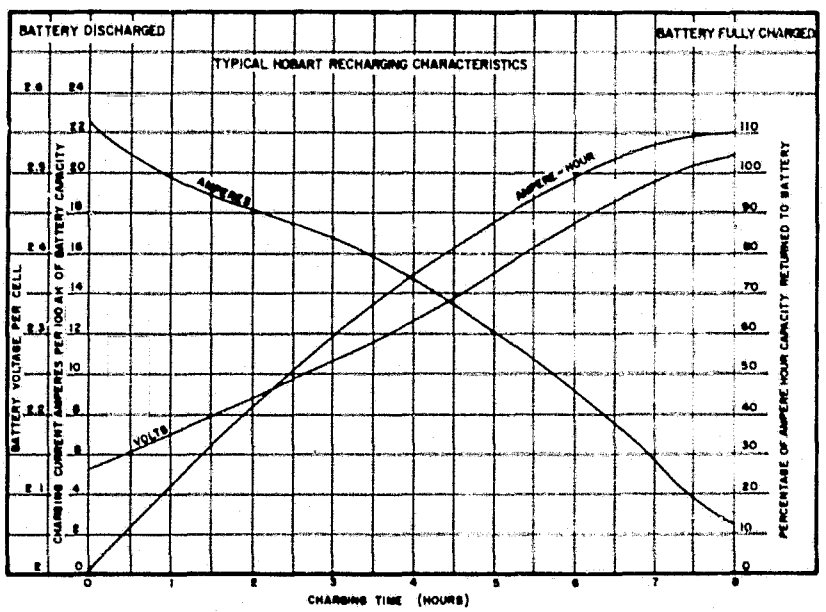
Model 1EV36-35
Input: 208/240/480 volts, 22/20/10 amps, 1 phase, 60 Hz
Output: 72 volts, 35 amps and 12 volts, 10 amps
Propulsion Battery: 36 cell, lead-acid EV type
Control Battery: 12 volt, SLI type
Recharge Time: 9 hours or less.

Model 1EV150-30 DR
Input: 240 volts, 30 amps, 1 phase, 60 Hz
Power Factor: 85-90%
Efficiency: 85-90%
Output: 140-165 volts, 8-30 amps (each independently adjustable)
Voltage Regulation: ±½%
Current Limit Regulation: ±½%
Current Limit Compliance Range: 100-165 volts
Propulsion Battery: Nickel-Zinc

HOBART charger characteristics

The graph at right shows typical recharge data for a Hobart rectifier-type battery charger. Note as the ampere-hours returned to the battery increase the battery voltage increases and the charging current gradually taper to a safe finish rate.

For a typical 8-hour charge, the recharge rate starts at approximately 23 amperes per 100 ampere-hours of battery capacity and 2.13 volts per cell then tapers to approximately 3 amperes per 100 ampere-hours at about 2.5 volts per cell. To assure complete recharge of a fully discharged battery, the total ampere-hours returned to the battery is 110% of the battery's capacity. If the battery is not fully discharged, the required number of ampere-hours will be returned to it after which it will be "floated" at a safe finish rate for the remainder of the recharge cycle.





SAMPLE SPECIFICATIONS—ELECTRIC VEHICLE BATTERY CHARGER

DESIGN. The battery charger shall have full-wave rectification with silicon diodes. The power transformer(s) shall be the ferroresonant type with taps on the resonant coil to facilitate increasing or decreasing the charging rate, if necessary. The charger shall provide stepless output continuously tapering from starting rate to finishing rate. An ammeter for monitoring the charging current and a pilot light to indicate that the charger is energized shall be provided.

Voltage transient protection shall be provided to protect the diodes. The complete circuit shall be fail-safe, i.e., failure of any component shall cause the charging rate to be reduced, not increased.

The AC input of the charger shall be adequately protected with fuse(s) or circuit breakers and the DC output shall be protected with a fast-clearing fuse.

REGULATION. The charging voltage shall be maintained within ±1% with AC line variation of ±10%. The starting current shall be limited to not more than 140% of full-load rating with AC line variation of ±10%. At the finishing rate or 2.5 volts per cell, the charging current shall not exceed 5 amperes per 100 AH of battery capacity. At the starting rate of 2.13 volts per cell, the charging current shall be adequate to recharge the battery in the time specified and as recommended by the battery manufacturer.

CABINET. The battery charger shall be convection cooled with screen or perforated metal covering the bottom and screened or louvered openings in the sides.

RATINGS. The battery charger shall automatically recharge the battery pack and be rated as follows per your requirements:

Input ratings

Voltage _____

Phase (1 or 3) _____

Hertz _____

Output ratings

Battery Cells _____

Manufacturers Rated Capacity _____

Type ☐ Lead-Antimony
☐ Lead-Calcium
☐ Other (Specify)_____

Recharge Time _____

The chargers shall be capable of operating in an ambient temperature of 40° C. (104° F).

MANUALS. Complete wiring diagrams, installation and operating instructions together with trouble shooting information shall be furnished with each charger.

WARRANTY. The battery charger manufacturer shall warrant to the original purchaser for use that each new battery charger is free from defects in material and workmanship in normal use. This warranty shall extend for at least one year from date of delivery except that (i) with respect to power transformer(s), silicon power diodes and capacitors the warranty shall extend for 10 years and (ii) with respect to expendable items normally requiring periodic replacement such as switch contacts, etc., the warranty shall apply only if the same are found to be defective prior to initial use.

We have the right Electric Vehicle Charger for you NOW, contact—

HOBART BROTHERS COMPANY, POWER SYSTEMS DIVISION

Dept. 610, Troy, Ohio 45373 U.S.A. • Phone (513) 339-6011, TWX: 810 456 2907

HOBART

KW BATTERY COMPANY

75-831
Descriptive Bulletin

LIFEGUARD
Ferroresonant Charger
Simple to operate
Simple to maintain





KW BATTERY COMPANY
3555 WEST HOWARD STREET / SKOKIE, ILLINOIS 60076 / TEL . (312) 982-8346

KW Lifeguard Ferroresonant Battery Charger has all of the features you would have included if you had designed it. Maybe more.

When you choose your battery chargers, you're looking for several important things: Reliability, durability, ease of operation and ease of maintenance.

The Lifeguard Ferroresonant Charger has been designed with all of the latest state-of-the-art components for functional assurance and years of trouble-free service.

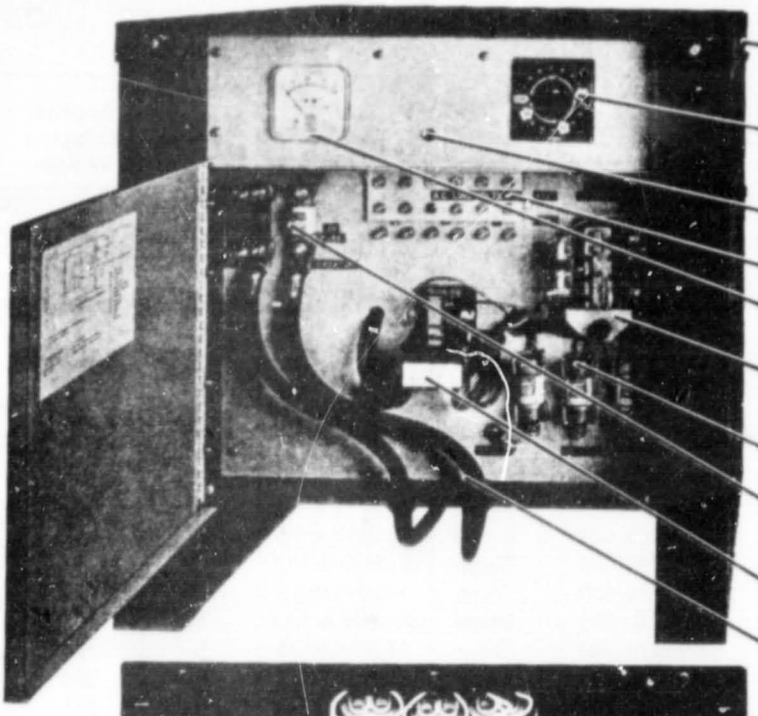
Here are the things we thought you'd like to know:

- **Multiple voltages.**
  Lifeguard standard single-phase chargers are available in 120/208/240 and 208/240/480 volt AC inputs, dependent on the ampere-hour capacity of the charger. Standard 3-phase chargers are available in 208/240/480 volt AC inputs. Special single- and 3-phase chargers are available in 480/575 volt AC inputs.
- **8-hour rechargeable.**
  A 100% discharged battery (with a 6-hour capacity equal to the charger's maximum 8-hour capacity rating) can be returned to a 105% charge in 8 hours.
- **Equalizing charge.**
  The Lifeguard charger permits equalizing of the battery at periodic intervals.
- **Line compensated.**
  If the AC input voltage varies by ± 10%, the DC output voltage will not vary by more than ± 1% at the finish rate.
- **Reverse polarity protection.**
  Should the charger be inadvertently connected to a battery with reverse polarity, the circuit is protected from damage by a DC fuse.
- **Ferroresonance.**
  The ferroresonant circuitry of the Lifeguard charger requires the least amount of AC power. It is the least responsive to AC voltage variation. It is inherently fail-safe, requiring virtually no maintenance. And it provides a true, constantly tapering charge without the use of relays, resistors or reactors.
- **Ease of maintenance.**
  The door on the front is hinged 90° right to left to make all fuses easily accessible. The timer, the AC indicator light and the ammeter are mounted on a removable front panel. Other major components are easily accessible through the removable cover.
- **Convection cooled.**
  Cooling is vented from the bottom out the charger sides, eliminating the need for fans or filters.
- **Automatic controls.**
  The Lifeguard charger features fully automatic controls which require only the battery/charger connection and setting of the timer.
- **Recessed controls.**
  Controls are recessed to prevent possible damage to the timer, ammeter and AC indicator light.
- **DC leads.**
  The DC leads come out of the bottom of the charger — in the front — and centered for easy attachment to the battery. They are protected with strain-release grommets.
- **AC indicator light.**
  This light shows at a glance when the charger is energized.
- **Drip-protected case.**
  The Lifeguard charger is assembled in a drip-protected case, protecting the internal components.
- **Wall mounting, floor mounting, stackable.**
  All models can be: Wall mounted with the addition of a bracket; floor mounted; stacked up to three high.
- **Fully warranted.**
  The Lifeguard Ferroresonant Charger carries a lifetime warranty on both the power transformer and semiconductors for the life of the equipment at its original installation. All other components are guaranteed for one full year.

KW Ferroresonant Battery Charger gives you all the features you've always looked for but probably have never found in a single unit. All of the things — as we said — that you would have designed into it if you had designed it yourself.

But now you don't have to.

KW BATTERY COMPANY
3555 WEST HOWARD STREET / SKOKIE, ILLINOIS 60076 / TEL. (312) 982-8346



Case — Drip protection contruction; ammeter, timer and AC indicator light mounted on separate panel; removable top.

Timer — Positions for 16 hr., 12 hr. and 8 hr. cycle. Terminates charge at completion of cycle. Provides equalizing charge capability.

AC Indicator light — Indicates when charger is energized.

AC Input voltage setting terminals — Easily accessible through charger door.

Ammeter — Internally and/or externally shunted accurate ± 3-5% of full scale.

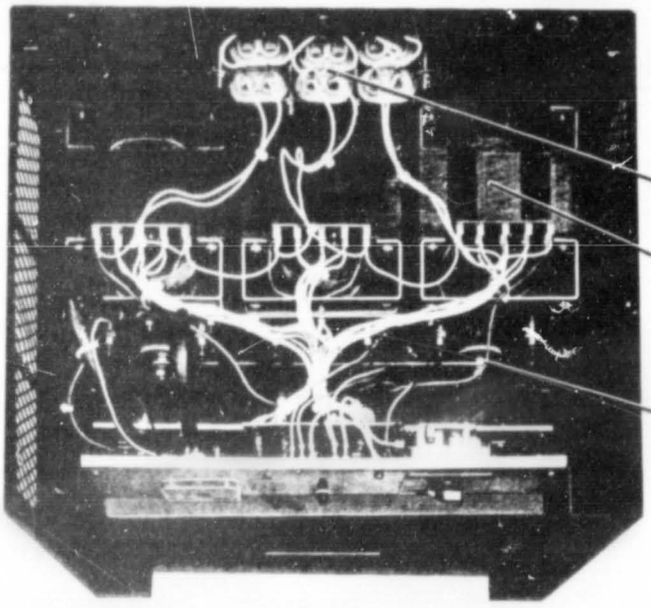
Control transformer — Underwriters recognized component. Minimum rating of 50 volts/amperes, protected with 1 amp fuse.

AC Fuses — Quick acting type of proper size; Underwriters recognized component.

DC Fuses — Semiconductor type offering protection to charger circuits against shorts and reversed connection.

AC Line contactor — Overload protection to avoid charger component damage.

DC Leads — Bottom front exit with strain release grommets.

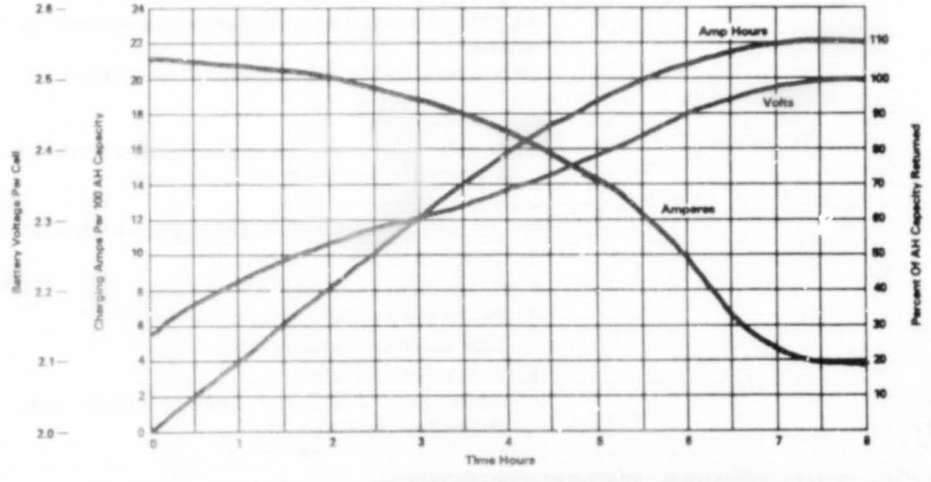


Resonant capacitors — 60 hertz, maximum 440 AC voltage, oil-filled matched to the transformer.

Power transformers — Ferroresonant transformer guaranteed for life; 3 coil isolated system balanced for optimum performance with resonant capacitors to provide minimum AC line voltage variations.

Rectifier assembly — Hermetically sealed diodes guaranteed for life mounted on aluminum heat sinks; PRV in excess of 400 volts.

Typical recharging characteristics



KW BATTERY COMPANY
3555 WEST HOWARD STREET / SKOKIE, ILLINOIS 60076 / TEL. (312) 982-8346

Details and specifications

No. of Cells	Battery Amp-Hr Capacity		Model Number	Alternating Current 60 Cycle		AC Input Amps	Cabinet Number	Approx. Shipping Weight
	8 Hour	16 Hour		Standard Voltage	Phase			
6	252-325	378-490	6-325F1	120/208/240	Single	10/5.9/5.0	4	69
	325-410	490-614	6-410F1	120/208/240	Single	12.8/7.4/6.4	4	73
	410-515	614-772	6-515F1	120/208/240	Single	16.0/9.2/8.0	4	78
	515-650	772-977	6-650F1	208/240/480	Single	11.8/10.2/5.1	5	123
	515-650	772-977	6-650F3	208/240/480	Three	6.9/5.9/2.9	5	141
	650-765	977-1155	6-765F3	208/240/480	Three	8.8/7.6/3.8	5	145
	765-975	1155-1470	6-975F3	208/240/480	Three	10.4/9.0/4.5	5	150
	975-1260	1470-1890	6-1260F3	208/240/480	Three	12.9/11.1/5.6	5	160
12	252-325	378-488	12-325F1	120/208/240	Single	19.5/11.3/9.7	4	83
	325-410	488-614	12-410F1	208/240/480	Single	15.0/12.8/6.4	4	98
	410-515	614-772	12-515F1	208/240/480	Single	20.0/17.3/8.6	5	145
	515-650	772-977	12-650F1	208/240/480	Single	23.5/20.3/10.1	5	159
	515-650	772-977	12-650F3	208/240/480	Three	13.8/11.9/5.9	5	174
	650-765	977-1155	12-765F1	208/240/480	Single	29.4/25.4/12.7	5	183
	650-765	977-1155	12-765F3	208/240/480	Three	17.3/14.9/7.5	5	174
	765-975	1155-1470	12-975F3	208/240/480	Three	21.0/18.2/9.1	5	200
	975-1260	1470-1890	12-1260F3	208/240/480	Three	26.0/22.5/11.2	5	241
18	325-410	488-614	18-410F1	208/240/480	Single	22.2/19.0/9.6	5	159
	410-515	614-772	18-515F1	208/240/480	Single	29.5/25.5/12.8	5	203
	515-650	772-977	18-650F1	208/240/480	Single	35.3/30.6/15.2	5	221
	515-650	772-977	18-650F3	208/240/480	Three	20.8/18.0/9.0	5	195
	650-765	977-1155	18-765F3	208/240/480	Three	26.1/22.6/11.3	5	261
	765-975	1155-1470	18-975F3	208/240/480	Three	31.2/27.0/13.5	5	288
	975-1260	1470-1890	18-1260F3	208/240/480	Three	38.0/32.9/16.4	5	302
24	410-515	614-772	24-515F1	208/240/480	Single	39.2/34.0/17.0	5	202
	410-515	614-772	24-515F3	208/240/480	Three	20.8/18.0/9.0	5	195
	515-650	772-977	24-650F3	208/240/480	Three	27.7/24.0/12.0	5	261
	650-765	977-1155	24-765F3	208/240/480	Three	34.6/29.9/14.9	5	288
	765-975	1155-1890	24-975F3	208/240/480	Three	41/36/18	5	300

Mechanical specifications

Cabinet No.	Depth	Width	Height
4	15¼"	12¾"	21¼"
5	18¼"	22½"	22¼"

Ordering information

When ordering, please specify:

1. KW Lifeguard Ferroresonant model number.
2. AC input voltage, phase, cycles.
3. Number and type of battery cells.
4. Ampere hour capacity of battery.
5. Allowable recharging time, 8 or 16 hours.
6. Battery connector number.

KW Battery
3555 Howard Street
Skokie, Illinois 60076
312-982-8346

Notes:

Units include 8 feet of charging cable and a standard plug or receptacle.

Standard voltages are as listed. Contact factory for special operating voltage.

Contact factory for availability of chargers to charge batteries having an unusual number of cells.

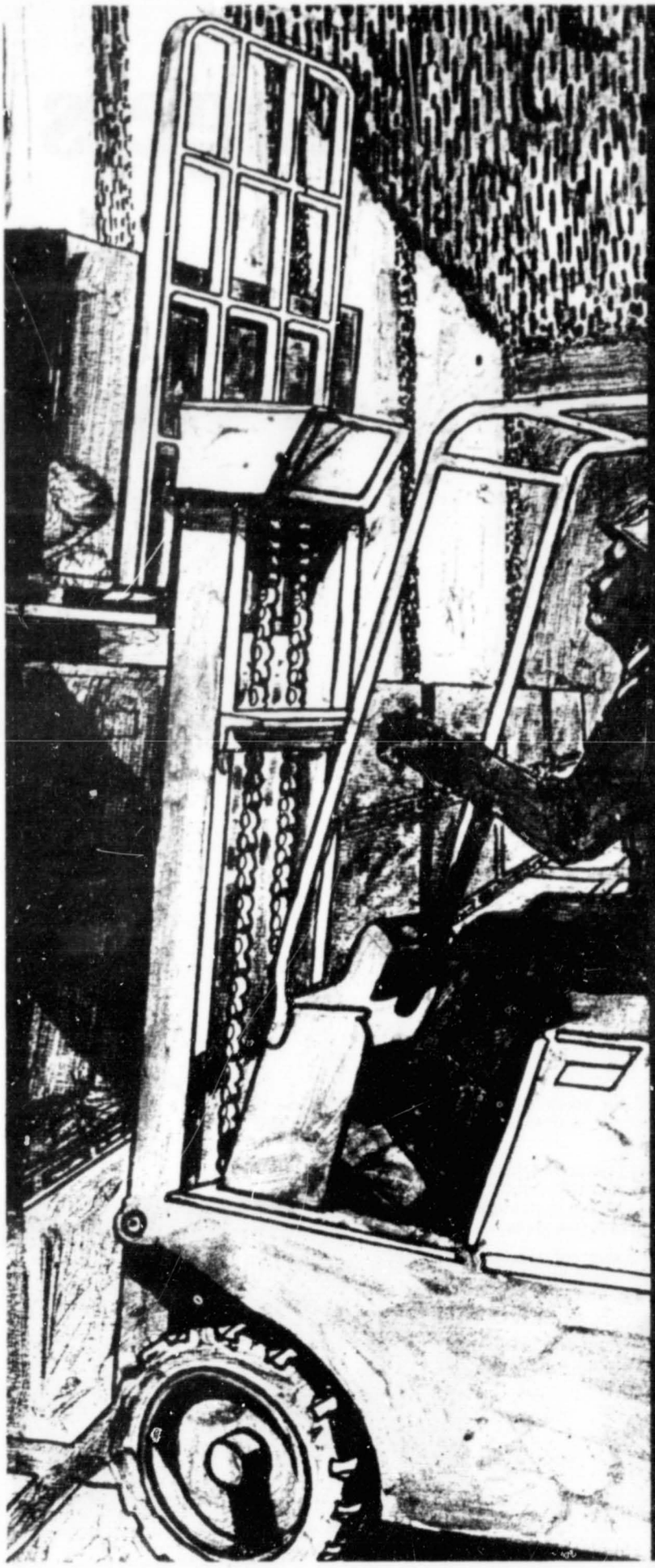
480/575 volt AC input single- or 3-phase units available upon request.

JIC assembly supplied with 3-phase 480 volt AC input only.

Optional features

1. Remote charge control (timer, pilot light and ammeter furnished separately for mounting).
2. Sequence relay.
3. JIC approved flange mounted disconnect switch on #5 case.
4. JIC approved push-to-test pilot light.
5. Series charging cable with standard plug.
6. Parallel charging cable with standard plug.
7. Type 922 or 924 manual release.
8. Wall-mounting brackets.
9. When 3-phase is desired for charger normally furnished in single-phase, contact factory.

KW BATTERY COMPANY
3555 WEST HOWARD STREET / SKOKIE, ILLINOIS 60076 / TEL. (312) 982-8346



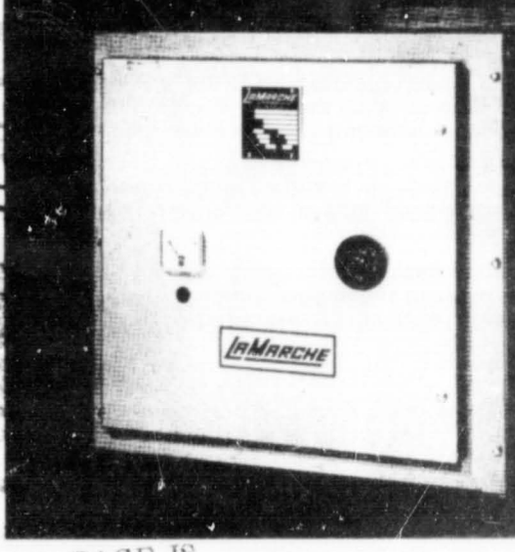
LAMARCHE®

A-45 MAG-AMP INDUSTRIAL TRUCK CHARGERS

LAMARCHE®

Manufacturing Company

106 Bradrock Drive, Des Plaines, Illinois 60018
Phone: 299-1188 (A.C. 312)



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LaMARCHE® Manufacturing Company A-45 Chargers

106 Bradrock Drive, Des Plaines, Illinois 60018
Phone: 299-1188 (A.C. 312)

Model A-45 features

- Highest quality components throughout. Silicon diode rectifiers and transistor-controlled magnetic amplifiers used exclusively.
- Automatic in operation and self-regulating.
- AC line compensation and current limiting are standard features.
- Only 13 components. 86% fewer parts than other designs.
- No voltage sensitive relays or other moving parts, except time clock.
- Operation-tested and approved by major battery manufacturers.
- Underwriters Laboratories listed.
- Built to meet OSHA requirements.
- Over 70,000 LaMarche patented mag-amp circuit chargers in use by thousands of satisfied companies.

LaMARCHE MODEL A-45 CHARGERS PERFORM BETTER, LONGER

The unique design of the model A-45 charger provides adjustment of the charging current curve to cover any operating situation.

The A-45 charger provides automatic AC line compensation for variation in AC line voltage. Therefore, it is ideally suited for around-the-clock operation without concern for voltage changes.

Automatic line voltage compensation is achieved with a specially designed input transformer and magnetic amplifier. This eliminates the need for additional semi-conductor components, and adds to long term reliability.

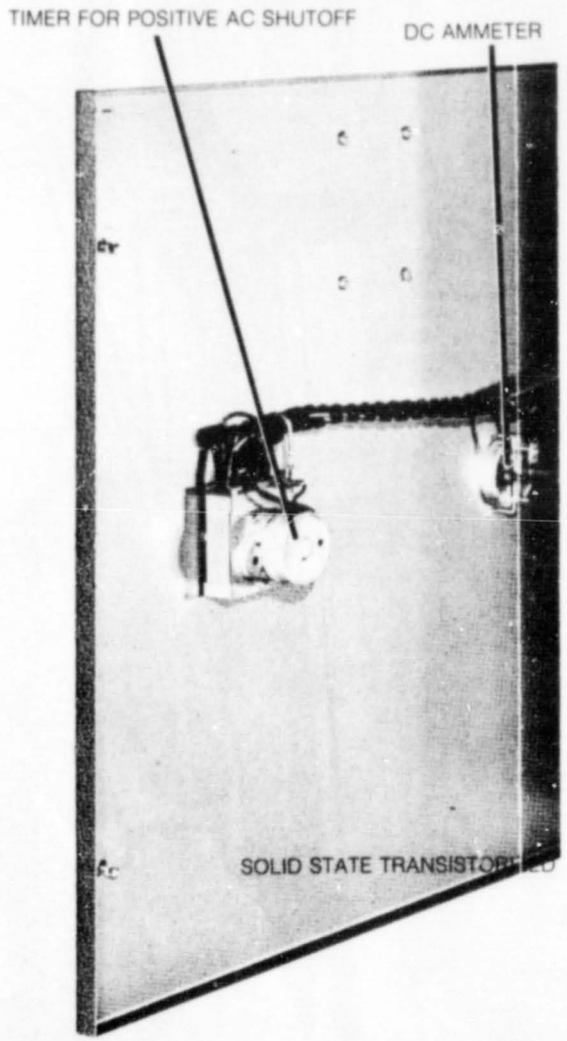
The A-45 has an inherent current limiting characteristic. Short circuiting the DC output will limit the output current to 135% of rated output. This current limiting feature is accomplished without additional circuitry.

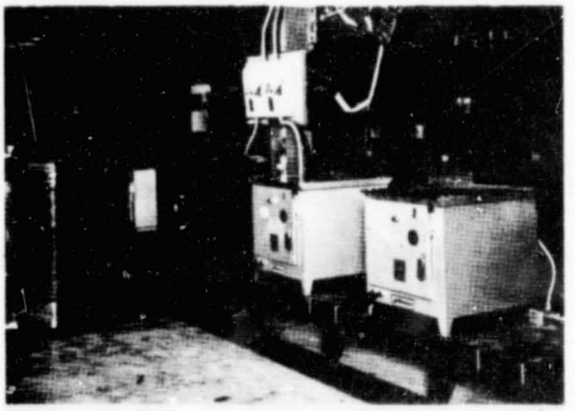
A simple variable resistor voltage control is provided for adjusting the charger for any environmental or battery condition. This control is especially useful when batteries are old or in poor condition.

The A-45 utilizes a relative constant current charging characteristic for the initial charging period, up to the "gassing point" of the battery. It then changes to a constant potential charging characteristic for the remainder of the charge, tapering to a low finish rate to prevent excessive gassing.

The A-45 returns a maximum of charge to a battery in the shortest possible time with a minimum of battery temperature rise. A completely discharged battery can have 88% of its capacity returned in the first five hours of charge.

The A-45 is designed to operate flawlessly with a minimum of attention. Design concept emphasizes simplicity and long-term reliability. *You can't buy a better, more trouble-free industrial truck battery charger!*





Dependable A-45 chargers at work in a parts depot of a major automobile manufacturer.

conform to OSHA!



CSA CHI LR 14209

30 amp through 250 amp
6 cells through 18 cells
File 14209

LaMARCHE®
Manufacturing Company
106 Bradrock Drive, Des Plaines, Illinois 60018
Phone: 299-1188 (A.C. 312)

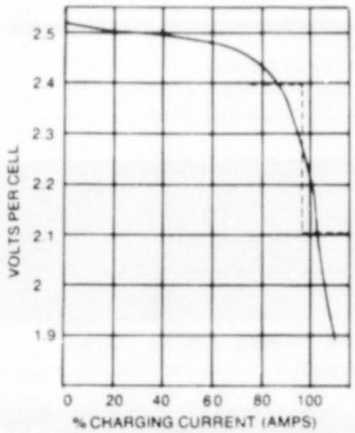
Automatic, statically controlled output curve is one of the basic features to lower charger cost, eliminate gassing and increase battery life.

Magnetic amplifier circuit design. Only 13 components, 86% fewer parts, no moving parts (except time clock), simplicity eliminates performance and maintenance headaches.

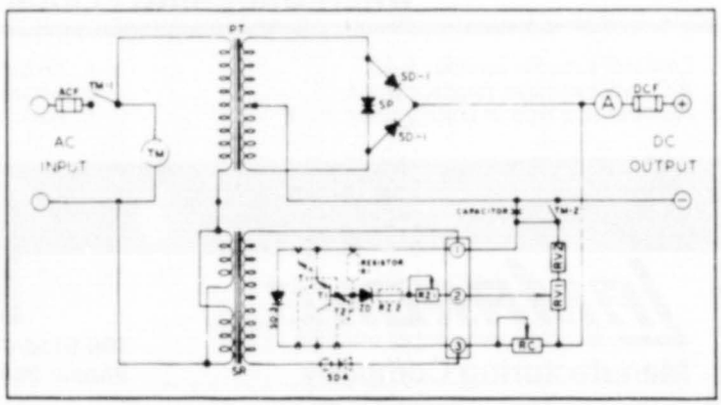
UL LISTED WHILE UNDER REEXAMINATION SERVICE — UNDERWRITERS' LABORATORIES, INC.

30 amp through 250 amp, 6 through 64 cells
Guide No. 360EO

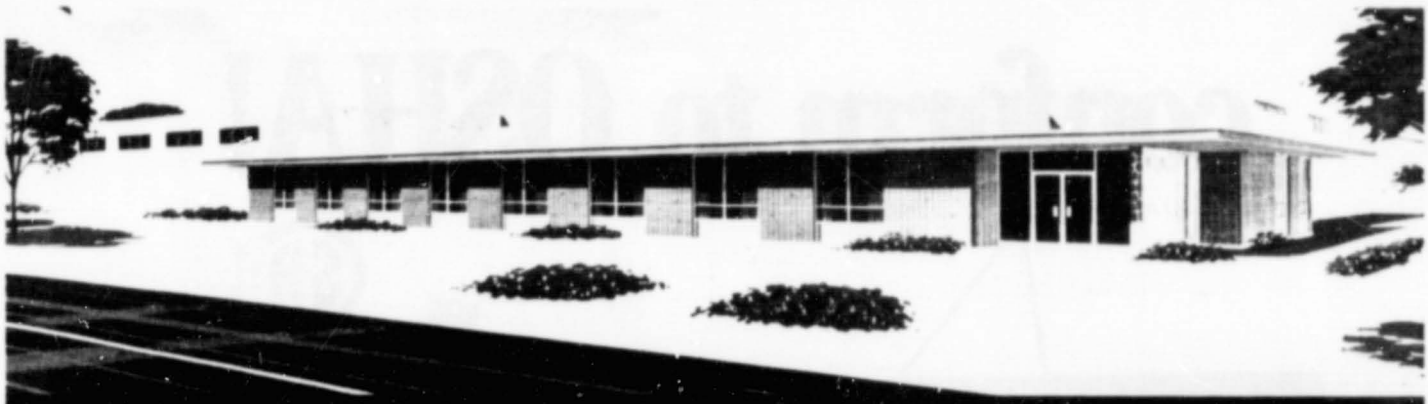
File 25071A



TYPICAL CHARGE CURVE FOR MODEL A-45



TYPICAL A-45 SCHEMATIC DIAGRAM



Modern LaMarche office and manufacturing facility includes new addition for a total of 100,000 square feet devoted to producing the world's most complete line of battery chargers.

SPECIFICATIONS:

ELECTRICAL: A.C. INPUT VOLTAGES:
120,208/240, 480 or 575 single phase, 50/60 cycles
208/240, 480 or 550 three phase, 50/60 cycles.

D.C. OUTPUT COMBINATIONS AVAILABLE:
D.C. amps-30 to 400, depends on amp hour capacity of the battery and allowable charging time.
D.C. volts-12 to 240 nominal, depends on number and type of cells.

MECHANICAL:
Overall dimensions and approximate shipping weights are listed on A-45 price sheets.

FINISH: Bonderized silicon baked enamel, Hammertone, light gray.

MOUNTING: Wall and floor, depending on case specified on price sheet.

STANDARD ACCESSORIES SUPPLIED:
1. Ten foot D.C. leads with charging connector (SB, EC or YC).
2. D.C. ammeter.
3. Time clock for positive A.C. shut-off.
4. Fused A.C. input and D.C. output for complete protection.
5. Internal terminal board for easy connection of A.C. input, D.C. output.
6. Combination A.C. input – 240/208 V.A.C. no charge.
7. 110 volt control provided on all 480 or 575 V.A.C. units.

OPTIONAL ACCESSORIES:
1. Sequence relay.
2. J.I.C. approved enclosure.
3. Remote control.
4. Push-to-test Pilot Light.
5. Forced cooling unit.
6. Bus bar module.
7. Three phase input where single phase is indicated.
8. Special paint.
9. Export packing.
10. Wall mount brackets for floor case.
11. Floor mount brackets for wall case.

SAMPLE SPECIFICATIONS FOR MODEL A-45
The charger to be furnished shall be the La Marche Mfg. Co. Model A-45 or approved equal. The charger shall employ transistor controlled magnetic amplifier circuit to provide continuous taper charging.

This charger shall have:
1. Automatic A.C. line compensation.
2. Automatic overload protection (current limiting).
3. Automatic D.C. voltage regulation.
4. Hermetically sealed silicone diode full-wave rectifiers.
5. Automatic surge suppressors.
6. No moving parts, except time clock.
7. D.C. ammeter.
8. Fused A.C. input and D.C. output.

WHEN ORDERING PLEASE SPECIFY

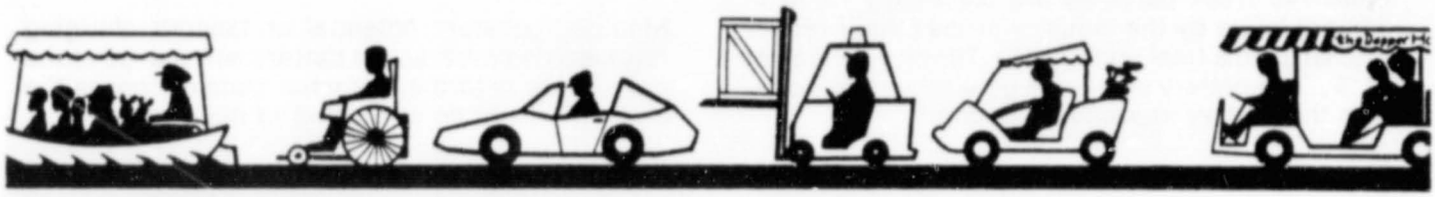
1. LaMarche model number A-45.
2. A.C. input voltage, phase, cycles.
3. Number and type of battery cells.
4. Ampere hour capacity of battery.
5. Allowable recharging time, 8 or 16 hours.
6. Battery connector number, if required.

LaMARCHE®
Manufacturing Company

106 Bradrock Drive, Des Plaines, Illinois 60018
Phone: 299-1188 (A.C. 312)

Lester

BATTERY CHARGERS



LESTER EQUIPMENT MANUFACTURING CO., INC.
2840 Coronado Street
Anaheim, California 92806
Telephone (714) 630-2260 (213) 860-6658

Line Compensated -L.C. types



For all Types of Industrial, Commercial, Medical and Sports Battery Operated Vehicles and Equipment

Lester BATTERY CHARGERS

The simplicity of the circuitry, the reliability of correct charging rates and dependability of overall operation provides you with superior performance. It prevents the battery from over-gassing, overheating; reduces battery water consumption and extends battery life.

Industrial truck batteries are commonly rated in ampere hours by the industry at the 6 hour rate of discharge to a final voltage of 1.70 volts per cell at 77°F. The battery charger is generally rated to return the battery capacity in 12 hours.

The best way to charge industrial batteries is to use our charger with a taper-type of charging characteristic. Silicon-diode ferroresonant chargers offer the ultimate in battery charging. By sensing the counter EMF voltage of the battery in the ferroresonant transformer circuitry, the proper charging rate is delivered to the battery so as to charge the battery efficiently and with a minimum amount of gassing which will help to extend battery life and give maximum performance. The inherent load regulation is such that the battery voltage controls the amount of current to the battery.

Modified constant potential or tapered charging rates are desirable so the battery will charge at the proper rate regardless of what state of charge the battery is in when connected to the charger.

The ferroresonant transformer holds the current at the start of charge within prescribed limits and holds the voltage near the finish of cycle to within ± 1% for line voltage variations as much as ±10% The output is current limited by design so as to protect the charger from blowing D.C. fuses due to overload.



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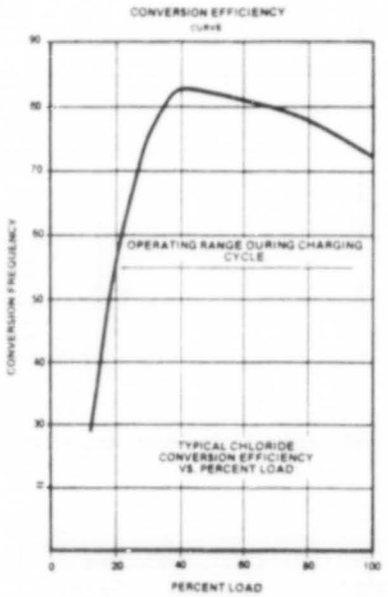
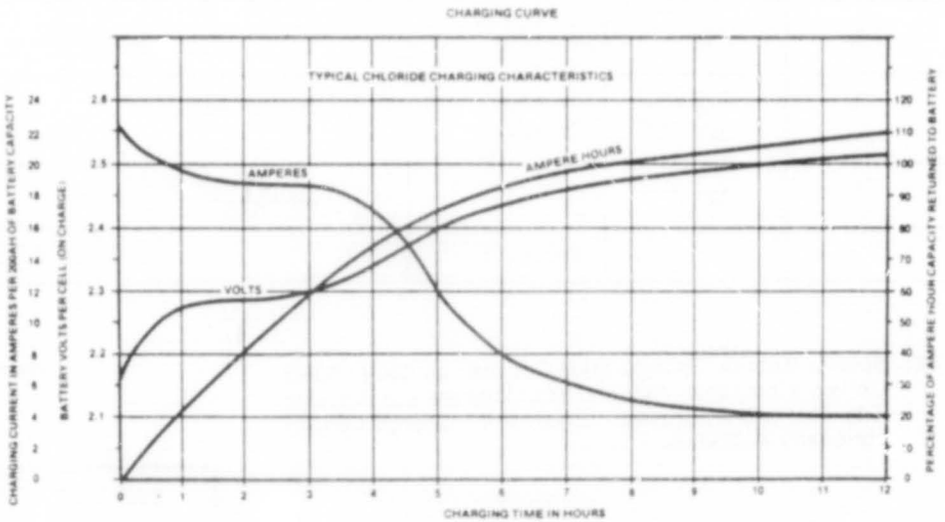
Telephone (714) 630-2260 (213) 860-6658

Features

• A.C. input regulated±10% — Automatically adjusts charger for variations. • Charger current regulated Automatically maintains rates and protects your charger and the battery. • Lester Equipment chargers are fail-safe designed — if any component of the charger fails it will not result in any damage to the battery. • Quick acting A.C. line fuses — Full charger protection. • Fast acting D.C. fuse — Protects your charger from reversed polarity. • Premium quality and reliability. • Higher rated P.I.V. silicon diodes — Protects against voltage surges. • Capacitors and tuned resonant transformers constantly monitor battery counter EMF — Resulting in proper tapering charge rate, and as an added safety factor capacitors are isolated from input and output. • Excellent power factor and efficiency — Lower A.C. current draw — Greater savings to the user — Lower operating costs. • Reliability — Trouble-free operation. • Simplified circuitry — Minimum maintenance required. • Los Angeles City Test Lab Approved. • Recessed control panel ammeter, timer — Protects against damage. • Heavy guage steel cabinets — Convection cooled — Drip-proof construction — Designed to be attractive and withstand abuse — Finish baked enamel paint. • Electronic Fail Safe Charger Control (optional)





Charging curve per ITA (INDUSTRIAL TRUCK ASSOCIATION) approximately 22.5 amperes per 100 A.H. battery capacity start rate of charge, and 5 amperes per 100 A.H. battery capacity finish rate.
Lester Equipment ferroresonant chargers are designed to completely recharge a lead acid battery from a rated discharge state in 12 hours or less returning 110% of battery's rated capacity. After battery is fully charged, the charger output will be at finish rate or lower depending upon battery counter EMF during charge. Various ampere hour capacity batteries of same battery voltage can be charged from same charger, within range of capacity, without damage to battery or charger.

Conversion efficiency is determined by multiplying by power factor. A high figure means lower A.C. current is required. The Lester Equipment charger has an average conversion efficiency of almost 80 per cent over an 12 hour charge cycle. Controlled types of chargers often have average conversion efficiencies of less than 60 per cent and sometimes less than 50 per cent. The high level obtained with Lester chargers means lower operating and installation costs plus energy savings.

Ordering Information

BATTERY SIZE			CHARGER MODELS			CABINET STYLE
NUMBER OF BATTERY CELLS	NOM BATTERY VOLTAGE	CHARGING CAPACITY A.H WITH12 HR.	SINGLE PHASE		THREE PHASE	
			115V/230V	208V/230V	230V/460V	
6	12 12	0-220 200-400	12LC25T12 12LC50T12			A A
9	18	0-220	18LC25T12			A
12	24 24 24 24 24	0-105 0-220 0-240 200-400 400-800	24LC12T12 24LC25T12 24LC30T12 24LC50T12	 24LC105T12		A A AorB C D
18	36 36 36	0-220 200-400 400-800	36LC25T12	36LC50T12 36LC105T12	 36LC105T12-3	A C D
24	48 48 48	0-220 200-400 400-800	48LC25T12	48LC50T12	 48LC105T12-3	A C D
36	72	0-320		72LC40T12		C
51	102/12 102/12	0-220 200-400	102/12LC25T12	 102/12LC25T12		 D
60	120/12	200-400	120/12LC25T12			D
72	144/12	200-400		144/12LC25T12		D

NOTE: Special Built-in Configurations as well as 220V, 50Hz Units are available. 24V and 36V Units are Los Angeles City Test Lab Approved. *"Electronic" Charge Control* optionally available.

Specifications subject to change without notice

CABINET	NOMINAL DIMENSIONS Heighth	Width	Depth
A	11"	8¾"	12½"
B	7½"	6½"	12"
C	11¾"	8¾"	12½"
D	18"	20"	24"

LESTER EQUIPMENT MANUFACTURING CO., INC.
2840 Coronado Street
Anaheim, California 92806
Telephone (714) 630-2260 (213) 860-6658

Manufacturers of Industrial and Motive Power Battery Chargers and Cathodic Protection Power Supplies.

MASTER CONTROL SYSTEMS, INC.

MODEL MBC6

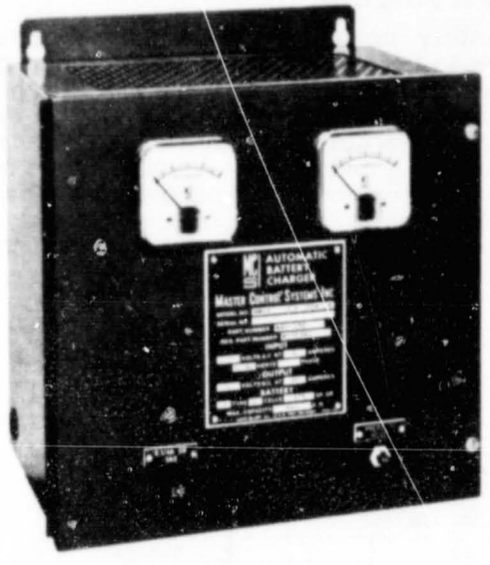
U.S. Pat. 3854082

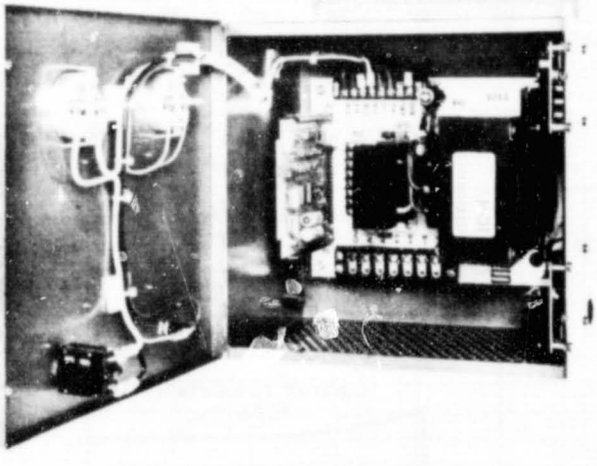
AUTOMATIC MODE SWITCHING

FLOAT-EQUALIZE

BATTERY CHARGER

This charger has been specifically designed for standby applications involving high battery loads of short duration which require fast recharging capability, such as heavy duty engine starting batteries. Continuous loads should not exceed 50% of the charger rating.





These Chargers Provide:

- **Fully Automatic Operation — switches to float mode when battery is fully charged**
- **Automatic Two Rate, float-equalize**
- **Automatic Fast re-charging capability**
- **A.C. Line Voltage compensated**
- **D.C. Voltage regulated**
- **Current Limited at rated capacity**

CHARGER OPERATION

The Model MBC6 is a two rate charger (equalize and float). Switching from one rate to the other is fully automatic.

When first connected to a discharged battery, the charger will produce its maximum rated current until the battery terminal voltage increases to the desired equalize point. The charger will replace most of the missing charge in this manner. When the equalize voltage has been reached, the charger will reduce the current to the value required to maintain the equalize voltage. This voltage limiting mode will bring the battery to a fully charged condition. THIS FEATURE GIVES THE CHARGER THE CAPABILITY OF AUTOMATICALLY RECHARGING THE BATTERY IN LESS THAN 1/2 THE TIME REQUIRED BY OTHER CHARGERS OF EQUAL CAPACITY.

When the current required to maintain equalize voltage falls below a specific level, (approximately 1/2 of its rated current) the charger will change to the float mode. The charger will then supply whatever current is required to maintain float voltage. THERE IS PRACTICALLY NO GASSING OF THE BATTERY WHEN KEPT AT A TRUE FLOAT VOLTAGE SO THE BATTERY MAINTENANCE IS REDUCED TO A MINIMUM AND BATTERY LIFE WILL BE SUBSTANTIALLY INCREASED.

MASTER CONTROL SYSTEMS, Inc.
910 NORTH SHORE DRIVE, LAKE BLUFF, ILLINOIS 60044
Telephone: Area Code 312/295-1010

MODEL MBC6

AUTOMATIC MODE SWITCHING
FLOAT-EQUALIZE
BATTERY CHARGER

EXTERNAL LOADS

When operating in the float mode, the charger will carry external loads of up to 50% of its rated current continuously and still maintain the battery in the charged condition.

Long-term continuous loads approaching 50% or more of charger rating will tend to delay or prevent the charger from switching back to the float mode after returning the battery to full charge. Keeping the charger in the high rate mode will cause excessive gassing and heating in the battery. Continuous loads well below 50% of charger rating will not interfere with normal mode-switching operation.

When a high current load is applied to the battery, (such as engine cranking) the charger will immediately switch to the equalize mode and operate at maximum capacity until it has returned all of the current into the battery. It will then switch back to the float mode in the manner previously described.

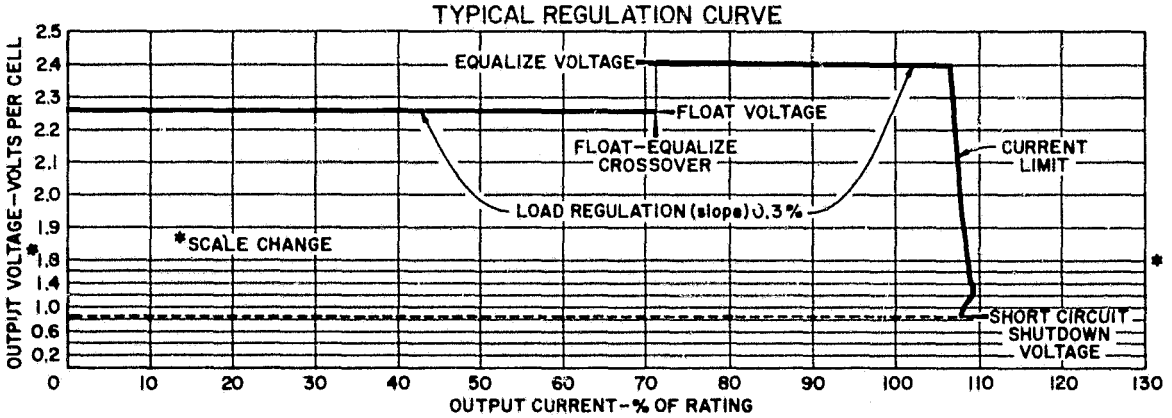
CURRENT LIMITING

Overloads or even short circuits on the output of the charger will not damage the charger since it current limits at rated capacity. Because of this feature, the charger need not be disconnected during cranking on engine starting applications. Charger is polarity protected so that it will not be damaged if battery polarity is accidentally reversed.

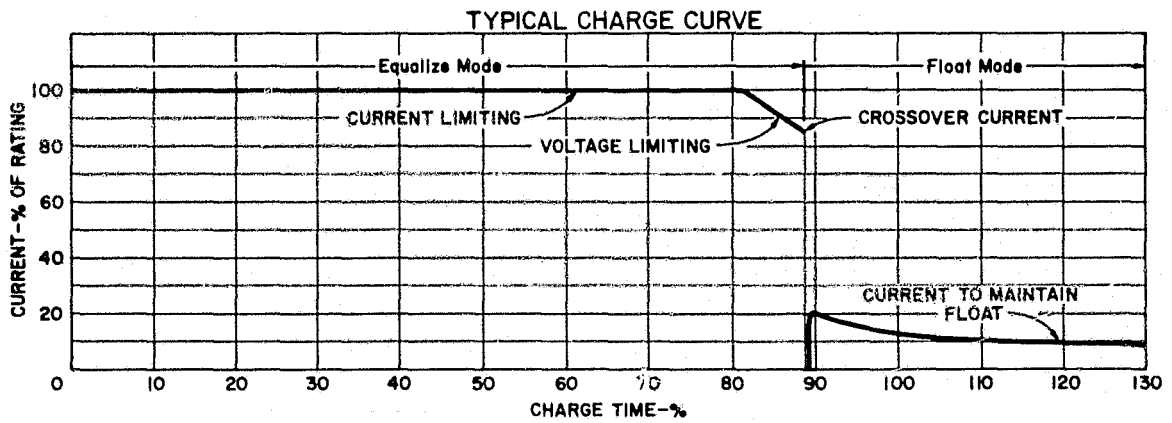
POWER FAILURE

Momentary power interruptions will cause the charger to be in the equalize mode when power is restored and will remain there for a length of time, dependent on the amount of discharge occurring during the interruption. If there was no discharge, the charger will remain in the equalize mode only momentarily. The charger will not discharge the battery, even on extended periods of power failure. Disconnecting the battery from the charger has the same effect as a power interruption.

TYPICAL REGULATION CURVE



TYPICAL CHARGE CURVE



Charge time is obtained by dividing battery capacity by charger rating. Thus, if a charger having a 10 ampere rating were connected to a completely discharged 200 ampere hour battery, 100% on the chart would represent 20 hours.

MASTER CONTROL SYSTEMS, Inc.
910 NORTH SHORE DRIVE, LAKE BLUFF, ILLINOIS 60044
Telephone: Area Code 312/295-1010

MODEL MBC6

AUTOMATIC MODE SWITCHING
FLOAT-EQUALIZE
BATTERY CHARGER

Construction Features:

- **Voltmeter and Ammeter are standard**
- **Both A.C. and D.C. Fuses are provided**
- **All semiconductors and integrated circuits are silicon and hermetically sealed**
- **Modular construction (Plug-in printed circuit regulator board)**
- **Remote sensing terminals are provided**
- **Float and equalize voltage levels are factory preset for the specific battery type**
- **No transformer tap settings are required**
- **Charge output is completely isolated from A.C. power**

CHARGER PERFORMANCE SPECIFICATIONS

MODE SWITCHING: Automatic — Mode depends on state of charge and use of battery.

INPUT LINE REQUIREMENTS: Nominal 117V. A.C. at 60 Hertz. Range of input voltage: 105-125V. A.C.

RECOMMENDED BATTERY CAPACITY: 5.0 to 23.0. Times rated current.

The following specifications apply at 117-125V. A.C. input at 25°C.

RECHARGING TIME: To obtain time required to recharge a fully discharged battery, take 1.2 times battery capacity in ampere hours (AH) divided by rated current (E.G. for 10A Charger and 200AH battery, rate = 1.2 × 200 ÷ 10 = 24 hours).

MAXIMUM OUTPUT CURRENT: Current limited at rated current ± 10%.

OUTPUT VOLTAGE LIMITS: Nominal Value (Factory Set).

BATTERY TYPE:	LA (1.275 S.G)	FL (1.220 S.G.)	NC (High Rate)
EQUALIZE:	2.34 V/Cell	2.29 V/Cell	1.50 V/Cell
FLOAT:	2.20 V/Cell	2.17 V/Cell	1.40 V/Cell

VOLTAGE REGULATION (LINE): ± 0.2% Maximum for ± 10% line change.

TEMPERATURE STABILITY: 0.08%/°C. Maximum.

OPEN CIRCUIT LEAKAGE: 50mA Maximum.

OUTPUT DRAIN (A.C. INPUT OFF): 10mA Maximum.

OUTPUT TERMINAL VOLTAGE FOR CHARGER SHUTDOWN (WITH SHUTDOWN OPTION): +4.0 Volts Maximum.

MALFUNCTION ALARMS

NFPA 76A requires that chargers used on starting batteries for emergency generator sets contain provisions for operating an annunciator when the charger is malfunctioning. Master Control's option MFA has been designed to meet these requirements. Output contacts are SPDT and rated for 10A @ 115 V.A.C. These contacts transfer in event of A.C. power failure, low battery voltage, loss of charge current and lack of high rate charge after a heavy battery discharge. The system is unique in that the low voltage alarm is locked out as long as the charger is producing at least 75% of its rated output current. This prevents the alarm contacts from transferring during heavy discharges such as engine cranking.

A low voltage alarm (LVA) for use with floating type systems is also available. This operates in the same manner as the MFA except that it is not locked out during periods of heavy battery discharge.

High voltage alarm (HVA) can also be supplied where the application necessitates its use.

Sample Specifications

The Battery Charger shall be a Master Control Automatic Mode Switching, Model MBC6 or approved equal. The Charger shall have an output current rating of at least 1/20 of the rated ampere hour capacity of the battery to which it is applied and shall be capable of automatically switching from one rate to the other, according to the needs of the battery. Voltage settings for both ranges shall be factory preset for the specific battery type and shall not be field adjustable. It shall maintain its rated output voltage within ± 0.2% with A.C. input variation of ± 10%.

The Charger shall have:

- Automatic Overload Protection (Current Limiting)
- Semiconductors and integrated circuits to be silicon and hermetically sealed
- D.C. Voltmeter and Ammeter
- Fused A.C. input and D.C. output
- Provisions for automatically switching to float mode when battery is fully charged

MASTER CONTROL SYSTEMS, Inc.
910 NORTH SHORE DRIVE, LAKE BLUFF, ILLINOIS 60044
Telephone: Area Code 312/295-1010

MODEL DESIGNATION

CHARGER						BATTERY	
MODEL NUMBER	U.L. Listed Δ	Nominal Output D.C. Volts	Rated Output D.C. Amp.	Max. A.C. Amps. Input at 120 VAC	Approx. Weight Lbs. (KG)	No. of LA or FL Cells	Recommended Capacity Range (A.H.)
MBC6-12-5 (*)	X	12	5	1.5	24 (11)	6	25-115
MBC6-12-10 (*)	X	12	10	3	35 (16)	6	50-230
MBC6-12-20 (*)		12	20	6	36 (16)	6	100-460
MBC6-24-5 (*)	X	24	5	3	35 (16)	12	25-115
MBC6-24-10 (*)	X	24	10	6	36 (16)	12	50-230
MBC6-24-20 (*)	X	24	20	12	38 (17)	12	100-460
MBC6-30-5 (*)		30	5	4	30 (14)	15	25-115
MBC6-30-10 (*)		30	10	8	38 (17)	15	50-230
MBC6-32-5 (*)		32	5	4	30 (14)	16	25-115
MBC6-32-10 (*)		32	10	8	38 (17)	16	50-230
MBC6-36-5 (*)		36	5	5	30 (14)	18	25-115
MBC6-36-10 (*)		36	10	9	40 (18)	18	50-230
MBC6-48-2 (*)		48	2½	3	26 (12)	24	12-65
MBC6-48-5 (*)		48	5	6	36 (16)	24	25-115
MBC6-48-10 (*)		48	10	12	38 (17)	24	50-230
MBC6-130-2 (*)		130	2½	7	39 (18)	60	12-65
MBC6-130-5 (*)		130	5	15	46 (21)	60	25-115
MBC6-130-10(*)		130	10	30	121 (55)	60	50-230
MBC6-130-20(*)		130	20	—	186 (84)	60	100-460

(*) Add Suffix (LA) to model number when charger is for use with automotive lead acid batteries having 1.265-1.285 sp. gr.
(*) Add Suffix (FL) to model number when charger is for use with float service lead acid batteries having 1.200-1.220 sp. gr.
(*) Add Suffix (NC) to model number when charger is for Nickel Cadmium Batteries.
(Δ) See current price sheet for complete approval information.

Battery manufacturers recommend that the equalizing current of the charger be not less than C/20 with C representing the ampere hour capacity of the battery. As an example, a 200 ampere hour battery would require that the charger have the capability of providing an equalizing current of 10 amperes. Design of the MBC6 Charger is based on this premise, therefore, it is most important that the charger rating be compatible with the recommended battery capacity as outlined in the above table. Use of these chargers on batteries that have either a **larger** or **smaller** capacity than recommended, may result in damage to the batteries.

Ordering Information:

- Catalog no. and mfg. of battery
  or
- Ampere Hour Capacity of Battery
- For Nickel Cadmium specify whether high or low rate type
- Specific gravity of lead acid battery
- State Master Control's Model number
- A.C. input voltage, frequency and phase
- Number and type of battery cells
- Continuous D.C. load
- Allowable Recharging Time from full discharge
- Indicate application, i.e., Stationary, Mobile or Marine

Specifications subject to change without notice.

MASTER CONTROL SYSTEMS, Inc.
910 NORTH SHORE DRIVE, LAKE BLUFF, ILLINOIS 60044
Telephone: Area Code 312/295-1010

MOTOR APPLIANCE CORPORATION

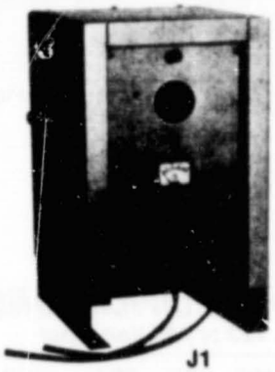
SPIRIT WEST INDUSTRIAL PARK

555 MERCURY BLVD. / P.O. BOX 22 / CHESTERFIELD, MO. 63017 / TELEPHONE: 314-532-3406

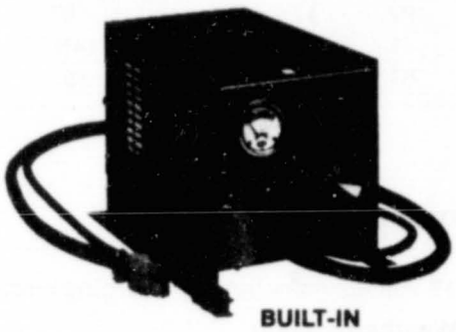
ELECTRIC VEHICLE BATTERY CHARGERS



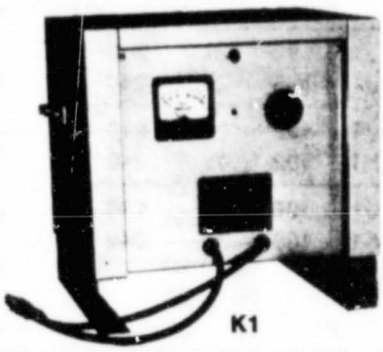
P1-P2



J1



BUILT-IN



K1

A NEW LINE

MAC's new EV line offers many of the features that make MAC Chargers so popular in the motive power field . . . ferro-resonant transformers, uncomplicated circuit designs and rugged case enclosures. The electric vehicle field knows that these features along with quality components in MAC Chargers such as grain oriented transformer lamina tions provide lower A.C. starting currents, lighter weight chargers and efficient recharging of electric vehicle batteries. MAC charges your batteries to ensure a full charge with minimum gassing for lower maintenance costs and longer battery life.

FEATURES

* Lower A.C. starting currents
* Precise voltage regulation
* Current limiting
* Fully automatic charging
* Failsafe battery protection if any charger component fails
* Reverse polarity protection
* Heavy duty steel case construction
* Lighter weight
* Flexible mounting configurations
* MAC Chargers backed by nationwide service network

AUTOMATIC CHARGING

MAC Battery Chargers incorporate advanced ferro-resonant transformer designs that deliver the proper charge to batteries at all times — automatically. The ferro-resonant transformer continuously monitors the back EMF voltage of the battery to regulate a tapering charge from start to finish. Excellent voltage regulation ensures a precise charge at the critical finish rate.

SPECIAL APPLICATION ENGINEERING

MAC Engineers have the most experience in the battery charger field designing special built-in/on-board units. Creative engineering and practical ideas mean that MAC can help you with design problems. Consult MAC for your on-board charger applications.

MOTOR APPLIANCE CORPORATION

SPIRIT WEST INDUSTRIAL PARK

555 MERCURY BLVD. / P.O. BOX 22 / CHESTERFIELD, MO. 63017 / TELEPHONE: 314-532-3406

Designers and Manufacturers of FHP Electric Motors & Battery Chargers

MAC TYPE EV SPECIFICATIONS

Sinige Phase 60 HZ 120 or 240 Volt Input

MODEL	CASE	DCV	DCA	ACV	ACA	WT
EVP3620	P2	36	20	120	10.5	35
EVP3620	P2	36	20	240	5.3	35
EVP3630	P1	36	30	120	14.4	48
EVP3630	P1	36	30	240	7.2	48
EVP4820	P1	48	20	120	12.0	45
EVP4820	P1	48	20	240	6.0	45
EVP4830	P1	48	30	240	10.0	75
EVP6020	P1	60	20	120	17.0	53
EVP6020	P1	60	20	240	8.5	53
EVP6030	P1	60	30	240	13.0	
EVP7220	P1	72	20	120	9.0	58
EVP7220	P1	72	20	240	4.5	58
EVJ7225	J1	72	25	240	13.0	63
EVJ7230	J1	72	30	240	15.3	83
EVJ9620	J1	96	20	240	13.5	107
EVJ9625	J1	96	25	240	17.0	111
EVJ10220	J1	102	20	240	14.5	115
EVK10225	K1	102	25	240	18.0	120
EVJ10820	J1	108	20	240	15.5	110
EVK10825	K1	108	25	240	19.0	119
EVJ12015	J1	120	15	240	13.0	107
EVK12020	K1	120	20	240	17.0	115
EVK14418	K1	144	18	240	18.5	185

Three phase models also available upon request.

DIMENSIONS

CASE SIZE	HEIGHT	WIDTH	DEPTH
P1	13″	9″	13″
P2	12″	8″	12″
J1	20″	14¾″	15″
K1	21″	15″	18″

OPTIONS:

* 12 Volt auxiliary battery charging circuits
* Weatherproofing
* Electronic charge termination
* Winter/Summer Finish Rate Control
* D.C. disconnect/A.C. interrupt

NOTES:

Other chargers to meet your specific requirements are available — consult factory.

IMPORTANT
When ordering specify

1. **Type and size of batteries**
2. **Number of cells**
3. **Allowable recharge time**
4. **A.C. Input Voltage & Amp Service**
5. **D.C. connector**
6. **Options**

SCHAUER MANUFACTURING CORPORATION
4500 ALPINE AVENUE
CINCINNATI, OHIO 45242
TEL: 513-791-3030

MODEL FC90, 60/90 AMPERE FAST CHARGER
115 V.A.C., 6/12 V.D.C.

Size: 22-3/4" (57.8 cm)H x 14" (35.5 cm)W x 12" (30.5 cm)D, with handle 35" (89 cm)H. Weight: 50 Lbs. (22.7 Kg.). Charges 6 or 12 volt batteries at 4 separate charging rated; up to 90 amperes on 6 volt and 60 amperes on 12 volt batteries. Conveniently located controls include 0-60 minute timer, charge rate selector switch with low rate maintenance-free position, color coded ammeter, manual re-set AC circuit breaker.

Non-aging silicon rectifiers and transformer are fan cooled. 6 ft. A.C. cord and 8 ft. D.C. cables are oil resistant. Convenient hangers keep cables neatly stored when not in use. Rugged steel housing, with baked-on enamel finish, is mounted on 6" rubber-tired wheels for portability.

Easy-to-read operating instructions located just above the operating controls.

Underwriters Laboratories listed and meets OSHA standards.

FULLY-AUTOMATIC BATTERY CHARGERS

MODEL TB6012, 6 AMP, 12 VOLT
115 V.A.C., 12 V.D.C.

Size: 6¼" (15.9 cm)H x 9¼" (23.8 cm)W x 5-3/4" (14.6 cm)D. Weight: 8¼ Lbs. (3.75 Kg.).

MODEL TB10012, 10 AMP, 12 VOLT
115 V.A.C., 12 V.D.C.

Size: 7¼" (18.4 cm)H x 9¼" (23.8 cm)W x 5-3/4" (14.6 cm)D. Weight: 11-3/4 Lbs. (5.3 Kg.).

MODEL TB20012, 20 AMP, 12 VOLT
115 V.A.C., 12 V.D.C.

Size: 8¼" (20.9 cm)H x 11¼" (28.6 cm)W x 7-7/8" (20 cm)D. Weight: 22-1/4 Lbs. (10.1 Kg.); 4/Master Carton, 89 Lbs. (40.5 Kg.).

MODEL TB10024, 10 AMP, 24 VOLT
115 V.A.C., 24 V.D.C.

Size: 11¼" (28.6 cm)H x 8¼" (20.9 cm)W x 7-7/8" (20 cm)D. Weight: 22½ Lbs. (10.2 Kg.).

BATTERY CHARGERS
(OFF-BOARD)

SCHAUER MANUFACTURING CORPORATION
4500 ALPINE AVENUE
CINCINNATI, OHIO 45242

TEL: 513-791-3030

MODEL ERM12, 15 AMPERE AUTOMATIC/MANUAL
115 V.A.C., 12 V.D.C.

Size: 8¼" (20.9 cm)H x 11¼" (28.6 cm)W x 7-7/8" (20 cm)D. Weight: 18-3/4 Lbs. (8.5 Kg.); 4/Master Carton, 75 Lbs. (34 Kg.). In addition to having a 33% greater charging capacity than the 10 amp model, this charger can be operated as a manual or an automatic battery charger. For quick recharge, set the switch to Manual; for overnight or extended charging or maintaining battery, set the switch to Automatic. Ideal for truck, farm and automotive equipment.

MODEL F5612, 20 AMPERE MANUAL
115 V.A.C., 6/12 V.D.C.

Size: 8¼" (20.9 cm)H x 11¼" (28.6 cm)W x 7-7/8" (20 cm)D. Weight: 22-3/4 Lbs. (10.3 Kg.); 4/Master Carton, 91 Lbs. (41.4 Kg.). This model is an excellent charger for car lots, garages, service stations and farms. With a charging rate of 20 amperes for 6 volt or 12 volt batteries, it will build a starting charge within a few minutes time and recharge the average battery in 1½ to 2½ hours. Can also be used to charge as many as 4 batteries at a 5 ampere rate when connected in parallel.

MODEL G6612, 30 AMPERE MANUAL
115 V.A.C., 6/12 V.D.C.

Size: 8¼" (20.9 cm)H x 11¼" (28.6 cm)W x 7-7/8" (20 cm)D. Weight: 22 Lbs. (10 Kg.); 4/Master Carton, 90 Lbs. (41 Kg.). With a charging rate of 30 amperes for 6 or 12 volt batteries, will build a starting charge within a few minutes time and will recharge the average battery in 1 to 2 hours. Can also be used to charge 6 batteries at a 5 ampere rate when connected in parallel.

MODEL DX5, 10 AMPERE MULTI-CELL MANUAL
115 V.A.C., 6,8,12, or 24 V.A.C.

Size: 8¼" (20.9 cm)H x 11¼" (28.6 cm)W x 7-7/8" (20 cm)D. Weight: 20-3/4 Lbs. (9.4 Kg.); 4/Master Carton, 83 Lbs. (37.7 Kg.). Ideal for farms, motels, resorts, garages having batteries of different voltages to charge. Charges 6, 8, 12, and 24 volt batteries at a 10 ampere rate. Will charge 4 six-volt or 2 twelve-volt batteries at 10 amperes when connected in series. Equipped with long-life silicon rectifiers, accurate ammeter, carrying handle, voltage selector switch and DC circuit breaker.

BATTERY CHARGERS
(OFF-BOARD)

SCHAUER MANUFACTURING CORPORATION

These highly advanced, fully-automatic battery chargers automatically reduce from their full charge rate to a safe maintaining charge rate as the battery becomes charged. Batteries can be left connected for extended periods of time without danger of overcharging; charger supplies just enough current to keep the battery charged.

TEMPERATURE COMPENSATED: Automatically supplies the proper charge in the hottest or coldest weather.

VOLTAGE COMPENSATED: Batteries are maintained at the proper voltage even where the AC line voltage varies (+ or - 10%).

POLARITY PROTECTED: No current flow unless the charger is properly connected.

ADJUSTABLE: Charger can be adjusted to provide the proper maintaining charge to suit the requirements of any age battery.

All models listed are equipped with accurate, numeral dial ammeters, stable, non-aging silicon rectifiers, and heavy-duty transformers with built-in protection. They are housed in rugged steel case. All models are Underwriters Laboratories listed.

For additional information on models listed, or special, custom-made designs, call: A/C 513-791-3030.

SCHAUER MANUFACTURING CORPORATION
4500 ALPINE AVENUE
CINCINNATI, OHIO 45242
TEL: 513-791-3030

"QUALITY PRODUCTS FOR OVER 70 YEARS"

BELTS

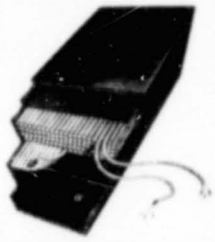
POWER TRANSMISSION; FLAT, VEE

(CODE **BE**)

Our Complete Line

The BFGoodrich Company
Industrial Products Division
Dept. 0709
500 S. Main Street
Akron, Ohio 44318
Telephone (216) 379-2114

Prime Mover Plus



Premium rated heavy industrial V-belt. Oil-resistant and static* conducting. This one versatile V-belt—sized in A, B, C, D, E sections—can power virtually every drive in your plant.

Ultra-V®*



A premium construction wedge-type, multiple drive belt that provides equal power transmission capacity in less space than ordinary multiple type belts. And it's oil-resistant and static-conducting at the same price. Operates at speeds up to 6500 FPM. Sizes 3V, 5V and 8V sections.

Prime Mover Plus Banded



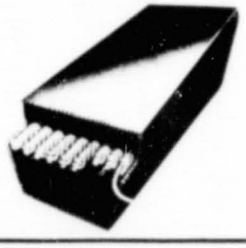
Premium Prime Mover V-belts are banded together to form a unitized belt set. Individual V's are spaced to permit it to operate in regular multiple belt sheaves. This construction prevents belt whip and turnover under pulsating and shockloads.

Ultra-V Band®



Premium Ultra-V-belts are banded together to form a unitized belt set. Individual V's are spaced to permit it to operate in regular multiple belt sheaves. This construction prevents belt whip and turnover under pulsating and shockloads.

FHP Glasstex® ORS



For light duty V-belt service, offering cool, quiet operation and long service life. Because of its glass cord construction, it will not shrink or stretch. It's oil-resistant and static-conducting,* all at a standard price.

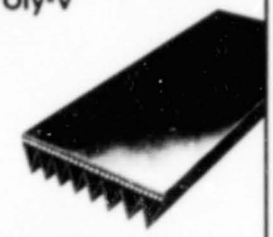
Cogged-Raw Edge



A premium construction belt for tough applications. Cogged belts offer great flexibility and increased capacity of a drive system. Heat and oil-resistant.

**Registered Trade Name of T. B. Wood's Sons Co.

Poly-V



More power per inch of drive width because, on drives where multiple belts are required, you eliminate the free space between belts. Provides about three times the traction areas of a flat belt of equal width. This belt is thinner, giving it better flexibility, reducing internal heating.

Variable Speed



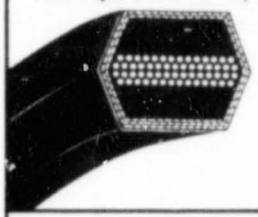
For drives where variable motion-control drives and mechanisms are employed. Belts transverse rigidity gives it excellent gripping action without crosswise distortion.

Grip-Tite Timing



Functions like a timing chain or gear. Precision-molded teeth engage the mating axial grooves on pulleys, entering and leaving the grooves in a smooth, rolling manner with negligible friction. Highly versatile in application, load and speed range.

HEX (Double-V)



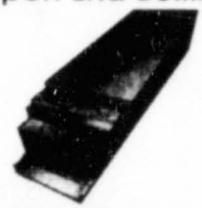
Used where a series of shafts rotating in opposite directions must be driven from a single source of power. Either side of the belt can be used as a driving surface.

Steel Cable



Tension member is steel wire, so it won't stretch under very heavy service loads. Belts to 105" long are notched for increased flexibility. Available in Prime Mover cross-sections.

Open End Belting



For drives not easily accessible to install endless V-belts, or for emergency use. Required length is cut off and its ends joined by a metal fastener. Available in Prime Mover cross-section for lower operating speeds.

V-Link



An open-end belt that doesn't require metal fasteners, for use where obstructions prevent use of endless belts. Can be quickly and easily installed without dismantling a drive. Available in Prime Mover cross-sections.

The BFGoodrich Company
Industrial Products Division
Dept. 0709
500 S. Main Street
Akron, Ohio 44318
Telephone (216) 379-2114

Selecting the Correct Belts

All the work and experience that goes into designing a V-belt drive is wasted if the specified belts are not used or the number of belts is changed. Over-belting is wasteful. Under-belting is even more expensive in the long run, because over-loaded belts wear out faster.

V-belts are identified for size according to industry standards. A combination of letters and numbers indicate the width across the top of the belt (often referred to as "cross section") and the belt length. Prime Mover Plus classical belts come in five widths: A, B, C, D, and E; while Ultra-V® Narrow belts are made in three widths: 3V, 5V, and 8V. In addition there are the fractional horsepower 2L, 3L, 4L, and 5L belts. If you are not sure which to use, measure the top width of the old belts carefully, or use BFGoodrich sheave or belt gauges described on pages 7 and 15.

Be careful in measuring V-belts. The top widths of the B and 5V belts are very close; however, the 5V is considerably thicker, and the groove angles of the sheaves are different. Do not attempt to use these belts interchangeably. The 4L and 5L FHP belts are also very close in size to the A and B belts. But again, groove angles may be different. **Never** use FHP belts on heavy duty industrial applications, even if they **seem** to fit the sheave grooves. The FHP belts have characteristics which are ideally suited for their own type of applications such as light machinery and appliances—but they aren't built for heavy duty jobs.

The belt number C270 indicates a belt with a nominal 7/8" top width and a nominal length of 270". Its pitch length is 270.9". These should be ordered as: matched set of (no. of belts on drive) C270 Prime Mover Plus Belts.

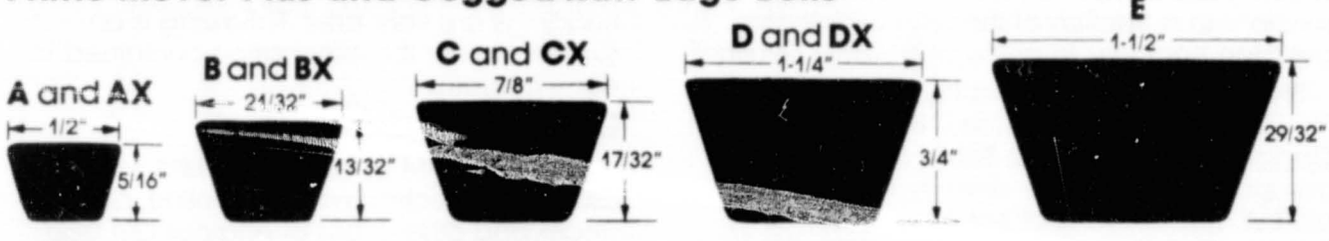
The number 5V1250 indicates a narrow belt with a nominal 5/8" top width and an effective outside length of 125". These belts should be ordered as follows: matched set of (no. of belts on drive) 5V1250 Ultra-V® belts.

The number 4L550 indicates a fractional horsepower belt having a nominal top width of 1/2" and a nominal outside length of 55". FHP Glasstex® belts are available for general purpose applications; specify 4L550 Glasstex®. It is designed to have little or no stretch and will require few take-ups during its life.

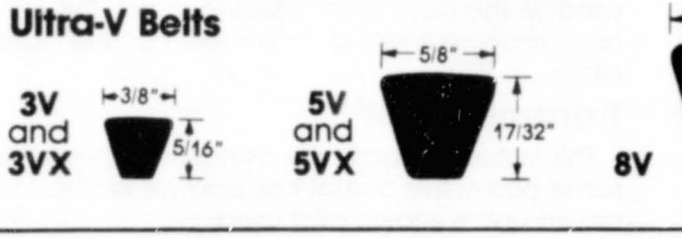
To assure maximum V-belt life, follow the minimum recommended pitch and sheave diameters for belts established by Mechanical Power Transmission Association and Rubber Manufacturers Association standards.

	Belt Section	Minimum Sheave Pitch Dia.
Classical	A	3"
	B	5.4"
	C	9"
	D	13"
	E	21"
Cogged-Raw Edge	AX	2.4"
	BX	3.4"
	CX	6.0"
Ultra-V	3V	2.6"
	5V	7.1"
	8V	12.5"
Narrow Cogged-Raw Edge	3VX	2.2"
	5VX	4.4"

Prime Mover Plus and Cogged-Raw Edge Belts



Ultra-V Belts



NOTE: Cross sections with Suffix "X" denote Molded Cogged-Raw Edge construction.

The BFGoodrich Company
Industrial Products Division
Dept. 0709
500 S. Main Street
Akron, Ohio 44318
Telephone (216) 379-2114

Let BFGoodrich Solve Your Drive-Design Problems

The dedicated and enthusiastic application of resources of power transmission problems by industrial giants, like BFGoodrich, has caused the design and construction of rubber power transmission V-belts to advance so greatly that most existing belt drives should be re-examined. The ratings on V-belts have changed four times in 25 years. A V-belt rated at 1 hp in 1950 was changed to 1.4 hp in 1959, to 1.7 hp in 1963, to 2.0 hp in 1971 and 2.2 hp in 1974. There are many drives in use today that were designed during one of these rating periods. In most instances, the drives are overbelted...and that, paradoxically, reduces rather than increases service life.

A redesigned drive may result in a change in the type and number of belts being used. That will mean a cost savings for you. There is a minimum of six and a maximum of ten different belt types that offer built-in savings, as well as other operating benefits for the average drive.

There are four additional types of belts that can be used when a special drive is required. BFGoodrich has the right belts to handle problem applications, efficiently and reliably.

Selection of the best possible drive is an important and extremely complex decision that demands absolute accuracy. Because it is so important, BFGoodrich offers a design service for engineers to provide the most economical, most efficient drive-design solution. More and more people are asking BFGoodrich—the V-belt professionals—to provide the answers. They know this special service will increase overall drive efficiency and lower their cost. They want superior power transmission.

Drives can be designed by our computer, which offers a wider choice of accurate solutions in a fraction of the time it takes the average engineer to arrive at a single solution.

BFGoodrich Prime Mover Plus, Prime Mover Plus Banded, Ultra-V,®* Ultra-V Band,® BFG Cogged-Raw Edge and Poly-V Belts can be computer designed for drive systems using two pulleys. This allows a direct comparison of these belt designs for use on the same drive. You can select the drive with the smallest applicable sheaves, least number of belts, lowest cost, etc., to meet your particular requirements.

*Registered Trade Name of T. B. Wood's Sons Co.

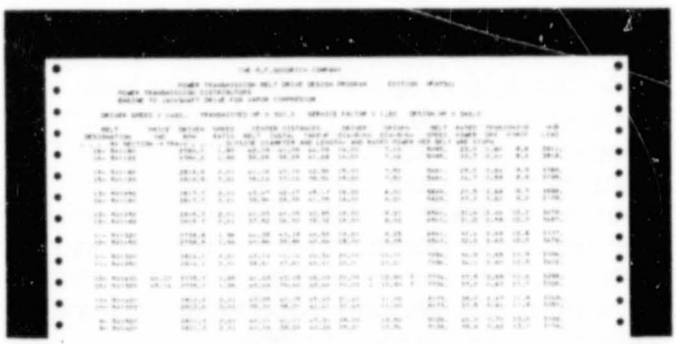
The BFG computer design service permits a quick and easy re-examination of existing drives to determine if there is overbelting. It can show you how to take advantage of the premium-rated Prime Mover Plus, at a standard belt price.

You reduce your drive costs. Use our special drive-design service on new applications, as well as on present drive systems that are causing problems.

It is available to everyone...and there is no charge. No wonder so many people are asking the BFGoodrich experts to design their drive systems.

Here's How It Works

First of all, you fill out the Data Design Sheet completely. This makes certain that all of the necessary information is made available to the BFGoodrich design engineers. When the data sheet is completed mail it to Elgin, South Carolina. In an emergency, you may phone the information to the number shown. Our engineers will immediately feed this information into our specially programmed computers. They will have the right answers to your problem in hours.



This is the computer "print-out" sheet. Because of space limitations, the column headings are very brief. Following is an explanation of the information contained in each column.

Driver Speed

This is the RPM of the driving unit which is usually an electric motor. Gasoline, diesel, steam and other types of engines are also used. In the case of an electric motor, the RPM and other pertinent data is shown on the name plate.

Transmitted HP

This value is usually the motor horsepower. In some cases, the actual horsepower of the driven unit is known and used.

Service Factor

The service factor is used to compensate for the various environmental and drive condition differences which are found in field applications. This type of drive, starting loads, temperature conditions, running loads, and time of operation all affect belt life. The value shown is our estimation of the effect of all of these factors on belt service life.

Design HP

The design HP is the product of the transmitted HP and service factor.

Belt Designation

This column indicates the number of belts required for the drive and the belt size number. Each line shows a separate solution for the drive requirements.

Price Index

This shows how the price of one drive compares to another. It is a reference number rather than an actual price. The drive with the lowest number has the lowest cost. The cost includes sheaves, belts, and bushings. If any one of the components is non-standard, the price index will not appear. This is why some spaces may be blank.

Driven RPM

This is the RPM of the driven sheave.

Center Distances Belt Install Take-up

The dimensions shown in these three columns are vital to a well-engineered V-belt drive. The first column labeled "BELT" shows the center distance of the drive when the belt is in place. The "INSTALL" column indicates the minimum center distance of the drive which allows for belt installation without prying the belt over the sheaves. The "TAKE-UP" column shows the maximum center distance required on the drive. This allows for belt stretch or growth during operation.

Driver Diameter-Bushing

These two columns contain the driver sheave information. The first colum indicates the diameter of the driver sheaves. This value will be either the outside diameter or the pitch diameter. An introductory statement on the printout sheet indicates which diameter will be listed. An example of this statement is shown. "5V SECTION ULTRA-V...OUTSIDE DIAMETER AND LENGTH, AND RATED POWER PER BELT ARE GIVEN." The sheave hub or bushing type is shown as SF, E, etc. Under the heading "BUSH" the cost of the bushing is included with the rest of the drive package in the price index.

Driven Diameter-Bushing

These two columns are the same as that for the "DRIVER" except the data is based in the "DRIVEN" sheave of the drive.

Belt Speed

This column lists the belt speed in feet per minute.

Rated Power

This column shows the rated HP per belt for the drive.

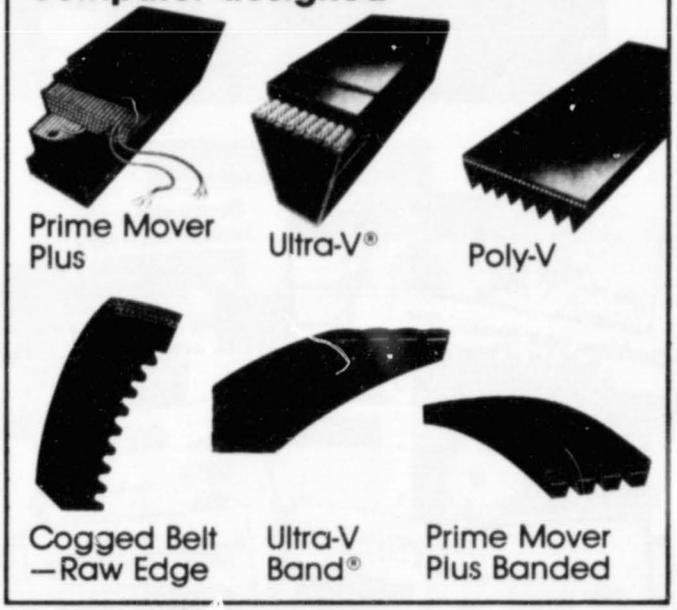
Tensioning, DEF Force

This column shows how to tension the belt for the particular design given. Under the column "DEF" the amount of deflection in inches is given at the center of the span for the force in pounds shown under the column headed "FORCE".

Hub Load

This column lists the resultant force of the two strands. This value may be used in determining bearing loads due to belt forces.

BFGoodrich V-belts that can be computer designed



Prime Mover Plus | Ultra-V® | Poly-V

Cogged Belt —Raw Edge | Ultra-V Band® | Prime Mover Plus Banded

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The BFGoodrich Company
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C-2

GOODYEAR

Your Key to Better Automotive Service Products

To your customers, the world-famous Goodyear name is an extra assurance of reliability. Every national magazine, newspaper, TV and radio ad helps you "Sell Goodyear" with its reputation for quality. Many of your customers will be replacing Goodyear original equipment parts, because Goodyear is one of the leading suppliers of automotive belts to the new car industry.





Goodyear's Lincoln, Nebraska Plant, is one of the most modern in the industry. All Goodyear automotive V-belts and radiator hose are made in this plant.

FULL RANGE OF PRODUCTS

The Goodyear automotive belt and hose line includes the full range of sizes and designs to fit virtually every kind of car, truck, bus or off-the-road equipment. It also includes a complete selection of fractional horsepower V-belts for light machinery, home appliances, power mowers, garden tractor, farm machinery and shop equipment. And, Goodyear carries a selection of garage and service station hose, heater hose, and other automotive replacement products.

COMPUTER COMPILED APPLICATION GUIDES

To help you select the correct replacement belt or hose quickly, Goodyear provides complete application guides covering passenger cars; light, medium and heavy duty trucks; off-the-road equipment and FHP applications. The data in Goodyear's application guides is compiled by computers, assuring you of complete accuracy and up-to-date information on part numbers, belt and hose numbers for virtually any vehicle you service.

LONG LASTING QUALITY

Goodyear quality is your assurance of customer satisfaction. In production, Goodyear sets high standards for quality—from raw materials selection and inspection to final packing and shipping. And, behind Goodyear's production is the latest in equipment, the finest in engineering and production personnel. In customer service, Goodyear saves you time and money—with computerized inventory controls, strategically located warehousing facilities, convenience packaging and simplified code numbers. In addition, Goodyear keeps you sales and profit ready with the regular publication of the very latest in application data. In research Goodyear has consistently led the way in new rubber product discoveries and improvements.

Goodyear — The Greatest Name In Rubber

THE GOODYEAR TIRE & RUBBER COMPANY
AUTOMOTIVE REPLACEMENT PRODUCTS
Lincoln, Nebraska 68501
Phone: (Area Code 402) 466-8311 (Ext. 372)

GOODYEAR

Multiple V-Belts

THE GOODYEAR TIRE & RUBBER COMPANY
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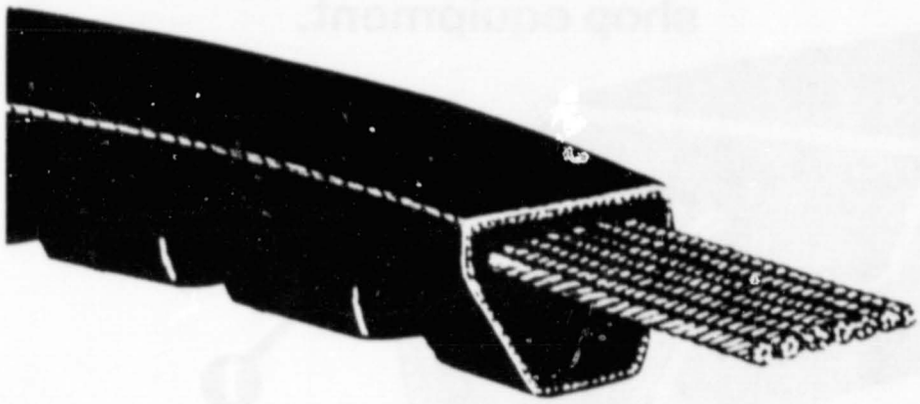
Phone: (Area Code 402) 466-8311 (Ext. 372)

Hy-T® Wedge Belts

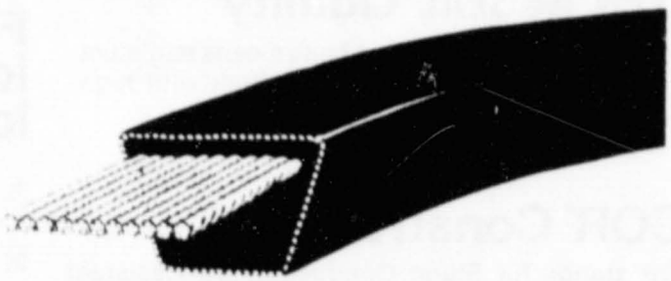


The 3V cross section measures 3/8" at the top and is available in standard lengths from 25" through 95".

The 3V Hy-T Wedge cross section is designed for use on drives with moderate horsepower, small diameter sheaves and short centers. 3V belts are precision notched on lengths up to 3V800. The "Green-Seal"® trademark signifies true dimensional stability. The SCOR® trademark signifies that the belt is made from a static conductive and oil resistant compound. Meets RMA standards.

INDUSTRY NO.	GOODYEAR PART NO.
3V560	79560

Hy-T® V-Belts



COMPASS BELT CONSTRUCTION
cross section under 120°

STRONG STRETCH-RESISTANT CORD
High strength Vytacord™ tension members, specially treated with a special Goodyear process, which eliminates excess stretch, increases resistance to shock loads, and improves flex-life.

EQUALIZED LOAD DISTRIBUTION
Oil-resistant insulation section distributes the load evenly. Each cord carries its share of the load—stress is uniform, belt works smoothly.

HEAT- AND OIL-RESISTANT
Specially compounded oil- and heat-resistant rubber in the cushion section resists compression fatigue, absorbs shock and keeps the belt flexing easily over the sheaves.

ABRASION-, HEAT- AND OIL-RESISTANT COVER
Belt cover stock is sturdy blended fabric, bias cut and impregnated with a special rubber compound to resist abrasion, heat and oil. Prevents static build-up and improves flexibility.

Meets RMA standards.

A SECTION	B SECTION	C SECTION
		
Top Width 1/2", Thickness 5/16", Angle 42°	Top Width 21/32", Thickness 13/32", Angle 42°	Top Width 7/8", Thickness 17/32", Angle 42°

INDUSTRY NO.	GOODYEAR PART NO.
A 55	76055
B 33	77033
C 105	78105

Standard FHP V-Belts

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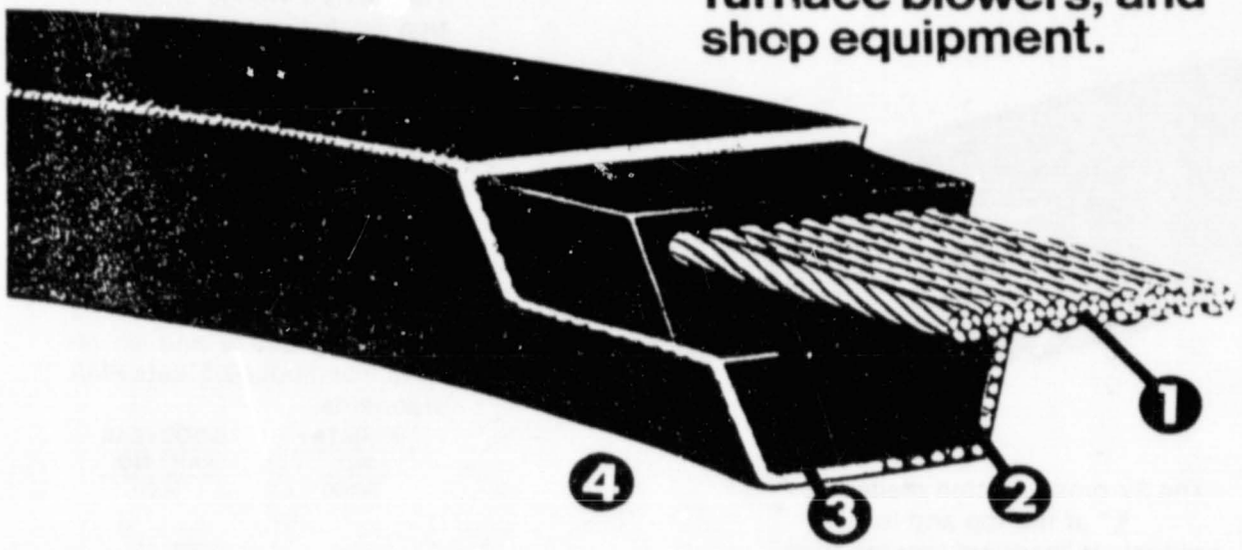
Specifically designed for light machinery, appliances, furnace blowers, and shop equipment.



GREEN SEAL® Quality

The Green-Seal on Goodyear belts means minimum stretch, true dimensional stability. Built with high strength synthetic cords.

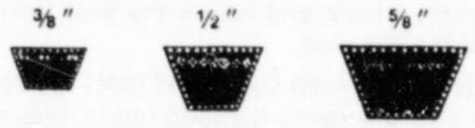
SCOR® Construction

SCOR stands for Static Conducting Oil Resistant envelope protection . . . bonus features of extra quality you get with all Goodyear FHP V-belts at no extra cost.

Features that mean longer service... lower costs

1. **STRONG** . . . continuous, low stretch, synthetic cords handle peak loads with ease.
2. **RESISTS SHOCK LOADS** . . . the compression section absorbs shock loads, transmits the load to the tension carrying cords.
3. **FLEXIBLE** . . . built-in flexibility is achieved with "dual-stretch" synthetic fabric covers.
4. **BALANCED DESIGN** . . . cords, cover and carcass work together in perfect harmony . . . pays off in longer belt life.

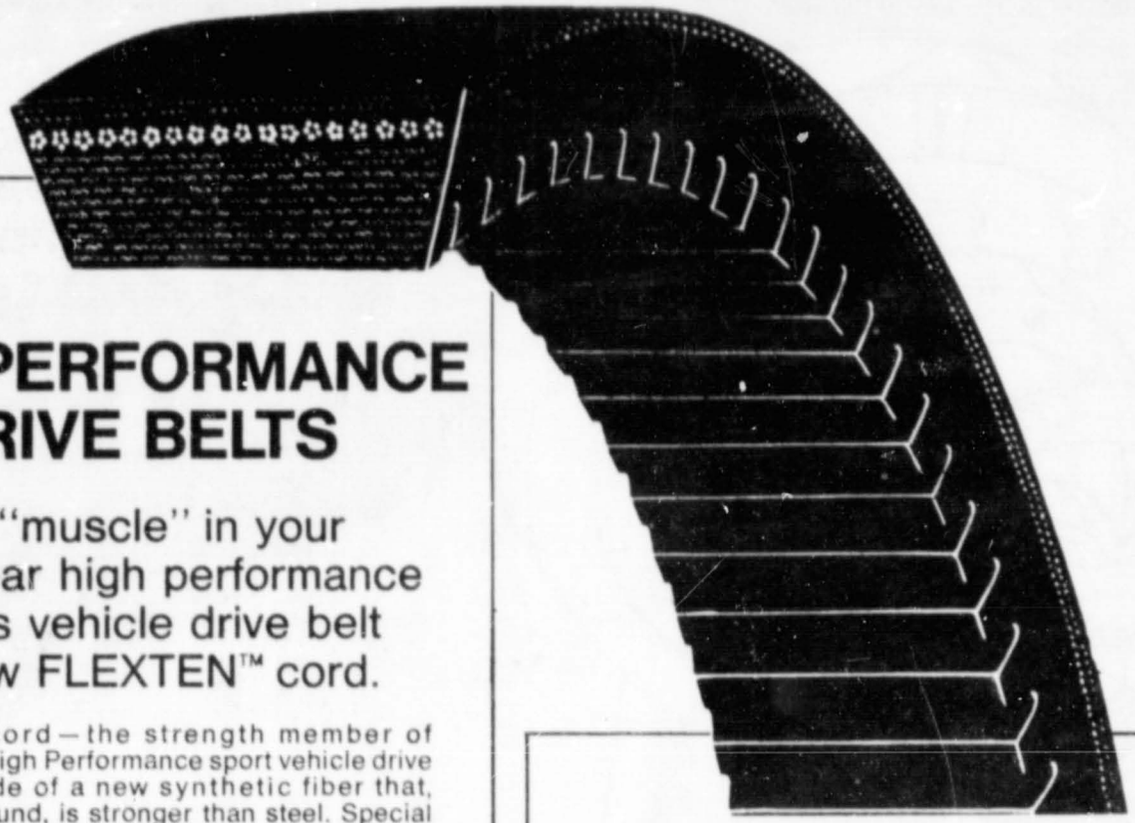
Available in three standard top widths or cross sections—3L, 4L and 5L—in lengths ranging up to 100 inches.



3L	4L	5L
73	74	75

GOODYEAR

Sports Vehicle Belts



HIGH PERFORMANCE DRIVE BELTS

the "muscle" in your Goodyear high performance sports vehicle drive belt ...new FLEXTEN™ cord.

FLEXTEN cord—the strength member of Goodyear's High Performance sport vehicle drive belt—is made of a new synthetic fiber that, pound for pound, is stronger than steel. Special Goodyear processing makes it exceptionally stretch and heat resistant. When FLEXTEN cord supplies the strength, your High Performance belt takes strain better than any sport vehicle drive belt Goodyear has ever made.

Goodyear's new high performance sports vehicle belts

For standard and high-performance vehicles (including stock-model racers).

Goodyear High Performance belts are made for long, reliable service — even in hard-driving stock-model racing! They are designed to resist distortion under high torque loads. The cut edge construction allows the belt to grip pulley surfaces for "non-slip" acceleration.

The tensile member is made with a new cord—FLEXTEN — that is stronger, by far, than any cord Goodyear has ever used in its sport vehicle drive belts. It has extremely low stretch—for all-season reliability.

Goodyear's new High Performance drive belt remains flexible at temperatures as low as —40°F.

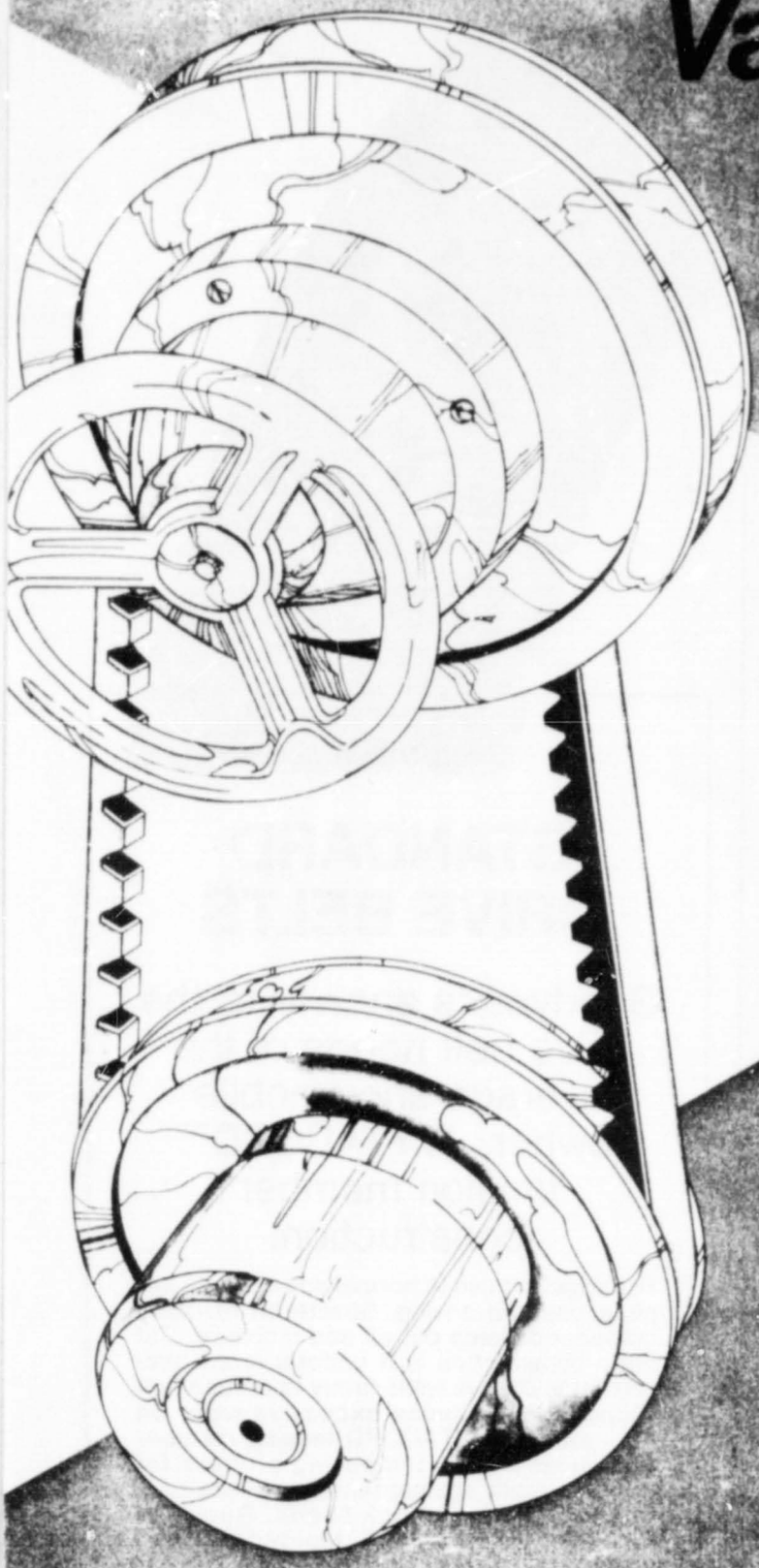
THE GOODYEAR TIRE & RUBBER COMPANY
AUTOMOTIVE REPLACEMENT PRODUCTS
Lincoln, Nebraska 68501
Phone: (Area Code 402) 466-8311 (Ext. 372)

STANDARD DRIVE BELTS

Goodyear's answer to the drive belt needs of the average snowmobile owner...VYTACORD™ tension member construction.

For standard use in normal snowmobile applications and driving. Special oil resistant compounds keep out oil and moisture. Cut edge construction and uniform cross section grips sheave walls firmly to reduce belt slippage that causes excessive wear on the belt. The VYTACORD tension member undergoes a triple tempering process for extra strength against tension, severe flexing and sudden shock loads. Remains flexible even at —40°F. Molded cogs for greater flexibility and cooler running.

Hi-Lo Variable Speed Pulley Drives



hi-lo

Hi-Lo Manufacturing Company
1700-G Freeway Blvd.
Minneapolis, MN 55430
Phone: 612-566-2510

... with automatic belt tensioning.

HI-LO pulley's unique design offers optimum v-belt drive efficiency, drive performance and drive component life

An automatic variable speed pulley is a v-grooved sheave in which the space between the groove can be mechanically increased or decreased to allow a v-belt to ride in the groove at various diameters. Its function is to vary the speed of and to transmit power to a driven shaft. The speed is varied by changing the ratio of the diameters at which the belt rides in the variable speed pulley and a driven sheave.

The amount of power a variable speed pulley can transmit depends on the belt tension. The greater the tension the greater the power capacity. Variable speed drives are subjected to short duration loads, such as high starting loads and peak loads, which are considerably larger than normal running loads. See Table II. To transmit these loads, without slippage or loss of performance, belt tension well in excess of required running load tension must be applied. However, if a belt is run continuously under the tension required for peak loads, its fatigue life, the fatigue life of the drive components, and the efficiency of the drive is substantially reduced. HI-LO PULLEYS solve this problem by incorporating a TORQUE CONTROLLED BELT TENSIONING MECHANISM in their design.

Belt tension in a variable speed pulley is obtained by applying an axial force against the v-belt through the sliding pulley faces. This force narrows the groove width forcing the belt to a slightly larger diameter. As the driven sheave diameter is fixed, the belt is stretched and the tension increased.

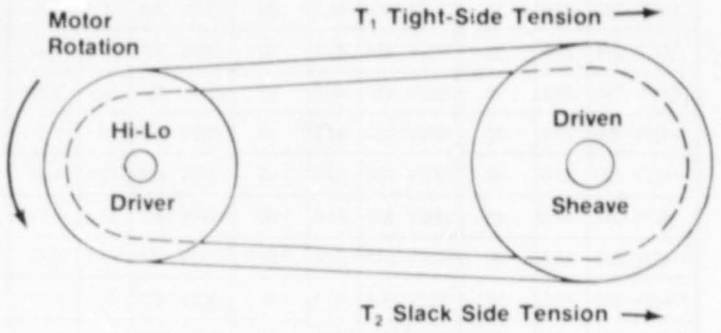


Fig. 1 Tension Force Direction

Refer to Fig. 1. The total tension (T_t) on a v-belt drive, omitting the effect of centrifugal force, is:

$$T_t = T_1 + T_2$$

T_t is the force that is applied by the belt against the pulley, tending to spread the pulley faces.

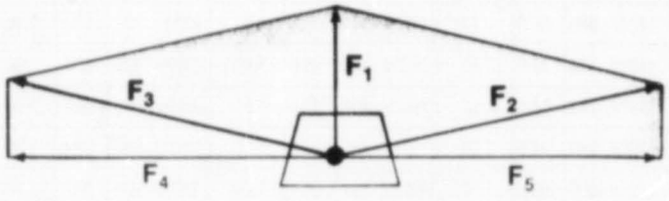


Fig. 2 Resolution of Tension Forces on V-Belt

In Fig. 2, $F_1 = T_t$. F_2 and F_3 are the forces applied perpendicular to the pulley faces by F_1 which axially move the faces. F_4 and F_5 are the axial forces which must be counteracted to maintain belt tension and diameter.

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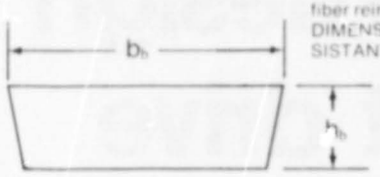
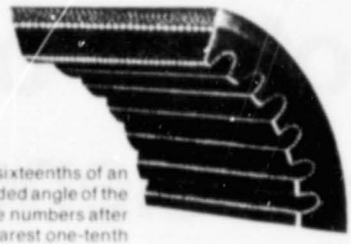
HI-LO VARIABLE SPEED BELTS are design coordinated so all belt elements perform as a unit to provide maximum efficiency and long service. Arched construction and a crush resistant compression section of fiber reinforced synthetic rubber gives MAXIMUM CROSSWISE RIGIDITY. Synthetic fiber tension cords give DIMENSIONAL LENGTH STABILITY. Synthetic rubber compounds provide high HEAT and OIL RESISTANT qualities. Electrical conductive material is compounded into the cover for STATIC DISSIPATING.





	Belt Cross Section					
	1422V	1922V	2322V	3226V	3230HV	4430V
b_b (in.)	.88	1.19	1.44	2.00	2.00	2.75
h_b (in.)	.31	.38	.44	.53	.62	.69

Industry Standard Numbering System

The first two numbers indicate the belt top width in sixteenths of an inch. The third and forth numbers indicate the included angle of the groove in which the belt is designed to operate. The numbers after the "V" indicate the pitch length of the belt to the nearest one-tenth of an inch. For example: A 2322V721 belt has a 1⅜" top width, is designed to operate in a sheave with a 22° included angle and has a 72.1" pitch length.

Belt No.	Pitch Lgth.	Approx. Wt. Lbs.	Belt No.	Pitch Lgth.	Approx. Wt. Lbs.	Belt No.	Pitch Lgth.	Approx. Wt. Lbs.	Belt No.	Pitch Lgth.	Approx. Wt. Lbs.	Belt No.	Pitch Lgth.	Approx. Wt. Lbs.	Belt No.	Pitch Lgth.	Approx. Wt. Lbs.
1422V 240	24.0	30	1922V 443	44.3	80	2322V 364	36.4	1.00	3226V 585	58.5	2.50	4430V 510	51.0	3.70	4430V 900	90.0	6.40
1422V 270	27.0	30	1922V 454	45.4	80	2322V 372	37.2	1.00	3226V 603	60.3	2.60	4430V 530	53.0	3.90	4430V 910	91.0	6.50
1422V 290	29.0	30	1922V 460	46.0	80	2322V 384	38.4	1.00	3226V 650	65.0	2.70	4430V 548	54.8	3.90	4430V 930	93.0	6.60
1422V 300	30.0	30	1922V 484	48.4	90	2322V 421	42.1	1.10	3226V 663	66.3	2.80	4430V 550	55.0	3.90	4430V 950	95.0	6.70
1422V 330	33.0	40	1922V 526	52.6	1.00	2322V 434	43.4	1.20	3226V 672	67.2	2.90	4430V 555	55.5	4.00	4430V 970	97.0	6.90
1422V 340	34.0	40	1922V 536	53.6	1.00	2322V 441	44.1	1.20	3226V 723	72.3	3.10	4430V 560	56.0	4.00	4430V 1000	100.0	7.10
1422V 360	36.0	40	1922V 544	54.4	1.00	2322V 461	46.1	1.25	3226V 783	78.3	3.30	4430V 570	57.0	4.10	4430V 1030	103.0	7.30
1422V 400	40.0	50	1922V 604	60.4	1.10	2322V 481	48.1	1.30	3226V 843	84.3	3.60	4430V 578	57.8	4.10	4430V 1060	106.0	7.50
1422V 420	42.0	50	1922V 630	63.0	1.10	2322V 521	52.1	1.40	3226V 903	90.3	3.90	4430V 600	60.0	4.30	4430V 1090	109.0	7.70
1422V 440	44.0	50	1922V 636	63.6	1.20	2322V 541	54.1	1.40	3226V 963	96.3	4.10	4430V 610	61.0	4.40	4430V 1120	112.0	7.90
1422V 460	46.0	50	1922V 646	64.6	1.20	2322V 601	60.1	1.60	3226V 1023	102.3	4.40	4430V 630	63.0	4.50	4430V 1150	115.0	8.10
1422V 466	46.6	50	1922V 666	66.6	1.20	2322V 621	62.1	1.60	3226V 1083	108.3	4.60	4430V 650	65.0	4.70	4430V 1180	118.0	8.40
1422V 470	47.0	50	1922V 686	68.6	1.20	2322V 661	66.1	1.70				4430V 660	66.0	4.70	4430V 1250	125.0	8.90
1422V 480	48.0	50	1922V 706	70.6	1.30	2322V 681	68.1	1.80	3230HV 528	52.8	2.60	4430V 670	67.0	4.80	4430V 1320	132.0	9.30
1422V 540	54.0	60	1922V 721	72.1	1.30	2322V 701	70.1	1.80	3230HV 553	55.3	2.80	4430V 690	69.0	4.90	4430V 1410	141.0	10.00
1422V 600	60.0	70	1922V 726	72.6	1.30	2322V 721	72.1	1.90	3230HV 570	57.0	2.90	4430V 700	70.0	5.00	4430V 1460	146.0	10.3
1422V 660	66.0	70	1922V 751	75.1	1.40	2322V 801	80.1	2.10	3230HV 585	58.5	2.90	4430V 710	71.0	5.10	4430V 1610	161.0	11.4
1422V 720	72.0	80	1922V 756	75.6	1.40	2322V 826	82.6	2.20	3230HV 603	60.3	3.00	4430V 718	71.8	5.10	4430V 1810	181.0	12.6
1422V 780	78.0	90	1922V 806	80.6	1.50	2322V 846	84.6	2.20	3230HV 613	61.3	3.10	4430V 730	73.0	5.20			
1422V 940	94.0	1.00	1922V 846	84.6	1.50	2322V 886	88.6	2.30	3230HV 620	62.0	3.10	4430V 740	74.0	5.30			
1422V 1000	100.0	1.10	1922V 891	89.1	1.60	2322V 921	92.1	2.40	3230HV 626	62.6	3.10	4430V 750	75.0	5.30			
			1922V 966	96.6	1.70	2322V 1001	100.1	2.60	3230HV 644	64.4	3.20	4430V 760	76.0	5.40			
1922V 302	30.2	60	1922V 1006	100.6	1.80	2322V 1061	106.1	2.80	3230HV 670	67.0	3.40	4430V 780	78.0	5.50			
1922V 321	32.1	60	1922V 1026	102.6	1.80	2322V 1271	127.1	3.30	3230HV 685	68.5	3.50	4430V 790	79.0	5.60			
1922V 332	33.2	60	1922V 1070	107.0	1.90	2322V 1301	130.1	3.40	3230HV 702	70.2	3.50	4430V 800	80.0	5.70			
1922V 338	33.8	60	1922V 1146	114.6	2.10				3230HV 723	72.3	3.60	4430V 850	85.0	6.00			
1922V 363	36.3	70	1922V 1200	120.0	2.10	3226V 400	40.1	1.70	3230HV 821	82.1	4.00						
1922V 380	38.0	70	1922V 1260	126.0	2.20	3226V 450	45.0	1.95	3230HV 856	85.6	4.25						
1922V 386	38.6	70	1922V 1276	127.6	2.30	3226V 465	46.5	2.00	3230HV 931	93.1	4.60						
1922V 403	40.3	70	1922V 1320	132.0	2.50	3226V 505	50.5	2.20	3230HV 960	96.0	4.75						
1922V 417	41.7	80	1922V 1406	140.6	2.50	3226V 514	51.4	2.20									
1922V 426	42.6	80				3226V 545	54.5	2.30									

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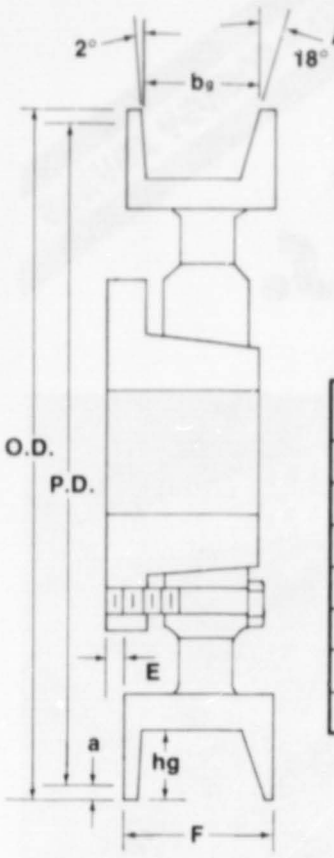
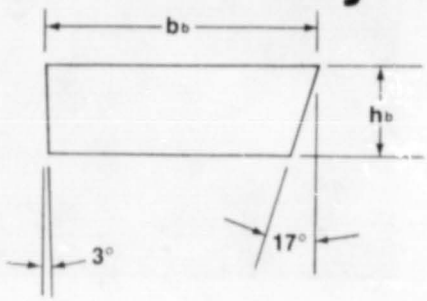
Asymmetric Companion Sheaves



Cross Section	F	bg ±.010	hg Min.	E ±.062	2a
23A	1 11/16	1.417	.625	13/32	.40
26A	1 15/16	1.653	.875	¼	.47
33A	2⅛	2.047	1.000	0	.59

Sheave No.	O.D.	P.D.	Bush	Sheave No.	O.D.	P.D.	Bush.	Sheave No.	O.D.	P.D.	Bush
23A66	7.00	6.60	SK	26A87	9.17	8.70	SF	33A97	10.29	9.70	SF
23A76	8.00	7.60	SK	26A97	10.17	9.70	SF	33A107	11.29	10.70	SF
23A86	9.00	8.60	SK	26A107	11.17	10.70	SF	33A117	12.29	11.70	SF
23A96	10.00	9.60	SK	26A117	12.17	11.70	SF	33A137	14.29	13.70	SF
23A116	12.00	11.60	SK	26A137	14.17	13.70	SF	33A157	16.29	15.70	SF
23A136	14.00	13.60	SK	26A157	16.17	15.70	SF	33A177	18.29	17.70	SF
23A156	16.00	15.60	SK	26A177	18.17	17.70	SF	33A197	20.29	19.70	SF

Asymmetric Belts



Cross Section Dimensions

Belt Section	b_b		h_b	
	MM	In.	MM	In.
23A	36	1.417	12	.472
26A	42	1.654	14	.551
33A	52	2.047	16	.630
36A	57	2.244	20	.787

Belt No.	Pitch Length MM	Pitch Length In.	Belt No.	Pitch Length MM	Pitch Length In.	Belt No.	Pitch Length MM	Pitch Length In.	Belt No.	Pitch Length MM	Pitch Length In.
23A 1060	1060	41.7	26A 1250	1250	49.2	33A 1500	1500	59.1	36A 1800	1800	70.9
23A 1100	1100	43.3	26A 1300	1300	51.2	33A 1600	1600	63.0	36A 1900	1900	74.8
23A 1180	1180	46.5	26A 1400	1400	55.1	33A 1700	1700	66.9	36A 2000	2000	78.7
23A 1250	1250	49.2	26A 1500	1500	59.1	33A 1750	1750	68.9	36A 2120	2120	83.5
23A 1400	1400	55.1	26A 1600	1600	63.0	33A 1800	1800	70.9	36A 2250	2250	88.6
23A 1500	1500	59.1	26A 1750	1750	68.9	33A 1900	1900	74.8	36A 2400	2400	94.5
23A 1600	1600	63.0	26A 1800	1800	70.9	33A 2000	2000	78.7	36A 2500	2500	98.4
23A 1700	1700	66.9	26A 1900	1900	74.8	33A 2120	2120	83.5	36A 2600	2600	102.4
23A 1800	1800	70.9	26A 2000	2000	78.7	33A 2300	2300	90.6	36A 2700	2700	106.3
23A 2000	2000	78.7	26A 2120	2120	83.5	33A 2400	2400	94.5	36A 2800	2800	110.2
			26A 2400	2400	94.5	33A 2500	2500	98.4	36A 3000	3000	118.1
			26A 2500	2500	98.4	33A 2650	2650	104.3			
			26A 2650	2650	104.3	33A 2800	2800	110.2			

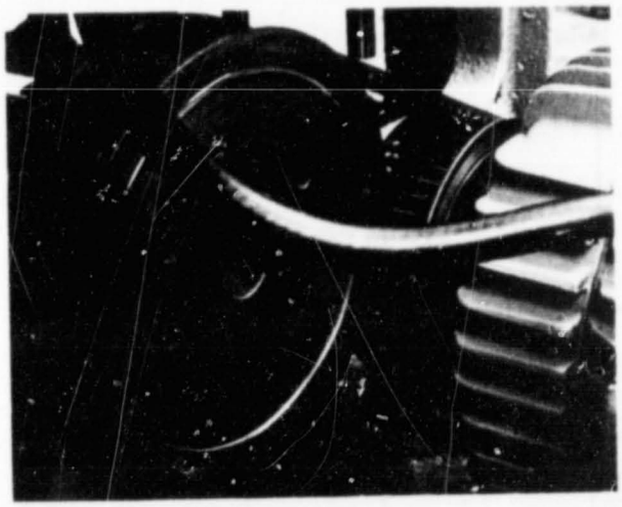
Hi-Lo Manufacturing Company
1700-G Freeway Blvd.
Minneapolis, MN 55430
Phone: 612-566-2510

HTD = ENERGY SAVING

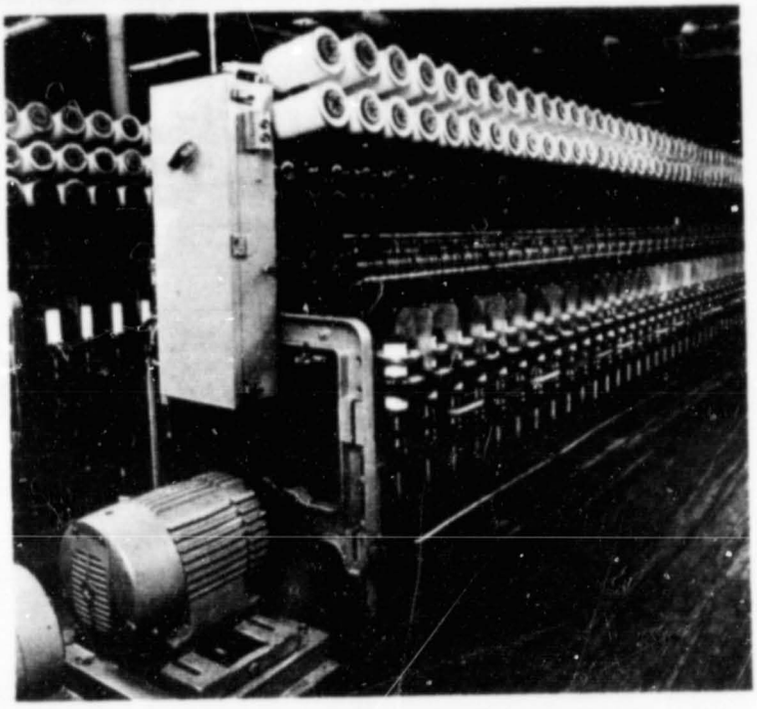
PowerGrip HTD® belt drives cut electric bills.

In Winnsboro, South Carolina they've demonstrated that replacing V-belt drives with HTD belt drives can cut direct electrical cost for power transmission, reduce the electrical load for air-conditioning and humidity control, and increase production at the same time. This plant produces tire cord and the "twister-frames" are the heart of the process. Each frame is driven by three V-belts powered by a 30 hp motor.

When HTD belt drives were substituted for V-belts electrical consumption dropped 4½% while power transmission efficiency increased. Also, HTD belts ran 25°F cooler than V-belts. Since the facility must be air conditioned, and there are approximately 200 twister frames, a temperature reduction of this magnitude can cut the air conditioning load significantly. And, the non-slip efficiency of HTD belts actually increased spindle rpms, providing higher production while consuming less energy.



We'll be glad to send you the actual test figures that document these results. Anyway you want to measure, these tests prove that PowerGrip HTD belts equal energy savings.

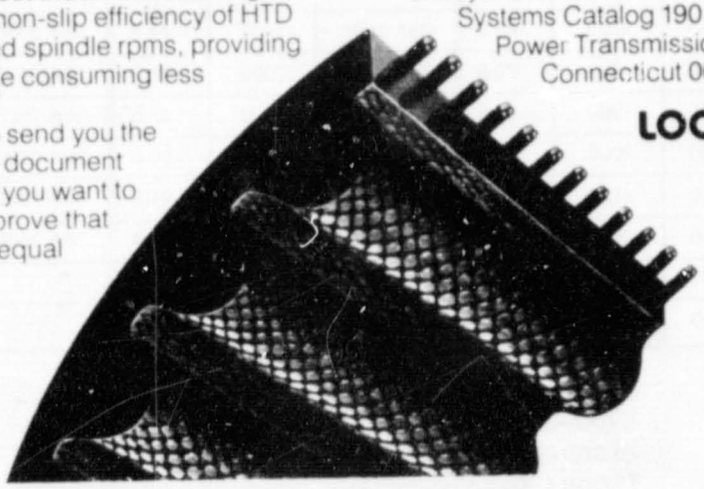


When a single PowerGrip HTD belt replaced three V-belts on this 30 hp twister frame drive electrical consumption was cut 4½% while production was increased. (Note: Protective belt guard removed for photography.)

You can use off-the-shelf components to design your own energy-saving PowerGrip HTD drives. Catalog designs are available to transmit up to 275 hp with a single belt, at speeds from 5500 rpm down to 10 rpm with speed ratios to 6.8. Ask your Uniroyal Distributor for a copy of our PowerGrip HTD Systems Catalog 190. Or, write to Uniroyal Power Transmission Division, Middlebury, Connecticut 06749. Tel. 203-573-3717

LOOK TO UNIROYAL

UNIROYAL

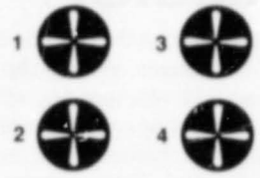


UN-PT-16

SYNCHRONOUS BELTS

CONSISTENT PERFORMANCE WITH 10% MORE EFFICIENCY

FAN NO.	V-BELTS		HTD BELTS	
	MOTOR RPM	FAN RPM	MOTOR RPM	FAN RPM
1	1760	295	1760	308
2	1760	180	1760	308
3	1760	303	1760	308
4	1760	302	1760	308



At the ARCO Atlantic Refining Company facility in Los Angeles, California the No. 1 coker blowdown air cooler was designed with standard V-belt drives to transmit power to the fans. After the air cooler was put in operation it developed that the air flow was not as large, or as consistent, as it should be. The problem was in the V-belt drives. There is always some slippage in a V-belt drive and the slippage increases as the belts wear, or stretch under load. At ARCO this inherent slippage caused a variation in air flow with a reduction in cooling efficiency, and additional maintenance was required to re-tension worn, stretched V-belts. ARCO then tested HTD belt drives with the results shown in the table above. As you can see, fan drives rpms were exactly the same for all fans. ARCO engineers estimated that HTD drives were at least 10% more efficient and provided the required volume of consistent air flow. In addition, HTD belts eliminated the extra maintenance required to compensate for V-belt stretch and slippage. Actual in-use performance has verified the efficiency of HTD belt drives and ARCO is presently evaluating them for other drive applications.

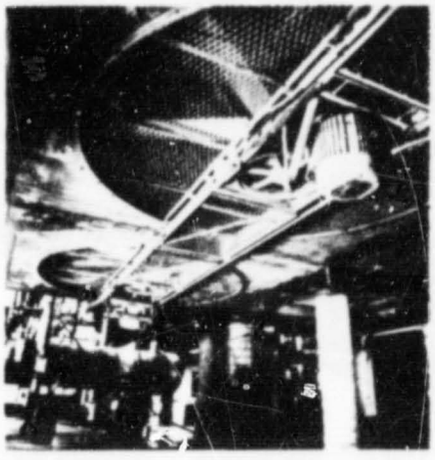
2-1/2 YEARS WITHOUT MAINTENANCE PLUS MORE COOLING

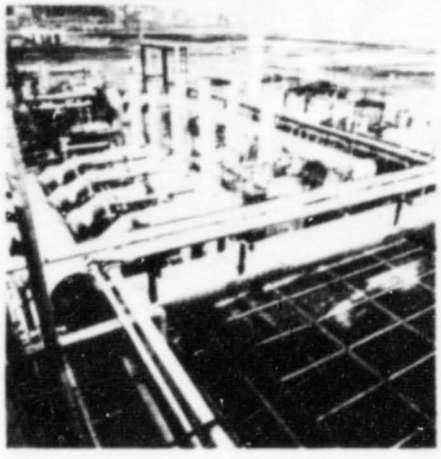
The Chemical Division of the Chevron Refinery, Richmond, California processes a wide range of petroleum by-products for the plastics and paint industries. In the alpha olefin plant an overhead heat exchanger was equipped with cooling fans powered by V-belt drives. Over a four month period the control stream was leaving the exchanger at a temperature of 200° to 210°F. The drives were changed to HTD belts and now the product leaves the heat exchanger at 150° to 160°F. The net result is that they have improved process control.

In the phthalic anhydride plant of the refinery, V-belt drives were used on the cooling fans and operating engineers were complaining of insufficient cooling and bearing failures. The four fans were changed to HTD belt drives and the bearing problems disappeared. Cooling was also improved.

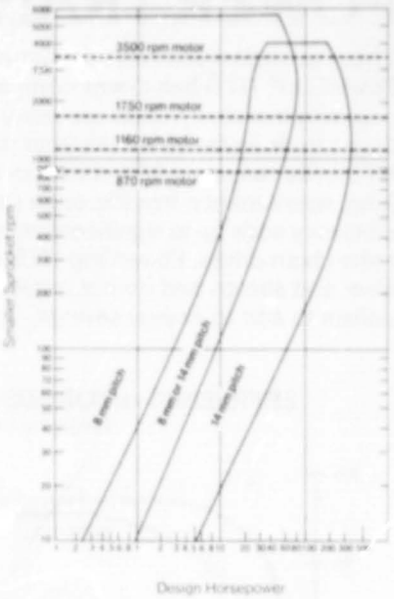
The first HTD drive was installed at Chevron in 1975. It has operated for over 2-1/2 years with no maintenance and no problems. Chevron now has 36 HTD drives.

At the Chevron refinery the PowerGrip HTD belts that replaced V-belt drives on four 12-ft. diameter, 6-bladed cooling fans in the phthalic anhydride plant have reduced bearing failures and improved cooling. There are presently 36 HTD drives in use throughout the refinery.





POWERGRIP HTD SYSTEMS



With Uniroyal's patented PowerGrip HTD belts you can use off-the-shelf components to design non-slip energy saving, maintenance and lubrication free drives that will transmit up to 275 hp with a single belt. Catalog designs are available for speeds from 5500 rpm down to 10 rpm with speed ratios to 6.8.

The Uniroyal synchronous belt line includes PowerGrip® Mini-Pitch Timing belts for small, lightweight drives and drive packages. Over 200 stock drive combinations can be ordered. PowerGrip® Timing belts are available in seven standard pitches in a wide range of lengths and widths. Long-Length PowerGrip® Belting that can be field or factory spliced is available in lengths up to 1,500-ft.

DESIGN AND ORDERING

Your Uniroyal Distributor can furnish quick delivery of stock components and assist with your power transmission problems. Call your Uniroyal Distributor or write directly to Uniroyal Power Transmission Division, Middlebury, Connecticut 06749.

Tel. 203-573-3717

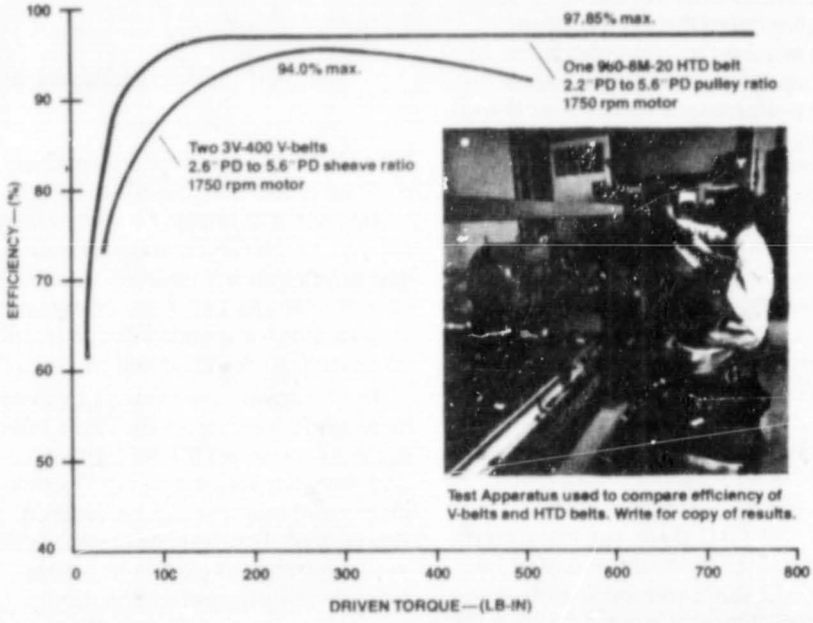
UNIROYAL

LOOK TO UNIROYAL

STATE OF THE ART IN
NON-SLIP ENERGY EFFICIENT POWER TRANSMISSION

The graph below illustrates the dramatic energy savings that can be achieved with PowerGrip® HTD belt drives compared to V-belt drives. V-belts slip. Even when originally installed, V-belts are rarely more than 94% efficient and efficiency continues to decrease as V-belts wear and stretch and slippage increases. PowerGrip HTD belts can attain 98% efficiency and maintain full efficiency throughout their long, maintenance-free life, *even when overloaded.* This consistently greater efficiency adds up to significant energy and dollar savings. And, unlike V-belt and roller chain drives, PowerGrip HTD drives do not need re-tensioning because of wear and stretch and do not require lubrication or other maintenance ... extra dollars to add to energy savings.

EFFICIENCY vs TORQUE OUTPUT REGRESSION CURVES
(Write for complete Test Report)

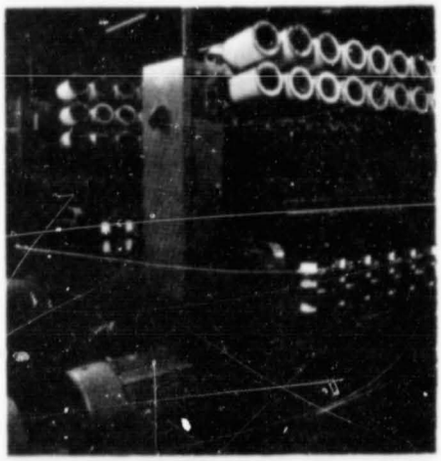


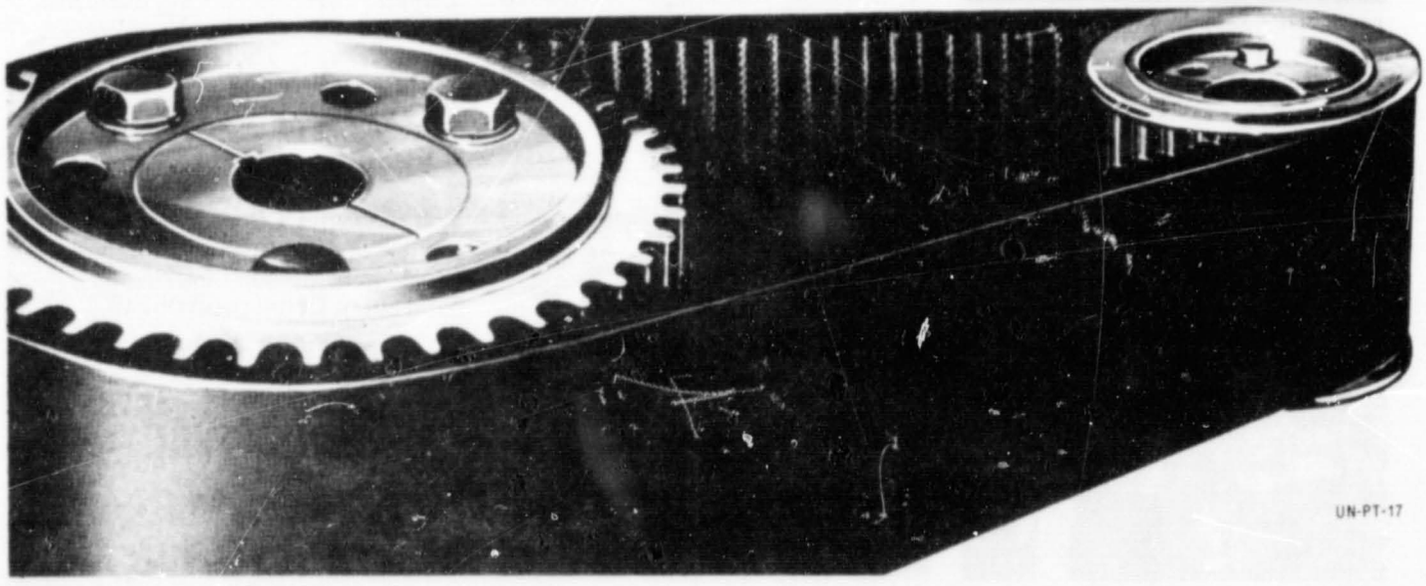
Test Apparatus used to compare efficiency of V-belts and HTD belts. Write for copy of results.

FOUR WAYS TO SAVE

There are approximately 200 twister frames in this Winnsboro, S.C. tire cord plant. Each frame is driven by three V-belts powered by a 30 hp motor. Recent tests substituting HTD drives show impressive energy saving potential in several areas. HTD drives use at least 4-1/2% less electricity while providing greater power transmission efficiency. HTD drives run up to 25°F cooler than V-belt drives, significantly reducing the load on air conditioning, giving additional savings in electricity. Because HTD belts don't slip, spindle rpm is increased, allowing higher production while using less energy. And, since HTD belts do not require high belt tension like V-belts, the load on motor and twister frame bearings is reduced.

A single HTD belt replaced three V-belts on this 30 hp, 1750 rpm twister frame motor, and cut electrical consumption 4½%. *(Belt guard removed for photgraphy.)*





UN-PT-17

Uniroyal Industrial Products, Middlebury, Connecticut 06749. Tel. 203-573-3717

BRAKING SYSTEMS and COMPONENTS

REGENERATE and NON-REGENERATIVE

(CODE **BK**)

Gustin-Bacon **MAXIBRAKE** Spring Brake

Quality components give Gustin-Bacon Maxibrake spring brakes the reliability needed for everyday operation. All-steel housings provide strength, durability and extra corrosion resistance.

Inside, wide skirt pistons in the spring chamber permit maximum guidance stability that diffuses lateral and twisting motion. The piston design provides a large pressure bearing area for low pressure modulation, release and hold-off of the emergency/parking spring.

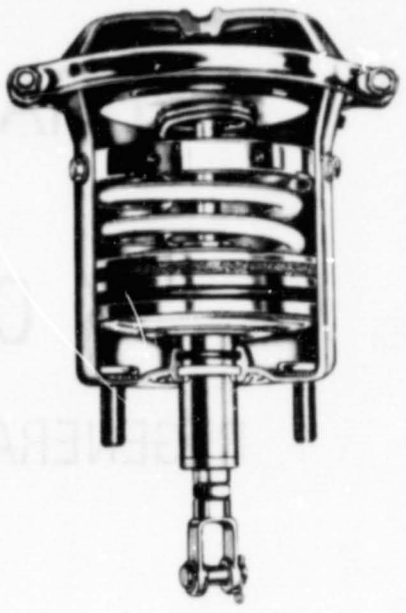
Strong steel-alloy springs used in Maxibrake spring brakes are coated with a self-sealing rust inhibitor for corrosion resistance.

Deeper spring cavities and optional spring force outputs allow the springs to operate at low stress levels with uniform output and a long service life.

Maxibrake units cannot be released manually making them inoperative. Once actuated, they cannot be released until there is sufficient air to compress the spring. Therefore, the vehicle cannot be moved until the air supply is at a safe level.

Inspection or replacement of the service chamber diaphragm is easy. The service brake diaphragm is readily accessible without first caging the spring brake. Simply loosen the band clamp and remove the pressure plate.

Complete spring brake units with heavy duty service chambers, or spring chambers only for use with original service equipment, are available in 20", 24", 30" and 36" sizes with #50, #55, #60 or #75 springs.



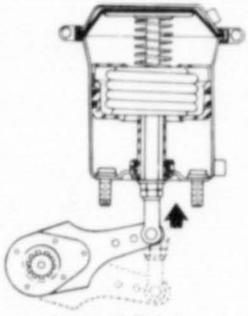
Maxibrake spring brake operation

The operating principle is sound and simple. The primary service chamber applies the foundation brake with the admission of air pressure and the secondary spring chamber applies the brake mechanically when air pressure is lost.

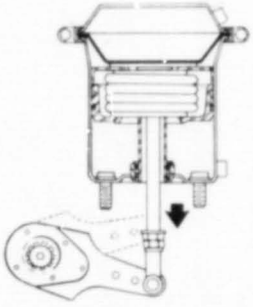
Normal Driving
Air pressure in the spring chamber acts against the piston to keep the spring compressed. The spring brake is released, but is ready for parking or emergency applications.

Service Brake Application
Operation of the foot valve releases air into the service chamber. Air pressure on the diaphragm actuates the push rod. The push rod operates independently through the piston tube for normal operation.

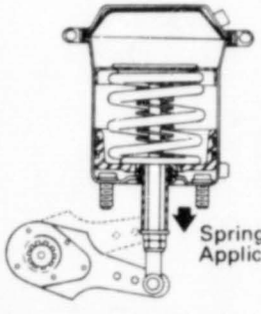
Spring Brake Operation
Parking. The dash control valve in the cab is operated to exhaust air in the spring chamber. The spring, acting against the piston, forces the push rod down as pressure is exerted against the push rod flange nut by the piston tube.
Emergency. The same principles apply, however, the system can be piped so the spring brakes can be actuated manually by the dash control valve to exhaust air from the spring chamber, or to serve as a modulating brake by metering the air in and out of the chamber through the control valve.



Normal Driving



Service Brake Application



Spring Brake Application

Aeroquip **GUSTIN-BACON DIVISON**

P.O. Box 927, LAWRENCE KS 66044, *Phone: 913-841-4000*

Service Output

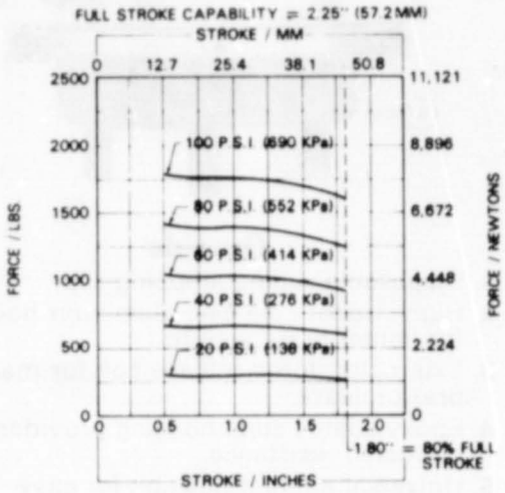
The service output requirements determine the size spring brake needed. These graphs show typical minimum force outputs at representative input pressures for the four sizes of Maxibrake units.

The size of the Maxibrake unit needed depends on determining the force output required at the operating stroke and input pressure. Refer to the graphs to find the force output which meets the corresponding requirements.

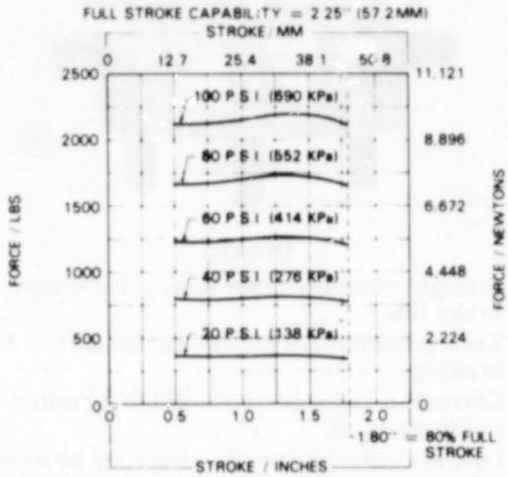
Note: Make sure the system air tank is adequately sized to provide the air pressure and volume required.

When replacing spring brakes it is recommended that both units on the axle be replaced with Maxibrake assemblies at the same time to maintain balance of the spring force output. The same service size and push rod projection should be as on the original installation. The compression spring selected should be compatible to the force output at the operating stroke.

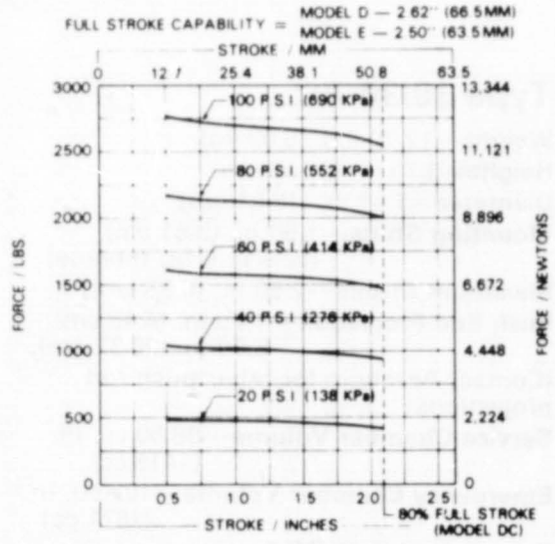
Type **20** Model DC



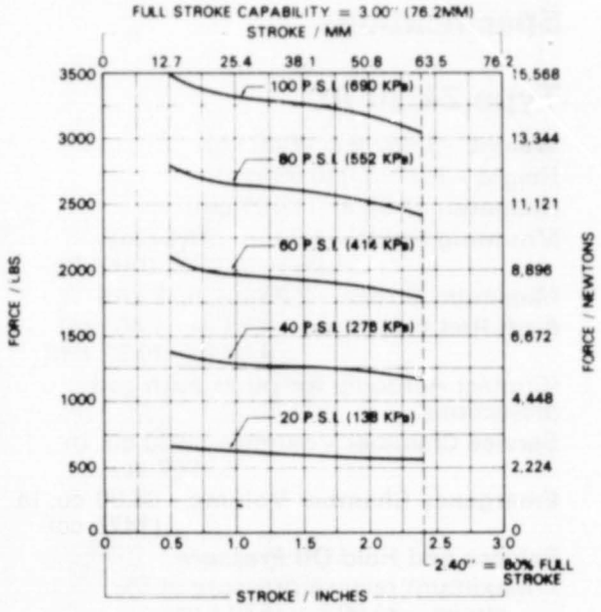
Type **24** Model DC



Type **30** Models DC and EC



Type **36** Model DC

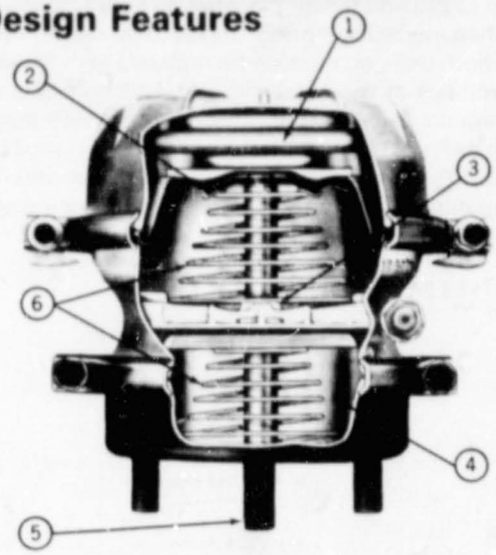


Aeroquip GUSTIN-BACON DIVISON

P.O. Box 927, LAWRENCE KS 66044, *Phone: 913-841-4000*

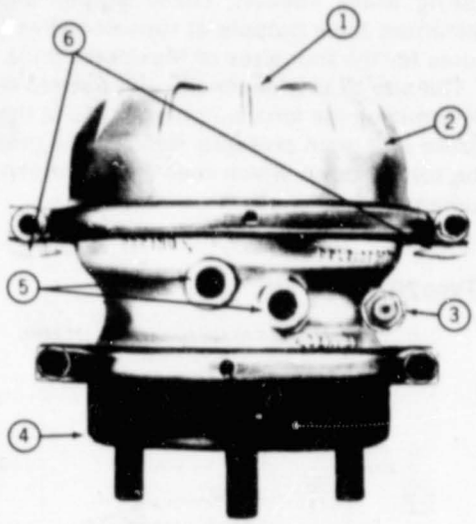
maxibrake II™ spring brake

Design Features



Inside

1. Straight running main spring for longer brake life.
2. Spring locating seats for consistent braking.
3. Corrosion resistant non-metallic center guide bearing.
4. Low air volume service chamber prolongs compressor life.
5. Various push rod projections available.
6. Long life return springs.



Outside

1. Disposable caging/shipping clip.
2. High strength die cast aluminum housing for lighter brake weight.
3. Externally stored release bolt for manual brake release.
4. Epoxy coated steel housing provides corrosion resistance.
5. Universal air inlet position for easy installation.
6. Safety lugs for extra protection during disassembly.

Specifications

Type 24/30 AC

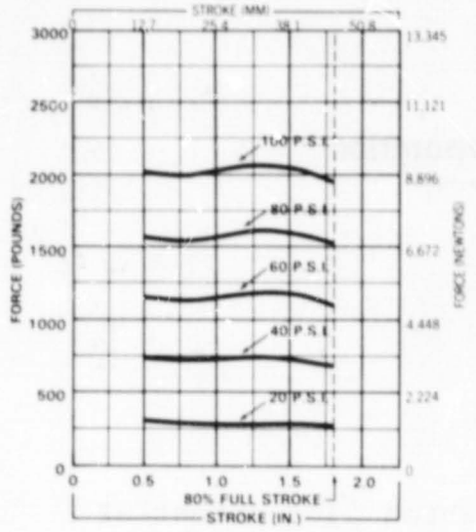
Weight—16.50 lbs. (7.48 kg)
Height—8.21 in. (20.85 cm)
Diameter—7.09 in. (18.01 cm)
Mounting Studs—1.50 in. (3.81 cm)
⅝—11 UNC threads)
Maximum Stroke—2.25 in. (5.72 cm)
Push Rod Projection—1.75 in. (4.45 cm)
8.00 in. (20.32 cm)
(Contact Aeroquip for other push rod projections)
Service Chamber Volume—59.00 cu. in. (967 cc)
Emergency Chamber Volume—88.90 cu. in. (1475 cc)
Release and Hold-Off Pressure
Maximum release pressure at 5% stroke—84.00 psi (579 Kpa)
Minimum hold-off pressure at 5% stroke—82.00 psi (565 Kpa)
Air Inlet—⅜ in. NPT Thread

Type 30/30 AC

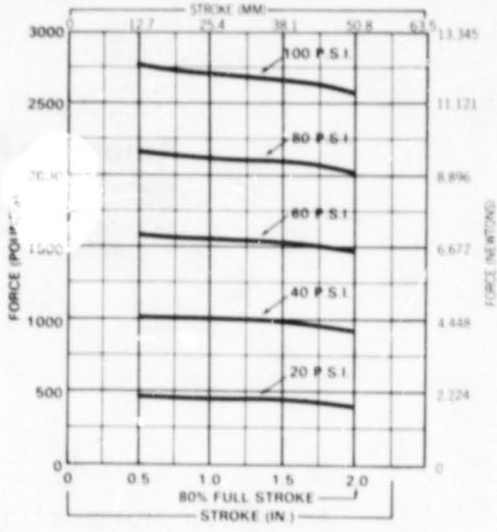
Weight—17.70 lbs. (8.03 kg)
Height—8.70 in. (22.20 cm)
Diameter—7.09 in. (18.01 cm)
Mounting Studs—1.50 in. (3.81 cm)
⅝—11 UNC threads)
Maximum Stroke—2.50 in. (6.35 cm)
Push Rod Projection—1.75 in. (4.45 cm)
8.00 in. (20.32 cm)
(Contact Aeroquip for other push rod projections)
Service Chamber Volume—86.50 cu. in. (1418 cc)
Emergency Chamber Volume—102 cu. in. (1671 cc)
Release and Hold-Off Pressure
Maximum release pressure at 5% stroke—84.00 psi (579 Kpa)
Minimum hold-off pressure at 5% stroke—82.00 psi (565 Kpa)
Air Inlet—⅜ in. NPT Thread

Aeroquip GUSTIN-BACON DIVISON
P.O. Box 927, LAWRENCE KS 66044, *Phone: 913-841-4000*

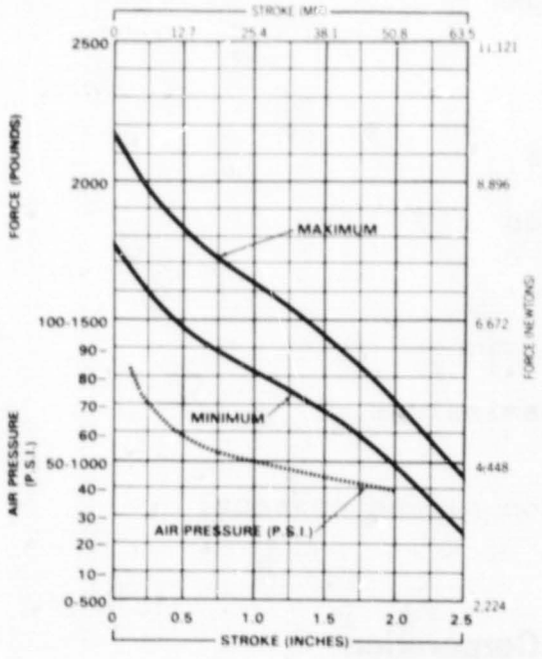
Average Type 24/30 Service Output Data



Average Type 30/30 Service Output Data



Maxibrake II Emergency/Parking Spring Force



Maxibrake II Spring Brake Ordering Information
Standard Unit Part Number

KSD 24 30 AC 175 Y N

- KSD — Basic Unit Code
- 24 — Size: 24" Service Chamber
- 30 — Size: 30" Service Chamber
- 30 — 30" Spring Chamber
- AC — Complete Unit (AC) (AP = Partial Unit)
- 175 — Push Rod Projection (175 = 1.75") or (800 = 8.00")
- Y — Yoke (Y = ½" pin Yoke) or (N = without Yoke) (Z = ⅝" pin Yoke)
- N — Boot (B = with boot) or (N = without boot)

Aeroquip GUSTIN-BACON DIVISON

P.O. Box 927, LAWRENCE KS 66044, *Phone: 913-841-4000*

American Motors Corporation
Engine and Component Sales Department
27777 Franklin Road
Southfield, Michigan 48034
(313) 827-3817

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- Alternators
- Axle Assemblies
- Brake Assemblies
- Differentials
- Manual Transmissions
- Automatic Transmissions

For additional information please contact:

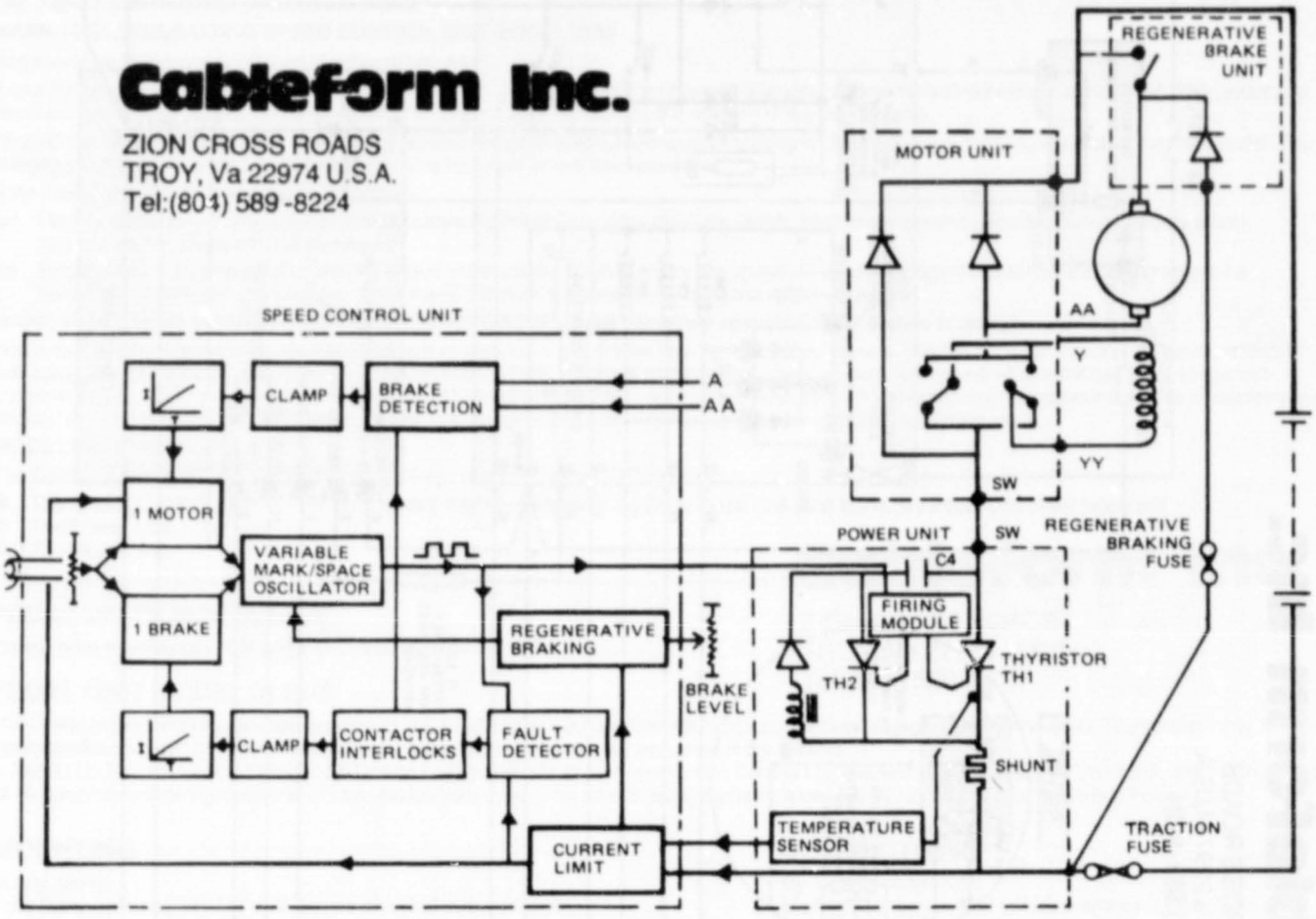
American Motors Corporation
Engine and Component Sales Department
27777 Franklin Road
Southfield, Michigan 48034
(313) 827-3817

Regenerative Braking With The Pulsomatic Mk 10

The use of regenerative braking has in the past only been considered for special applications due to the circuit complexity and consequent penalties in high cost and poor reliability.

For the first time, following an extensive development programme, simple but effective regeneration is now available using a standard Pulsomatic Mk 10 system with few additional components.

Cableform Inc.
ZION CROSS ROADS
TROY, Va 22974 U.S.A.
Tel:(804) 589-8224



FUNCTIONAL DIAGRAM OF PULSOMATIC MK10 CONTROL SYSTEM WITH REGENERATIVE BRAKING

The conditions when accelerating were recognised as having much in common with those in braking, so the components already in the control circuits for the Mk 10 system were given a dual function.

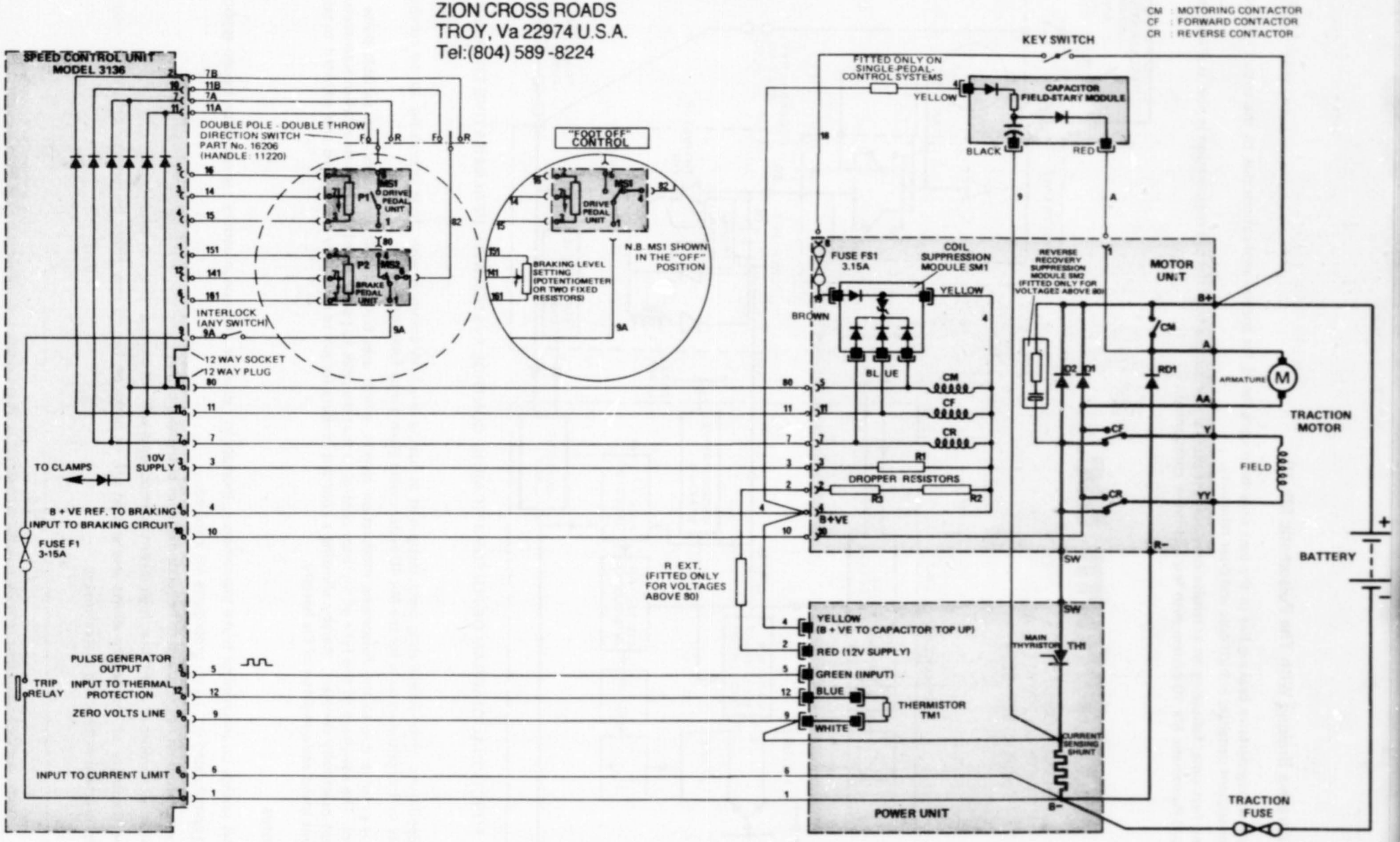
This is possible due to the Pulsomatic modulation system, which uses both variable frequency and variable pulse width control. The advantage of this type of thyristor control, is that the peak to peak current ripple content when regenerating can be kept practically constant, thereby allowing a constant braking torque to be simply maintained and adjusted to take into account speed and condition of the battery.

Features

- Cost savings on mechanical brake maintenance, increase in range (or decrease in battery capacity) for a given application.
- No complicated setting up procedures are involved.
- The system does not required to be tailor-made for every application.
- The small number of additional, high quality, components will not cause a reliability problem.
- The flexibility of the system allows acceleration off, or brake on (which may either be fixed or progressive) operation.
- Improvement in handling characteristics.

Cableform Inc.

ZION CROSS ROADS
TROY, Va 22974 U.S.A.
Tel:(804) 589 -8224



CONNECTION DIAGRAM FOR PULSOMATIC MARKIO SYSTEMS USING SPEED CONTROL UNIT MODEL 3136
(BRAKE PEDAL OPERATED OR "FOOT OFF" OPERATED REGENERATIVE BRAKING)

FEATURES

- Eliminates commutator problems and maintenance costs caused by arcing under the heavy currents, which always exceed the motor rating during dynamic braking.
- Armature and commutator do not have to be rated to take the heat which must be dissipated with the dynamic braking system. Consequently, the motor frame size may often be reduced.
- Braking is smoother than with dynamic braking over similar stopping distances, with an attendant improvement in handling characteristics.
- Reduces stress loading on transmission components.
- Better use is made of battery energy per charge, resulting in longer life or equivalent battery savings.
- Added bonus in recovery of energy (16% under typical conditions).
- No complicated setting up procedures are involved.

Two major types of Control Systems are available.

MARK 10 SYSTEMS USING SPEED CONTROL UNIT MODEL 3136

Regenerative Braking is controlled in either of two ways.

Brake Pedal Operation: When the vehicle is being driven in either forward or reverse, regenerative braking is obtained by releasing the drive pedal and depressing the brake pedal. The braking effort is continuously adjusted by the position of the brake pedal.

"Foot Off" Control: When the vehicle is being driven in either direction, regenerative braking is obtained simply by lifting the foot off the drive pedal. The braking effort is set to a fixed level by either a potentiometer or two fixed resistors.

Note that on the two above systems of control:–

(a) Regenerative Braking is obtained without changing the setting of the direction switch, field reversal being provided **automatically** when regenerative braking effort is demanded.

(b) Regenerative Braking applies braking torque continuously down to a very low speed, at which the regenerative current can no longer be sustained. Thereafter the back-up of mechanical brakes is necessary to bring the vehicle to a halt.

MARK 10 SYSTEMS USING SPEED CONTROL UNIT MODEL 3138 (Reverser operated regenerative braking)

When the vehicle is being driven in either forward or reverse, regenerative braking is obtained by selecting the opposite direction of travel, **without releasing the drive pedal.** Regenerative braking applies braking torque continuously down to a very low speed, at which it becomes ineffective. Dynamic braking then **automatically** takes over to halt the vehicle which will immediately move off in the opposite direction if the drive pedal remains depressed. The position of the drive pedal continuously controls the braking torque over the complete braking cycle.

MODULAR CONSTRUCTION

The Control System is built in three major functional units.

- The Speed Control Logic Unit which operates in conjunction with the Drive Pedal Unit (and the Brake Pedal Unit when required).
- The Power Unit.
- The Motor Unit.

Cableform Inc.

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TROY, Va 22974 U.S.A.
Tel:(804) 589 -8224

PEDAL UNITS 3500 SERIES

Please refer to 3500 SERIES SPEED CONTROL UNITS leaflet.

PEDAL UNIT MODEL 3112-3

This unit is in the form of a die-cast aluminium box which houses a potentiometer and a single-pole change-over microswitch. The control input is via a rotary shaft and lever, by which the unit is coupled to the appropriate control pedal of the vehicle.

The 3112-3 is used as the Drive Pedal Unit on any Pulsomatic system in which the Control Logic is remote from the Pedal Unit itself, and this includes all Regenerative Braking Systems. On two-pedal-control Regenerative Braking Systems a second 3112-3 is used as the Brake Pedal Unit.

MOUNTING

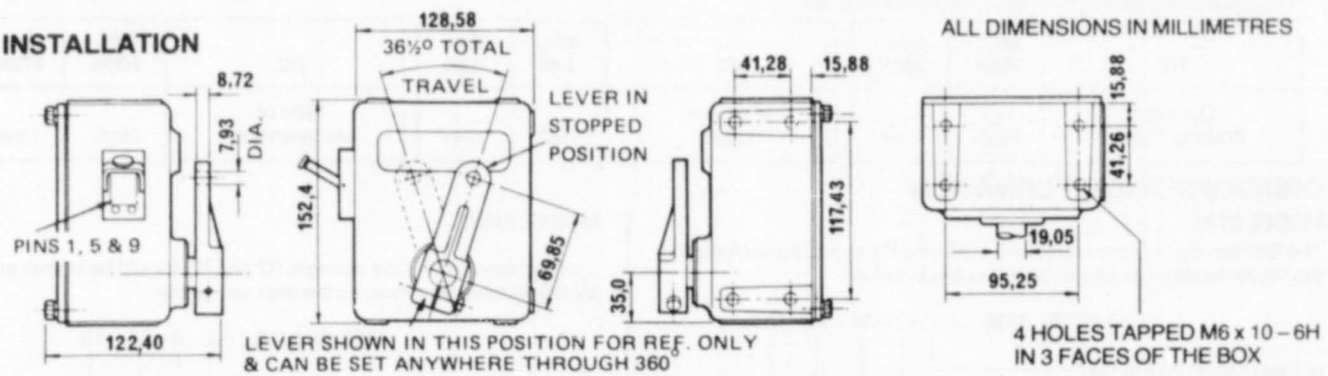
In any plane.
Four fixing holes tapped M6 x 10-6H are provided in three faces of the box for ease of attachment to the vehicle.

CONNECTIONS

By 12 way connector.
Mating half required for vehicle harness is Cableform Part No. 10479-3 (female pins) + 11021-3 (cover shell).

INSTALLATION

ALL DIMENSIONS IN MILLIMETRES



ORDER WRITING INFORMATION

Order by Model Number, as in table.

Model No.	Internal Return Spring To the Off Position
3112-3-1	Not required
3112-3-2	Required

SPEED CONTROL UNITS MODEL 3136 OR 3138

This steel sheet "black box" houses all the control logics on two printed circuit cards.

MOUNTING

In any plane.
Two holes located in the base of the box and tapped M5 x 0.8 are provided for securing the unit to the vehicle.

CONNECTIONS

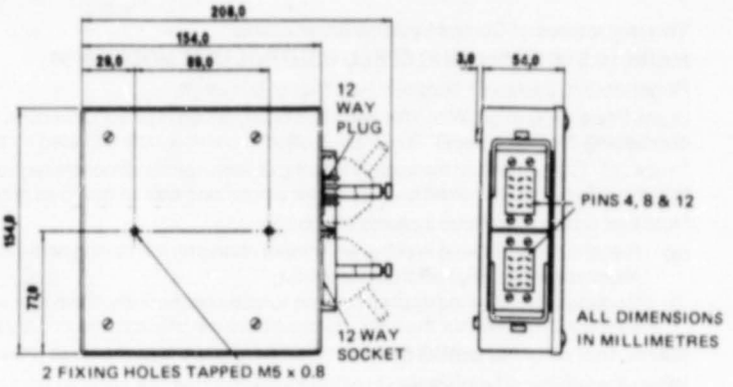
By two 12 way connectors.
Cableform Part Nos. of mating halves required for vehicle harness are as follows:

PLUG : 10478-3 (male pins) + 11021-3 (cover shell)
SOCKET : 10479-3 (female pins) + 11021-3 (cover shell)

Cableform Inc.

ZION CROSS ROADS
TROY, Va 22974 U.S.A.
Tel:(804) 589-8224

INSTALLATION



MODEL VARIATION TABLES

1. TABLE I – VOLTAGE RANGE

Battery Voltage	Specify
24V to 80V	–1
81V to 220V	–2

2. TABLE II – OPTIONS

MODEL 3136

Field Weakening	Specify
Not required	–1
Low Gain	–2
High Gain	–3

Field Weakening Low Gain or High Gain are selected according to the Power Unit Model No., as shown in the table below:

Field Weakening	Power Unit Model No.			
Low Gain	4011	4012	4013	4014
High Gain	4021	4022	4023	4024

NB. If Power Units other than the ones stated in this table are used, please consult Cableform.

MODEL 3138

● Options Fitted			
Return to Neutral	Field Weakening	Ramp Start	Specify
–	–	–	–1
●	–	–	–2
–	●	–	–3
–	–	●	–4
●	●	–	–5
●	–	●	–6
–	●	●	–7
●	●	●	–8

PERFORMANCE SELECTION

The following performance characteristics can be preselected for the individual applications by stating the value of the respective fixed resistors.

- Dynamic braking torque on model 3136
- Minimum speed
- Rate of acceleration

} on both model 3136 and 3138

The table below gives the range of the resistor values.

R1	Min. 100K	Max. 330K	R2	Min. 15K	Max. 33K	R3	Min. 100K	Max. 470K
Dynamic Braking Torque	High	Low	Minimum Speed	High	Low	Rate of Acceleration	High	Low

ORDER WRITING INFORMATION

MODEL 3136

The first two digits of the resistors R1, R2 and R3 should be written after the Model Number as shown on the example below:

MODEL 3136 – 1 – 2 – 33 – 15 – 18

- voltage range: 24V to 80V
- fitted with field weakening low gain
- R1 = 330K (low dynamic braking torque)
- R2 = 15K (high minimum speed)
- R3 = 180K (average rate of acceleration)

MODEL 3138

The first two digits of the resistors R2 and R3 should be written after the Model Number as shown on the example below:

MODEL 3138 – 2 – 6 – 33 – 10

- voltage range: 81V to 220V
- fitted with return to neutral and ramp start
- R2 = 33K (low minimum speed)
- R3 = 100K (High rate of acceleration)

If the values of the resistors are not specified by the customer, standard values will be fitted:
R1 = 180K R2 = 22K R3 = 180K

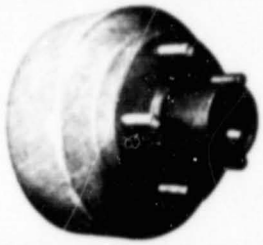


DEMOUNTABLE 7" BRAKE DRUM

Dico Company, Inc.
A Subsidiary of Dyneer Corporation
200 S.W. 16th Street
P.O. Box 1344
Des Moines, IA 50305
515/244-7286

DEMOUNTABLE 7" BRAKE DRUMS

PART NO.	NO. OF BOLTS	BOLT CIRCLE	DRUM MATERIAL	CENTER HOLE SIZE	WEIGHT
18059	4	4"	Cast Iron	2½"	6.3
18060	5	4½"	Cast Iron	2½"	6.3



INTEGRAL HUB & 7" BRAKE DRUM ASSEMBLY

INTEGRAL HUB AND 7" BRAKE DRUM ASSEMBLIES

PART NO.	NO. OF BOLTS	BOLT CIRCLE	BEARINGS	FITS DICO SPINDLE AND FLANGE NO.	DRUM MATERIAL	WEIGHT
16549	5	4½"	1¼"x¾"	8898	Cast Iron	10.8
16390	5	4½"	1"x1"	18842	Cast Iron	10.8
18773	5	4½"	1 1/16"x1 1/16"		Cast Iron	10.8

NOTE: ABOVE ASSEMBLIES COME WITH TAPERED ROLLER BEARINGS, RUBBER SEAL, WHEEL NUTS, & DUST CAP.

INTEGRAL HUB AND 8½" BRAKE DRUM ASSEMBLY

PART NO.	NO. OF BOLTS	BOLT CIRCLE	BEARINGS	MOUNTS ON SPINDLE NO.	SEAL SIZE	WEIGHT
16194**	5	5½	1⅜ x 1 1/16	12111	1.718	21 lbs.
12509**	5	5½	1⅜ x 1⅜	9419*	1¾	21½ lbs.
15654	5	4½	1¼ x ¾	7208 or 545U	1½ or 1 11/16	18 lbs.
15445	5	4½	1⅜ x 1 1/16	15642 or 545UH	1.718	18 lbs.
16621	5	5½"	1¼ x ¾	7208 or 545U	1½ or 1 11/16	19 lbs.
16622	5	5½"	1⅜ x 1 1/16	15642 or 545 UH	1.718	19 lbs.

ABOVE ASSEMBLIES INCLUDE BEARINGS, SEAL, WHEEL NUTS, AND DUST CAP.

* Prints only are available.

**For use with 10" 7 ga. wheel #10258.
12509 also accepts 9" wheel #5197.

DEMOUNTABLE 8½" BRAKE DRUMS

PART NO.	NO. OF BOLTS	BOLT CIRCLE	BOLT HOLE SIZE	CENTER HOLE SIZE	DRUM WIDTH	WEIGHT
12350	5	5½	⅝	3¼	4.40	12 lbs.
12351	5	5½	⅝	4⅜	4.40	12 lbs.
12487	4	4	33/64	2½	4.00	12 lbs.
12488	5	4½	33/64	2½	4.00	12 lbs.

12487-8 Adapt to B.I.A. recommended practice spindle. (7 in.) DICO 9036

EIS BRAKE PARTS

EIS Division
Parker Hannifin Corporation
695 High Street - P.O. Box 701
Middletown, CT 06457
Phone (203) 346-8624

PRODUCT LINES MANUFACTURED

- Brake Drums
- Brake Shoes
- Disc Brake Rotors
- Disc Brake Pads
- Brake System Hardware

FOR MORE INFORMATION WRITE TO:

EIS Division
Parker Hannifin Corporation
695 High Street - P.O. Box 701
Middletown, CT 06457
Phone (203) 346-8624

P.T. BRAKE LINING COMPANY, INC.
17 SHEPARD STREET LAWRENCE INDUSTRIAL PARK LAWRENCE, MASSACHUSETTS 01842
TELEPHONE (617) 686-3861

PM BLOCK

FRICTION	μ
Anchor Block: Normal	.250–.350
Hot	.250–.350
Cam Block: Normal	.250–.350
Hot	.250–.350
AXLE FRICTION AVERAGE	
Normal	.250–.350
Hot	.250–.350
Range	.250–.350

Wear	Good
Drum Use Ratio	Average
Temperature Range	600°+
Retardation Effectiveness	Average
Resistance to Fade	Good
Recovery	Good
Hot Stop Effectiveness	Average
Cold Stop Effectiveness	Average

USE: STANDARD DUTY

FRICTION: EF

EDGE BRAND: BI J3 EF

Our tough PM Block is economy-priced to keep your costs down — yet it provides efficient braking and good mileage under normal user conditions.

Made of fine grades of organic material, the PM Block also offers these features:
engineering that meets all state requirements
availability in most popular numbers

FERRA BLOCK

FRICTION	μ
Anchor Block: Normal	.350–.450
Hot	.350–.450
Cam Block: Normal	.250–.350
Hot	.250–.350
AXLE FRICTION AVERAGE	
Normal	.250–.350
Hot	.350–.450
Range	.250–.450

Wear	Superior
Drum Use Ratio	Excellent
Temperature Range	900°+
Retardation Effectiveness	Good
Resistance to Fade	Excellent
Recovery	Excellent
Hot Stop Effectiveness	Excellent
Cold Stop Effectiveness	Excellent

USE: PREMIUM DUTY

FRICTION: FF/EE

EDGE BRAND: BL L3 EE/BL K3 FF

A winning combination — our top-of-the-line Ferra Block set is made of semi-metallic/organic premium heavy-duty materials that stand up to the toughest kind of braking stress.

Ferra Block features include:
- special rugged design to meet the demands of heavy-duty truck, trailer, bus tractor and construction equipment users
- extra-long lining life and maximum stopping ability under all conditions
- a semi-metallic combination that offers a cooler running brake, resulting in longer drum life
- optimum fade recovery from all temperatures encountered in most severe operations

P.T. BRAKE LINING COMPANY, INC.

17 SHEPARD STREET LAWRENCE INDUSTRIAL PARK LAWRENCE, MASSACHUSETTS 01842
TELEPHONE (617) 686-3861

FRICTION	μ
Anchor Block: Normal	.350–.450
Hot	.350–.450
Cam Block: Normal	.350–.450
Hot	.350–.450
AXLE FRICTION AVERAGE	
Normal	.350–.450
Hot	.350–.450
Range	.350–.450

Wear	Excellent
Drum Use Ratio	Good
Temperature Range	800°+
Retardation Effectiveness	Good
Resistance to Fade	Excellent
Recovery	Excellent
Hot Stop Effectiveness	Excellent
Cold Stop Effectiveness	Good

USE: HEAVY DUTY

FRICTION: FF

EDGE BRAND: BL K3 FF

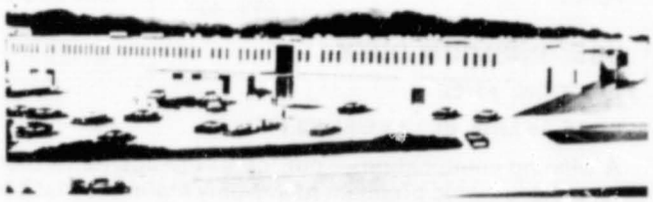
Our heavy-duty X-10 Brake Block is specially formulated from high quality organic friction materials to provide excellent resistance to fade — without sacrificing long drum wear. More than a generation of truck owners and drivers have found it consistently reliable even under very rugged driving conditions.

The X-10 offers:

excellent braking and recovery characteristics
equal efficiency on highways or city roads
complete availability including oversizes

The two most important qualities a brake block can have are friction and resistance to wear. To ensure that P.T. brake blocks meet the highest standards for these qualities, our blocks are continually performance-tested on fleets of vehicles throughout the world under a variety of road conditions. For extra protection, additional testing is performed at the P.T. factory.

The result: extra-safe, reliable brake blocks that you can depend on — plus a longer lining life that saves you dollars.



P.T. Brake Lining is located on a 20-acre site in the Lawrence (Massachusetts) Industrial Park — just 35 minutes from major trucking terminals, the port of Boston and Logan airfreight terminal. You're assured of fast, efficient delivery of your shipment — anywhere in the world.

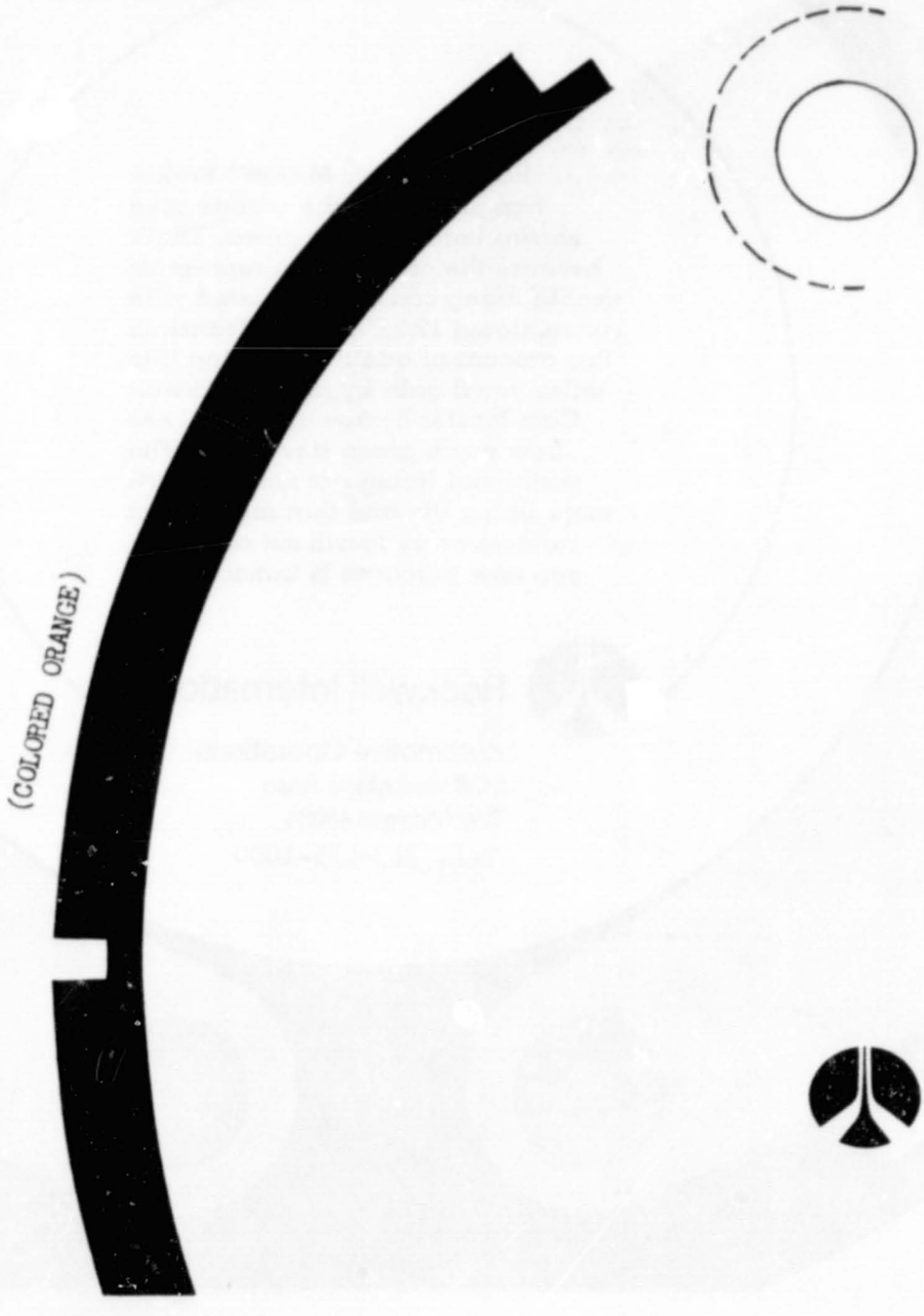
Plus we offer completely modern facilities that contain 150,000 square feet of manufacturing space, 27 shipping and receiving doors and 40,000 square feet of finished goods ready to ship.

Come visit our plant — find out why we're one of the country's leading manufacturers of quality brake linings.

Rockwell International

Automotive Operations

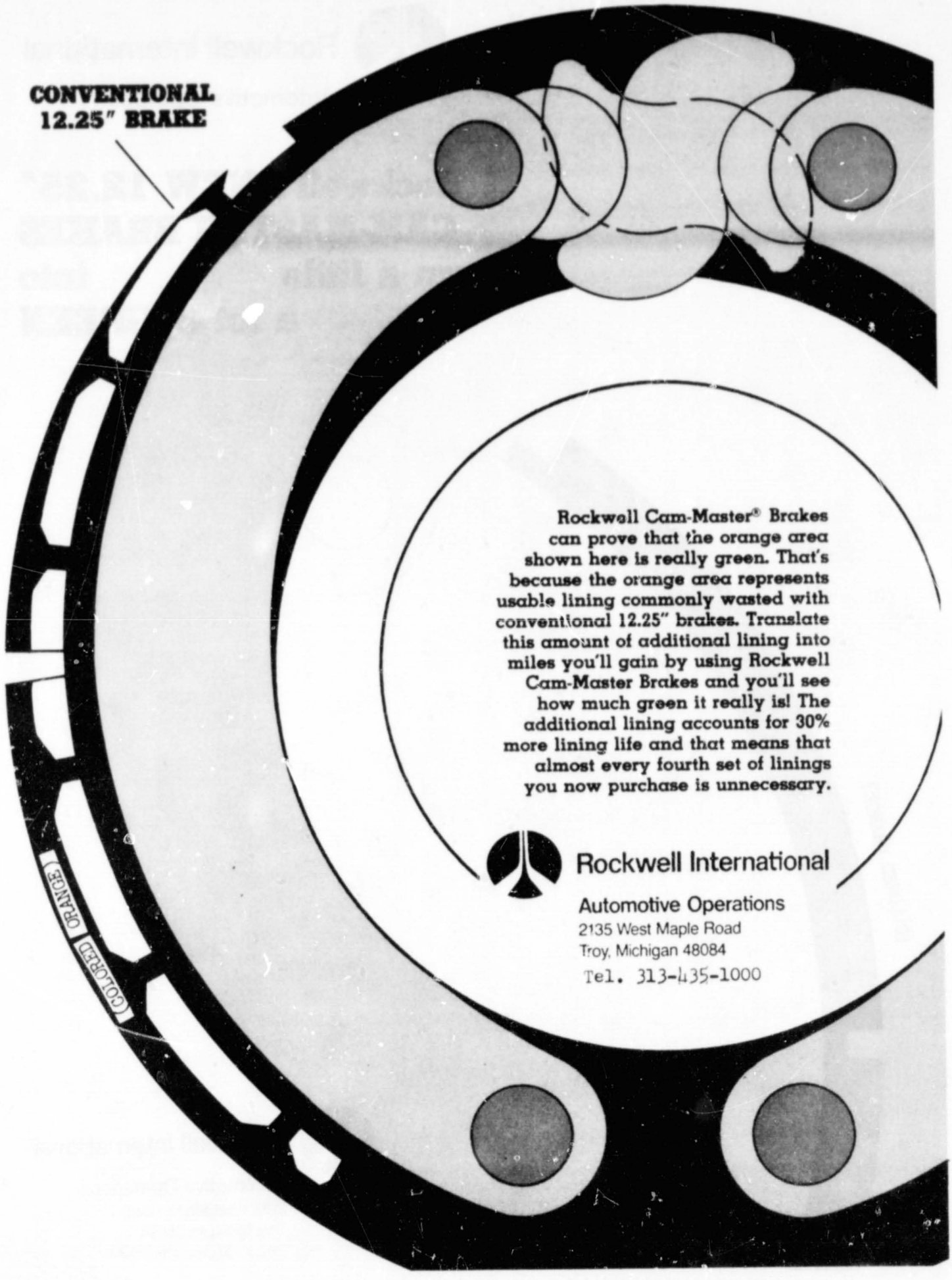
Rockwell's NEW 12.25" CAM-MASTER® BRAKES turn a little into a lot of GREEN



Rockwell International

Automotive Operations
2135 West Maple Road
Troy, Michigan 48084
Tel. 313-435-1000

BK-15



Rockwell Cam-Master® Brakes can prove that the orange area shown here is really green. That's because the orange area represents usable lining commonly wasted with conventional 12.25" brakes. Translate this amount of additional lining into miles you'll gain by using Rockwell Cam-Master Brakes and you'll see how much green it really is! The additional lining accounts for 30% more lining life and that means that almost every fourth set of linings you now purchase is unnecessary.

Rockwell International

Automotive Operations
2135 West Maple Road
Troy, Michigan 48084
Tel. 313-435-1000

Rockwell International developed this new Cam-Master® Brake to provide high performance 12.25" brakes for high cube van and car-carrier axles, that would also prolong brake lining life. By specially designing our cam we created the brakes that accomplish both these goals.

And the best part is that we didn't sacrifice any of our Cam-Master quality along the way. With Rockwell Cam-Master Brakes, you still get:

- Cam rollover prevention
- Camshaft that fits all suspensions
- Rubber-clad, spring-loaded camshaft seals that better retain lubricant, keep out contaminants, and extend lube intervals up to 100,000 miles
- High mechanical advantage cam head
- Twin anchor pins with stainless steel bushings
- Stepped anchor pins held by shoes, which eliminate snap rings, felts, and set screws
- Shoes are open-ended for easy 1, 2, 3 removal, and they are hook-engaged for more stable brake action
- Heat-treated shoe webs
- Welded-on spider

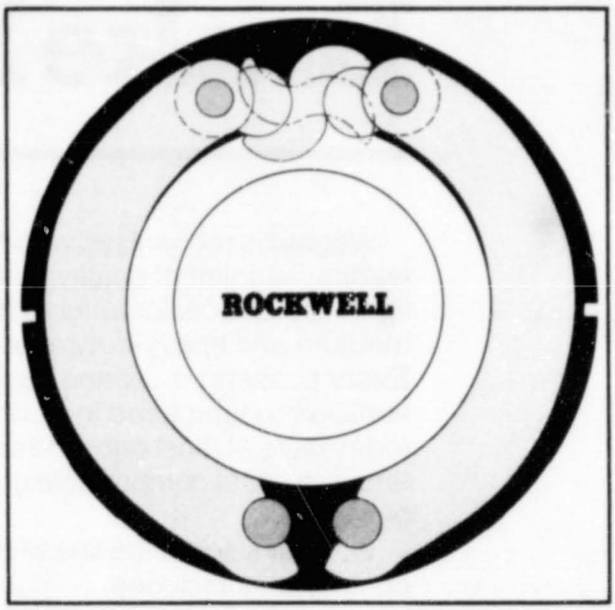
Add it all up — the usual Cam-Master quality together with a big economic plus of 30% longer brake lining life. It adds up to savings without sacrificing performance. Rockwell Cam-Master brakes can really add a little color to your life — in helping you keep 30% of the green dollars you spend on linings!

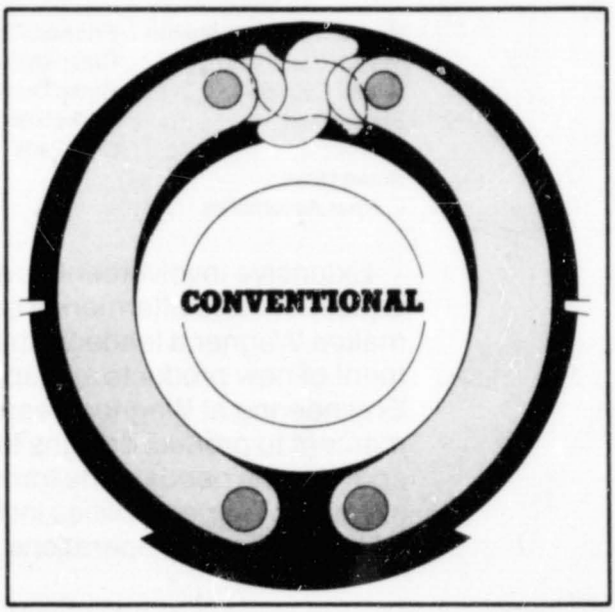
To see how much green the Rockwell Cam-Master Brakes can save you, fill in the amount you spent on brake linings for your operation last year. Multiply that figure by 4, and then divide by 3. Then we think you'll agree with us that, "A little orange is a lot of green!"

_____ x 4 = _____ ÷ 3 = _____

Yr. cost of linings

Your savings with Rockwell Cam-Master Brakes





Rockwell International

Automotive Operations
2135 West Maple Road
Troy, Michigan 48084
Tel. 313-435-1000

Wagner Division
McGraw-Edison Company
100 Misty Lane
Parsippany, NJ 07054
201-386-9300

WAGNER Gives You What You Want In Brake Products

Wagner is recognized worldwide as a leading supplier of quality brake and lighting products for automotive, medium and heavy-duty applications. Every passenger car and commercial vehicle manufactured in North America today uses at least one, and as many as ten, individual components engineered by Wagner.

Wagner's complete line of braking components includes:

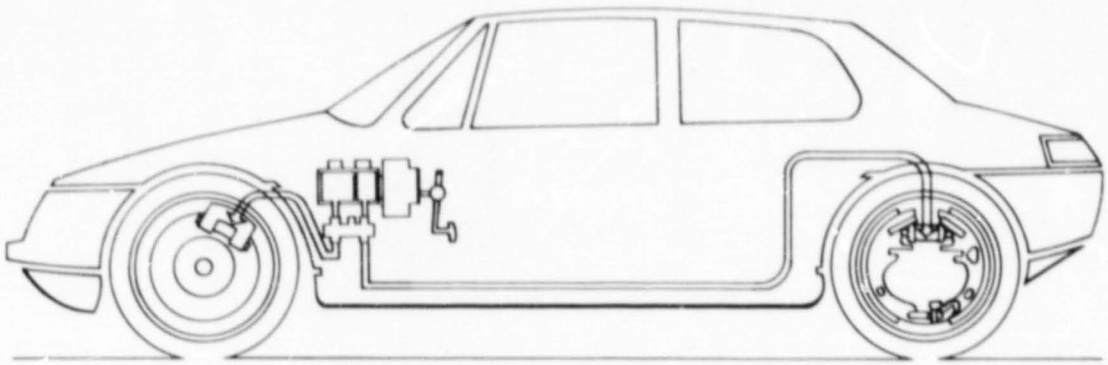
Hydraulic Components	Friction Components
Master Cylinders	Hubs and Rotors
Wheel Cylinders	Brake Drums
Brake Fluid	Brake Shoes
Hardware	Disc Pads
Brake Hoses	
Caliper Assemblies	

Extensive involvement as an original equipment and aftermarket supplier makes Wagner a leader in the development of new products and applications. Engineering at Wagner means a commitment to product designs that respond to the needs of the transportation industry. Wagner facilities include fully integrated testing operations to handle all phases of braking component and system testing in various environments. A full-time testing staff of approximately 35 engineers and skilled technicians experienced in many aspects of brake systems, perform these tests in Wagner's five different facilities.

Dynamometer Testing (St. Louis) — This is particularly effective in the development of new brake design, sizing and certification, as well as lining compound and brake component investigation. All environmental variables such as temperature, torque, speed and cooling air can be accurately controlled.

Experimental Test Laboratory (St. Louis) — This laboratory is utilized in the development and evaluation of materials, components, assemblies and brake systems. The laboratory instruments can accurately document the performance of braking systems and components in both normal operating and hostile environments.

Vehicle Test Center (Burns Flatt, Oklahoma) — This facility offers the



use of a three-mile runway (the longest commercial runway in the U.S.) as well as 90-acre vehicle dynamics area. One of the largest in the world, this dynamics testing facility includes a 1,000-foot skid pad and water recovery pit. Routine burnish, wear, effectiveness, and fade tests are run at this facility as well as level sections of highway in the surrounding area.

Jennerstown Mountain Test Facility (PA) — This facility is maintained for testing brake systems under harsh mountain conditions. Approximately 25 miles of highway in mountainous terrain, with some grades of 10%, subject the brakes to severe temperatures and operating environments.

Experimental Garage (St. Louis) — Located at the Wagner Engineering/ Research Center, the garage has approximately 4,500 square feet of floor space to handle passenger cars, trucks, tractors and trailors. A low speed spike shop test strip and skid pad are located here. This facility is designed for routine burnish, wear effectiveness and fade tests.

Wagner's engineers are constantly developing new products to provide safe, reliable, economical, more energy-efficient transportation in the future.

Wagner wants to be your brake company.

Wagner Division
McGraw-Edison Company
100 Misty Lane
Parsippany, NJ 07054
201-386-9300

McGRAW-EDISON
WAGNER™
BRAKE PRODUCTS

BLOWERS

COOLING

(CODE **BL**)

Kool-O-Matic's

Recreational Vehicle Power Roof Ventilator

Kool-O-Matic Corporation
1831 Terminal Road
Niles, Michigan 49120
Phone: 616-683-2600

For travel trailers, truck campers, fifth wheels, or motor homes, choose Kool-O-Matic's low-profile power ventilator to keep your vehicles comfortably cool.

It's aerodynamic! The sleek attractive ventilator design complements any recreational vehicle, But more important, the streamline low profile reduces wind drag to a minimum while the low unit weight provides maximum travel stability. In addition, the ABS plastic and aluminum ventilator construction makes it virtually rust, dent, stain, and chip-proof.

It's efficient! Your RV unit can be ventilated of stale odors and severe heat in less than a minute. The Kool-O-Matic ventilator's quiet, powerful operation completely removes hot, stuffy air and cooking heat replacing it with cool fresh outdoor air. By simply opening the windows and turning the Kool-O-Matic ventilator on the complete RV is rid of stuffiness in less time than it takes to unhitch, level, and settle down. Once initial ventilating is complete, the variable speed control can be dialed to desired level for true "comfort conditioning."

It's economical! This low-cost, maintenance-free ventilator provides total fresh air living comfort without the high cost of air conditioning. Special air conditioning park hook-up charges and the problems associated with inadequate electrical power existing in many parks will be avoided. Kool-O-Matic ventilator's low electrical power requirement, 4.0 amps, makes it suitable for operation in any park. In addition, you will never have that closed-in, refrigerated air conditioning feeling with a Kool-O-Matic ventilator. Kool-O-Matic ventilators are available installed by your RV manufacturer. They are also simple to install on existing RV's as they require no special roof reinforcing or modification and fit the standard 14" skylight opening.

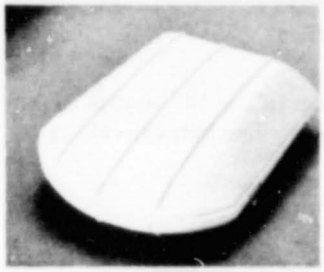
❶ High strength ABS plastic hood, Korad capped for lifetime ultra violet protection. ❷ Light weight screened aluminum housing for lifetime service. ❸ Weathertite self-flashing, pre-drilled base. ❹ Maintenance-free, lifetime lubricated motor. ❺ Balanced fan and motor assembly mounted in sound absorbing isolators. ❻ Satin finished anodized aluminum ceiling grille. ❼ Manual close-off damper with built-in fan speed control.



Kool-O-Matic's variable speed control provides infinite speed and ventilation adjustments.

KOOL-O-MATIC
Corporation
1831 Terminal Road, Niles, Michigan 49120
Phone: 616-683-2600

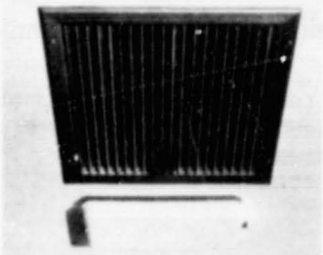
...simple, inexpensive to install



Simplicity of design allows the ventilator to be positioned and attached to the RV roof with ease. Requires no special flashing or roof modification. Comes complete with attaching hardware, sealing tape, and simplified plug-in electrical connectors.



The cover assembly fits snugly over the venturi base flashing assembly, and is secured in three places to provide a weather-tight installation. The fully screened cover assembly assures protection against entry of birds and squirrels.

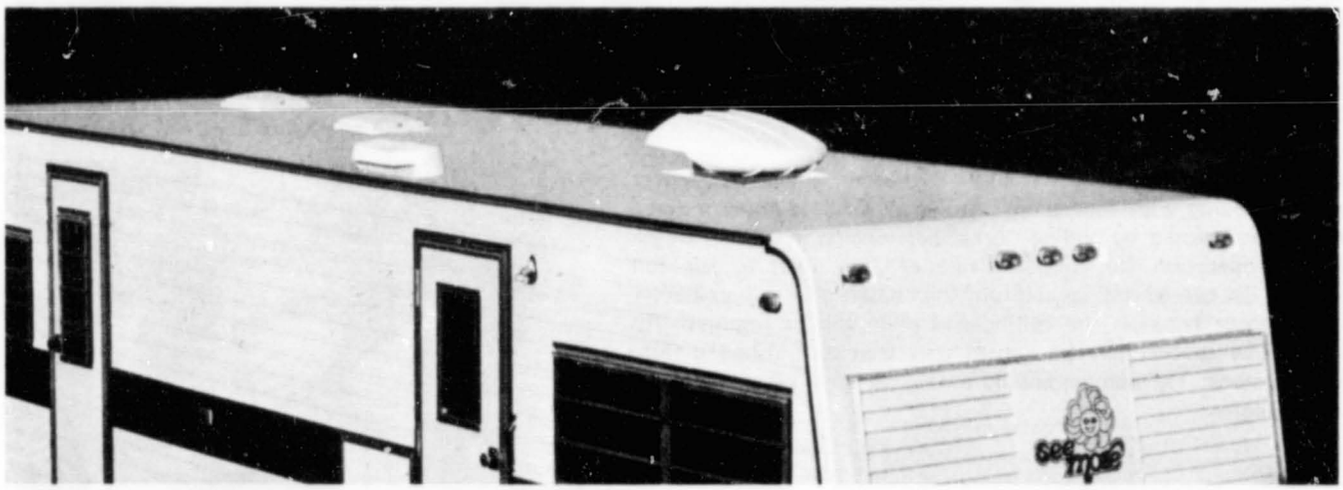


The power vent is designed to fit directly into any existing 14" square skylight roof opening. Requires as little as 2½" roof thickness. Adapts easily to curved ceilings or thin roofs by use of a decorative wood spacer.



Simply fit the ceiling grille and damper assembly into place and attach to the ceiling with the four screws provided. A damper closer is built into the grille for complete closure of the opening.

New! Aerodynamic profile



Kool-O-Matic specifications

Housing constructed of ABS plastic and heavy gauge .050 aluminum, with wide self-flashing base flange pre-drilled for easy installation and a weather-tight seal. Unit extends only 10" above the roof, measures 28" by 23" across the top, and is designed to fit a standard 14" x 14" roof opening.

Ventilators are powered by direct drive electric motors, semi-enclosed unit bearing type, lifetime lubricated for maximum maintenance-free operation. Ventilator assemblies are mounted in neoprene for complete isolation of operational sound transmission.

Units are furnished with a satin finished anodized aluminum ceiling grille with manual damper and built-in controls. Ventilation and fan speed are controlled by either a solid state or rheostat variable speed switch for infinite speed and ventilation adjustment.

Kool-O-Matic ventilators are shipped completely assembled with attaching hardware, sealing tape, and all electrical components and connectors.

Model RV-12	12 Volt D.C. Operation
Speed:	460-910 RPM
12 Volt Electrical Load:	4.5-8.0 AMPS
Capacity:	334-700 CFM
Net Weight:	25 lbs.
Model RV-110	115 Volt A.C. Operation
Speed:	300-1035 RPM
115 Volt Electrical Load:	4.0 AMPS
Capacity:	295-1045 CFM
Net Weight:	30 lbs.

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INSTALLATION INSTRUCTIONS

KOOL-O-MATIC

Kool-O-Matic Corporation
1831 Terminal Road
Niles, Michigan 49120
Phone: 616-683-2600

MODELS RV-12 & RV-110 POWER VENTILATORS FOR RECREATIONAL VEHICLES

(Read Instructions Carefully and Completely Before Starting Installation)

1. **VENTILATOR LOCATION** – Your Kool-O-Matic ventilator may be installed in any existing 14" x 14" skylite or air conditioning opening. If required, a 14" x 14" ventilator opening may be cut in the roof and ceiling between rafters using the templates printed on the carton.

2. **ELECTRICAL POWER SUPPLY** – In most cases, your Kool-O-Matic ventilator may be connected to an existing electrical circuit. Model RV-110 for 115 volt A.C. operation has an electrical load of 4.0 amps. Model RV-12 for 12 volt D.C. operation has a maximum load of 8.5 amps.

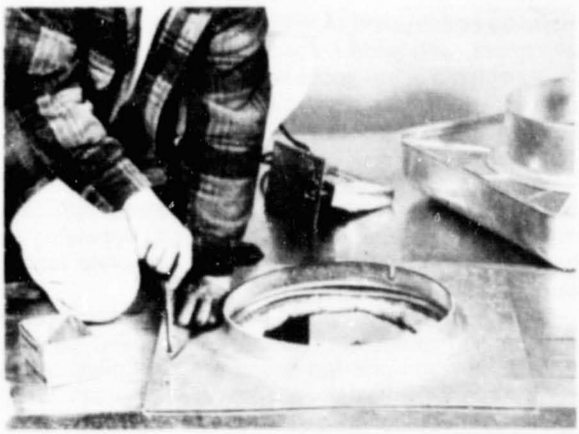
   Power supply wires should be furnished to the roof opening area from any convenient source. You'll find many recreational vehicle manufacturers pre-wire skylite and air conditioning openings for future power accessory installation.



3. **INSTALLING CEILING GRILLE** – Fasten adjustable louver grille to ceiling with four screws provided. Grille damper may be opened and closed by sliding plastic bar located in corner. Check damper operation for proper clearance and open to the full positon. On curved ceilings and roof thicknesses of less than 2½", a wood spacer between the ceiling and grille will be required. An inexpensive spacer may be constructed from unfinished picture framing stock. The damper should always be open when operating the ventilator.



4. **ATTACHING FLASHING FLANGE TO ROOF** – Remove three external fan assembly nuts and washers, using 7/16" wrench. Separate flashing flange from ventilator assembly. Turn flange section upside down. Apply putty tape provided along all four edges, covering mounting screw holes. Press tape firmly in place and remove protective paper. Now turn flange section rightside up. Place it in position on roof centered over opening. Make sure the fan mounting slot closest to the flashing flange edge is located opposite the control. Make starting holes in roof for screws. Begin with center hole in each side of flange. Drive nail into roof, using flange holes as guides. Insert a No. 8 screw into each of these holes and tighten. Repeat the procedure for remaining screw holes. Tighten all screws from each flange center toward each corner. This prevents wrinkles in flange or air gaps in putty seal. Tighten all screws until putty protrudes from under the flange edges. DO NOT OVER-TIGHTEN, as the roof screw holes will strip. If desired, apply a coating of roofing cement around edges of flashing and heads of mounting screws.



5. **ELECTRICAL CONNECTION** – Place fan and motor assembly in flashing flange so three bolts at ends of mounting brackets are in the slots at top edge of flange. Fan blade should be in upward position as shown. Carefully reaching through the fan blade assembly, plug in the motor and control to the power supply using the insulated connectors and terminals provided. Electrical connection should be made as shown in the electrical diagrams. Make sure that the power supply wires clear the fan blades and do not lay on top of the grille damper in the open position.

6. **HOOD ASSEMBLY INSTALLATION** – Slip hood assembly over flashing flange collar. Make sure the three hood slots line up with fan and motor assembly mounting bolts. Replace and tighten the three mounting washers and nuts.

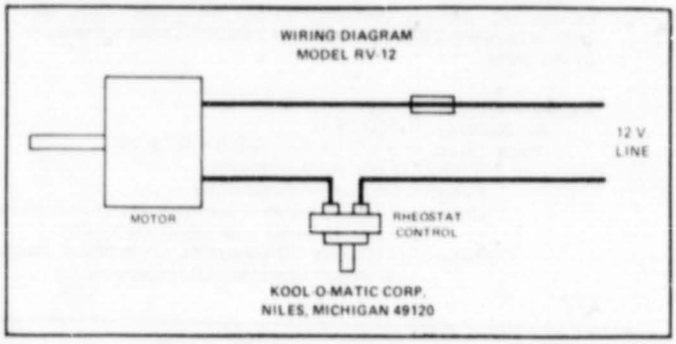


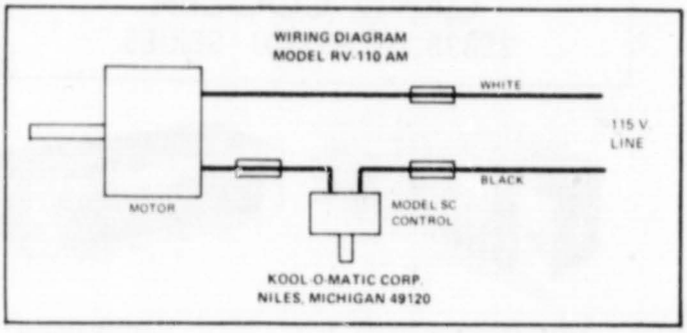
7. **OPERATING YOUR KOOL-O-MATIC VENTILATOR** – Your ventilator is now completely installed and ready to operate. Turn control knob on and ventilator will begin to operate. By continuing to turn the control knob, fan speed and desired ventilation level may be varied.

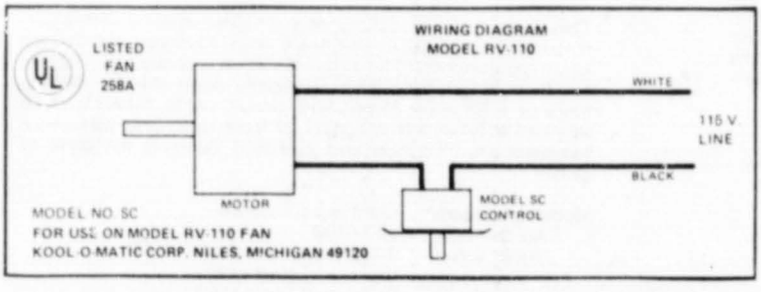
WARRANTY IS VOID IF MISWIRED

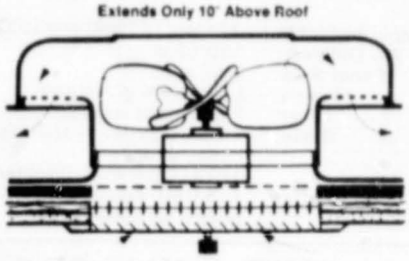
CAUTION – Disconnect electrical power before connecting RV ventilator and controls. All electrical connections must conform to electrical code requirements.

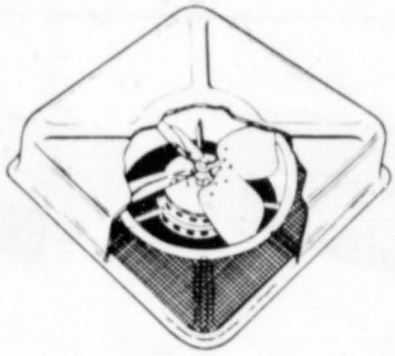
Be sure your power supply is suitable for the Kool-O-Matic ventilator model being installed.









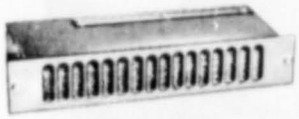


For ANSI Standard A119.2 installations specify Model RV-110. Model RV-110 ventilators are furnished with separate control including conduit box and cover plate and are supplied for ceiling installation adjacent to the grille. On roof thicknesses of less than 3", remote wall installation of the control is suggested. Model RV-110 is Underwriters' Laboratories Listed.

KOOL-O-MATIC CORP
1831 Terminal Road, Niles, Michigan 49120
Phone: 616-683-2600

PACKAGED CENTRIFUGAL BLOWERS

1E220C–1E221C SERIES



SERIES 1E220C



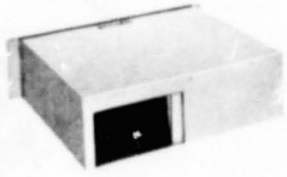
SERIES 1E221C

The Slot Blower is an exclusive McLean design using only 3½" of panel height, producing 150 cfm, with a low audible noise level. This model has a 12½" wide jet airstream discharging vertically into the electronic enclosure. This air velocity and pressure are adequate to assure efficient cooling of densely packed electronic equipment. Filter can be serviced without removing blower from rack.

Models Available:	Models 1E220C and 1E221C
Air Delivery:	150 CFM
Panel Size:	3½" x 19"
Finish:	Light semi gloss gray
Filter:	Permanent (washable)
Grille:	1E220C Series — stainless steel, heavy gauge 1E221C Series — brushed aluminum
Motor:	115 V 50/60 cycles, single phase, U/L approved

SIDE WINDERS
1EB710/1EB920/1EB980





These McLean "Sidewinder" Centrifugal Blowers are designed to deliver maximum cfm and pressure in a minimum of panel space. "Sidewinder" models have a large single centrifugal blower wheel operating at slow quiet speeds. The powerful two speed UL approved motor delivers huge quantities of clean, cool air at unusually high static pressure.

Model:	1EB710, 3½" H x 19" W x 12" D, 180/130 cfm
Model:	1EB920, 5¼" H x 19" W x 14½" D, 350/160 cfm
Model:	1EB980, 7" H x 19" W x 14½" D, 515/280 cfm
Finish:	Light Semi gloss gray
Filter:	Permanent (Washable)
Grille:	Stainless steel, heavy gauge
Motor:	115 volts, 50/60 cycles, two speed, ball bearings, UL approved

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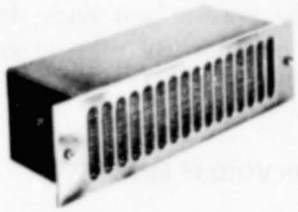
PHONE 609-799-0100

2EB300-2EB301 SERIES



SERIES 2EB300

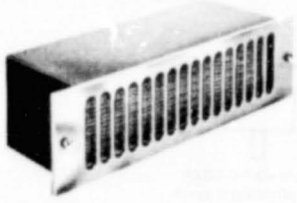


SERIES 2EB301

McLean 2EB300 and 2EB301 Series Blowers are designed for ultimate quietness in limited space requirements. These models have unusually low height for their width, and feature two wide small diameter blower wheels that supply large volumes of filtered air at a low db noise level. Filter can be serviced without removing blower from rack. Only difference between 2EB300 Series and 2EB301 Series is the style of the grille.

Models Available:	Eight in each Series
Air Delivery:	150 CFM
Panel Sizes:	3-1/2" x 19", and 5-1/4" x 19"
Finish:	Light semi-gloss gray
Filter:	Permanent (washable)
Grille:	2EB300 Series — stainless steel, heavy gauge 2EB301 Series — brushed aluminum
Motor:	115 volts, 50/60 cycles, single phase, motor with ball bearings. UL approved.

CARD COOLER
2EB3500/2EB3501 SERIES



SERIES 2EB3500



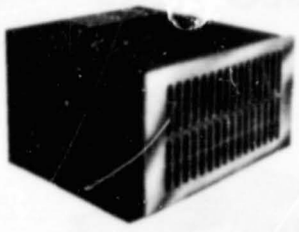
SERIES 2EB3501

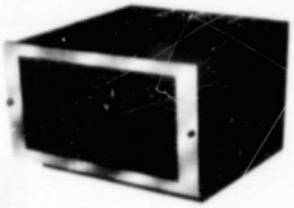
This Series produces 290 CFM at a higher velocity with a corresponding increase in the noise level. Designed for limited space requirements. The units have exceptionally high volume for their height and width. Especially applicable for cooling rows of solid state component circuit cards. Filters can be serviced without removing blower from rack. Only difference between the 2EB3500 and 2EB3501 Series is the style of grille.

Models Available:	Eight in each Series
Air Delivery:	290 CFM
Panel Sizes:	3-1/2" x 19", or 5-1/4" x 19"
Finish:	Light semi-gloss gray
Filter:	Permanent (washable)
Grille:	2EB3500 Series — stainless steel, heavy gauge 2EB3501 Series — brushed aluminum
Motor:	115 volts, 50/60 cycles, ball bearings. UL approved.

PACKAGED CENTRIFUGAL BLOWERS

1EB810 – 1EB811 SERIES



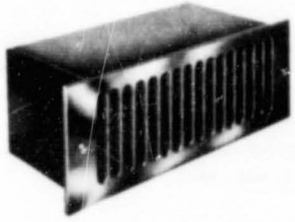


SERIES 1EB810G **SERIES 1EB811G**

The 1EB810G and 1EB811G Series Blowers are recessed models for applications where maximum air delivery is required, but limited space is available. Panel height is only 10-1/2", but case height is 12-1/4". These models feature easy adaptability to all width cabinets. Large, slow-speed, single centrifugal blower wheel operates at slow, quiet speeds.

Models Available: One in each series
Air Delivery: 1000 CFM
Panel Sizes: 10-1/2" x 19"
Finish: Light semi-gloss gray
Filter: Permanent (washable)
Grille: 1EB810 Series — stainless steel, heavy gauge
1EB811 Series — brushed aluminum
Motor: 115 volts, 50/60 cycles, split capacitor with ball bearings. UL approved.

PACKAGED PROPELLER MODEL



MODEL 2EB55B

Mount in racks like standard panels. Filter may be serviced without removing fan from rack.

Air Delivery: 250 CFM
Panel Sizes: 7" x 19"
Case: Steel, light semi-gloss gray
Filters: Permanent (washable)
Grille: Stainless steel, heavy gauge
Motors: Two, 115 volts, 50/60 cycles, ball bearing motors. UL approved.

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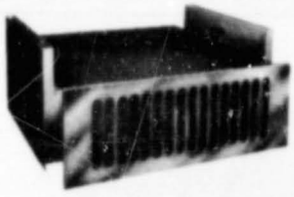
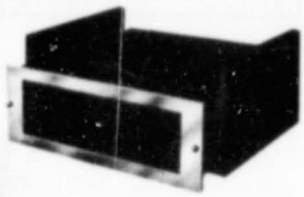
PRINCETON JCT. N.J. 08550
PHONE 609-799-0100

SIDE DISCHARGE BLOWERS FOR DUCT PANELS





McLean Packaged Centrifugal Blowers of the 2EB412-2EB413, 2EB512-2EB513 and 2EB612-2EB613 Series may be equipped with a duct panel adapter diverting air into a side or rear panel duct system. Cool, clean filtered air may then be exhausted directly on hot components or tubes for spot cooling where required. Ducts can be supplied on either side, both sides or rear of blower.

Models Available: Ten in each Series
Air Delivery: 350 CFM, 500 CFM, 700 CFM, 800 CFM
Panel Sizes: 5-1/4" x 19", 7" x 19", 8-3/4" x 19", 10-1/2" x 19"
Finish: Light semi-gloss gray
Filter: Permanent (washable)
Grille: Stainless steel, heavy gauge / or brushed aluminum
Motor: 115 volts, 50/60 CPS, single phase heavy-duty permanent split capacitor, with ball bearings. UL approved.

WIDE DISCHARGE BLOWERS



Stainless Steel Grille



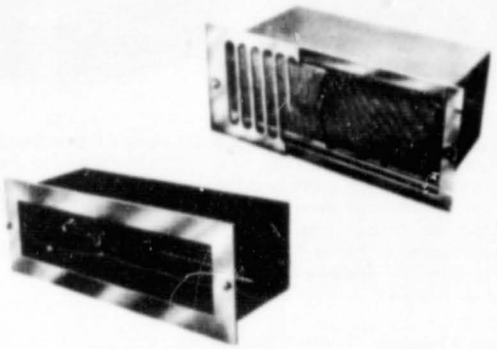
Computer Age Aluminum Grille

McLean Wide Discharge Blowers provide a wide turbulent air stream discharging vertically into the electronic enclosure, providing an even distribution of air across the entire cabinet. These models are especially adapted to cooling rows of solid state cards mounted above the blower package.

Models Available: Four in each series
Air Delivery: 250 and 350 CFM
Panel Sizes: 5-1/4" x 19" and 7" x 19"
Finish: Light semi gloss gray
Filter: Permanent (washable)
Grille: Stainless steel, heavy gauge/or brushed aluminum
Motor: One 115 volts 50/60 CPS. single phase, ball bearings. UL approved.

COOLING FOR ELECTRONIC EQUIPMENT

RFI SHIELDED BLOWERS
Commercial



McLean packaged centrifugal blowers are available with an RFI shield and wave guide media built into the air stream and are capable of maintaining a 100DB attenuation through the range 15KC to 10 KMC when installed properly. These blowers are designed to cool critical electronic components with clean, filtered air in areas where Radio Frequency Interference is a serious problem. Blower capacities available from 150 CFM to 1000 CFM.

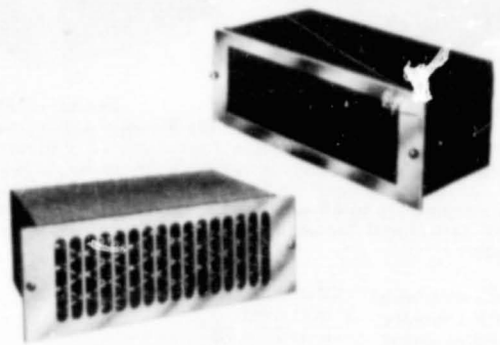
McLean RFI shielded blowers have been certified by government agencies and reports are available from independent testing laboratories. All models conform to MIL-I-6181D, MIL-I-16910, MIL-I-26600. The compression flange is cadmium plated per QQ-P-416 and chromate passivated per MIL-C-5541.

All models ready for quick, easy installation from front of shielded electronic rack. Filters are serviced from front without use of tools. These models have low audible noise level and are without RF noise generation or transmission.

MIL-SPEC RFI SHIELDED BLOWERS

Blowers described above are designed to meet RFI Military Specifications exclusively. Where full MIL-SPEC requirements, in addition to RFI specs must be met, McLean has a line of packaged blowers to meet these specifications as well. These models have full Mil-Spec motors, materials and finishes and can be certified to most specifications applying to the military.

MIL-SPEC BLOWERS



All Packaged Blowers and Fans featured in this catalog are also manufactured to rigid military specifications, and in particular those applying to the electronic industry. Materials, finishes and inspection procedures also conform to Military Specification. Our library contains copies of the most important and more frequently referred to specifications which affect our products. Immediate reference and consultation is available on any of these specifications, all of which can be met. Government source inspection is available (Air Force cognizant).

McLean Engineering Laboratories is the largest manufacturer of MIL-SPEC packaged blowers. Tens of thousands of McLean blowers are in use all over the world . . . in radar stations, aircraft, missile control centers, computers, ground stations, communication centers, nuclear reactors, etc., etc.

Wherever reliability in sensitive electronic equipment is vital, McLean cooling equipment is employed because McLean units are inherently reliable in every way . . . windings, bearings, lubrication, wiring, construction and performance. Every component part of a McLean blower is custom designed to surpass, with wide safety margins, the most critical environmental conditions to which it will ultimately be subjected! Shock, vibration, impact . . . corrosion, high temperature, moisture . . . sudden acceleration, radiation . . . these and other severe conditions McLean equipment can withstand and still provide continuous peak performance.

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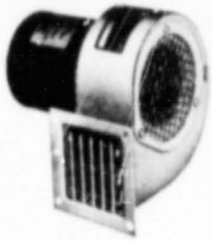
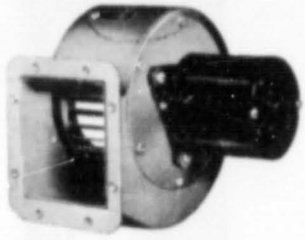
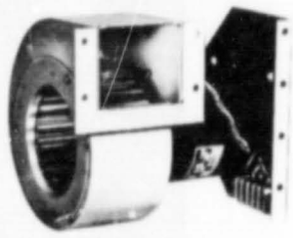
SINGLE CENTRIFUGAL BLOWERS









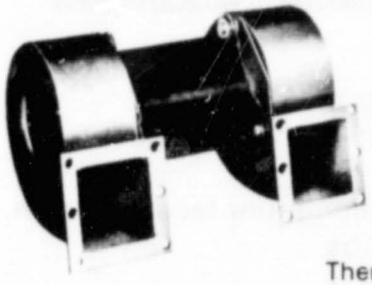


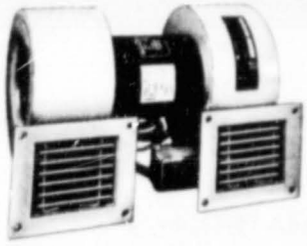
McLean does have a large selection of single centrifugal blowers engineered to meet a wide variety of CFM output and pressure characteristics. Inlet duct flanges, exhaust outlet flanges and protective screens are available. CW and CCW rotations can be supplied. Each motor has been specifically designed for the application, bearings are properly loaded, double shielded and permanently lubricated. Motor and wheels are balanced to precision tolerances assuring vibration free operation. All motors are UL approved. These blowers may be operated in any shaft position.

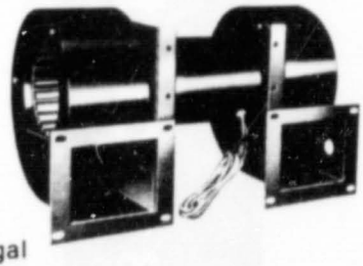
CFM output ranges from 50 to 2000 CFM with static pressures from 0." to 3.0" SP. Motors can be supplied for any AC frequency or power.

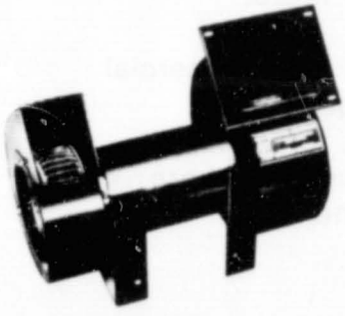
Send your specifications. There may be a model in stock to meet your requirement.

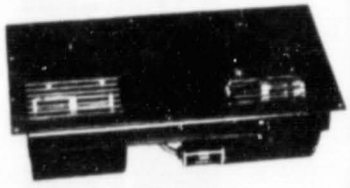
DUAL CENTRIFUGAL BLOWERS











There is an extensive variety of McLean Dual Centrifugal Blowers offering a wide choice of static pressure and output characteristics. Wheel diameters range from 3" to 12". Motors can be supplied for any AC frequency or power, single or three phase. Each motor has been specifically designed for the application, bearings are properly loaded, double shielded and permanently lubricated. Motors and wheels are balanced to precision tolerances assuring vibration free operation. All motors are UL approved.

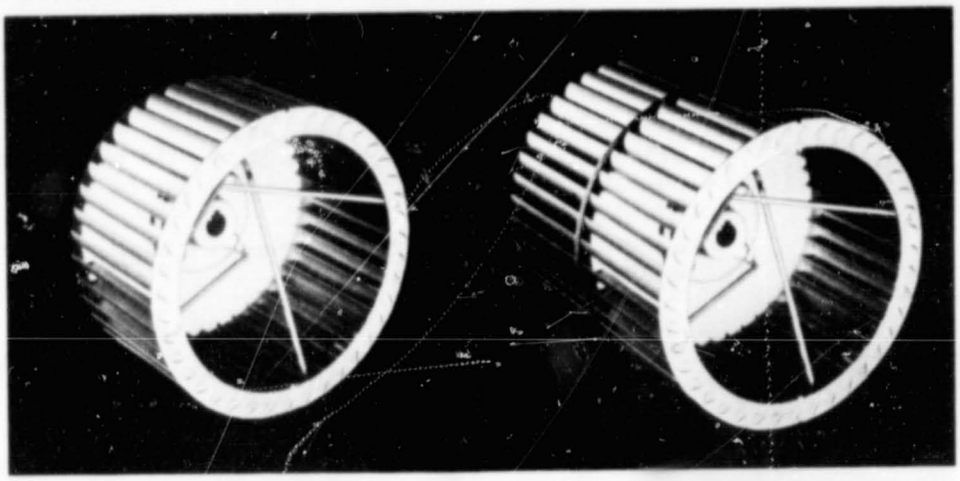
Exhaust outlet flanges, inlet duct flanges, protective screens and various types of mounting flanges and supports are available.

Let us have your application information; our engineers will help in selecting the proper blower to meet the need. Many models are in stock.

McLEAN ENGINEERING LABORATORIES
70 WASHINGTON ROAD
PRINCETON JCT. N.J. 08550
PHONE 609-799-0100

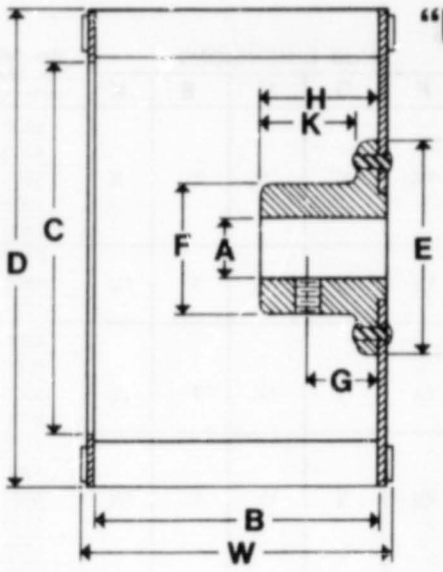
REVCOR

"R" series industrial blower wheels



SIZES:	Diameters from 5" to 12-5/8". Widths from 1" to 6" single inlet.
MATERIALS:	Steel with aluminum lacquer finish, cast iron hubs.
FEATURES:	Heavy duty construction for rpm's of 3450 or more.
APPLICATIONS:	Air conditioning for commercial transportation, generators, industrial ovens, furnaces, oil burners and other units where rugged construction is needed.

REVCOR
251 Edwards Street • Carpentersville, Illinois 60110 • (312) 428-4411



"R" series

Dimensions shown are standard. Special Hubs, Bores or Keyways can be furnished at extra cost. Socket head set screws are standard. Square head set screws can be furnished at no extra cost. All wheels are true and statically balanced and are furnished in steel material with aluminum lacquer finish. Consult factory for special applications or when operating speed exceeds that shown as Maximum Safe Operating Speed. Four Braces standard in starred (*) sizes. Puller holes are standard in (***) sizes.

ROTATION IS DETERMINED VIEWING CLOSED END OF WHEEL.

CATALOG NUMBER	D	B	W	C	N	STD. HUB	STD. BORES "A"	HUB DIMENSIONS F	G	H	E	K	Max. Safe Oper. Speed Inside Hub	WT. STEEL
R506-100S		1	1 3/16			R506 SERIES							8000	.73
R506-150S		1 1/2	1 11/16										7500	.80
R506-200S	5 5/16	2	2 3/16	3 13/16	26								6000	.87
R506-250S		2 1/2	2 11/16			34-103	3/16, 3/8, 1/2, 5/8	1 3/16	5/8	15/16	3	5/8	5200	.95
R506-300S		3	3 3/16										4200	1.02
R506-350S		3 1/2	3 11/16										3600	1.10
R525-100S		1	1 3/16			R525 SERIES							8000	.77
R525-150S		1 1/2	1 11/16										7500	.84
R525-200S		2	2 3/16										6000	.91
R525-250S	5 1/4	2 1/2	2 11/16	4 3/32	26								5200	.99
R525-300S		3	3 3/16			34-103	3/16, 3/8, 1/2, 5/8	1 3/16	5/8	15/16	3	5/8	4200	1.06
R525-350S		3 1/2	3 11/16										3600	1.14
R575-100S		1	1 3/16			R575 SERIES							7500	1.08
R575-150S		1 1/2	1 11/16										6500	1.17
R575-200S	5 3/4	2	2 3/16	4 3/8	32								4800	1.26
R575-250S		2 1/2	2 11/16										4000	1.36
R575-300S		3	3 3/16			34-103	3/16, 3/8, 1/2, 5/8	1 3/16	5/8	15/16	3	5/8	3400	1.44
R575-350S		3 1/2	3 11/16										3000	1.53
R631-100S		1	1 3/16			R631 SERIES							7000	1.19
R631-150S		1 1/2	1 11/16										5500	1.28
R631-200S		2	2 3/16										4400	1.37
R631-250S	6 5/16	2 1/2	2 11/16	5 1/4	32	34-103	3/16, 3/8, 1/2, 5/8	1 3/16	5/8	15/16	3	5/8	3800	1.46
R631-300S		3	3 3/16										3200	1.55
R631-350S		3 1/2	3 11/16										2800	1.64
R631-400S		4	4 3/16										2500	1.73
R700-100S		1	1 3/16			R700 SERIES							6000	1.41
R700-150S		1 1/2	1 11/16										5500	1.52
R700-200S		2	2 3/16			34-103	3/16, 3/8, 1/2, 5/8	1 3/16	5/8	15/16	3	5/8	4600	1.62
R700-250S		2 1/2	2 11/16										4000	1.73
R700-300S	7	3	3 3/16	5 1/4	36								3500	1.83
R700-350S		3 1/2	3 11/16			34-117	1/2, 3/8, 3/4	1 1/2	7/8	1 1/16	3	1 1/8	2900	1.94
R700-400S		4	4 3/16										2600	2.68
R762-100S		1	1 3/16			R762 SERIES							5600	1.52
R762-150S		1 1/2	1 11/16										4900	1.65
R762-200S		2	2 3/16			34-103	3/16, 3/8, 1/2, 5/8	1 3/16	5/8	15/16	3	5/8	4000	1.77
R762-250S	7 43/64	2 1/2	2 11/16	6 5/16	40								3500	1.90
R762-300S		3	3 3/16										3000	2.02
R762-350S		3 1/2	3 11/16			34-117	1/2, 3/8, 3/4	1 1/2	7/8	1 1/16	3	1 1/8	2800	2.78
R762-400S		4	4 3/16										2400	2.91
R762-450S		4 1/2	4 11/16										2200	3.32

REVCOR INC.
251 Edwards Street • Carpentersville, Illinois 60110 • (312) 428-4411

LARGEST EXCLUSIVE MANUFACTURERS OF AIR IMPELLERS

"R" series

CATALOG NUMBER	D	B	W	C	N	STD. HUB	STD. BORES "A"	HUB DIMENSIONS F	G	H	E	K	Max. Safe Oper. Speed Inside Hub	WT. STEEL
R825-100S		1	1 3/16			R825 SERIES							5200	1.66
R825-150S		1 1/2	1 7/16										4400	1.80
R825-200S		2	2 3/16			34-103	3/16, 3/8, 1/2, 5/8	1 3/16	1/8	5/16	3	1/8	3600	1.93
R825-250S		2 1/2	2 7/16										3000	2.07
R825-300S	8 1/4	3	3 3/16	7	44								2400	2.21
R825-350S		3 1/2	3 7/16										2100	2.98
R825-400S		4	4 3/16			34-117	1/2, 5/8, 3/4	1 1/2	1/8	1 1/16	3	1 1/8	1800	3.75
*R825-450S		4 1/2	4 7/16										1725	4.81
R912-100S		1	1 3/16			R912 SERIES							4800	2.79
R912-150S		1 1/2	1 7/16										3800	2.96
R912-200S		2	2 3/16			34-117	1/2, 5/8, 3/4	1 1/2	1/8	1 1/16	3	1 1/8	3000	3.13
R912-250S		2 1/2	2 7/16										2600	3.92
R912-300S		3	3 3/16										2100	4.64
R912-350S	9 1/8	3 1/2	3 7/16	7 7/8	48								1900	5.58
R912-400S		4	4 3/16			34-123	3/8, 1/2, 1, 1 1/4	2 3/8	1/8	1 3/8	5 1/8	1 3/8	1800	5.75
*R912-450S		4 1/2	4 7/16			* * *							1725	5.92
*R912-500S		5	5 3/16										1725	6.09
*R912-550S		5 1/2	5 7/16										1725	6.26
R987-100S		1	1 3/16			R987 SERIES							4400	3.09
R987-150S		1 1/2	1 7/16										3500	3.27
R987-200S		2	2 3/16										2800	3.45
R987-250S		2 1/2	2 7/16			34-117	1/2, 5/8, 3/4	1 1/2	1/8	1 1/16	3	1 1/8	2400	4.57
R987-300S		3	3 3/16										2100	5.93
R987-350S	9 1/8	3 1/2	3 7/16	8 1/4	48								1900	6.11
R987-400S		4	4 3/16										1725	6.29
*R987-450S		4 1/2	4 7/16										1725	6.47
*R987-500S		5	5 3/16			34-123	3/8, 1/2, 1, 1 1/4	2 3/8	1/8	1 3/8	5 1/8	1 3/8	1725	6.65
*R987-550S		5 1/2	5 7/16			* * *							1725	6.83
*R987-600S		6	6 3/16										1725	7.03
R1075-100S		1	1 3/16			R1075 SERIES							4000	3.32
R1075-150S		1 1/2	1 7/16										3300	3.50
R1075-200S		2	2 3/16			34-117	1/2, 5/8, 3/4	1 1/2	1/8	1 1/16	3	1 1/8	2700	3.68
R1075-250S		2 1/2	2 7/16										2300	4.97
R1075-300S		3	3 3/16										2050	6.33
R1075-350S	10 3/4	3 1/2	3 7/16	9 1/8	52								1850	6.73
*R1075-400S		4	4 3/16										1725	6.91
*R1075-450S		4 1/2	4 7/16			34-123	3/8, 1/2, 1, 1 1/4	2 3/8	1/8	1 3/8	5 1/8	1 3/8	1725	7.09
*R1075-500S		5	5 3/16			* * *							1725	7.27
*R1075-550S		5 1/2	5 7/16										1725	7.45
*R1075-600S		6	6 3/16										1725	7.63
R1162-100S		1	1 3/16			R1162 SERIES							3800	3.49
R1162-150S		1 1/2	1 7/16										3000	3.67
R1162-200S		2	2 3/16			34-117	1/2, 5/8, 3/4	1 1/2	1/8	1 1/16	3	1 1/8	2600	3.88
R1162-250S		2 1/2	2 7/16										2300	5.40
R1162-300S		3	3 3/16										2000	6.79
R1162-350S		3 1/2	3 7/16										1800	6.98
*R1162-400S	11 1/8	4	4 3/16	9 1/8	56								1725	7.18
*R1162-450S		4 1/2	4 7/16			34-123	3/8, 1/2, 1, 1 1/4	2 3/8	1/8	1 3/8	5 1/8	1 3/8	1725	7.37
*R1162-500S		5	5 3/16			* * *							1725	7.57
*R1162-550S		5 1/2	5 7/16										1725	7.78
*R1162-600S		6	6 3/16										1725	7.96
R1262-100S		1	1 3/16			R1262 SERIES							3500	4.06
R1262-150S		1 1/2	1 7/16										2900	4.25
R1262-200S		2	2 3/16			34-117	1/2, 5/8, 3/4	1 1/2	1/8	1 1/16	3	1 1/8	2500	4.46
R1262-250S		2 1/2	2 7/16										2200	4.67
R1262-300S		3	3 3/16										1800	7.65
*R1262-350S		3 1/2	3 7/16										1725	7.86
*R1262-400S	12 1/8	4	4 3/16	10 3/4	60	34-123	3/8, 1/2, 1, 1 1/4	2 3/8	1/8	1 3/8	5 1/8	1 3/8	1725	8.07
*R1262-450S		4 1/2	4 7/16			* * *							1725	8.23
*R1262-500S		5	5 3/16										1725	8.49
*R1262-550S		5 1/2	5 7/16										1725	8.70
*R1262-600S		6	6 3/16										1725	8.91

REVCOR INC.

251 Edwards Street • Carpentersville, Illinois 60110 • (312) 428-4411

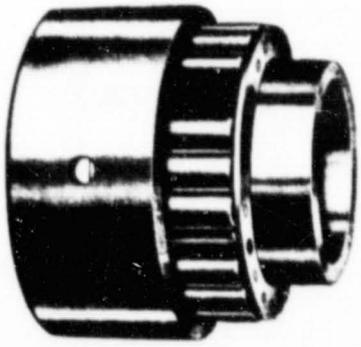
LARGEST EXCLUSIVE MANUFACTURERS OF AIR IMPELLERS

BEARINGS

WHEEL and MOTOR

(CODE **BR**)

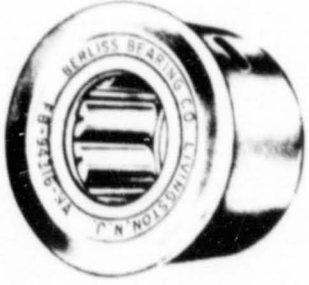
berliss bearing company



Roller assemblies with solid inner and outer races



Roller assemblies and split outer race



Flanged roller bearings



Bearing–retainer seals

644 west mt. pleasant ave., livingston, n.j. 07039

(201) 992-4242

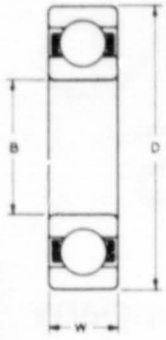
Fafnir Bearing Division of Textron Inc.

37 Booth Street
New Britain, CT 06050
203/225-5151

Light

MM200K Series





BEARING DIMENSIONS

Bearing Number	Bore B		Outside Diam. D		Width W		Fillet Radius*	Brg. Wt.
	mm	Inches	mm	Inches	mm	Inches	Inches	Lbs.
MM201KD	12	.4724	32	1.2598	10	.3937	.024	.10
MM202K	15	.5906	35	1.3780	11	.4331	.024	.12
MM203K	17	.6693	40	1.5748	12	.4724	.024	.15
MM204K	20	.7874	47	1.8504	14	.5512	.039	.25
MM205K	25	.9843	52	2.0472	15	.5906	.039	.30
MM206K	30	1.1811	62	2.4409	16	.6299	.039	.50
MM207K	35	1.3780	72	2.8346	17	.6693	.039	.70
MM208K	40	1.5748	80	3.1496	18	.7087	.039	.90
MM209K	45	1.7717	85	3.3465	19	.7480	.039	.96
MM210K	50	1.9685	90	3.5433	20	.7874	.039	1.05
MM211K	55	2.1654	100	3.9370	21	.8268	.059	1.50
MM212K	60	2.3622	110	4.3307	22	.8661	.059	1.90
MM213K	65	2.5591	120	4.7244	23	.9055	.059	2.35
MM214K	70	2.7559	125	4.9213	24	.9449	.059	2.50
MM215K	75	2.9528	130	5.1181	25	.9843	.059	2.70
MM216K-CR	80	3.1496	140	5.5118	26	1.0236	.079	3.10

* Maximum shaft or housing fillet radius which bearing corners will clear.

Ball-piloted steel cage is standard for Conrad (K) type bearings except where designated CR (steel cage only for PP type).

NOTE: When other than standard cage is desired, specify by appropriate suffix letters. Example: MM202K CR.

CR — Inner ring-piloted composition cage.
MBR — Inner ring-piloted machined bronze cage.
SMBR — Inner ring-piloted machined iron silicon bronze cage.

Check for availability.

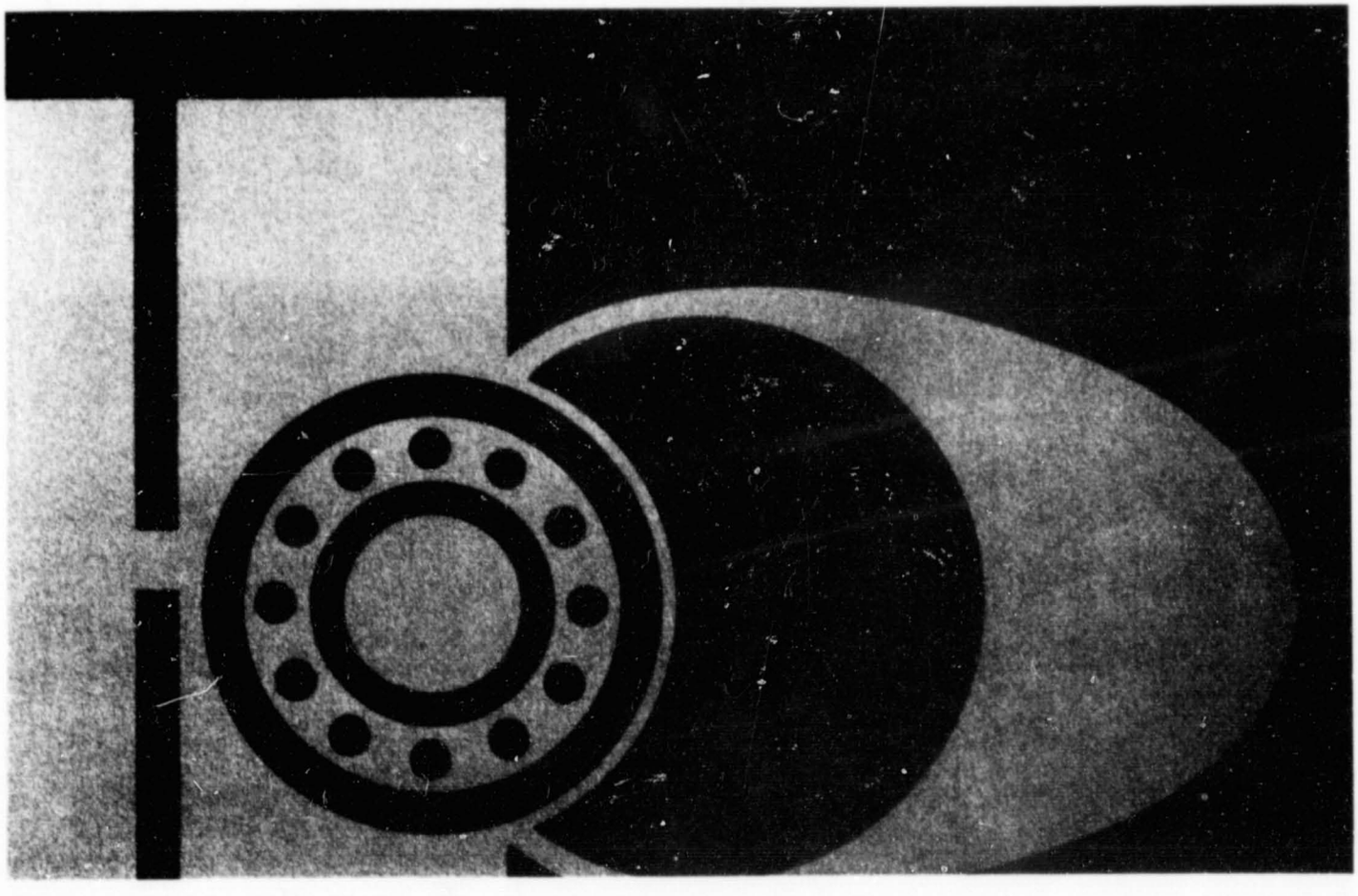
NOTE: These bearings are supplied in four ranges of internal clearance or radial play designated as Snug (no prefix), Standard (prefix R), Loose (prefix P), and Extra Loose (prefix J). Examples: RMM209K, JMM215K.

Load Ratings

Bearing Number	Radial Load Rating @ 500 RPM											
MM201KD	1180	1030	815	645	565	477	392	356	330		247	221
MM202K	1340	1170	930	735	645	545	446	405	376	354	281	252
MM203K	1650	1440	1150	910	795	670	550	500	464	43	347	311
MM204K	2210	1930	1530	1220	1060	895	740	670	620	5	465	416
MM205K	2640	2300	1830	1450	1270	1070	880	800	740		555	497
MM206K	3570	3120	2480	1970	1720	1450	1190	1080	1000		750	670
MM207K	4620	4040	3200	2540	2220	1870	1540	1400	1300	1220	970	870
MM208K	5640	4930	3910	3100	2710	2290	1880	1710	1590	1490	1180	1060
MM209K	5650	4940	3920	3110	2720	2290	1880	1710	1590	1500	1190	1060
MM210K	6060	5290	4200	3330	2910	2460	2020	1840	1700	1600	1270	1140
MM211K	7490	6540	5190	4120	3600	3040	2500	2270	2100	1980	1570	1410
MM212K	8430	7360	5850	4640	4060	3410	2810	2560	2370	2240	1770	1590
MM213K	9960	8700	6900	5480	4790	4030	3320	3020	2800	2640	2090	1870
MM214K	10700	9380	7440	5910	5160	4350	3580	3250	3020	2840	2250	2020
MM215K	10710	9360	7430	5890	5150	4340	3570	3240	3010	2830	2270	2020
MM216K	12500	10900	8670	6880	6010	5060	4170	3790	3510	3310	2630	2350

CLOSE TOLERANCE UNGROUND BEARINGS

Hartford Bearing Company
A Division of Virginia Industries
951 West St., Rocky Hill, Connecticut 06067 • (203) 529-7441



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A Division of Virginia Industries
951 West St., Rocky Hill, Connecticut 06067 • (203) 529-7441

BEARINGS BY HARTFORD

The Hartford Bearing Company specializes in:

- High quality anti-friction products.
- Unground single and double row ball bearings.
- Ball thrust bearings, retainers and thrust races.
- Angular contact cup and cone retainers.
- Value analysis designed, special anti-friction assemblies.
- Corrosion-resistant bearings of stainless steel and plastic.

Life and Load Ratings

Unground bearings are designed for modest load and speed applications. Actual performance rating depends on (1) the relationship of operating load and speed, (2) environmental conditions present, (3) lubrication and (4) shock loads. Generally, the capacity will be 25% to 35% of an ABEC 1 bearing of like size. We will gladly help you specify a Hartford bearing with the exact bearing performance you need. Simply furnish us with details about the loads, speeds and other operating parameters of your application.

Standard Tolerances

Outside diameter	±.001″
Bore	±.0015″
Width	±.0025″
Radial clearance	.000 to +.006″

(Closer tolerances available on special order.)

WARRANTY

We warrant all products to be free from defects in material and workmanship when used in normal service. This warranty is limited to repair or replacement of the Hartford product at no charge within three months of sale date, when our inspection has determined it to be defective.

NO RETURNS ACCEPTED UNLESS AUTHORIZED IN ADVANCE IN WRITING

Inspection Limits

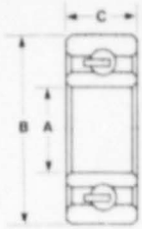
AQL of 4.0 is standard practice; tighter levels available on special order.

RADIAL
—
UNGROUND
—
SEPARATOR TYPE

Inch Series

Unground and Ground O.D.





Economical anti-friction operation in the two most popular inch dimension series. Designed for moderate load-speed applications. Case hardened, bearing quality steel in close machined tolerances. Separator type construction. O.D. available knurled or flanged. Available open; single shield; or double shield, also greased for life. Furnished with unground O.D. as A8 series and ground O.D. as J8 series. Precision bore tolerances available special order.

Hartford Bearing Company

A Division of Virginia Industries

951 West St., Rocky Hill, Connecticut 06067 • (203) 529-7441



PART NO.		A	B O.D.		C	BALLS	
Unground O.D.	Ground O.D.	Bore ±.0015	Unground ±.001	Ground +.0000 −.0005	Width ±.0025	No.	Dia.
A8-0499	J8-0499	.188	.500	.5000	.188	6	3/32"
A8-0500	J8-0500	.250	.500	.5000	.188	6	3/32"
A8-0530	J8-0530	.250	.530	.5300	.200*	6	3/32"
A8-0625	J8-0625	.250	.625	.6250	.196	6	1/8"
A8-0689	J8-0689	.188	.688	.6875	.250	8	3/32"
A8-0687	J8-0687	.250	.688	.6875	.250	8	3/32"
A8-0688	J8-0688	.312	.688	.6875	.250	8	3/32"
A8-0750	J8-0750	.250	.750	.7500	.281	8	3/32"
A8-0867	J8-0867	.276	.866	.8661	.276	7	5/32"
A8-0874	J8-0874	.312	.875	.8750	.281	7	5/32"
A8-0875	J8-0875	.375	.875	.8750	.281	7	5/32"
A8-0905	J8-0905	.312	.906	.9063	.312	7	5/32"
A8-0906	J8-0906	.375	.906	.9063	.312	7	5/32"
A8-1123	J8-1123	.375	1.125	1.1250	.375	7	3/16"
A8-1124	J8-1124	.438	1.125	1.1250	.375	7	3/16"
A8-1125	J8-1125	.500	1.125	1.1250	.375	7	3/16"
A8-1126	J8-1126	.500	1.125	1.1250	.312*	7	3/16"
A8-1373	J8-1373	.438	1.375	1.3750	.438	8	7/32"
A8-1374	J8-1374	.500	1.375	1.3750	.438	8	7/32"
A8-1375	J8-1375	.625	1.375	1.3750	.438	8	7/32"
A8-1376	J8-1376	.625	1.375	1.3750	.344*	8	7/32"
A8-1377	J8-1377	.625	1.375	1.3750	.433	8	7/32"
A8-1624	J8-1624	.625	1.625	1.6250	.500	8	1/4"
A8-1625	J8-1625	.750	1.625	1.6250	.500	8	1/4"
A8-1626	J8-1626	.750	1.625	1.6250	.438*	8	1/4"
A8-1749	J8-1749	.625	1.750	1.7500	.500	8	1/4"
A8-1750	J8-1750	.750	1.750	1.7500	.500	8	1/4"
A8-1875	J8-1875	.875	1.875	1.8750	.500	10	1/4"
A8-1998	J8-1998	.750	2.000	2.0000	.562	8	5/16"
A8-1999	J8-1999	.875	2.000	2.0000	.562	8	5/16"
A8-2000	J8-2000	1.000	2.000	2.0000	.562	8	5/16"
A8-2001	J8-2001	1.000	2.000	2.0000	.500	8	5/16"

*Not available with shields in this width.

FLANGED O.D.

Part No.	A Bore	B O.D.	C Outer Race Width	c Inner Race Width	FLANGE O.D.	FLANGE Width	BALLS No.	BALLS Dia.
A8-0684**	.312	.688	.226	.250	.750	.042	8	3/32"

To specify open or shielded configuration, add proper suffix:
A8-1124-00 = open bearing A8-1124-70 = single shield A8-1124-77 = double shield

**Other flanged outer ring sizes available on special order.

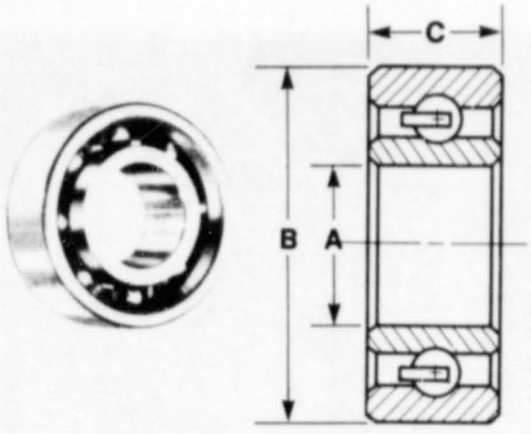
Metric Series
Unground and Ground O.D.

RADIAL
—
UNGROUND
—
SEPARATOR TYPE

Hartford Bearing Company
A Division of Virginia Industries
951 West St., Rocky Hill, Connecticut 06067 • (203) 529-7441

Metric dimension bearings are used in the vast majority of all bearing applications. Now Hartford offers a cost-reducing alternative in all moderate speed and load applications.

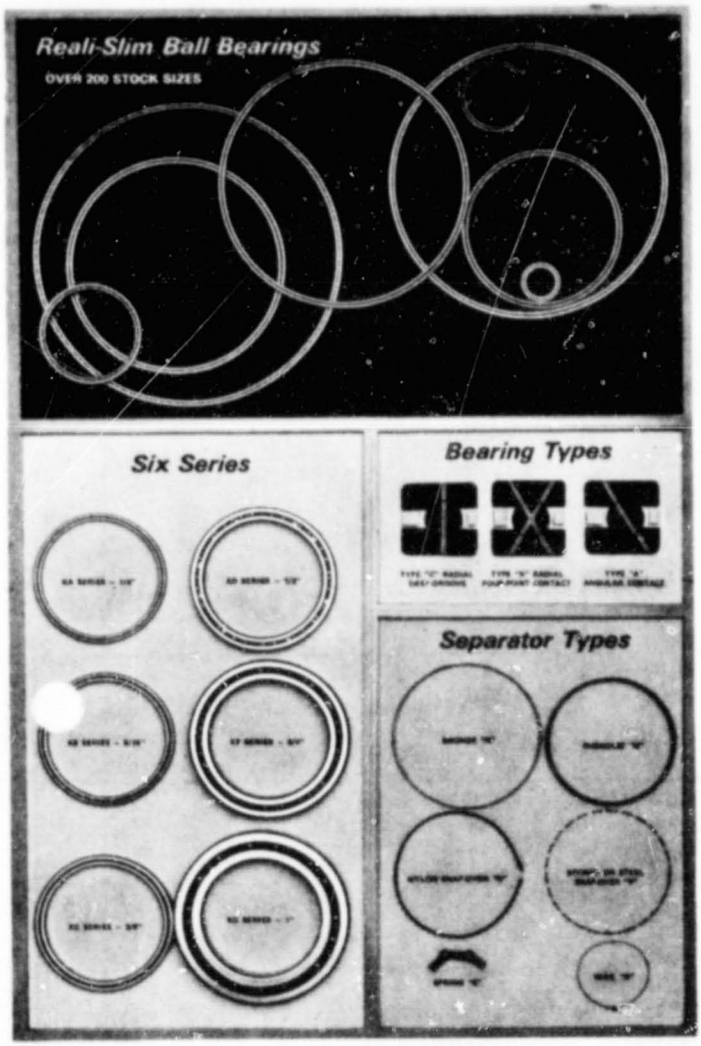
Case hardened, bearing quality steel in close machined tolerances. Deep groove, separator type construction. Available open; single shield; or double shield, greased for life. Precision bore tolerances available special order.



PART NO.		A	B	C	BALLS	
Unground O.D.	Ground O.D.	Bore ±.0015	O.D. *Tolerance	Width ±.0025	No.	Dia.
A8-8035	J8-8035	5 mm	19 mm	6 mm	8	3/32"
A8-8036	J8-8036	6 mm	19 mm	6 mm	8	3/32"
A8-8037	J8-8037	7 mm	22 mm	7 mm	7	5/32"
A8-8038	J8-8038	8 mm	22 mm	7 mm	7	5/32"
A8-8039	J8-8039	9 mm	26 mm	8 mm	7	5/32"
A8-8100	J8-8100	10 mm	26 mm	8 mm	7	3/16"
A8-8101	J8-8101	12 mm	28 mm	8 mm	7	3/16"
A8-8102	J8-8102	15 mm	32 mm	9 mm	7	3/16"
A8-8103	J8-8103	17 mm	35 mm	10 mm	8	7/32"
A8-8104	J8-8104	20 mm	42 mm	12 mm	8	1/4"
A8-8105	J8-8105	25 mm	47 mm	12 mm	8	5/16"
A8-8200	J8-8200	10 mm	30 mm	9 mm	7	3/16"
A8-8201	J8-8201	12 mm	32 mm	10 mm	7	3/16"
A8-8202	J8-8202	15 mm	35 mm	11 mm	8	7/32"
A8-8203	J8-8203	17 mm	40 mm	12 mm	8	1/4"
A8-8204	J8-8204	20 mm	47 mm	14 mm	8	5/16"
A8-8205	J8-8205	25 mm	52 mm	15 mm	8	5/16"

*O.D. tolerance for A8 series is ±.001
O.D. tolerance for J8 series is +.0000, −.0005
To specify open or shielded, add suffix to part number:
A8-8100-00 = open bearing A8-8100-70 = single shield A8-8100-77 = double shield

Kaydon REALI-SLIM® Bearings



KEENE
CORPORATION

KAYDON BEARING DIVISION

MUSKEGON, MICHIGAN 49443

PH. (616) 755-3741

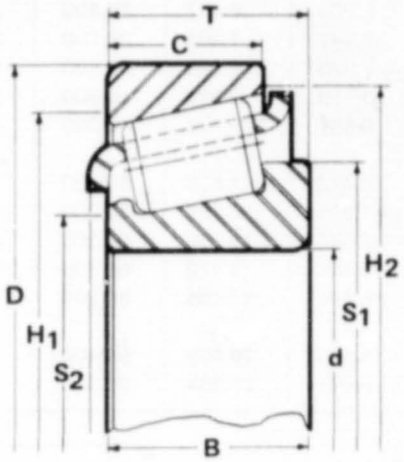
- **LARGE DIAMETERS – UP TO 40"**
- **AVAILABLE FROM STOCK**
- **COMPACT SEALED MODELS**

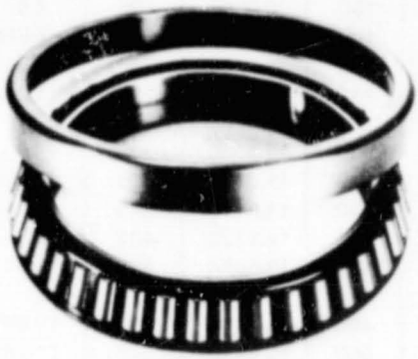
Kaydon Reali-Slim Bearings are the industry standard in narrow section ball bearings, available from stock in 1" to 40" bores and 3/16" to 1" cross section, with and without seals. The compact design permits broad application benefits. Volume production of these standard bearings means surprisingly low first cost. Quality manufacturing and superior heat treating provide exceptional load capacity. The Kaydon Reali-Slim Bearings, in addition to the basic type "C" radial bearing and type "A" angular contact bearing configurations, are also available in Kaydon's unique type "X", 4 point design. This design permits a substantial combination of simultaneous radial, thrust and moment loading. Modifications to standard bearings, as well as special bearings, are available at additional cost. Please contact your local Bearing Distributor or Kaydon Sales Engineer in your area.

Large Bore KT Tapered Roller Bearings

KT tapered roller bearings are fully hardened, lightweight, thin section bearings with added capacity and stiffness for today's modern design concepts of simplicity and compactness. They are ideally suited because of their large bore sizes (7" - 20") for "hollow shaft" applications where hydraulic lines, wiring, etc. are accommodated within the shaft resulting in a neater, more efficient design.

The bearings listed are typical sizes carried in stock, however, are in no way inclusive of our tapered roller bearings program. As a manufacturer of tapered roller bearings, we are the alternative choice for many applications, especially above 7" bore sizes offering quicker delivery and in many cases, more competitive pricing.





KT SERIES

BEARING NO.	BORE d (IN)	Outside Diam. D (IN)	Assem. Width T (IN)	Factor K (IN)	Rating at 500 RPM for 3000 Hrs. L-10		Cone Width B (IN)	Cup Width C (IN)	SHOULDER DIAMETERS				Bearing Wt. (LB)
									SHAFT		HOUSING		
					Radial (LB)	Thrust (LB)			S1 (IN)	S2 (IN)	H1 (IN)	H2 (IN)	
KT-070	7.000	8.500	.812	1.74	4970	2860	.812	.625	7.375	7.300	8.125	8.250	3.11
KT-091	9.125	10.250	.718	1.79	4920	2750	.722	.597	9.625	9.312	9.850	10.050	2.88
KT-098	9.875	11.500	1.062	1.85	9260	5000	1.062	.875	10.375	10.225	11.063	11.250	6.05
KT-100	10.000	11.125	.625	1.79	4020	2250	.625	.500	10.500	10.300	10.750	10.900	2.88
KT-110	11.000	12.500	.875	1.86	7620	4100	.875	.688	11.438	11.250	12.000	12.250	5.06
KT-112	11.250	12.750	.812	1.86	7150	3860	.812	.625	11.688	11.500	12.313	12.500	4.72
KT-118	11.875	13.562	.937	1.76	7250	4120	.812	1.125	12.438	12.210	13.000	13.320	6.63
KT-130	13.000	14.562	.843	1.44	5580	3880	.843	.594	13.438	13.320	14.125	14.300	5.20
KT-132	13.250	15.000	.937	1.69	6160	3650	.937	.750	13.875	13.625	14.375	14.500	6.79
KT-151	15.125	17.375	1.125	1.72	11760	6840	1.125	.812	15.750	15.625	16.750	16.875	13.57
KT-165	16.500	18.750	.875	1.78	8220	4620	.882	.812	17.250	17.000	18.125	18.500	11.14
KT-180	18.000	19.625	.812	1.69	7400	4330	.812	.687	18.438	18.375	19.188	19.300	8.19
KT-200	20.000	21.750	.812	1.80	4000	2220	.812	.687	20.625	20.375	21.125	21.250	9.78

Tolerances are:

BORE (d): +.001" -.000" up to KT-110; +.002" -.000" for KT-110 to KT-200.
OUTSIDE DIAMETER (D): Same as for bore.
WIDTH (T): ± .010" up to KT-112; ±.015" for KT-112 to KT-200.

CUP RADIAL RUNOUT .0015" TOTAL INDICATOR READING
CONE RADIAL RUNOUT .0020" TOTAL INDICATOR READING

KEENE
CORPORATION

KAYDON BEARING DIVISION

2660 McCRACKEN, MUSKEGON, MICHIGAN 49443 • TELEPHONE (616) 755-3741

Large Bore KR Cylindrical Roller Bearings

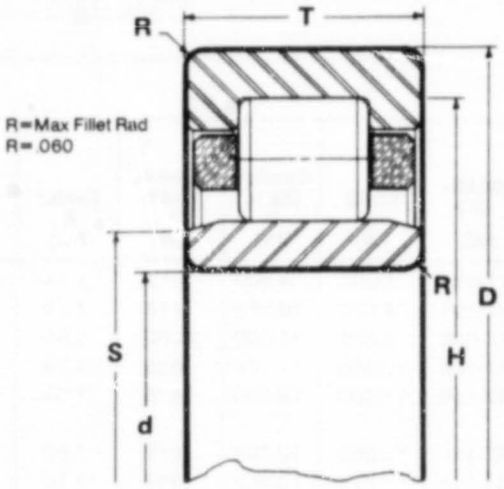
KR Cylindrical Roller Bearings offer the same basic design advantages of compactness and higher capacity from thin section bearings as the KT Line, however, they are designed for pure radial load.

KR SERIES

KAYDON Bearing Number	Bore d		Outside Diameter D		Width T		Shoulder Diameter		Load Capacity* Static	Load Capacity* Dynamic	Bearing Weight
							S	H	C_o	C	
	mm	in	mm	in	mm	in	in	in	lb	lb	lb
KR50	130	5.1181	175	6.8898	24	.9449	5.354	6.417	27,300	22,400	3.00
KR60	150	5.9055	195	7.6772	24	.9449	6.142	7.205	29,700	23,200	3.25
KR70	180	7.0866	225	8.8583	24	.9449	7.323	8.386	36,500	26,000	3.75
KR80	200	7.6740	250	9.8425	24	.9449	8.110	9.370	40,600	27,700	4.25
KR90	240	9.4488	285	11.2205	24	.9449	9.685	10.748	48,000	30,000	4.75
KR100	260	10.2362	305	12.0079	24	.9449	10.472	11.535	50,400	30,500	5.75
KR110	280	11.0236	325	12.7953	24	.9449	11.260	12.323	55,000	32,000	6.25
KR120	300	11.8110	345	13.5827	24	.9449	12.047	13.110	59,500	33,500	6.75
KR140	360	14.1732	405	15.9449	24	.9449	14.409	15.472	68,700	35,700	7.75
KR165	420	16.5354	465	18.3071	24	.9449	16.772	17.835	80,200	38,600	9.75
KR180	460	18.1102	505	19.8819	24	.9449	18.346	19.409	89,400	41,200	11.00
KR200	500	19.6850	545	21.4567	24	.9449	19.921	20.984	96,300	42,800	12.25

*Basic Dynamic Capacity C per AFBMA Standard 11, Based on 1.0 million revolutions L-10 life.





ROLLER THRUST BEARINGS:

We produce roller thrust bearings from the standard bore sizes through 130 inches for applications where rigidity and smooth rotation is necessary under a larger vertical load.

RADIAL ROLLER BEARINGS:

For the more demanding application where added capacity is required, we manufacture radial roller bearings from 4 inches through 130 inches.

BI-ANGULAR ROLLER BEARINGS

Bi-angulars have the capability to withstand radial, thrust and over turning moment loads, either separately or in combination. They are available in sizes through 130 inches. Ask for Bulletin 303.

KEENE
CORPORATION

KAYDON BEARING DIVISION

2860 McCRACKEN, MUSKEGON, MICHIGAN 49443 • TELEPHONE (616) 755-3741

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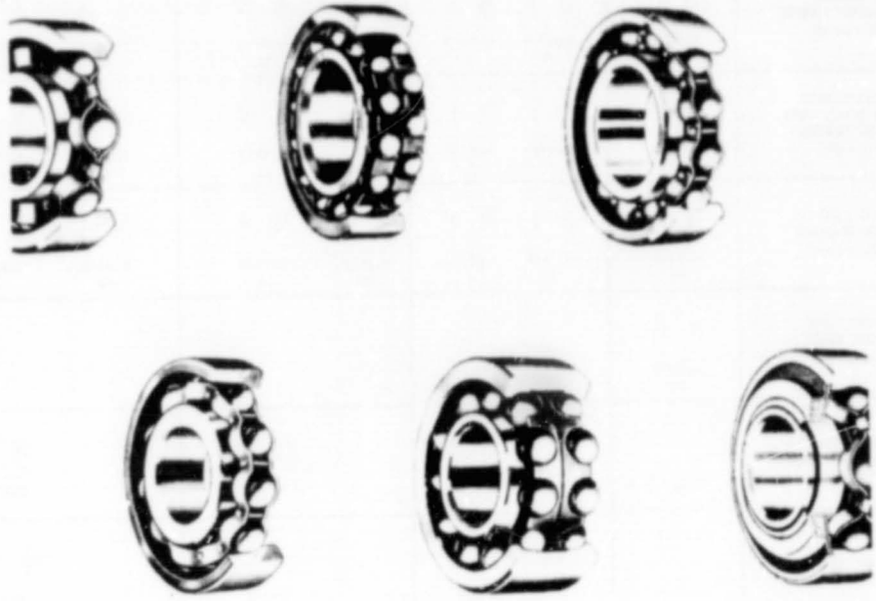
Tel. 914-452-6000



Schatz Federal Bearings Co. Inc., a supplier of ball bearings to every major manufacturing industry, is prepared to satisfy every original equipment and replacement bearing need. The competent engineering, research and manufacturing facilities, which have enabled the company to become one of America's largest ball bearing producers, is your assurance of consistent, trouble-free anti-friction performance in every Federal bearing.

The information and engineering data in this catalog have been carefully assembled for quick and easy reference. To the best of our knowledge and belief such information is accurate and correct. However, we cannot guarantee absolute accuracy or freedom from error.

how to use this catalog

These Dimensional Tables have been designed to allow easy selection of ball bearings according to type and size and to assist in the identification of ball bearings for which a replacement is required.

When using this catalog please note that bearing dimensions include three specifications and where possible both metric and inch measurements are shown. The three specifications are bore, outside diameter, and overall width. Variances in inner and outer widths have also been listed.

When selecting a bearing, first consult the selector guide index and determine the type of ball bearing needed, by name and sectional drawing. Then merely consult the proper page and determine the correct size by use of the three dimensions listed.

FEDERAL BALL BEARINGS

TYPES AND SERIES	DOUBLE SHIELD	SINGLE SEAL	DOUBLE SEAL	SHIELD AND SEAL	SNAP RING GROOVE AND SHIELD
METRIC SINGLE ROW RADIAL NON FILLING SLOT 30 SERIES (Formerly 9400) Extra Small	SUFFIX FF	SUFFIX R; SUFFIX L	SUFFIX RR; SUFFIX LL	SUFFIX FR; SUFFIX FL	
METRIC SINGLE ROW RADIAL NON FILLING SLOT 1900 SERIES Extremely Light 9100 SERIES Extra Light	SUFFIX FF	SUFFIX R; SUFFIX L	SUFFIX RR; SUFFIX LL	SUFFIX FR; SUFFIX FL	SUFFIX GF
METRIC SINGLE ROW RADIAL NON FILLING SLOT 1200 Light 1300 Medium 1400 Heavy	SUFFIX FF	SUFFIX R; SUFFIX L	SUFFIX RR; SUFFIX LL	SUFFIX FR; SUFFIX FL	SUFFIX GF
METRIC SINGLE ROW RADIAL FILLING SLOT 1200M Light 1300M Medium 1400M Heavy	SUFFIX FF				SUFFIX GF
FELT SEAL SINGLE ROW RADIAL NON FILLING SLOT 7000X5 SERIES FS8000 SERIES FS87000 SERIES FS88000 SERIES		7000X5 FS8000	FS88000	FS87000	
LABYRINTH FELT SEAL SINGLE ROW RADIAL NON FILLING SLOT 8000 SERIES 8000F SERIES 88000 SERIES		8000	88000	8000F	
INCH SINGLE ROW RADIAL NON FILLING SLOT R SERIES Small (Formerly S-R) XLS Extra Light LS SERIES Light MS SERIES Medium	SUFFIX FF	SUFFIX R; SUFFIX L	SUFFIX RR; SUFFIX LL	SUFFIX FR; SUFFIX FL	
METRIC SINGLE ROW ANGULAR CONTACT 7200 Light 7300 Medium 7400 Heavy					
DOUBLE ROW ANGULAR CONTACT INWARDLY CONVERGING CONTACT LINES 5200 Light 5300 Medium	FS55500 FS55600				FS5500G FS5600G
DOUBLE ROW ANGULAR CONTACT OUTWARDLY CONVERGING CONTACT LINES A5200 Light A5300 Medium	FSA55500 FSA55600				FSA5500G FSA5600G

1300 MWI Medium (Ext. Inner Ring)

1200XY SERIES SINGLE ROW RADIAL — 1500XY SERIES DOUBLE ROW INTERNAL SELF ALIGNING

Both have tapered bores and adapter sleeves

FRONT WHEEL — REAR WHEEL — CLUTCH RELEASE

METRIC DOUBLE ROW INTERNAL SELF ALIGNING — 13.300 Extra Small; 1200SA Light; 1300SA Medium

METRIC MAGNETO TYPE SEPARABLE ANGULAR CONTACT — FB SERIES

DOUBLE ROW INTERNAL SELF ALIGNING WITH EXT. INNER RING AND SET SCREWS — 1-71200 SERIES

SINGLE ROW RADIAL EXTENDED INNER RING WITH LOCKING COLLAR — SOC SERIES

WIDE SINGLE ROW RADIAL NON FILLING SLOT — W1200KK Light; W1300KK Medium

METRIC SINGLE ROW EXTERNAL SELF ALIGNING — 200S SERIES

PUMP AND FAN — PF SERIES

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1200XY, 1500XY



1200 XY



1500 XY

single and double row radial, with tapered bore and adapter sleeve

The Federal 1200XY series is a standard type single row radial ball bearing with a tapered bore, while the 1500XY series is a standard type double row internal self-aligning ball bearing also with a tapered bore. Both series are supplied with split tapered sleeves and locknuts for mounting on shoulderless shafts.

The standard locknut draws the tapered sleeve into the bearing, thereby reducing its bore until the unit is tight on the shaft. The locknut is fixed in its tightened position by a standard lockwasher.

Federal adapter type bearings are suitable for line shaft hangers, pillow blocks, and assemblies where shoulderless shafts are required. Load capacities are the same as for corresponding standard type bearings. For heavier duty service, maximum type bearings with tapered bores and adapters can be supplied, as well as medium 1300XY and 1600XY series.

Race rings and balls are made from vacuum degassed SAE 52100 steel. The cages are made from low carbon strip steel. Consult the Federal Sales Department for availability, dimensions and load ratings.

FB SERIES



single row, separable (magneto type) bearings

The Federal FB magneto series is a separable type ball bearing. The outer ring is easily removable which allows for a maximum number of balls and facilitates assembly in many applications. The outer ring can be mounted in a housing and the inner ring ball and cage assembly can be mounted on a shaft prior to assembling the unit using these bearings. This feature not only provides assembly advantages, but also makes it easier to disassemble the units for inspection and cleaning, if necessary.

Race rings and balls are made from the recently developed, higher quality, vacuum degassed SAE 52100 steel which assures longer bearing life, while the cages are made of brass. The unusual design of the cages helps retain the bearing lubricant in the contact area between the balls and races. Consult the Federal Sales Department for availability, dimensions, and load ratings.

SOC SERIES



single row radial bearings with extended inner ring and separate locking collar

Federal SOC series ball bearings are designed to facilitate mounting on shoulderless shafts.

The inner ring is extended on one side and has an unhardened steel collar mounted on it. Two set screws in the collar engage the shaft through holes drilled 90° apart in the inner ring extension. This method secures the bearing to the shaft without distorting the inner ring, a feature not found in other type set screw bearings. Bores fit standard inch dimensioned shafts, whereas the outside diameters are metric.

The SOC series are basically light series single shielded bearings and have the same load ratings as the corresponding size 1200 series. A heavier series, designated as SOC-H, can also be supplied. These are basically 1300F series bearings with extended inner rings and separate locking collars. These bearings have the same load ratings as the corresponding size 1300 series bearings.

Race rings and balls are made from the recently developed, higher quality, vacuum degassed SAE 52100 steel which assures longer bearing life. The cages are made from low carbon steel. Consult the Federal Sales Department for availability, dimensions, and load ratings.

FEDERAL BALL BEARINGS

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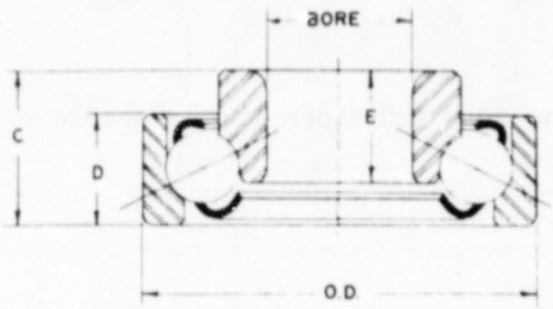

BOUNDARY DIMENSIONS

BORE inches	DIAMETER inches	WIDTH overall C	WIDTH outer D	WIDTH inner E	BEARING NUMBERS
0.7503	2.0800	0.708	0.608	0.595	F 001
1.1904	2.9630	1.145	0.770	0.870	F 002
0.8440	2.2500	0.790	0.690	0.659	F 025
1.4065	3.1496	1.226	0.851	0.917	F 026
1.2504	2.5640	0.759	0.563	0.750	F 040
0.7503	1.9395	0.650	0.500	0.595	F 041
0.9062	2.2500	0.790	0.690	0.659	F 045
1.5000	3.1496	1.226	0.851	0.917	F 046
0.9065	2.2503	0.790	0.480	0.590	F 047
1.5000	3.1496	0.900	0.650	0.700	F 048
1.2815	2.9630	1.145	0.770	0.870	F 052
1.3750	2.8125	1.062	0.625	0.850	F 060
1.3750	2.9630	1.140	0.770	0.870	F 062
0.8440	2.2500	0.790	0.690	0.590	F 065
1.3750	2.9630	0.758	0.566	0.645	F 066
0.7503	2.0800	0.708	0.470	0.470	F 067
1.2504	2.6500	0.800	0.515	0.700	F 070
1.3750	2.9630	0.770	0.770	0.695	F 072
0.8440	2.2503	0.790	0.480	0.590	F 073


type 1 type 2 type 3 type 4 type 5


type 6 type 7 type 8 type 9 type 10

BOUNDARY DIMENSIONS

BORE	O.D.	OUTER WIDTH	INNER WIDTH	TYPE	BEARING NUMBERS
1.1811	2.4409	.7874	.7874	1	RW206A
1.1811	2.4409	.6299	.9449	2	RW206JJ
1.1811	2.6772	.8268	.9449	2	RW2065A
1.3386	2.6772	.8268	.9449	2	RW2065JJ
1.3780	2.8346	.8449	.8449	1	RW207HH
1.2500	2.5625	.6693	.7282	4	RW506A
1.3780	2.8346	.8858	.9250	8	RW507
1.3780	2.8346	.8858	.9250	6	RW507A
1.3780	2.8900	.7000	.7400	3	RW507B
1.3780	2.7470	.6600	.7000	3	RW507C
1.4375	2.8906	.7000	.7400	3	RW507D
1.3780	2.7470	.660	.983	2	RW507E
1.4320	2.8755	.700	.930	2	RW507F
1.5312	3.1496	.8268	.9850	7	RW508
1.5312	3.0625	.7350	.7750	3	RW508A
1.6250	3.2677	1.0136	1.0236	6	RW509
1.6250	3.2677	1.0136	1.0236	4	RW509FJ
1.6250	3.2677	1.0136	1.0625	8	RW509FR
1.6250	3.2677	1.0136	1.0236	3	RW509JJ
1.3780	3.0000	.9050	.9050	5	RW607
1.3780	3.0000	1.0000	1.0320	8	RW707
1.3780	3.0000	1.0000	1.0320	9	RW707A
1.3780	3.0000	1.0000	1.0320	10	RW707B
1.3780	2.8346	.6693	.9843	2	FS88107
1.5312	3.1496	.8268	1.0830	2	FS88128
1.5312	3.2520	.849	1.025	2	FS88131

front wheel bearings
single row, angular contact ball bearings

Federal front wheel ball bearings are not only suitable for use in the front wheels of automotive vehicles but are also widely used in many other applications. Federal front wheel bearings are separable angular contact bearings which are capable of supporting thrust loads in one direction in addition to radial loads and are intended for applications where both radial and thrust loads exist. When mounted in pairs with endwise adjustment to maintain the angle of contact, these bearings will accommodate a pure radial load or a combination radial and thrust load with thrust in either direction. Means for endwise adjustment must be provided and care should be exercised in making the adjustment since excessive looseness or tightness is undesirable.

Race rings and balls are made from vacuum degassed SAE 52100 steel which assures longer bearing life.

rear wheel bearings
single row, radial ball bearings

Federal rear wheel ball bearings are prelubricated single row radial bearings which are specially designed to support the loads encountered in automotive rear wheel applications. A rugged seal designed to protect against dirt and other adverse conditions is permanently assembled into the bearings on both sides, providing a maintenance free, integral unit. Various designs and seals are shown below. Their ability to support heavy thrust loads in addition to radial loads, makes them ideally suited for this and non-automotive applications where similar conditions exist. In automotive rear axle usage, the bearing is mounted on the shaft with a heavy interference fit. In addition, a supplemental heavy section ring is press fitted against the bearing thereby providing axial retention and affords a stronger unit assembly than other methods of retention requiring the use of threads or snap ring grooves. Race rings and balls are made from vacuum degassed SAE 52100 steel; cages are made from low carbon steel.

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MRC BEARINGS

MRC BALL AND ROLLER BEARINGS

are used in a widely diversified selection of mechanized products – general industrial and machine tools, automotive, aerospace, marine, agricultural and off-the-road equipment. Supplied to most of the country's leading industries, they range from miniature bearing sizes for guidance systems to extra large bearings in massive machine tools.

This Bearing Selection Guide provides a concise view of the extensive MRC bearing line and furnishes brief descriptive data and dimensions for standard MRC bearings. The five basic ball bearing types plus roller bearings are charted to show relative radial and thrust capacities, bearing series and range of bore sizes.

Bearing life and load ratings must be considered in the final selection of a bearing for any application. This Guide provides only basic data for initial bearing selection of type and size. TRW Bearings Division maintains a Product Engineering Department to assist customers in selecting the final size and type of bearing for specific applications.

STANDARD MATERIALS, INSPECTION, TOLERANCE GRADES

The standard material used in MRC race rings and balls is a vacuum-processed high chromium steel identified as SAE 52100 or AISI E-52100. Nitrile rubber having a useful temperature range of –70°F. to +225°F. is the material in MRC bearing seals. Ball cages are pressed from low carbon steel of 1010 analysis but many Type S, M, and 5000 Series Bearings are now supplied with nylon molded cages.

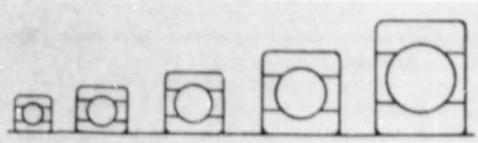
During the process of manufacture, component parts of MRC Bearings receive rigid examination and multiple inspections. Finished bearings are given an additional series of inspections. Immediately prior to packaging, bearings are thoroughly cleaned by special processes and a special protective coating compound applied.

MRC Bearings listed in this Guide are available in ABEC-1 tolerance grade. Where requirements justify, closer tolerances are available. MRC Super-Precision Ball Bearings, described on page 6, are produced with ABEC-5, ABEC-7 or ABEC-9 tolerances.

BEARING SELECTION

The five basic types of ball bearings produced by TRW Bearings Division – Type S, M, R, Double-Row and Angular-Contact – are charted at the right. Angular-Contact bearings are divided into the 7000, 7000-P and 9000 Series due to the difference between the 7000 and 7000-P contact angles and the inner ring design of the 9000 Series. Cylindrical roller bearings are included in the chart as they have the same external dimensions as corresponding sizes of MRC ball bearings but offer much heavier radial load capacity.

The cross-section of each bearing type shows bearing construction and contact angles, the angle at which the ball contacts the inner and outer ring ball grooves. The vertical bar graphs indicate the relative radial load-carrying capacities and the horizontal bars show the relative thrust-carrying capacities of the bearing type in both directions. Thus the basic Type S bars in color beside the black bars of the other bearing types provide a basis for visual comparison of the relative capacities for each type.



1900 Series | 100-K Series | 200 Series | 300 Series | 400 Series

Dimensional columns on page 5 are headed with "Series" titles and bearing types as shown below.

1900 Series – Extremely Light
100-K Series – Extra Light
200 Series – Light
300 Series – Medium
400 Series – Heavy

All MRC bearing types are made in "Series" ranging from "Extremely Light" (1900 Series) to "Heavy" (400 Series) as shown in the scaled drawings above. The bore remains the same while the outside diameter, width and ball size become progressively larger in each series. This makes it possible to select the appropriate bearing for a given shaft size to meet dimensional or load-carrying requirements.

In the gray column on page 3, MRC bearing series and range of bore sizes are listed. On page 4, MRC bearing numbers can be determined for each bore size and on page 5, millimeter dimensions are provided for reference.

SPECIAL PURPOSE BEARINGS

The wide range of MRC Special Purpose Bearing types and sizes simplify the task of selecting the proper bearing for specific applications. Special types include Airframe types for aircraft controls . . . Cartridge types with grease reservoir . . . Industrial Truck and Agricultural Implement types. These and others are described on pages 6-7.

TYPE S CONRAD



TYPE M MAXIMUM-CAPACITY



TYPE R RADIAL



DOUBLE-ROW 5000 SERIES



ANGULAR-CONTACT 7000 SERIES

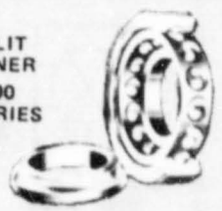


SINGLE-ROW



DUPLEX PAIR

SPLIT INNER 9000 SERIES



CYLINDRICAL ROLLER BEARINGS



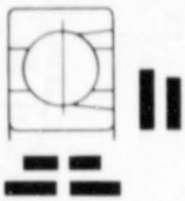
BEARING SERIES AND BORE SIZE



Type S – Single-Row Deep Groove Conrad Bearings. Ordinarily supplied with loose internal clearance. Other degrees of internal clearance may be necessary for special conditions.

Load Capability – Has equal load-carrying capacities in either direction. Recommended for moderately heavy radial loads, thrust loads in either direction, or combination loads.

R-2	thru	R-24	1/8" thru 1-1/2"
FB	(Instrument)		3/16" thru 5/16"
34	thru	39	4 thru 9mm
1900-S	thru	1940-S	10 thru 200mm
100-KS	thru	136-KS	10 thru 180mm
200-S	thru	224-S	10 thru 120mm
300-S	thru	322-S	10 thru 110mm
403-S	thru	422-S	17 thru 110mm



Type M – Single-Row, Maximum-Capacity Filling Notch Bearings. Ordinarily supplied with standard internal clearance. Other degrees of internal clearance may be necessary for special conditions.

Load Capability – Can carry heavier radial loads than Type S and heavier combined radial and thrust loads. Recommended for majority of heavily loaded bearing positions – heavy industrial machinery, farm equipment, tractors and trucks.

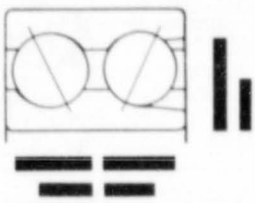
202-M	thru	226-M	15 thru 130mm
303-M	thru	322-M	17 thru 110mm
403-M	thru	420-M	17 thru 100mm



Type R – Single-Row, Maximum-Capacity Counterbored Outer Bearings. Supplied with loose internal clearance for normal applications. Other degrees of internal clearance may be necessary for special conditions.

Load Capability – Higher radial load-carrying capacity than Type S, heavy thrust load in one direction only, or combined loads where radial load predominates and thrust is always against heavy shoulder of outer ring.

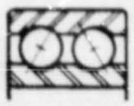
1900-R	thru	1940-R	10 thru 200mm
100-KR	thru	164-KR	10 thru 320mm
200-R	thru	264-R	10 thru 320mm
301-R	thru	356-R	12 thru 280mm
403-R	thru	422-R	17 thru 110mm



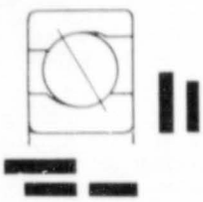
Double-Row – Angular-Contact, Maximum-Capacity 5000 Series Bearings. Filling notches on each side for inserting full quota of balls. Supplied with standard clearance but tighter or looser internal clearance can be supplied to suit special service conditions.

Load Capability – Will support very heavy radial loads and equal heavy thrust loads in either direction, or heavy combined radial and thrust loads.

5200(K)	thru	5222	10 thru 110mm
5300	thru	5322	10 thru 110mm
5403	thru	5419	17 thru 95mm



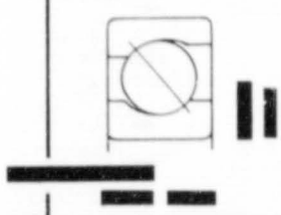
Sizes 5200-5208, 5300-5305 furnished in conrad type with "inverted" contact angle. (with suffix SB)



7000 Series – Angular-Contact Bearings. Counterbored outer ring, non-separable type with initial contact angle of 30°. Two-piece steel cage for normal use or one-piece non-metallic or solid bronze cage for high speed, high operating temperature or severe vibration applications.

Load Capability – Very high thrust load in one direction, combined radial and thrust load where thrust load predominates.

7100-KR	thru	7164-KR	10 thru 320mm
7202	thru	7264	15 thru 320mm
7302	thru	7356	15 thru 280mm
7403	thru	7422	17 thru 110mm



7000-P – Angular-Contact Bearings, Heavy Duty Type. Similar in design to 7000 Series Bearings but 40° contact angle. Ball complement and race groove depth designed for increased thrust capacity.

Load Capability – Capacity is 1.18 to 1.40 times that of 7000 Series, varies with individual sizes. Restricted to primarily **thrust** loads. Should not be used for radial loads only or combined radial and thrust loads where radial load is predominant.

7200-P	thru	7264-P	10 thru 320mm
7300-P	thru	7356-P	10 thru 280mm
7416-P	thru	7422-P	80 thru 110mm

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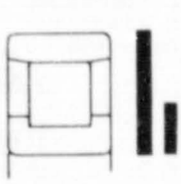
9000 Series – Angular-Contact, Split Inner Ring. Designed with solid one-piece outer ring and two-piece inner ring, maximum ball complement and one-piece machined cage.

Load Capability – Construction allows bearing to carry greater thrust in either direction than Type S. May be used where there is substantial radial load providing there is always sufficient thrust load present.

9100-UK	thru	9122-UK	10 thru 110mm
9202-U	thru	9222-U	15 thru 110mm
9302-U	thru	9322-U	15 thru 110mm



Cylindrical Roller Bearings. Internal flanges on both sides of one ring, either inner or outer, for accurate roll guiding. External dimensions same as corresponding sizes of MRC Ball Bearings. Rolling elements are cylindrical and crowned to increase load-carrying capacity by eliminating edge loading. For heavy radial loads and high speeds, can support light or locating thrust load. Produced only in RBEC-5 grade.

MR-1900	thru	MR-1950	10 thru 250mm
MR-100-K	thru	MR-150-K	10 thru 250mm
MR-200	thru	MR-240	10 thru 200mm
MR-300	thru	MR-340	10 thru 200mm
MR-406	thru	MR-430	30 thru 150mm

MRC BEARING NUMBER

When the bearing type has been selected (pages 2-3), establish the MRC bearing number in the table below as follows:

1. Find Bore Size in millimeters required to fit on shaft in application. Example: shaft size – 25mm bore size.
2. Basic Bearing Size shows the last two digits to be inserted in the MRC bearing number. Example: 25mm bore = 05 Basic Bearing Size.
3. MRC Bearing Series column – use the two-digit number Basic Bearing Size as the last two digits in the MRC Bearing Series number. Example: 25mm bore = 05 Basic Bearing Size = 1905-S, 105-KS, 7205 etc.
4. Some 5200 and 5300 Series bearings include a suffix, SB or K, and are listed in the table. These must be shown when specifying the complete MRC bearing number. Use the suffix letters in the bearing number when shown in place of "X" in the table.
5. Most MRC Bearings with "X" in the table are available but those with a colored background must be checked for availability before specifying for applications.

MRC BEARING DIMENSIONS

Dimensional data is provided for all standard MRC bearings on page 5. Millimeters are used except for the 5000 Series where width is shown in inches. To determine dimensions, use the Basic Bearing Size and Bore Size determined for the application. On the same line, find the Outside Diameter (OD) and Width (W) for the MRC Bearing Series selected. OD and W will be the

BORE SIZE MM	BASIC BRG. SIZE	100-KS	100-KR	200-S	200-M	200-R	300-S	300-M	300-R	400-S	400-M	400-R	1900-S	1900-R	5200	5300	5400	7100-KR	7200	7200-P	7300	7300-P	7400	7400-P	9100-UK	9200-U	9300-U
10	00	X	X	X		X	X						X	X	SB	SB		X		X		X			X		
12	01	X	X	X		X	X		X				X	X	SB	SB		X		X		X			X		
15	02	X	X	X	X	X	X		X				X	X	SB	SB		X	X	X	X	X			X	X	X
17	03	X	X	X	X	X	X	X	X	X	X	X	X	X	SB	SB		X	X	X	X	X	X		X	X	X
20	04	X	X	X	X	X	X	X	X	X	X	X	X	X	SBK	SB	X	X	X	X	X	X	X		X	X	X
25	05	X	X	X	X	X	X	X	X	X	X	X	X	X	SBK	SB	X	X	X	X	X	X	X		X	X	X
30	06	X	X	X	X	X	X	X	X	X	X	X	X	X	SBK	X	X	X	X	X	X	X	X		X	X	X
35	07	X	X	X	X	X	X	X	X	X	X	X	X	X	SBK	X	X	X	X	X	X	X	X		X	X	X
40	08	X	X	X	X	X	X	X	X	X	X	X	X	X	SBK	X	X	X	X	X	X	X	X		X	X	X
45	09	X	X	X	X	X	X	X	X	X	X	X	X	X	K	X	X	X	X	X	X	X	X		X	X	X
50	10	X	X	X	X	X	X	X	X	X	X	X	X	X	K	X	X	X	X	X	X	X	X		X	X	X
55	11	X	X	X	X	X	X	X	X	X	X	X	X	X	K	X	X	X	X	X	X	X	X	X	X	X	X
60	12	X	X	X	X	X	X	X	X	X	X	X	X	X	K	X	X	X	X	X	X	X	X	X	X	X	X
65	13	X	X	X	X	X	X	X	X	X	X	X	X	X	K	X	X	X	X	X	X	X	X		X	X	X
70	14	X	X	X	X	X	X	X	X	X	X	X	X	X	K	X	X	X	X	X	X	X	X		X	X	X
75	15	X	X	X	X	X	X	X	X	X	X	X	X	X	K	X	X	X	X	X	X	X	X	X	X	X	X
80	16	X	X	X	X	X	X	X	X	X	X	X	X	X	K	X	X	X	X	X		X	X	X	X	X	X
85	17	X	X	X	X	X	X	X	X	X	X	X	X	X	K	X	X	X	X	X	X	X	X	X	X	X	X
90	18	X	X	X	X	X	X	X	X	X	X	X	X	X	K	X	X	X	X	X	X	X	X		X	X	X
95	19	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
100	20	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
105	21	X	X	X	X	X	X	X	X	X		X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
110	22	X	X	X	X	X	X	X	X	X		X	X	X	X	X		X	X	X	X	X	X	X	X	X	X
120	24	X	X	X	X	X			X				X	X				X	X	X	X	X					
130	26	X	X		X	X			X				X	X				X	X	X	X	X					
140	28	X	X			X			X				X	X				X	X	X	X	X					
150	30	X	X			X			X				X	X				X	X	X	X	X					
160	32	X	X			X			X				X	X				X	X	X	X	X					
170	34	X	X			X			X				X	X				X	X	X	X	X					
180	36	X	X			X			X				X	X				X	X	X	X	X					
190	38	X	X			X			X				X	X				X	X	X	X	X					
200	40	X	X			X			X				X	X				X	X	X	X	X					
210	42					X			X										X	X	X	X					
220	44	X	X			X			X									X	X	X	X	X					
230	46					X													X	X							
240	48	X	X			X			X									X	X	X	X	X					
250	50					X													X	X							
260	52	X	X			X			X									X	X	X		X					
280	56	X	X			X			X									X	X	X		X					
300	60	X	X			X												X	X	X							
320	64	X	X			X												X	X	X							

MRC BEARINGS

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same for all series listed at the top of the column. A special table in the lower right corner shows dimensions for R-2, FB and 30 Series.

SHIELDS, SEALS, SNAP RINGS

Bearings in Type, S, M, and Double-Row 5000 Series are available in many sizes with shields (F or FF), seals (Z or ZZ), or snap rings (G) or a combination of these. Availability for specific sizes should be checked with our Marketing Department.

DUPLEX BEARINGS

Duplex Bearings are Type R and Angular-Contact single-row bearings specially ground for use in matched sets. They are usually supplied in pairs for mounting face-to-face (DF), back-to-back (DB) or tandem (DT). Same external dimensions apply as for equivalent single-row bearings except width. Duplex set width is number of bearings in the set times the width of a single-row bearing.

BEARING LIFE AND LOAD RATINGS

This Guide does not provide Bearing Life and Load Rating data, important factors in the selection of any bearing. Catalog 382 provides necessary data to calculate bearing life and load ratings.

BASIC BRG. SIZE	BORE SIZE	EXTREMELY LIGHT		EXTRA LIGHT		LIGHT			MEDIUM			HEAVY		
		1900		100-7100 9100		200-7200 9200		5200	300-7300 9300		5300	400-7400		5400
	B	OD	W	OD	W	OD	W	W	OD	W	W	OD	W	W
00	10	22	6	26	8	30	9	9/16	35	11	3/4			
01	12	24	6	28	8	32	10	5/8	37	12	3/4			
02	15	28	7	32	9	35	11	5/8	42	13	3/4			
03	17	30	7	35	10	40	12	11/16	47	14	7/8	62	17	1-3/16
04	20	37	9	42	12	47	14	13/16	52	15	7/8	72	19	1-3/8
05	25	42	9	47	12	52	15	13/16	62	17	1	80	21	1-3/8
06	30	47	9	55	13	62	16	15/16	72	19	1-3/16	90	23	1-9/16
07	35	55	10	62	14	72	17	1-1/16	80	21	1-3/8	100	25	1-3/4
08	40	62	12	68	15	80	18	1-3/16	90	23	1-7/16	110	27	1-15/16
09	45	68	12	75	16	85	19	1-3/16	100	25	1-9/16	120	29	2-1/8
10	50	72	12	80	16	90	20	1-3/16	110	27	1-3/4	130	31	2-15/16
11	55	80	13	90	18	100	21	1-5/16	120	29	1-15/16	140	33	2-1/2
12	60	85	13	95	18	110	22	1-7/16	130	31	2-1/8	150	35	2-5/8
13	65	90	13	100	18	120	23	1-1/2	140	33	2-5/8	160	37	2-13/16
14	70	100	16	110	20	125	24	1-9/16	150	35	2-1/2	180	42	3-1/8
15	75	105	16	115	20	130	25	1-5/8	160	37	2-11/16	190	45	3-1/4
16	80	110	16	125	22	140	26	1-3/4	170	39	2-11/16	200	48	3-7/16
17	85	120	18	130	22	150	28	1-15/16	180	41	2-7/8	210	52	3-5/8
18	90	125	18	140	24	160	30	2-1/16	190	43	2-7/8	225	54	3-7/8
19	95	130	18	145	24	170	32	2-3/16	200	45	3-1/8	250	55	4-3/16
20	100	140	20	150	24	180	34	2-3/8	215	47	3-1/4	265	60	
21	105	145	20	160	26	190	36	2-9/16	225	49	3-7/16	290	65	
22	110	150	20	170	28	200	38	2-3/4	240	50	3-5/8	320	70	
24	120	165	22	180	28	215	40		260	55				
26	130	180	24	200	33	230	40		280	58				
28	140	190	24	210	33	250	42		300	62				
30	150	210	28	225	35	270	45		320	65				
32	160	220	28	240	38	290	48		340	68				
34	170	230	28	260	42	310	52		360	72				
36	180	250	33	280	46	320	52		380	75				
38	190	260	33	290	46	340	55		400	78				
40	200	280	38	310	51	360	58		420	80				
42	210					380	61		440	84				
44	220			340	56	400	65		460	88				
46	230					420	68							
48	240			360	56	440	72		500	95				
50	250					460	76							
52	260			400	65	480	80		540	102				
56	280			420	65	500	80		580	108				
60	300			460	74	540	85							
64	320			480	74	580	92							

MRC BRG. NO.	B	OD	W
34	4mm	16mm	5mm
35	5mm	19mm	6mm
36	6mm	19mm	6mm
37	7mm	22mm	7mm
38	8mm	22mm	8mm
39	9mm	26mm	8mm
R2	.1250	.3750	.1562
R2A	.1250	.5000	.1719
R3	.1875	.5000	.1562
R4	.2500	.6250	.1960
R4A4	.2500	.7500	.2188
R6	.3750	.8750	.2188
R8	.5000	1.1250	.2500
R10	.6250	1.3750	.2812
R12	.7500	1.6250	.3125
R14	.8750	1.8750	.3750
R16	1.0000	2.0000	.3750
R18	1.1250	2.1250	.3750
R20	1.1250	2.2500	.3750
R24	1.5000	2.6250	.4375
FB3	.1875	*.5632	1.220
FB4	.2500	*.6257	1.252
FB5	.3125	*.6882	1.252

*Add .062 for flange
†Outer ring width: FB3 .195, FB4, FB5 .226

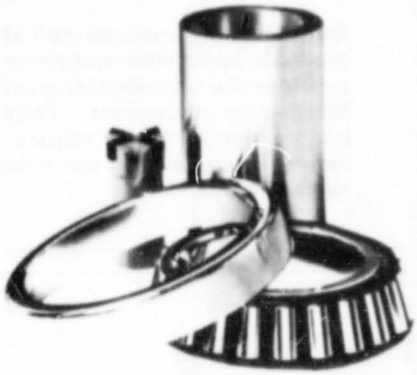
Tel. 716-661-2600

TRW INC. 402 CHANDLER STREET JAMESTOWN, NY 14701

TIMKEN®

REGISTERED TRADEMARK

TAPERED ROLLER BEARINGS



The Timken Company with its three products --- tapered roller bearings, specialty alloy steel, percussion rock bits ---- is one of the major manufacturers in the anti-friction bearing industry. With manufacturing facilities in 7 different countries, it's a multinational company specializing in tapered roller bearings since its early beginning in 1899. Serving hundreds of industries including Automotive, Construction and General Industrial, over 130 tapered roller bearing types are produced in approximately 26,000 bearing combinations. Bearing sizes range from 7.9 mm (5/16") inside diameter to 2820 mm (111") outside diameter.

As illustrated at the bottom of the page, if you have a job that calls for a bearing, The Timken Company is almost certain to make a tapered roller bearing that is just right for the job.



A world leader in the design, development, manufacture and application of tapered roller bearings and specialty alloy steel, The Timken Company has Sales Engineers and Application Engineers to help you in selecting and applying Timken bearings to your designs.



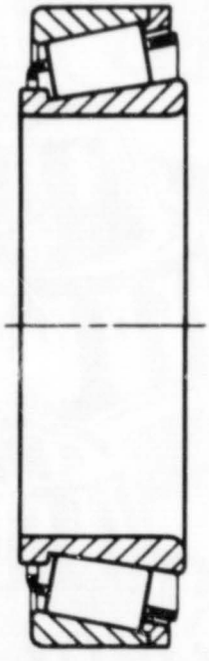
With hand-held computers, our sales engineers can analyze all the conditions that affect bearing life and select bearings to fit customer needs right in their office.



Our highly professional staff of graduate application engineers provides the ultimate technical service to customers. They handle special design requirements in support of our field sales engineers.

The following tapered roller bearing products and their applications may be of interest to your design activity.

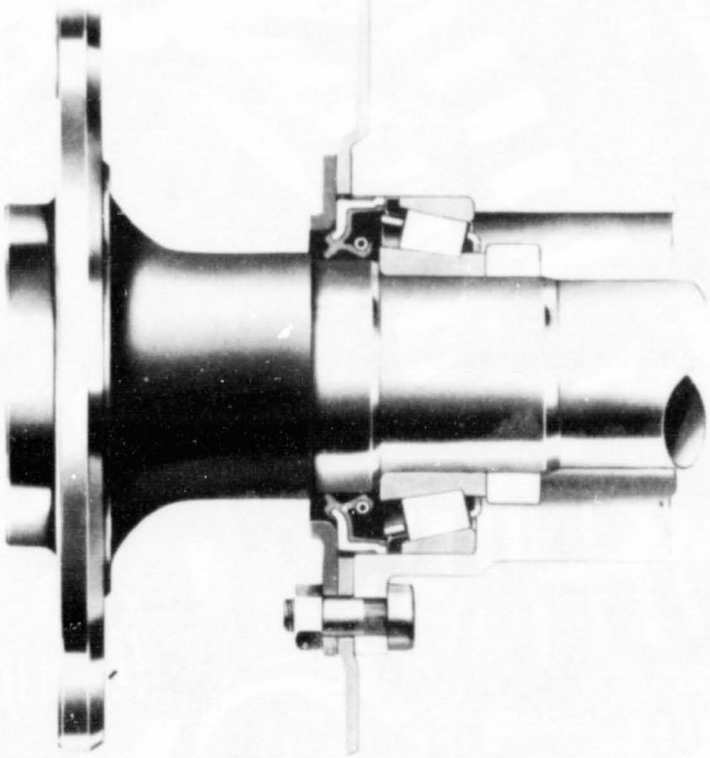
SINGLE BEARING MOUNTINGS



Timken® UNIT-BEARING

Timken UNIT-BEARING provide, in addition to high radial load carrying capacity, the ability to take thrust loads in either direction in a single bearing mounting. The bearing is preset requiring no manual adjustment.

Design them into axle stub shafts, semi-floating rear axles and other single row mountings.



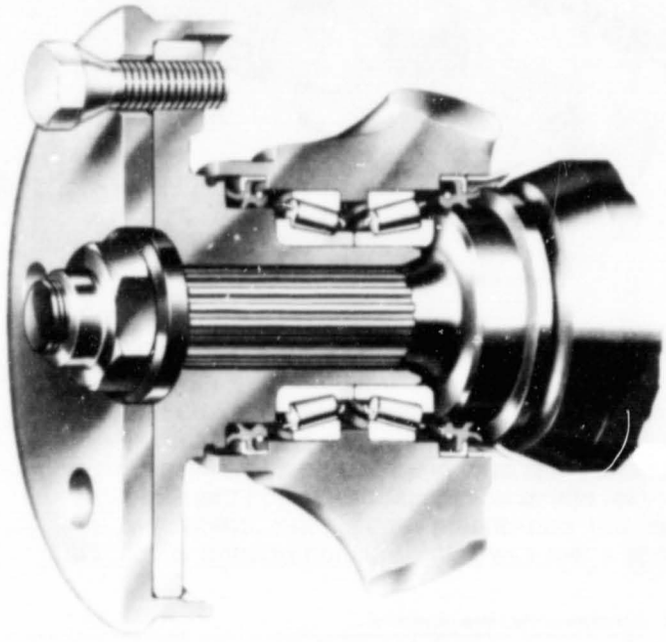
Higher Load Capacity



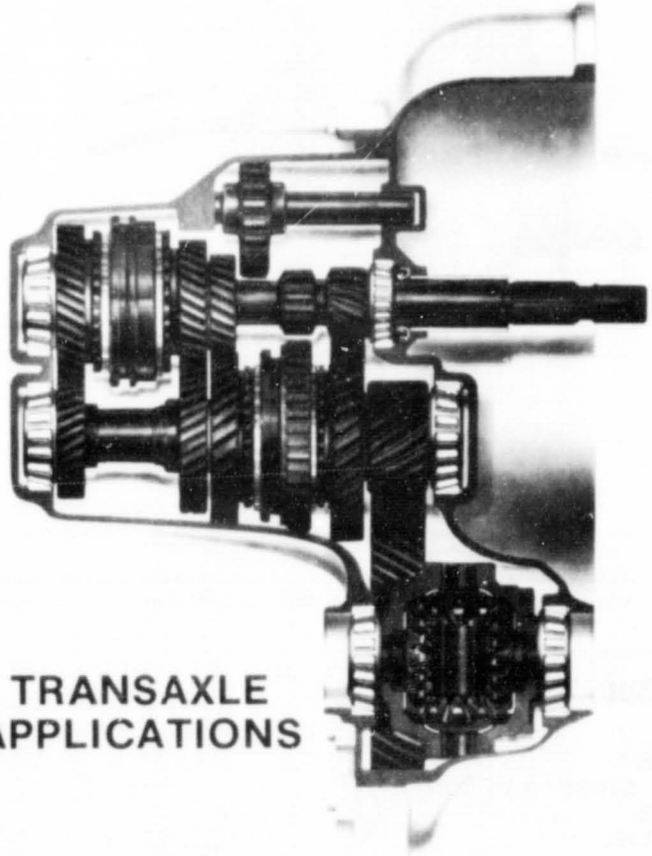
Timken® Bearings

Timken® tapered roller bearings are engineered to give vehicle builders higher load capacity and a smaller O.D. for a given bore size than other types of bearings.

Design them into wheels, transmissions, axle centers, transaxles and other vehicle bearing positions to reduce weight and lower manufacturing cost.



DRIVING WHEEL MOUNTING

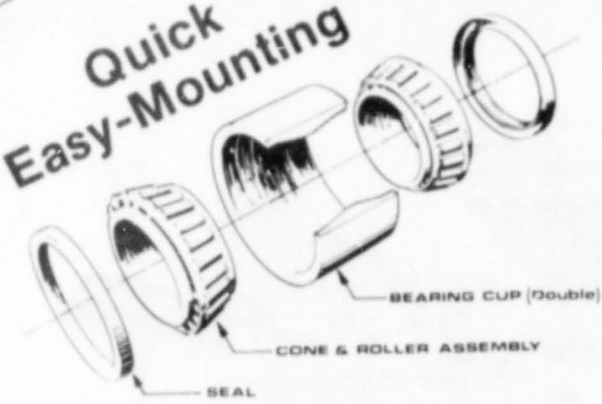


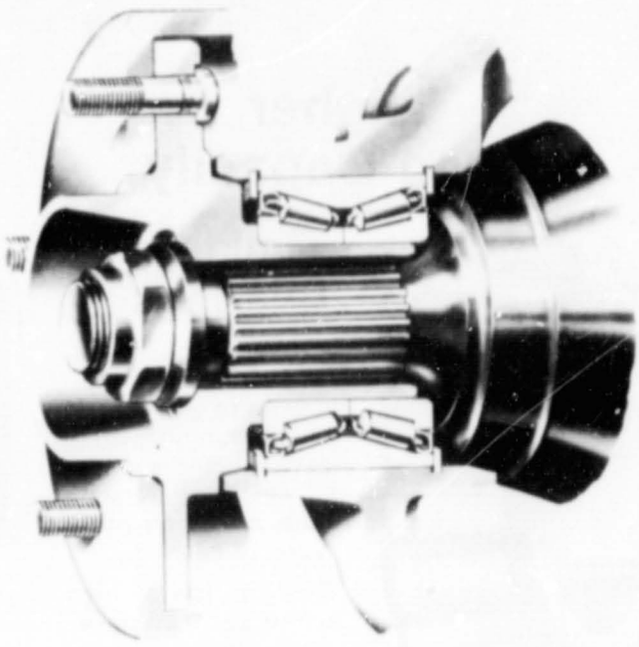
TRANSAXLE APPLICATIONS



NON-DRIVING WHEEL MOUNTING

Quick
Easy-Mounting





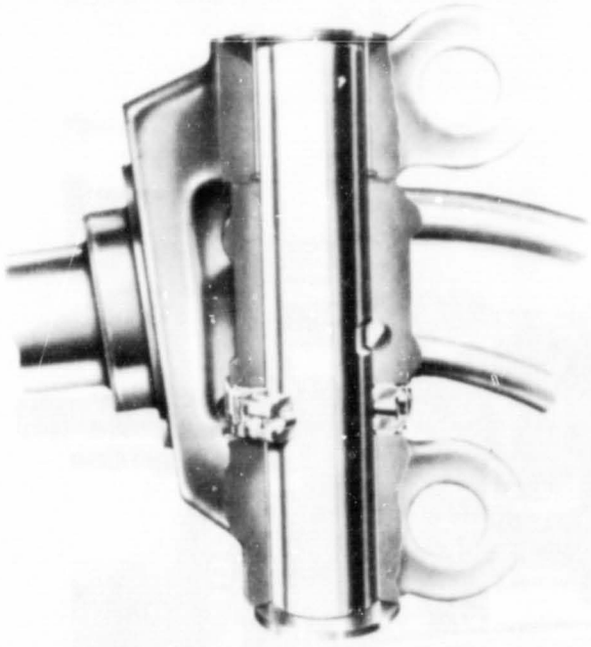
UNIPAC™ Bearings

Timken® UNIPAC bearings can save you time and dollars on your assembly line because they're pre-assembled, preset, pregreased and presealed ready for fast and easy installation. Design them into driving and non-driving wheels, fan drives and any place a two-row self-contained bearing is desired.

TM - Trademark of The Timken Company

High Thrust Load Capacity





Timken Thrust Bearings

Timken Thrust Bearings are specifically designed for oscillating or slow rotation applications. In either a sealed or non-sealed version they provide heavy thrust load capacity in a small envelope.

Design them into steering pivots, suspension supports or wherever thrust load needs to be handled.

For more information on Timken Bearings . . .

CALL TOLL FREE: 800-221-3333*

or write:
THE TIMKEN COMPANY
P.O. BOX 1126E WALL STREET STATION
NEW YORK, N.Y. 10268
***In N.Y. State, collect 212 775-1395**



TORRINGTON

Part of worldwide Ingersoll-Rand

BEARING DIVISIONS

South Bend, Ind./Torrington, Ct.

59 Field Street
Torrington, Conn. 06790
(203) 482-9511

BR-23

TORRINGTON BEARINGS SELECTION GUIDE

The Torrington Company
59 Field Street
Torrington, CT 06790
(203) 482-9511

	TYPE	ADVANTAGES	VARIATIONS	SIZE RANGE
	**needle roller**	Lowest cost, highest capacity anti-friction bearing per pound of capacity. Use with hardened raceways where production rate warrants assembly equipment.	Spherical, flat, ball, crankpin or other end shapes. Material: 50100, stainless, even M-50.	.025″ diam. up 1mm diam. up
	**radial needle roller and cage assembly**	Highest capacity with lowest possible cross section in a unit assembly. Use with hardened raceways.	Steel or plastic retainers unit or split assembly.	3/8″ to 5″ bore inch series 5mm to 100mm bore metric series
	**drawn cup full complement needle roller bearing**	Hardened drawn steel outer race with full roller complement. Easily installed by press fit. High radial capacity in small cross section. Use on hardened shaft or inner raceway.	Mechanically or greased retained—open or closed end.	1/8″ to 7 1/4″ bore inch series 8mm to 55mm bore metric series
	**drawn cup caged needle roller bearing**	Dimensionally interchangeable with needle bearing. One piece retainer for maximum roller guidance. Excellent service at high speeds and moderate loads. Easy installation—long pregreased life.	Open or closed end-steel or plastic retainer—with or without seals.	3/16″ to 2 3/4″ bore inch series 4mm to 55mm bore metric series
	**heavy duty needle roller bearing**	Machined and ground outer race provides high capacity and shock resistance. Long pregreased life on hardened shaft or inner race. Can be used with split housing.	——	5/8″ to 9 1/4″ bore inch series 14mm to 160mm bore metric series
	**thrust needle roller and cage assembly**	Non-separable assembly designed for high thrust loads in restricted space. Runs directly on adjacent hardened and ground surfaces.	Steel or plastic retainer—standard thrust races in various thicknesses available as required.	.252″ to 4.13″ bore inch series 15mm to 100mm bore metric series
	**roller thrust bearing**	High capacity assembly for heavy thrust loads at a wide range of speeds. Hardened steel non-roller riding retainer piloted by shaft housing. Extremely low cost.	Available without thrust races to run directly on adjacent hardened and ground surfaces.	2″ to 3 1/2″ (51mm to 89mm) bore inch series
	**cylindrical roller thrust bearing**	Two hardened and ground steel races with a cage retaining cylindrical roller. Simplicity of design and application offer economy for high capacity installation.	Available with lower race spherically ground to seat against an aligning washer for initial misalignment.	2″ to 30″ (51mm to 762mm) bore inch series
	**tapered roller thrust bearing**	Hardened and ground steel races with conical raceways and tapered rollers assure true rolling motion. For high thrust loads and heavy shock conditions.	For maximum thrust capacity at very low speeds, a full complement of rollers can be provided.	3″ to 16″ (76mm to 406mm) bore inch series
	**ball thrust bearing**	For lighter loads and higher speeds. Hardened and ground steel races with grooved raceways for axial rigidity in one direction—easily mounted.	Ball cage material to suit application. Angular contact bearing will handle combined radial and thrust loads at relatively high speeds.	5″ to 16″ (127mm to 406mm) bore inch series

TORRINGTON MAKES EVERY BASIC TYPE OF ANTI-FRICTION BEARING TO THE SAME EXACTING STANDARDS THROUGHOUT THE WORLD.

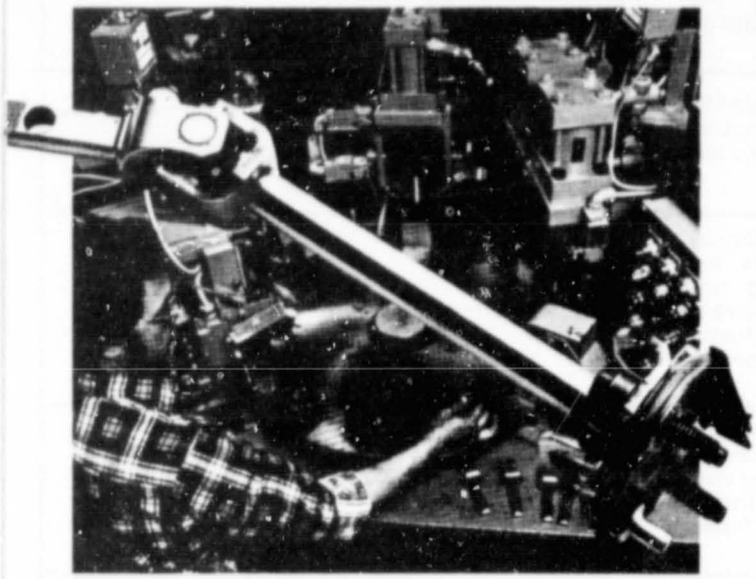
TORRINGTON BEARINGS SELECTION GUIDE

The Torrington Company
59 Field Street
Torrington, CT 06790
(203) 482-9511

TYPE	ADVANTAGES	VARIATIONS	SIZE RANGE
 **spherical roller thrust bearing**	High thrust capacity with low friction, continuous roller alignment. Pure thrust or combined radial and thrust loads. For speeds higher than other roller thrust bearings.	——	120mm to 530mm (4.724″ to 20.866″) bore metric series
 **spherical roller bearing**	Self-aligning bearing with high radial and thrust capacity. The integral center guide flange prevents roller skew for even load distribution and free rolling action.	Oil grooves and holes—straight or tapered bore—internal fits to accommodate operating conditions—land riding or pin type—CEVM to M-50 steels.	35mm to 1250mm (1.378″ to 49.213″) bore metric series
 **spherical roller bearing pillow block**	Split housing eases installation and inspection. Triple labyrinth seals retain lubricant and exclude dirt. Stabilizing ring permits assembly to be used as fixed or float block.	Cast iron or alloy steel blocks with 2 or 4 bolts—straight bore or adapter mounting—open or closed end housings.	2 15/16″ to 14″ (74.6mm to 356mm) shaft diameter
 **track roller**	Heavy outer race withstands high rolling and shock loads. For high capacity performance on cams or tracks.	Both stud and yoke types. Available with or without labyrinth seals.	roller O.D. ½″ to 7″ inch series 13mm to 110mm O.D. metric series
 **airframe needle roller bearing**	Unit assemblies with lubrication holes and grooves for high static or oscillating motion loads. Conform to current Military Standards for Airframe bearings. For slow speeds only.	——	3/16″ to 4″ (4.8mm to 101mm) bore inch series
 **spherical plain bearing**	Unit assembly—a steel ball housed in a mating, spherically ground, single-fractured outer ring for heavy radial, thrust or combined loads. Oil holes and grooves provided.	Extended inner race series, thrust series, double fractured outer ring series.	½″ to 6″ bore inch series 12mm to 300mm bore metric series
 **tapered roller bearing**	Tapered design offers best support for combined heavy radial and thrust loads at moderate speeds. Two Row Series offers increased radial capacity and takes thrust loads either direction.	Standard and steep roller angle. Single and multiple row. 2-row bearings available with double cone—single cups or double cup—single cones.	10″ to 60″ (254mm to 1525mm) bore inch series
 **ball radial bearing**	Most widely used radial bearing capable of handling moderate thrust loads from either direction at relatively high speeds.	Maximum capacity bearings for radial load and single direction thrust. Angular contact type for thrust load equal to or greater than radial load.	4″ to 40″ (100mm to 1000mm) bore inch series
 **cylindrical roller bearing (series 5200)**	Designed to support heavy radial loads. Consists of a double flanged outer ring, straight inner ring and a stamped steel land-riding retainer with cylindrical rollers.	With or without inner ring. Machined land-riding cast retainers, bronze or ductile iron.	100mm to 240mm (3.937″ to 9.449″) bore metric series
 **drawn cup roller clutch**	Low cost, high torque overrunning clutch with same radial section as needle bearings. Use on hardened shaft. Easily installed by press fit.	Clutch only unit or clutch bearing assembly. Integrally molded plastic springs or separate stainless steel springs in the clutch retainer.	¼″ to 1″ bore inch series 8mm to 35mm bore metric series

Some application requirements cannot be fulfilled by a standard bearing. Torrington can supply bearings of special design, in any practicable size, configuration, material and finish; however, quantities should be sufficient to achieve economical production.

Could you benefit in six ways from giving us your next "design and make" project?









Ask Ford Motor Company — When Ford invited Torrington Special Products to develop a new automotive steering U-Joint assembly, they needed a unit that would meet strict performance and safety standards, yet save weight. The result was a package of benefits: 20% lower unit cost, improved performance, weight reduction, high-volume output from two TSP facilities, a specialized stocking and delivery program, and easier installation.

The Story — Torrington Special Products and two other companies developed competitive proposals for a new Ford steering intermediate shaft assembly. This critical component connects the steering column and steering gear of an automobile. A universal joint on one end accommodates the primary working angle between column and gear; a rubber coupling at the other end isolates noise and vibration.

Our Contribution — TSP sales and engineering personnel worked closely with Ford to define the product requirements. After Ford evaluation of our preliminary ideas and final design, TSP was awarded the contract. Main components of the TSP assembly are fabricated of high-strength, low alloy steel stampings and cold-rolled bar, replacing heavier, more costly forgings. New press-fit and staked connections were created during the prove-out program and new assembly techniques with built-in monitors developed to assure reliability.

Your needs are next — You may need something similar for another automotive application, or something completely different. If it's a high-volume OEM component or assembly . . . if you need "black box" original designs or redesign capability . . . if high quality manufacturing is involved, our total skills are waiting.

For immediate help, call (203) 482-9511. Ask for one of our Product Managers. Or write for our new "Total Skills" brochure. The Torrington Company, Special Products Division, Torrington CT 06790.



TORRINGTON SPECIAL PRODUCTS

BR-26

ORIGINAL PAGE IS OF POOR QUALITY

CABLES, ELECTRIC

BATTERY and POWER

(CODE **CA**)

...Ask what American can do for you.



Because, at American, you'll find we take pride in meeting your total wire and cable needs. We offer you the finest quality power; control and instrumentation cable, airport lighting cable, signal cable, portable cord, power supply cords, flexible cords, appliance/range wire, fixture and machine tool wire for every application. And, all our products are tested to conform to the most stringent specifications. Need custom cable for special applications? No problem. Our custom design specialists are ready and waiting to work with your specs and your engineers to turn special design requirements into performance realities.

Why is our reputation for insuring total capability from a single source so important to us? Simple. It's just the American way. Call or write: American Insulated Wire Corp., Central Avenue and Freeman Street, Pawtucket, R.I. 02862 **Tel: (401) 726-0700. TWX: 710-384-0150.**

AMERICAN
INSULATED WIRE CORP.

DISCOVER AMERICAN
A LEVITON COMPANY

DLS, Inc.
PO Box 235
222 East 2nd Street
Bremen, Indiana 46506
219/546-4717

COMPANY NAME:	D L S, Inc. A wholly owned subsidiary of Gateway Industries, Inc.
NAME OF ITEMS:	Electrical Wire Harnesses and Lead Assemblies for use with 6 to 220 volt AC; DC. Electrical Systems. Battery Cables.
FUNCTION OF ITEM:	To transmit electrical current from power supply to various other electrical components: (ie, lights, horn, etc.)
PRODUCTION STATUS:	Production
AVAILABILITY:	4 - 6 weeks after receipt of written purchase order.
MODEL NUMBER/ PART NUMBER:	Various.
DRAWINGS and/or PHOTOGRAPHS:	None.
DIMENSIONS:	As required.
WEIGHT:	Various.
RATINGS:	Manufactured to customers' prints and/or specifications, in accordance with SAE recommended materials. In compliance with UL, CSA, and RVI specifications.
OPERATING INSTRUCTIONS:	Wire harness and lead assemblies with quick connect terminals, connector blocks or molded connections, for transmission of electrical current.

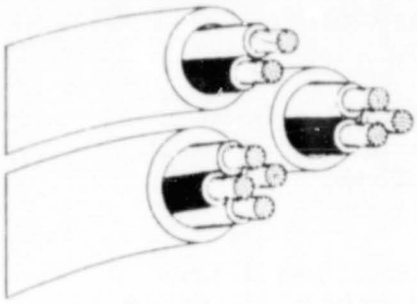
DLS, Inc.
PO Box 235
222 East 2nd Street
Bremen, Indiana 46506
219/546-4717

ELECTRICAL CONDUCTORS, Inc.
2500 COMMONWEALTH AVENUE
NORTH CHICAGO, ILLINOIS 60064

Phone: 800-323-9355
Illinois: 312-689-9090

PORTABLE CORD

Heavy-duty Polar/Solar® service cord, available in black or yellow. Pack 250' UL Listed.



600 VOLT—SEO

Catalog No. Yellow	Catalog No. Black	GA/Cond.	Wt.	Catalog No. Yellow	Catalog No. Black	GA/Cond.	Wt.
22225	22205	18/2	64		22210	8/2	232
22325	22305	18/3	73	Contact	22310	8/3	293
22425	22405	18/4	84		22410	8/4	395
22226	22206	16/2	67	Factory	22510	8/5	455
22326	22306	16/3	87		22211	6/2	300
22426	22406	16/4	109	For	22311	6/3	412
22227	22207	14/2	118		22411	6/4	504
22327	22307	14/3	140	Availability	22511	6/5	627
22427	22407	14/4	157		22212	4/2	574
22228	22208	12/2	151	Of	22312	4/3	756
22328	22308	12/3	182		22412	4/4	931
22428	22408	12/4	204	Yellow	22512	4/5	868
22229	22209	10/2	182		22213	2/2	819
22329	22309	10/3	232	Cord	22313	2/3	1043
22429	22409	10/4	272		22413	2/4	1323

NOTE: Order color preference by appropriate part number.

300 VOLT—SJEO

Catalog No. Yellow	Catalog No. Black	GA/Cond.	Wt.
23225	23205	18/2	7
23325	23305	18/3	8
23226	23206	16/2	8
23326	23306	16/3	11
23227	23207	14/2	11
23327	23307	14/3	14
23228	23208	12/2	14
23328	23308	12/3	19
23329	23309	10/3	25

MULTIPLE CONDUCTOR CONTROL CABLE

T*PRENE insulation gives it flexible all-weather strength, plus lightweight portability. UL listed.



18 Gauge—16 Strands—SEO

Catalog No.	No. of Cond.	Nom'l O.D. (inches)	Current* Carrying Capacity (amps)	Weight lbs./M
30505	5	.495	5.6	95
30605	6	.530	5.6	112
30705	7	.565	4.9	126
30805	8	.575	4.9	140
31005	10	.630	4.9	168
31205	12	.660	4.9	186
31405	14	.710	4.9	196
31605	16	.740	4.9	238
31805	18	.770	4.9	265
32005	20	.820	4.9	294
32205	22	.870	4.9	322
32405	24	.890	4.9	350
32705	27	.930	4.2	389
33005	30	.950	4.2	427
33605	36	1.050	4.2	490
33905	39	1.080	4.2	539
34405	44	1.180	3.5	557
35205	52	1.265	3.5	662
36005	60	1.340	3.5	742

16 Gauge—26 Strands—SEO

Catalog No.	No. of Cond.	Nom'l O.D. (inches)	Current* Carrying Capacity (amps)	Weight lbs./M
30506	5	.530	8	116
30606	6	.570	8	133
30706	7	.605	7	151
30806	8	.615	7	168
30906	9	.740	7	206
31006	10	.740	7	217
31206	12	.760	7	242
31406	14	.785	7	263
31606	16	.820	7	298
31806	18	.840	7	333
32006	20	.920	7	364
32206	22	.930	7	399
32406	24	1.010	7	469
32706	27	1.030	6	480
33006	30	1.050	6	532
33606	36	1.130	6	588
33906	39	1.175	6	672
34406	44	1.310	5	728
35206	52	1.365	5	833

14 Gauge—41 Strands—SEO

Catalog No.	No. of Cond.	Nom'l O.D. (inches)	Current* Carrying Capacity (amps)	Weight lbs./M
30507	5	.695	12	196
30607	6	.750	12	224
30707	7	.760	10.5	256
30807	8	.820	10.5	287
30907	9	.925	10.5	319
31007	10	.925	10.5	333
31207	12	.930	10.5	382
31407	14	1.010	10.5	455
31607	16	1.065	10.5	508
31807	18	1.110	10.5	560
32007	20	1.210	10.5	602
32407	24	1.325	10.5	704

12 Gauge—65 Strands—SEO

Catalog No.	No. of Cond.	Nom'l O.D. (inches)	Current* Carrying Capacity (amps)	Weight lbs./M
30508	5	.750	16	249
30608	6	.810	16	280
30708	7	.870	14	322
30808	8	.920	14	364
30908	9	1.000	14	421
31008	10	1.000	14	448
31208	12	1.050	14	501
31408	14	1.100	14	595
31608	16	1.160	14	655
31808	18	1.270	14	721
32008	20	1.320	14	770

10 Gauge—105 Strands—SEO

Catalog No.	No. of Cond.	Nom'l O.D. (inches)	Current* Carrying Capacity (amps)	Weight lbs./M
30509	5	.830	24	322
30609	6	.900	24	364
30709	7	.995	21	441
30809	8	1.060	21	490
31009	10	1.160	21	539
31209	12	1.190	21	595
31609	16	1.330	17.5	833

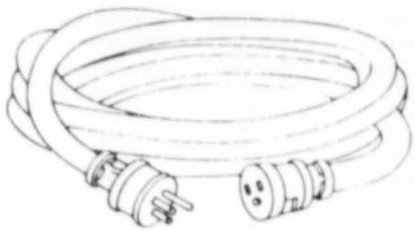
*Values shown are for current carrying conductors. A grounding conductor, or one which carries only the unbalanced current from other conductors, is not counted in determining current carrying capacity.

POLAR SOLAR CORD

ELECTRICAL CONDUCTORS

CORD SETS

Single outlet Polar/Solar* cord sets available in 2 conductor, 3 conductor, medium-duty, heavy-duty, black or yellow. UL listed.



300 VOLT—SJEO

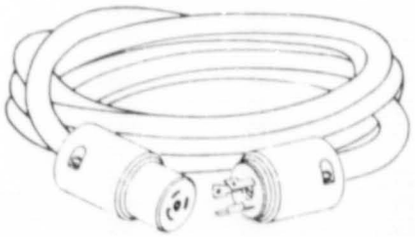
Catalog No. Yellow	Catalog No. Black	Gauge	Voltage	Length	Pkg.	Wt.
01017	01027	18/2	300 V	25'	24	24
01018	01028	18/2	300 V	50'	12	24
01019	01029	18/2	300 V	100'	6	24
01117	01127	16/2	300 V	25'	24	27
01118	01128	16/2	300 V	50'	12	27
01119	01129	16/2	300 V	100'	6	27
01217	01227	16/3	300 V	25'	18	17
01218	01228	16/3	300 V	50'	12	22
01219	01229	16/3	300 V	100'	6	32
01317	01327	14/2	300 V	25'	10	15
01318	01328	14/2	300 V	50'	8	24
01319	01329	14/2	300 V	100'	6	36
01417	01427	14/3	300 V	25'	12	21
01418	01428	14/3	300 V	50'	6	22
01419	01429	14/3	300 V	100'	6	42
01517	01527	12/2	300 V	25'	10	20
01518	01528	12/2	300 V	50'	8	28
01519	01529	12/2	300 V	100'	4	28
01617	01627	12/3	300 V	25'	12	32
01618	01628	12/3	300 V	50'	6	30
01619	01629	12/3	300 V	100'	4	40
01717	01727	10/3	300 V	25'	6	22
01718	01728	10/3	300 V	50'	4	30
01719	01729	10/3	300 V	100'	3	45

600 VOLT—SEO

01467	01477	14/3	600 V	25'	6	16
01468	01478	14/3	600 V	50'	4	22
01469	01479	14/3	600 V	100'	3	30
01667	01677	12/3	600 V	25'	6	19
01668	01678	12/3	600 V	50'	4	24
01669	01679	12/3	600 V	100'	3	35

LOCKING TYPE EXTENSIONS

Black or yellow Polar/Solar* cord sets with locking type extensions. 20 AMP—125 volt. UL listed.



300 VOLT—SJEO 600 V SEO

Catalog No. Yellow	Catalog No. Black	Gauge	Voltage	Length	Pkg.	Wt.
09128	09228	12/3	300 V	50'	6	30
09129	09229	12/3	300 V	100'	4	40
09628	09728	12/3	600 V	50'	4	30
09629	09729	12/3	600 V	100'	3	45
09108	09208	10/3	300 V	50'	4	30
09109	09209	10/3	300 V	100'	3	45
09608	09708	10/3	600 V	50'	3	35
09609	09709	10/3	600 V	100'	2	45

REPLACEMENT CORDS

Available in black. UL listed.



300 VOLT—SJEO

Catalog No.	Gauge	Voltage	Length	Pkg.	Wt.
09851	18/2	300 V	6'	50	13
09852	18/2	300 V	9'	50	20
09853	16/2	300 V	6'	50	18
09854	16/2	300 V	9'	50	25
09855	16/3	300 V	6'	50	23
09856	16/3	300 V	9'	50	32
09857	14/3	300 V	6'	25	18
09858	14/3	300 V	9'	25	23

UL

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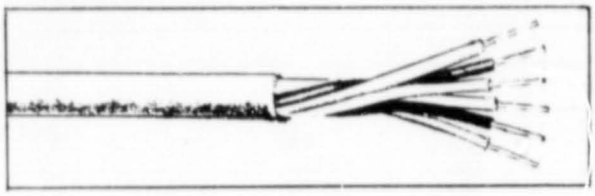
TEL: 312-689-9090

ELECTRICAL CONDUCTORS, Inc.
2500 COMMONWEALTH AVENUE
NORTH CHICAGO, ILLINOIS 60064

Polar/Solar Cord... an ECI innovation and a new UL classification. The new SEO and SJEO designations for 600 and 300 volt Polar/Solar cables replace SO... and for good reasons!

ELECTRICAL CONDUCTORS

MULTIPLE CONDUCTOR CABLES
UNSHIELDED



CONSTRUCTION: Copper Conductors, Color Coded, Polypropylene Insulated*, Conductors Cabeled, Gray Vinyl Jacket.

SPECIFICATIONS: -20°C to +60°C. Jacket Passes FR-1 Vertical Flame Test. U/L Listed (Wires, Misc.)

Old Number	New Number	No. of Conductors	Awg and Stranding	Insulation Thickness (Inches)	Jacket Thickness (Inches)	Nominal O.D. (Inches)	Suggested Working Voltage
1100	91100	2	22 (Solid)	.010	.020	.130	200
1101	91101	2	22 (7/28)	.010	.020	.140	200
1102	91102	2	20 (7/28)	.010	.020	.150	200
1103	91103	2	19 (Solid) Bare	.015	.025	.165	300
1104	91104	2	18 (16/30)	.015	.025	.225	300
1105	91105	2	16 (19/29)	.015	.025	.240	300
1140	91140	2	14 (19/27)	.032	.035	.335	600
1142	91142	2	12 (19/25)	.032	.040	.385	600
1107	91107	3	22 (7/30)	.010	.020	.150	200
1108	91108	3	20 (7/28)	.010	.020	.165	200
1110	91110	3	19 (Solid) Bare	.015	.025	.180	300
1109	91109	3	18 (16/30)	.015	.025	.240	300
1139	91139	3	16 (19/29)	.015	.025	.255	300
1141	91141	3	14 (19/27)	.032	.035	.350	600
1143	91143	3	12 (19/25)	.037	.040	.420	600
1112	91112	4	22 (7/30)	.010	.020	.170	200
1134	91134	4	20 (7/28)	.010	.025	.180	200
1113	91113	4	19 (Solid) Bare	.015	.025	.200	300
1114	91114	4	18 (16/30)	.015	.025	.250	300
1115	91115	4	16 (19/29)	.015	.030	.275	300
1126	91126	5	22 (7/30)	.010	.020	.175	200
1127	91127	5	22 (Solid) Bare	.010	.020	.170	200
1144	91144	5	18 (16/30)	.015	.030	.275	300
1116	91116	6	22 (7/30)	.010	.025	.195	200
1130	91130	6	22 (Solid) Bare	.010	.020	.190	200
1117	91117	6	18 (16/30)	.015	.025	.290	300
1118	91118	8	22 (7/30)	.010	.025	.210	200
1131	91131	8	22 (Solid) Bare	.010	.025	.205	200
1119	91119	8	18 (16/30)	.015	.025	.305	300
1120	91120	10	22 (7/30)	.010	.025	.260	200
1132	91132	10	22 (Solid) Bare	.010	.025	.255	200
1121	91121	10	18 (16/30)	.015	.025	.365	300
1122	91122	12	22 (7/30)	.010	.025	.270	200
1133	91133	12	22 (Solid) Bare	.010	.025	.265	200
1123	91123	12	18 (16/30)	.015	.030	.390	300
1124	91124	15	22 (7/30)	.010	.030	.300	200
1125	91125	15	18 (16/30)	.015	.030	.445	300

*Except for catalog numbers 91105, 91140, 91142, 91139, 91141, 91143 and 91115 which are PVC insulated.

COLOR CODE—Multiple Conductor Cable

Conductor	Color	Conductor	Color
1st	Black	9th	Purple
2nd	Red	10th	Gray
3rd	Green	11th	Pink
4th	White	12th	Tan
5th	Brown	13th	Red/Green
6th	Blue	14th	Red/Yellow
7th	Orange	15th	Red/Black
8th	Yellow		

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NORTH CHICAGO, ILLINOIS 60064
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BEST BY COMPARISON!

See for yourself how POLAR/SOLAR CORD, made with ELECTRICAL CONDUCTORS' T*PRENE, stacks up against other jacketing materials!

Comparison of Flexible Cord Jacket Materials

	ECI's T*PRENE	SBR Rubber	Polychloroprene Rubber (NEOPRENE)	NBR/PVC Rubber	PVC
UNAGED PHYSICALS					
Tensile Strength (psi)	1,000	1,420	1,630	1,010	1,410
100% Modulus (psi)	340	690	770	640	780
Elongation (%)	580	300	300	280	330
LOW TEMPERATURE PROPERTIES					
Brittle Point, (°F)	<-100°	-52°	-38°	-14°	-32°
Cold Bend @ -35° C	Pass	Pass	Pass	Fail	Pass
-50° C	Pass	Pass	Fail	Fail	Fail
-65° C	Pass	Fail	Fail	Fail	Fail
AGING PROPERTIES					
—Air Oven 7 days @ 121° C					
% Retention of Tensile	123	104	188	172	124
% Retention of Elongation	89	17	17	29	0
—Air Oven 7 days @ 136° C					
% Retention of Tensile	150	0	0	87	0
% Retention of Elongation	116	0	0	0	0
—Air Bomb 42 hrs @ 127° C					
% Retention of Tensile	117	56	93	[illegible]	97
% Retention of Elongation	116	18	43	79	83
—Oxygen Bomb 7 days @ 80° C					
% Retention of Tensile	109	118		137	109
% Retention of Elongation	100	87		114	94
OZONE RESISTANCE					
Hours to cracking (100pphm/100° F)	>1000	24		288	>1000
HEAT DEFORMATION (T_2/T_1)					
2000gms @ 121° C	76	93	95	91	70
MECHANICAL PROPERTIES					
(Crushing Strength —lbs. force to failure	3,400	2,000		3,300	3,000
Abrasion resistance (Uniroyal) —cycles to wear thru jacket	36	18	14	20	43(1)

(1) Material coated abrasive wheel

ELECTRICAL CONDUCTORS

T*PRENE—protection for every condition. POLAR/SOLAR CORD delivers flexible strength when you need it. And so does ECI.

At Electrical Conductors, our job is providing you with the right quality wire products that *work for you*. So, if you have special needs, just ask us. For POLAR/SOLAR CORD or other fine wire products, we're ready to help you get the job done.

Need extra service fast? Just call our toll-free number: 800-323-9355. In Illinois, call 312-689-9090.

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POWER CABLES

These quality power cables provide an excellent combination of electrical and environmental protection. Capacities range from 100 Amps to 375 Amps. Neoprene coated for protection against common damaging elements. Select cable capacity at least double the full load ampere rating of the EV motor to provide a reserve for acceleration and hill climbing. Order the number of linear feet needed in each cable size.



Part No.	Description	OD	Amps
20-004-200	4 Ga Power Cable	.435"	100
20-002-200	2 Ga Power Cable	.500"	200
20-001-200	1 Ga Power Cable	.600"	250
20-000-200	2/0 Power Cable	.730"	375

ELECTRIC VEHICLE COMPONENTS
FLIGHT SYSTEMS
HEADQUARTERS
P.O. BOX 25, MECHANICSBURG, PA 17055
PHONE (717) 697-0333

GVI®

Great Valley Industries, Inc.

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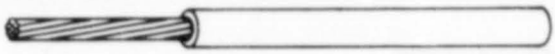
electrical wire



PLASTIC PRIMARY WIRE

PART NO. 100 FOOT SPOOLS	PART NO. 1000 FOOT SPOOLS	GAUGE	STRANDING	NOM. O.D.
WP-C-22	WP-M-22	22	10 x .010 (30)	.078"
WP-C-20	WP-M-20	20	7 x .0126 (28)	.085"
WP-C-18	WP-M-18	18	16 x .010 (30)	.094"
WP-C-16	WP-M-16	16	19 x .0112 (29)	.103"
WP-C-14	WP-M-14	14	19 x .0142 (27)	.120"
WP-C-12	WP-M-12	12	19 x .0179 (25)	.145"
WP-C-10	WP-M-10	10	19 x .0223 (23)	.175"
WP-C-8	WP-M-8	8	19 x .0280 (21)	.215"
WP-C-6	WP-M-6	6	49 x .0223 (23)	.315"

GVI's most economical wire for general circuit wiring. This wire conforms to SAE J558A and SAE J1128. Wire is constructed of twisted bare copper and insulated with PVC rated at 60°C.

Colors Available: white, red, black, light and dark green, orange, light and dark blue, brown, yellow, purple, pink, gray and tan. Also available striped.

HYPALON PRIMARY WIRE

PART NO. 100 FOOT SPOOLS	PART NO. 1000 FOOT SPOOLS	GAUGE	STRANDING	NOM. O.D.
WPH-C-18	WPH-M-18	18	16 x 30	.110"
WPH-C-16	WPH-M-16	16	19 x 29	.120"
WPH-C-14	WPH-M-14	14	19 x 27	.140"
WPH-C-12	WPH-M-12	12	19 x 25	.165"
WPH-C-10	WPH-M-10	10	19 x 23	.195"
WPH-C-8	WPH-M-8	8	65 x 26	.244"
WPH-C-6	WPH-M-6	6	105 x 26	.305"

GVI's most versatile insulation; has high heat resistance and high dielectric strength. It is resistant to abrasion, abuse, aging, oils, chemicals, ozone and corona. It conforms to SAE J156.

Colors Available: white, red, black, green, blue, yellow, brown and orange (8 and 6 gauge available in white and red only).

MARINE PRIMARY WIRE/APPLIANCE WIRE

PART NO. 100 FOOT SPOOLS	PART NO. 1000 FOOT SPOOLS	GAUGE	STRANDING	NOM. O.D.	INSULATION THICKNESS
APL-C-18	APL-M-18	18	16 x .010 (30)	.112"	2/64"
APL-C-16	APL-M-16	16	26 x .010 (30)	.124"	2/64"
APL-C-14	APL-M-14	14	19 x .0147 (26-27)	.138"	2/64"
APL-C-12	APL-M-12	12	19 x .0185 (24-25)	.158"	2/64"
APL-C-10	APL-M-10	10	19 x .0234 (22-23)	.182"	2/64"
APL-C-8	APL-M-8	8	19 x .0295 (20-21)	.265"	3/64"
APL-C-6	APL-M-6	6	133 x .0142 (26-27)	.340"	4/64"

GVI's appliance wire is UL and CSA approved. This wire is rated at 105°C and 600 volts and is moisture resistant.

Colors Available: red, black, white, green, blue, orange, yellow, brown, purple, gray and pink. Also available striped.

HEAVY DUTY PRIMARY WIRE

PART NO. 100 FOOT SPOOLS	PART NO. 1000 FOOT SPOOLS	GAUGE	STRANDING	NOM. O.D.
WPG-C-16	WPG-M-16	16	19 x .0112 (29)	.136"
WPG-C-14	WPG-M-14	14	19 x .0142 (27)	.155"
WPG-C-12	WPG-M-12	12	19 x .0179 (25)	.185"
WPG-C-10	WPG-M-10	10	19 x .0223 (23)	.206"

GVI's toughest PVC wire conforms to SAE J558A and SAE J1128.

Colors Available: gray only.

Great Valley Industries, Inc.

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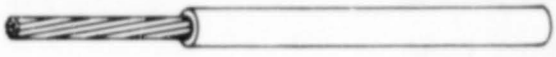
electrical wire

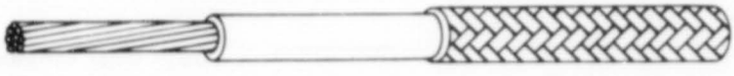


THHN

PART NO. 100 FOOT SPOOLS	PART NO. 500 FOOT SPOOLS	GAUGE	STRANDING	NOM. O.D.
THHN-C-14	THHN-D-14	14	19 x .0142 (27)	.117"
THHN-C-12	THHN-D-12	12	19 x .0179 (25)	.136"
THHN-C-10	THHN-D-10	10	19 x .0226 (23)	.170"
THHN-C-8	THHN-D-8	8	7 x .0486 (16-17)	.222"
THHN-C-6	THHN-D-6	6	7 x .0612 (14-15)	.259"

For use in wiring commercial passenger carrying boats and as 600 volt building wire. Equivalent to 90°C MTW and 105°C appliance wire.

Colors stocked - black, red and white.

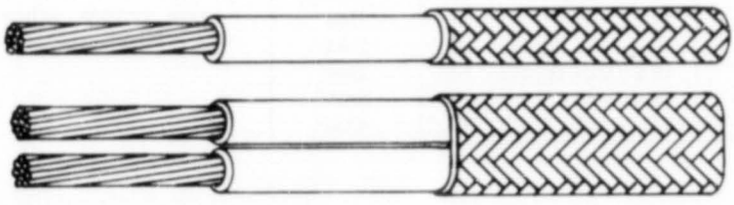


BRAID AND LACQUER PRIMARY WIRE

PART NO. 100 FOOT SPOOLS	PART NO. 1000 FOOT SPOOLS	GAUGE	STRANDING	NOM. O.D.
WPBL-C-18	WPBL-M-18	18	16 x .010 (30)	.124"
WPBL-C-16	WPBL-M-16	16	19 x .0113 (29)	.134"
WPBL-C-14	WPBL-M-14	14	19 x .0142 (27)	.147"
WPBL-C-12	WPBL-M-12	12	19 x .0179 (25)	.184"
WPBL-C-10	WPBL-M-10	10	19 x .0226 (23)	.208"
WPBL-C-8	WPBL-M-8	8	19 x .0285 (21)	.250"

Standard primary wire covered with a cotton braid and lacquered for abrasion resistance.

Colors Available: red, black, white, green, blue, yellow, brown and oak.



FLEET DUTY PRIMARY WIRE

PART NO. 100 FOOT SPOOLS	PART NO. 1000 FOOT SPOOLS	GAUGE	STRANDING	NOM. O.D.
WPF-C-16	WPF-M-16	16	19 x .0113 (29)	.150"
WPF-C-14	WPF-M-14	14	19 x .0142 (27)	.185"
WPF-C-14/2	WPF-M-14/2	14/2	19 x .0142 (27)	.210" x .350"
WPF-C-12/2	WPF-M-12/2	12/2	19 x .0179 (25)	.230" x .400"

Standard primary wire covered with a seine braid and lacquered. Offers better abrasion resistance than braid and lacquer.

Only available with black jacket.

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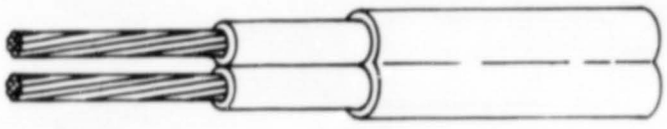
electrical wire

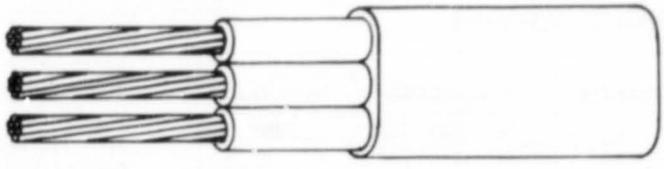


AUTOMOTIVE DUPLEX

PART NO. 100 FOOT SPOOLS	PART NO. 1000 FOOT SPOOLS	GAUGE	STRANDING	NOM. O.D.
WPG-C-18/2	WPG-M-18/2	18/2	16 x .010 (30)	.150" x .230"
WPG-C-16/2	WPG-M-16/2	16/2	19 x .0112 (29)	.162" x .265"
WPG-C-14/2	WPG-M-14/2	14/2	19 x .0142 (27)	.180" x .300"
WPG-C-12/2	WPG-M-12/2	12/2	19 x .0179 (25)	.210" x .360"
WPG-C-10/2	WPG-M-10/2	10/2	19 x .0223 (23)	.235" x .420"
WPG-C-8/2	WPG-M-8/2	8/2	19 x .0281 (21)	.290" x .520"
WPG-C-6/2	WPG-M-6/2	6/2	49 x .0223 (23)	.385" x .680"
WPG-C-14/1 & 10/1	WPG-M-14/1 & 10/1	14/1 & 10/1	19 x .0142 (27) 19 x .0223 (23)	.235" x .420"

Standard plastic primary wire covered with a gray PVC jacket rated at 80°C. This wire is designed to eliminate the need for loom.

Color: Jacket - gray
Inners - black and white
(Some sizes available in red and black)
14/1 and 10/1 is blue on the 14 gauge conductor and black on the 10 gauge conductor.



AUTOMOTIVE TRIPLEX AND QUADRUPLEX

PART NO.	GAUGE	STRANDING	NOM. O.D.
WPG-18/3	18/3	16 x .010 (30)	.150" x .320"
WPG-16/3	16/3	19 x .0112 (29)	.162" x .365"
WPG-14/3	14/3	19 x .0142 (27)	.180" x .420"
WPG-12/3	12/3	19 x .0179 (25)	.210" x .500"
WPG-10/3	10/3	19 x .0223 (23)	.235" x .595"
WPG-18/4	18/4	16 x .010 (30)	.152" x .445"
WPG-16/4	16/4	19 x .0112 (29)	.166" x .474"

Standard plastic primary wire with a flat gray jacket.

Colors: 3 wire cables - black, green and white conductors
4 wire cables - black, white, red and green conductors

MARINE DUPLEX AND TRIPLEX

PART NO. 100 FOOT SPOOLS	PART NO. 1000 FOOT SPOOLS	GAUGE	STRANDING	NOM. O.D.
WMG-C-14/2	WMG-M-14/2	14/2	41 x .010 (30)	.195" x .335"
WMG-C-12/2	WMG-M-12/2	12/2	65 x .010 (30)	.225" x .385"
WMG-C-10/2	WMG-M-10/2	10/2	105 x .010 (30)	.258" x .445"
WMG-C-14/3	WMG-M-14/3	14/3	41 x .010 (30)	.195" x .470"
WMG-C-12/3	WMG-M-12/3	12/3	65 x .010 (30)	.232" x .547"
WMG-C-10/3	WMG-M-10/3	10/3	105 x .010 (30)	.258" x .622"

U.L. boat wire, 600 volt, 105°C jacket and insulation.

Colors: 2 wire - black and white conductors
(Some available with red and black conductors)
3 wire - black, white and green

Great Valley Industries, Inc.

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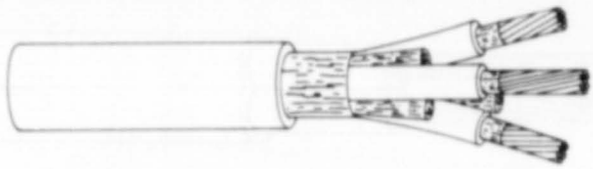
electrical wire



PORTABLE CORD
300 VOLT SERVICE

PART NO. TYPE SJ	PART NO. TYPE SJO	GAUGE	STRANDING	NOM. O.D.
SJ-18/2	SJO-18/2	18/2	16 x .010 (30)	.305"
SJ-18/3	SJO-18/3	18/3	16 x .010 (30)	.330"
SJ-18/4	SJO-18/4	18/4	16 x .010 (30)	.360"
SJ-16/2	SJO-16/2	16/2	26 x .010 (30)	.330"
SJ-16/3	SJO-16/3	16/3	26 x .010 (30)	.360"
SJ-16/4	SJO-16/4	16/4	26 x .010 (30)	.390"
SJ-14/2	SJO-14/2	14/2	41 x .010 (30)	.370"
SJ-14/3	SJO-14/3	14/3	41 x .010 (30)	.390"
SJ-14/4	SJO-14/4	14/4	41 x .010 (30)	.440"

Stranded copper conductors, separator, color-coded rubber (SJ) or neoprene (SJO) insulation and black rubber (SJ) or neoprene (SJO) jacket. Rated at 60°C for small motors, tools and appliances.

PORTABLE CORD
600 VOLT SERVICE

PART NO. TYPE S	PART NO. TYPE SO	GAUGE	STRANDING	NOM. O.D.
S-18/2	SO-18/2	18/2	16 x .010 (30)	.385"
S-18/3	SO-18/3	18/3	16 x .010 (30)	.400"
S-18/4	SO-18/4	18/4	16 x .010 (30)	.430"
S-16/2	SO-16/2	16/2	26 x .010 (30)	.410"
S-16/3	SO-16/3	16/3	26 x .010 (30)	.430"
S-16/4	SO-16/4	16/4	26 x .010 (30)	.460"
S-14/2	SO-14/2	14/2	41 x .010 (30)	.550"
S-14/3	SO-14/3	14/3	41 x .010 (30)	.575"
S-14/4	SO-14/4	14/4	41 x .010 (30)	.620"
S-12/2	SO-12/2	12/2	65 x .010 (30)	.625"
S-12/3	SO-12/3	12/3	65 x .010 (30)	.655"
S-12/4	SO-12/4	12/4	65 x .010 (30)	.710"
S-10/2	SO-10/2	10/2	103 x .010 (30)	.685"
S-10/3	SO-10/3	10/3	103 x .010 (30)	.720"
S-10/4	SO-10/4	10/4	103 x .010 (30)	.775"
S-8/3	SO-8/3	8/3	65 x .0159 (26)	.757"
S-8/4	SO-8/4	8/4	65 x .0159 (26)	.827"
S-6/3	SO-6/3	6/3	105 x .0159 (26)	.892"
S-6/4	SO-6/4	6/4	105 x .0159 (26)	.957"

Stranded copper conductors, separator, color-coded rubber (S) or neoprene (SO) insulation, cabled with filler, separator and jacketed with rubber (S) or neoprene (SO). Rated at 60°C for heavy duty service such as battery chargers, heavy tools and equipment.

PORTABLE CORD
SHORE LINE CORD

PART NO.	GAUGE	STRANDING	NOM. O.D.
ST-14/3Y	14/3	41 x .010 (30)	.575"
ST-12/3Y	12/3	65 x .010 (30)	.655"
ST-10/3Y	10/3	105 x .010 (30)	.720"

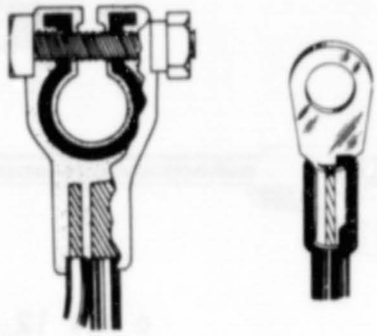
This 600 volt wire is made from stranded copper conductors, twisted, reinforced with fillers, paper separator under jacket and insulated with a yellow PVC jacket to conform to UL and CSA requirements.

BATTERY CABLES

SUPERIOR FEATURES

High quality Battery Cables with extra features for durability and performance. Cover all applications with these consolidated numbers.

Battery terminal is die cast lead alloy. Pre-dipped soldered cable and lead wire applied under great pressure for perfect bondability. Spring steel insert gives extra reinforced contact. The solid brass lug end is dip soldered for high tensile strength, then covered with molded insulator. Concentrically stranded cable has abrasion resistant, acid proof insulation.



POST TYPE HEAVY DUTY BATTERY CABLES

NOTE: Lead wire may be cut off if not required.



6 OR 12 VOLT HEAVY DUTY INSULATED
(w/Lead Wire)

109	9 Inches	**130**	30 Inches	**148**	48 Inches
112	12 Inches	**134**	34 Inches	**153**	53 Inches
116	16 Inches	**138**	38 Inches	**158**	58 Inches
120	20 Inches	**142**	42 Inches	**165**	65 Inches (w/o Lead Wire)
124	24 Inches				

Insulated battery cables recommended as replacement for braided ground straps.



12 VOLT HEAVY DUTY INSULATED
(w/Double Pigtail)

134 D/P	34 Inches	**138 D/P**	38 Inches	**148 D/P**	48 Inches	**158 D/P**	58 Inches

SIDE/TERMINAL HEAVY DUTY BATTERY CABLES



12 VOLT INSULATED
(w/Lead Wire)

115S/T	15 Inches	**135S/T**	35 Inches	**155S/T**	55 Inches
120S/T	20 Inches	**140S/T**	40 Inches	**160S/T**	60 Inches
125S/T	25 Inches	**145S/T**	45 Inches	**165S/T**	65 Inches
130S/T	30 Inches	**150S/T**	50 Inches	**178S/T**	78 inches

TEL: 315-568-5844

Guaranteed Parts Company - Seneca Falls, New York 13148

BATTERY & STARTER CABLES

BATTERY CABLES (EXTRA HEAVY DUTY)



6 OR 12 VOLT INSULATED
1 GAUGE FOR SPECIAL APPLICATIONS

512	12 inches	**527**	27 inches	**540**	40 inches	**565**	65 inches
516	16 inches	**534**	34 inches	**553**	53 inches	**578**	78 inches
521	21 inches						

STARTER CABLE



Manufactured to S.A.E. specifications using concentrically stranded copper conductor. Has tough Neoprene insulation to protect against oil, acid and heat.

PART NO.	700	710	711	714
Gauge	00	0	1	4
Strand & Ga.	127 x 20	127 x 21	127 x 22	61 x 22
Nominal O.D.	.550	.505	.460	.360
Coil Length	25′	25′	50′	50′

SWITCH TO STARTER CABLES



6 OR 12 VOLT INSULATED

218	18 Inches	**236**	36 Inches
224	24.5 Inches	**252**	52 Inches

Insulated cables with adequate length can also be used for Engine to Ground connections.

TEL: 315-568-5844
Guaranteed Parts Company - Seneca Falls, New York 13148

MULTI-CONDUCTOR WIRE

MULTI-CONDUCTOR

Guaranteed Multi-Conductor Primary Wire has one white and one black wire—each separately insulated with PVC. Heavy outer jacket of gray vinyl gives full, lasting protection.

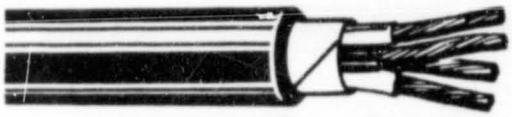


TWO CONDUCTOR

PART NO.	1602
Gauge	16-2
Strand & Ga.	19 x 20
Nominal O.D.	.168 x 280"
Spool	100'

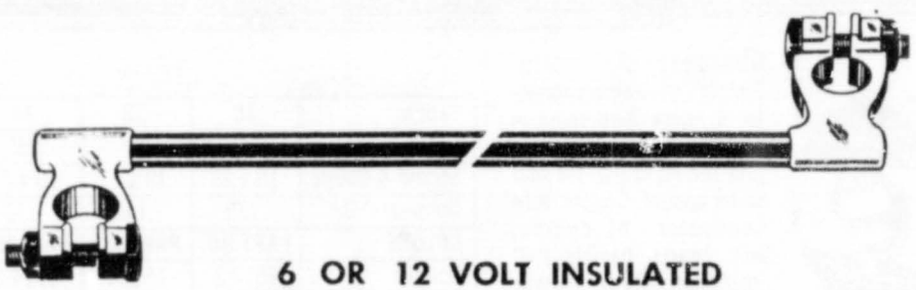
TRAILER LEADS

All Guaranteed trailer lead is jacketed with tough, black or red neoprene for long service. The copper conductors are individually rubber insulated and color coded. The 7 conductor is manufactured to A.T.A. and S.A.E. specifications.



PART NO.	1644	1646	1647	1657
Conductors	4	6	7	7
Gauge	14	14	1-10, 6-12	1-8, 1-10, 5-12
Strand & Ga.	41 x 30	41 x 30	105 x 30	168 x 30, 105 x 30, 65 x 30
Nominal O.D.	.470"	.580"	.690"	.690
Coil Length	100'	50'	50'	50'

BATTERY JUMPER CABLES



6 OR 12 VOLT INSULATED

308 8 inches | 315 15 inches

ORIGINAL PAGE IS OF POOR QUALITY

TEL: 315-568-5844
Guaranteed Parts Company - Seneca Falls, New York 13148

PRIMARY (SPOOLED) WIRE

SINGLE CONDUCTOR-P V C



High quality Primary (low tension) Wire for many uses in automotive vehicles, marine, industrial and farm equipment fields. Copper conductor. Insulation is PVC (Polyvinylchloride) — a plastic that is flexible, smooth — yet very tough. Select from a broad range of wire gauges and insulation colors.

Gauge	8	10	12	14	16	18
Spool	50′	100′	100′	100′	100′	100′
Strand & Gauge	19 x 21	19 x 23	19 x 25	19 x 27	19 x 29	16 x 30
Nominal O.D.	.215	.175	.142	.117	.104	.092
COLOR:	PART NO.	PART NO.	PART NO.	PART NO.	PART NO.	PART NO.
Black (0)	—	—	1312-0	1314-0	1316-0	—
Brown (1)	—	—	—	1314-1	1316-1	—
Red (2)	—	1310-2	1312-2	1314-2	1316-2	1318-2
Yellow (4)	—	1310-4	1312-4	1314-4	1316-4	—
Green (5)	—	—	1312-5	1314-5	1316-5	—
Blue (6)	—	1310-6	1312-6	1314-6	1316-6	—
Gray (8)	1308-8	—	—	—	—	—
White (9)	—	—	1312-9	1314-9	1316-9	—

SINGLE CONDUCTOR-HI TEMP



High Temperature Characteristics Withstand 350°F.

There is none better in Primary Wire. The thermo setting polyethylene insulation is "chemically cross-linked" to withstand higher temperatures than any other Primary Wire insulation. For all applications where extreme heat resistance — and durable performance — is important.

Gauge	14	16
Spool	100′	100′
Strand & Gauge	19 x 27	19 x 29
Nominal O.D.	.140	.120
COLOR:	PART NO.	PART NO.
Red (2)	1414-2	1416-2
Yellow (4)	1414-4	1416-4

SINGLE CONDUCTOR-MINI SPOOLS





Available only in package of 4

Guaranteed's "Mini Spools" of single conductor Primary Wire come in just the right length, for just the right job, for real sales appeal. Copper wire conductor, of course, with tough, flexible PVC insulation. These popular Mini Spools also come in attractive counter or shelf Merchandisers. (See Page 43.)

Gauge	10	12	14	16
Spool	12′	15′	25′	35′
Strand & Gauge	19 x 23	19 x 25	19 x 27	19 x 29
Nominal O.D.	.175	.142	.117	.104
COLOR:	PART NO.	PART NO.	PART NO.	PART NO.
Red (2)	1510-2	1512-2	1514-2	1516-2
Yellow (4)	—	—	1514-4	1516-4
Green (5)	—	—	1514-5	1516-5
Blue (6)	1510-6	1512-6	1514-6	1516-6

TEL: 315-568-5844

Guaranteed Parts Company - Seneca Falls, New York 13148

Gulf + Western Manufacturing Company

Electric Vehicle Components

Bohn Heat Transfer Division

1625 East Voorhees Street
Danville, Illinois 61832
Telephone: 217/446-3710

Heat Exchangers	Air to air, liquid to air and liquid to liquid designs. Custom manufacture.

Michigan Plating & Stamping Division

1860 Alpine Avenue, N.W.
Grand Rapids, Michigan 49504
Telephone: 616/363-4847

Fuel Tanks	Supplier to automotive industry of terneplate stamped and welded tanks.

Automotive Marketing and Engineering Center

Detroit Sales and Engineering Office
24114 Research Drive
Farmington Hills, Michigan 48024
Telephone: 313/478-8140

Relays	Miniaturized 12VDC to control circuits to 20 amperes.
Solenoids	Build to customer requirements.
Switches	Build to customer requirements.
Transducers	Current, Position, Pressure, Speed, Temperature, Torque, Voltage - Build to customer requirements.
Voltage Regulators	12VDC Solid State

Collyer Insulated Wire Division

100 Higginson Ave.
Lincoln, RI 02865
Telephone: 401/723-7800

Apparatus Cables	**Single conductor, Type A.I.A.** IPCEA S-28-357, NEMA WC-1; Underwriters' Lab. Sizes #4 AWG and larger. Asb. covered, 300V and 600V.
Appliance Wires	**Single conductor** Collyer P-400 THHN/THWN PVC/NYLON in those sizes which are 19W uncompressed. U.L. Listed Rate AWM 105°C Dry and 80°C in oil.
Control Cables	**Single and multi conductor** THERMOPLASTIC: Collyer C-141 — PZR — PE/NYLON condrs. PVC Jacket 600V, 1000V, 75°C. Collyer C-140 — PVC insulated and jacketed 600V. Collyer C-143 — PE/PVC conductors, PVC jacket 600V, 1000V. Collyer C-153 — PE/NYLON, PZR 90°C, PVC jacket 600V, 1000V. Collyer C-154 — THHN/THWN conductors Type T.C. U.L. Listed.

Collyer Insulated Wire Division

100 Higginson Ave.
Lincoln, RI 02865
Telephone: 401/723-7800

Control Cables	THERMOSET: Collyer C-150, C-151 — XLP insul. — PVC or Neoprene jacket 600V. Collyer C-148 — XLP XHHW FR-1 conductors, Type T.C. U.L. Listed. Collyer C-191 — EPR/HYPALON conductors — Neoprene or PVC jacket U.L. Listed Type T.C. Collyer C-190 — EPR insul. — Hypalon jacketed extra — flame resistant for nuclear station use. C-140, C-143, C-153, C-150, C-151, C-148, C-190 meet IPCEA — NEMA requirements. C-154, C-148, C-190 meet U.L. Type T.C. requirements.
Machine Tool Wire	**Single conductor** Collyer P-400 U.L. Type THHN/THWN when supplied with 19 wire or more stranding, non compressed, has U.L. Listing as MTW 90°C dry and 60°C in oil. Must be specially ordered.
Motor Lead Cables	**Single conductor — Flexible** IPCEA S-19-81, NEMA WC-3 — RUB. insul., neoprene jacket, 600V 75°C. IPCEA S-68-516, NEMA WC-8 — EPR insul., neoprene or hypalon jkt. 600V, 1000V, 2000V. 90°C. AAR581.3 — Rub. insul., Neop. jkt. diesel locomotive cable — 600V. AAR589 — Hypalon insul., 600V. — Also 1000V non AAR spec.
Traction Cable	**Single conductor** Collyer "Track Star", EPR insulated, Neoprene jacketed, 1000 volt. Also XLP insulated & EPR Insulated manufactured to any Transit company's specifications. 600V., 1000V, 2000V.
Tray Cable	**Multi-conductor power and control — U.L. Listed Type TC per NEC article 340** C-148 — XLP, XHHW FR-1 conductors, PVC jacket, 600V. C-154 — THWN/THHN conductors, PVC jacket, 600V. C-191 — EPR/Hypalon FR-1 conductors — Neop., or PVC jacket, 600V.

Eagle Signal Corporation

8004 Cameron Road
Austin, Texas 78753
Telephone: 512/837-8300

Battery Charger	In conjunction with the G+W zinc chloride battery program, Eagle Signal is currently developing a battery charger. Basic specifications are given below. Custom chargers or adaptations of the basic charger will be considered. Basic Specifications: AC Input Voltage — 230 VAC single phase 60Hz DC Rating — 140VDC 85 amperes continuous Control Range — From 10% voltage and current to 100% voltage and current Cooling — Convection Transformer — Class H insulation, Class B temperature rise Circuit Configuration — Single phase full wave thyristor bridge on secondary side of rectifier transformer Off Board Design
Controllers, Motor, Variable Speed	DC traction motor controller now under development. Custom manufacture.
DC-DC Converters (on board)	Under development. Custom manufacture.

Eagle Signal Industrial Controls Division

736 Federal St.
Davenport, IA 52803
Telephone: 319/326-8111

Control Relays

For very competitive specifications and prices contact EAGLE SIGNAL, 925 Lake Street, Baraboo, Wisconsin 53913, Telephone (608) 356-8321.

DESCRIPTION	CONFIGURATION	POLES	AMPERES
GENERAL PURPOSE			
6/12/24/120/240 VAC	Open Type, solder lug	1, 2, 3	5, 10
6/12/24/48/110 VDC	Open Type, quick disconnect	1, 2, 3	5, 10
	Open Type, printed circuit	1, 2, 3	5, 10
	Enclosed, Plug-in Octal Base	1, 2, 3	5, 10
	Enclosed, Plug-in, Octal base w/light	1, 2, 3	5, 10

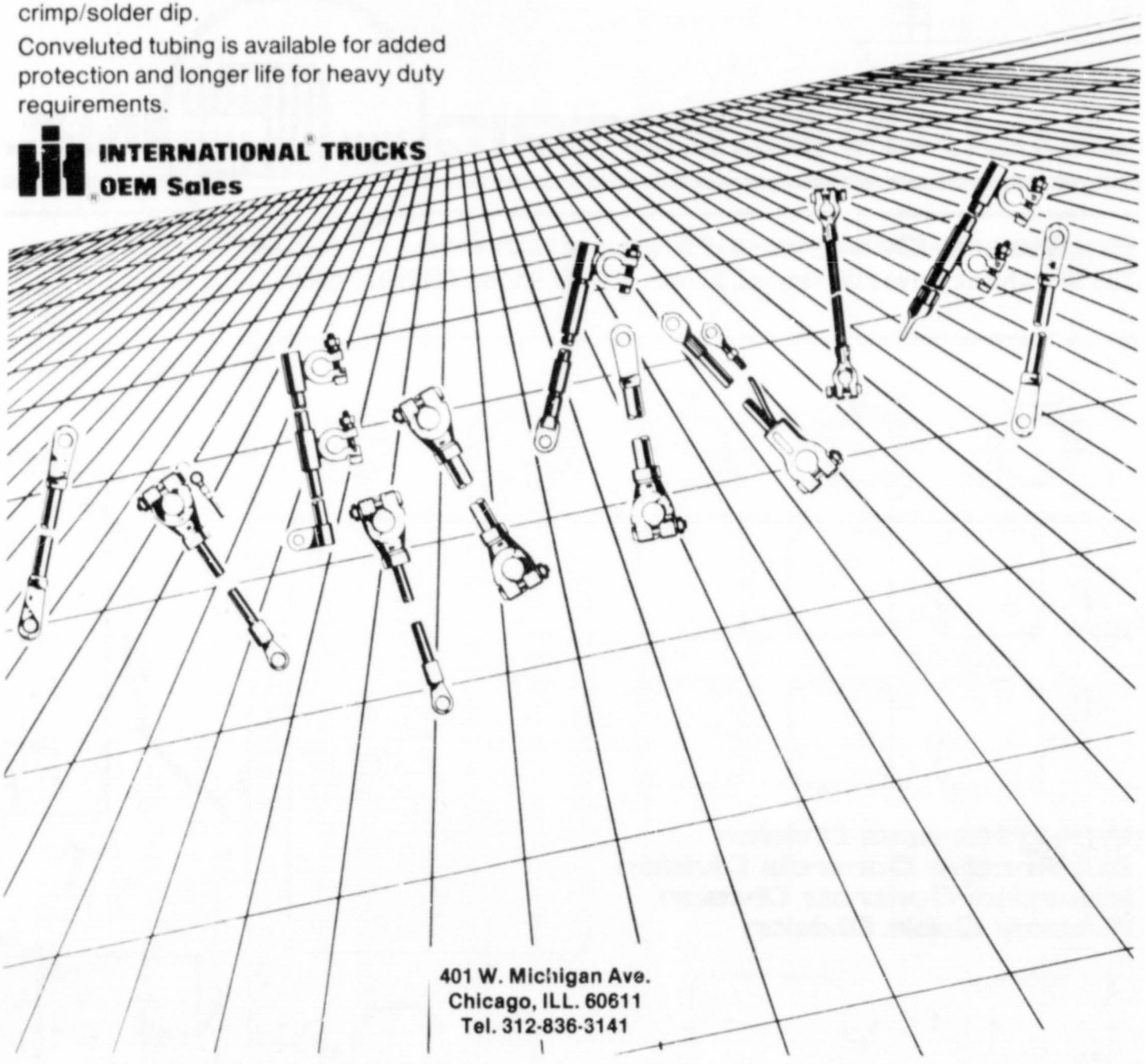
POWER TO MOVE A CHANGING WORLD

Battery Cables and ground straps...to fit your needs

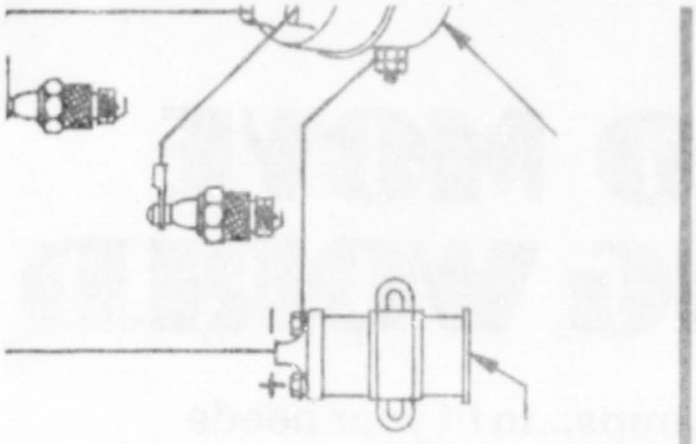
Battery cables in lug type, die cast, bolt-on, and crimp/solder dip available in 8 ga. to 0000 ga. in any length. Ground straps in lug, bolt-on and crimp/solder dip.

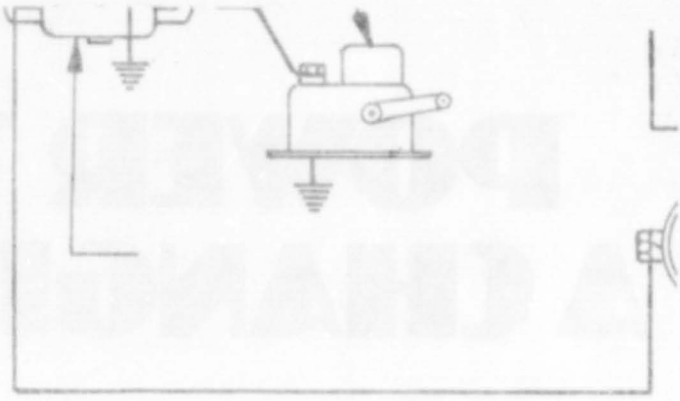
Conveluted tubing is available for added protection and longer life for heavy duty requirements.

INTERNATIONAL® TRUCKS
OEM Sales



401 W. Michigan Ave.
Chicago, ILL. 60611
Tel. 312-836-3141

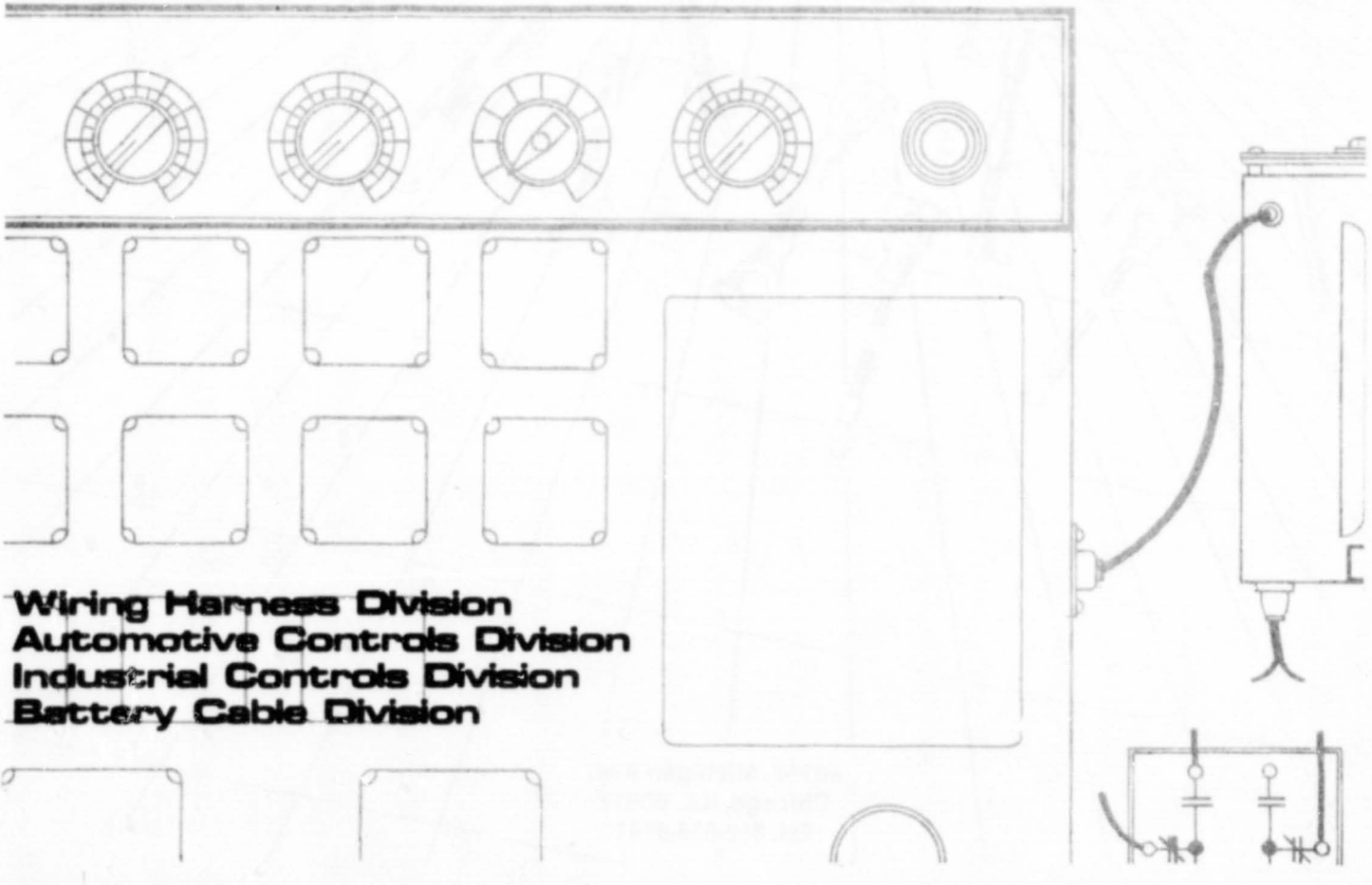




JULIAN ELECTRIC INC.

Engineers•Designers•Manufacturers

701 Blackhawk Drive / Westmont, Illinois 60559 / Phone: (312) 920-8950



Wiring Harness Division
Automotive Controls Division
Industrial Controls Division
Battery Cable Division

WE ARE DEPENDED ON FOR OUR INSTRUMENT PANEL AND AUTOMOTIVE CONTROL EXPERTISE!

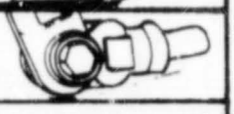
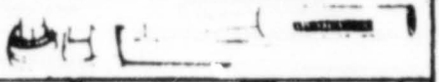
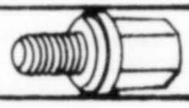
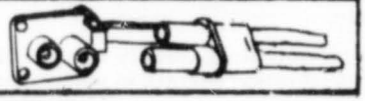
Julian Electric's extensive background in instrument panels for the heavy equipment and truck industry has made us a leader in the field.

By designing our own test modules for each panel we build we can GUARANTEE our panels 100% against all functional defects. Each panel is tested, vibrated and then re-tested. Tests are performed for all electrical, pneumatic and hydraulic functions. Our panels are complete. We manufacture and install, before testing, all harnesses required for a particular panel. The harness is then tested as a part of the panel. Our professionals are available to help our customers with the design of their instrument panels and harnesses.

Julian Electric is ready to give you this same full service on your panel requirements.

product index — battery cables

DESCRIPTION

Battery Applications — Series, Series-Parallel, Parallel, Top Stud or Side Post
Terminals for Starter Connector, prior to Sealing 
Top Stud Battery Sealed Connectors 
Top Stud Battery Stackable/Non-Stackable Sealed Connectors 
Side Post Battery Sealed Connectors 
Side Post Battery Stackable/Non-Stackable Sealed Connectors 
Pigtail Battery Cables Low Shoulder Provision 
"T" Splice Sealed Connectors 
Protective Caps and Boots 
Protective Jackets 
Nuts/Battery Cable Fasteners to Battery 
Emergency Start Connector 

JULIAN ELECTRIC INC.

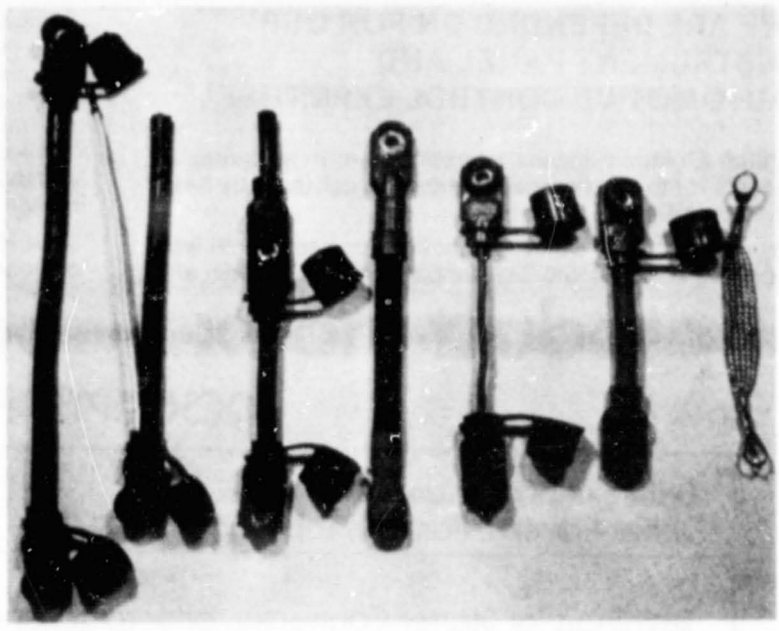
701 BLACKHAWK DRIVE
WESTMONT, ILLINOIS 60559
Phone (312) 920-8950

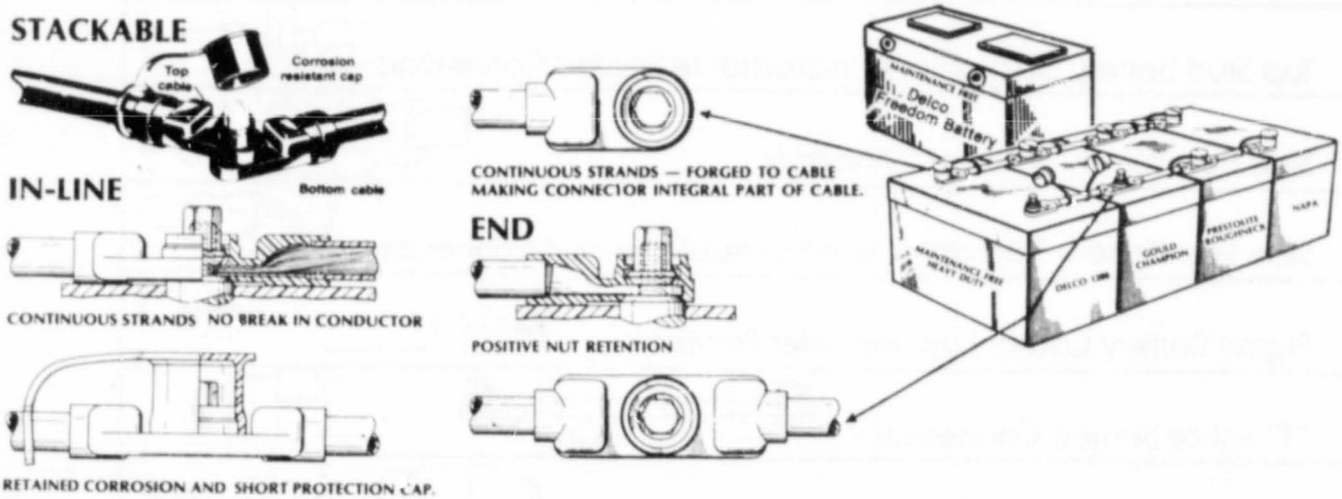
Engineers Designers Manufacturers

OUR OWN PATENTED MAINTENANCE-FREE BATTERY CABLES

Julian Electric developed superior cable assemblies for use with ANY number of maintenance free batteries (Top Stud) or side post. The assemblies consist of **in-line connectors** without breaking the conductor, or **stackable** versions, cable, sealing, nut, **and** a unique protective cap for electrical short protection and added environmental sealing.

- Patent No. 4,049,335, only one of kind approved
- Lowest millivolt drop connector available
- Solid copper connectors, break strength exceeds cable strength
- Complete metal compatibility
- Color coding, private labeling provisions
- **Any Cable Combination**, 1/0, 2/0, 3/0, 4/0
- Very economical due to routing choices
- Used on farm, construction, off the road equipment, trucks, generators
- Gould
- Delco approved
- Prestolite
- Free samples





WE MANUFACTURE WIRING HARNESS ASSEMBLIES TO EXACTING SPECIFICATIONS

We specialize in assembling wiring harnesses for heavy off-the-road vehicles. Our production know-how and modern facilities enable us to give you fast delivery of any quantity.

Our thorough and strict quality control program in all phases of production results in exceptional reliability and performance. All solder type multiple pin connections are hi-potential tested.

We manufacture to your most exacting specifications, or will design and build to meet your requirements.

Julian Electric strives to give you the most personalized service in the industry. Whatever your needs, send us your specifications or contact us. We'll give you fast, accurate, complete quotations. Also UL approved labels supplied as required. Julian is listed under file no. E 65202.

JULIAN ELECTRIC INC.

701 BLACKHAWK DRIVE
WESTMONT, ILLINOIS 60559
Phone (312) 920-8950

Engineers Designers Manufacturers

A STORY OF OUTSTANDING GROWTH

During his long, distinguished career with General Electric Corporation, Victor J. Julian had observed that there was a need for a specialized service to industry in control panel system design and engineering. When he retired from his executive post with GE, he decided to do something about it. Mr. Julian, a registered professional engineer, organized what was then called Julian Electric Service & Engineering Co. in June of 1960.

First contract for the fledgling company was a major one that got Julian Electric off to a good start. It was with Argonne National Laboratories, to build graphic display panels and instrumentation relay racks for the laboratory synchrotron.

In 1963, 1968, 1975 and 1980, significant additions to Julian capabilities were made when manufacturing facilities were expanded to produce wiring harness assemblies for off-the-road heavy equipment, battery cables and instrumentation.

Julian's strong growth trend was sparked over the years by the addition of a number of important manufacturing customers who are leaders in such major industries as building materials, food processing, electrical appliances and a wide range of electrical equipment, heavy farm and industrial equipment, automotive, trucking and many others.

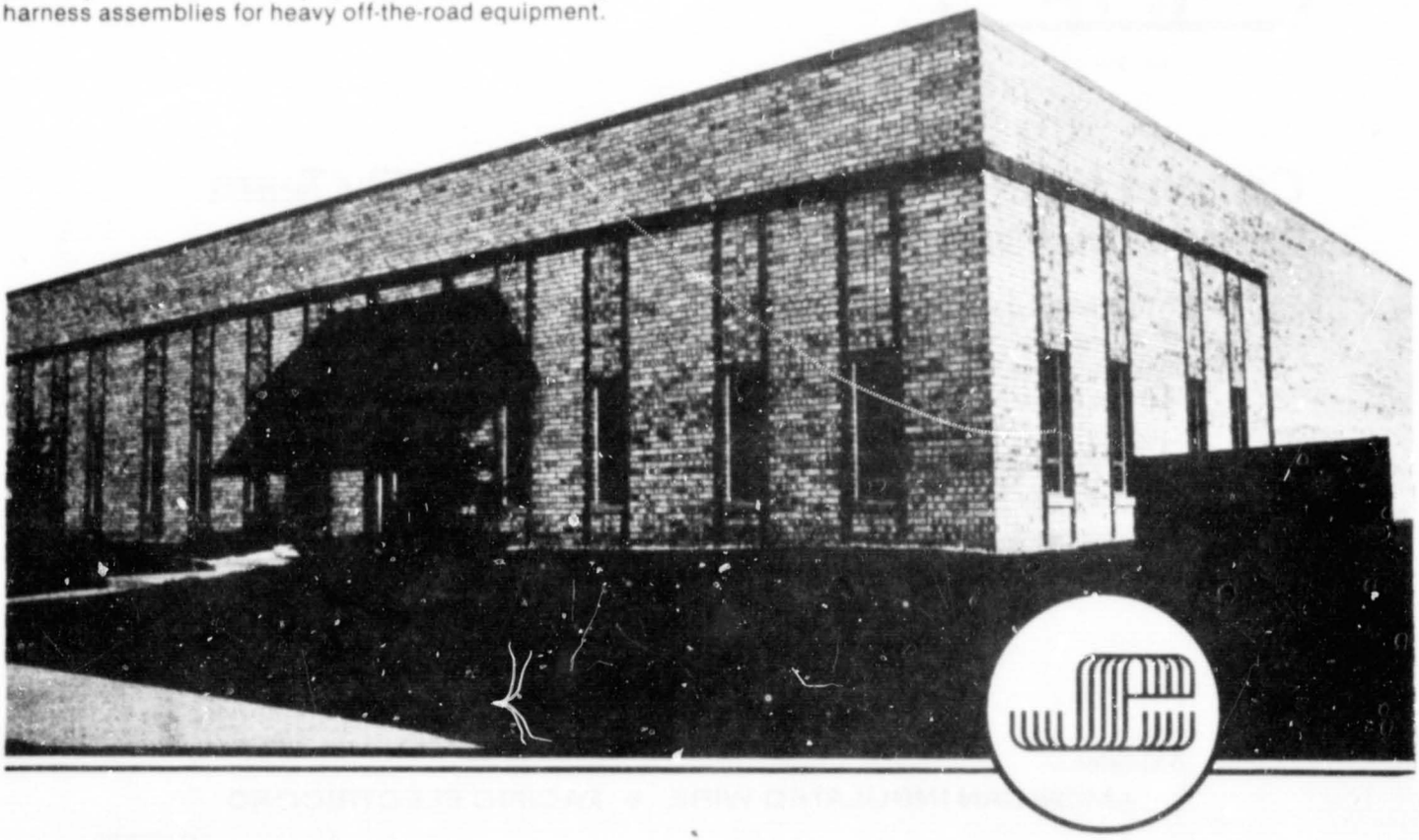
Today, Julian Electric is a leader in its areas of specialization. The major original equipment manufacturers in the Midwest take advantage of our electrical engineering know-how for design and production layout of control, sensing, system interpretation, process intelligence, relay logic, switchgear and timing systems. And major manufacturers throughout the nation rely on Julian as a top quality supplier of wiring harness assemblies for heavy off-the-road equipment.

JULIAN ELECTRIC INC.
EASILY ACCESSIBLE LOCATION

Located in a western suburb of Chicago, Julian Electric is just 20 minutes from O'Hare International Airport, 30 minutes from downtown Chicago or Midway Airport via expressway, and only minutes away from the intersection of interstate expressways.



701 Blackhawk Drive / Westmont, Illinois 60559 / Phone: (312) 920-8950



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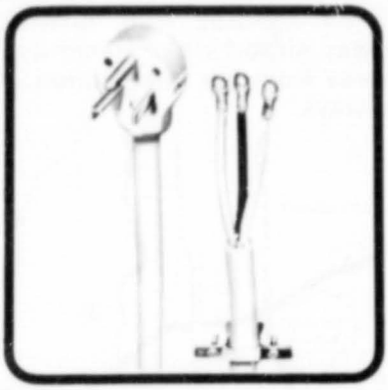
Power Cables



No. 932

2-pole, 3-wire grounding round vinyl cable with unbreakable molded-on right-angle plug.

Cord type: 3 No. 10 ST

30A-125V **NEMA 5-30P**



No. 935

2-pole, 3-wire grounding round vinyl cable with unbreakable molded-on right-angle plug.

Cord type: 2 No. 6; 1 No. 8 ST

50A-250V **NEMA 6-50P**

Call on Leviton's Custom Design Capability Team for personal attention to your requirements.

Whatever you need—be it a consultation with the engineering-wise Marketing Manager of our Appliance Products Division, or a full-scale meeting between your staff and ours, including the Chief Engineer of our Design Capability Team—you'll find that the session is more like a think-tank experience than the usual cut-and-dried "what-do-we-have-that-we-can-sell-you?" Not that we don't have a vast product line to show you. We do. We offer a complete line of wiring devices, power supply cords, wire and specialty cable, which is what we mean by "Total Capability from a Single Source".

Phone us at 212-229-4040, ext. 532. Or write Mr. Lou Vlismas, Marketing Manager, Leviton, 59-25 Little Neck Parkway, Little Neck, N.Y. 11362.

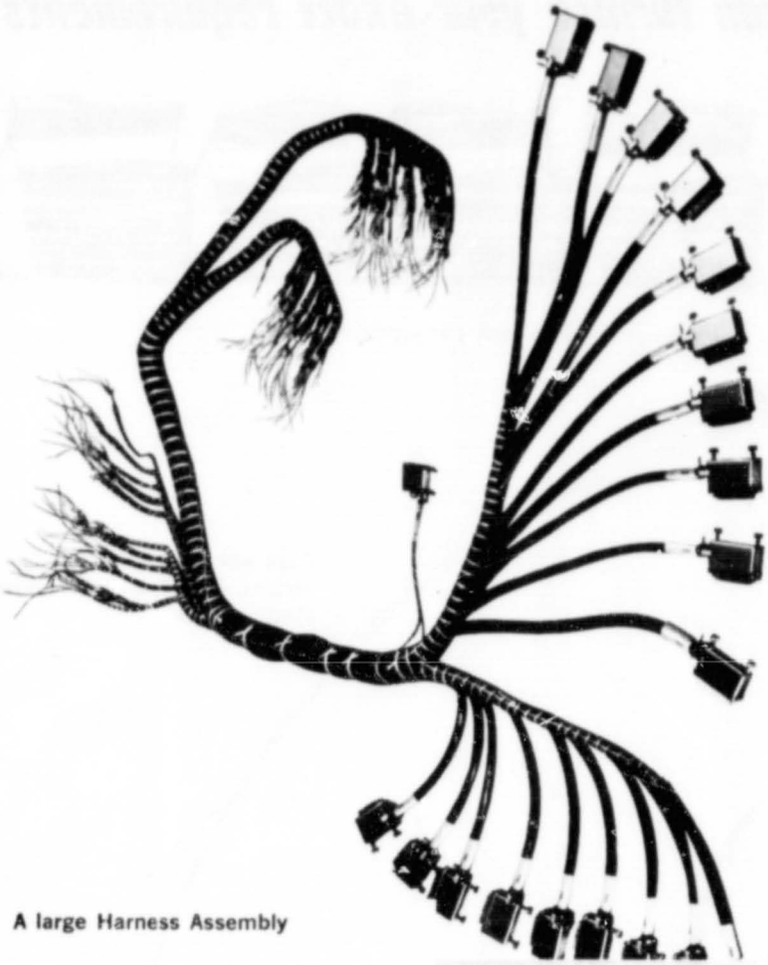
LEVITON

Affiliates:

AMERICAN INSULATED WIRE • PACIFIC ELECTRICORD

CM-277/J80

Mercury ELECTRONICS CORPORATION



A large Harness Assembly

Our business has grown and expanded steadily since it was established in 1946. (Until January 1, 1964 we were known as Mercury Engineering Corporation.) Our wide field of endeavor in the cable, harness, and electronic assembly field enables us to render an economical service.

Quality and workmanship are of the highest caliber. Whatever your requirements, we welcome the opportunity to quote them for you.

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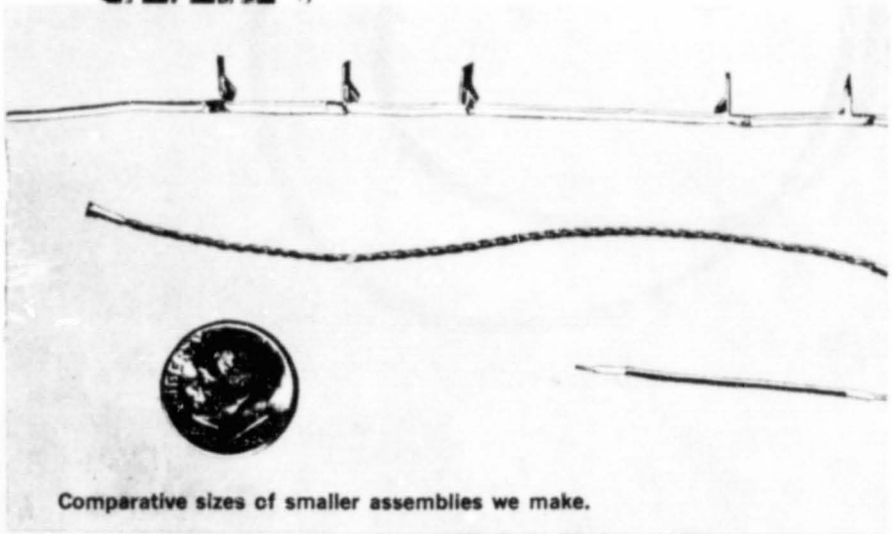


Comparative sizes of smaller assemblies we make.

MERCURY ELECTRONICS CORPORATION

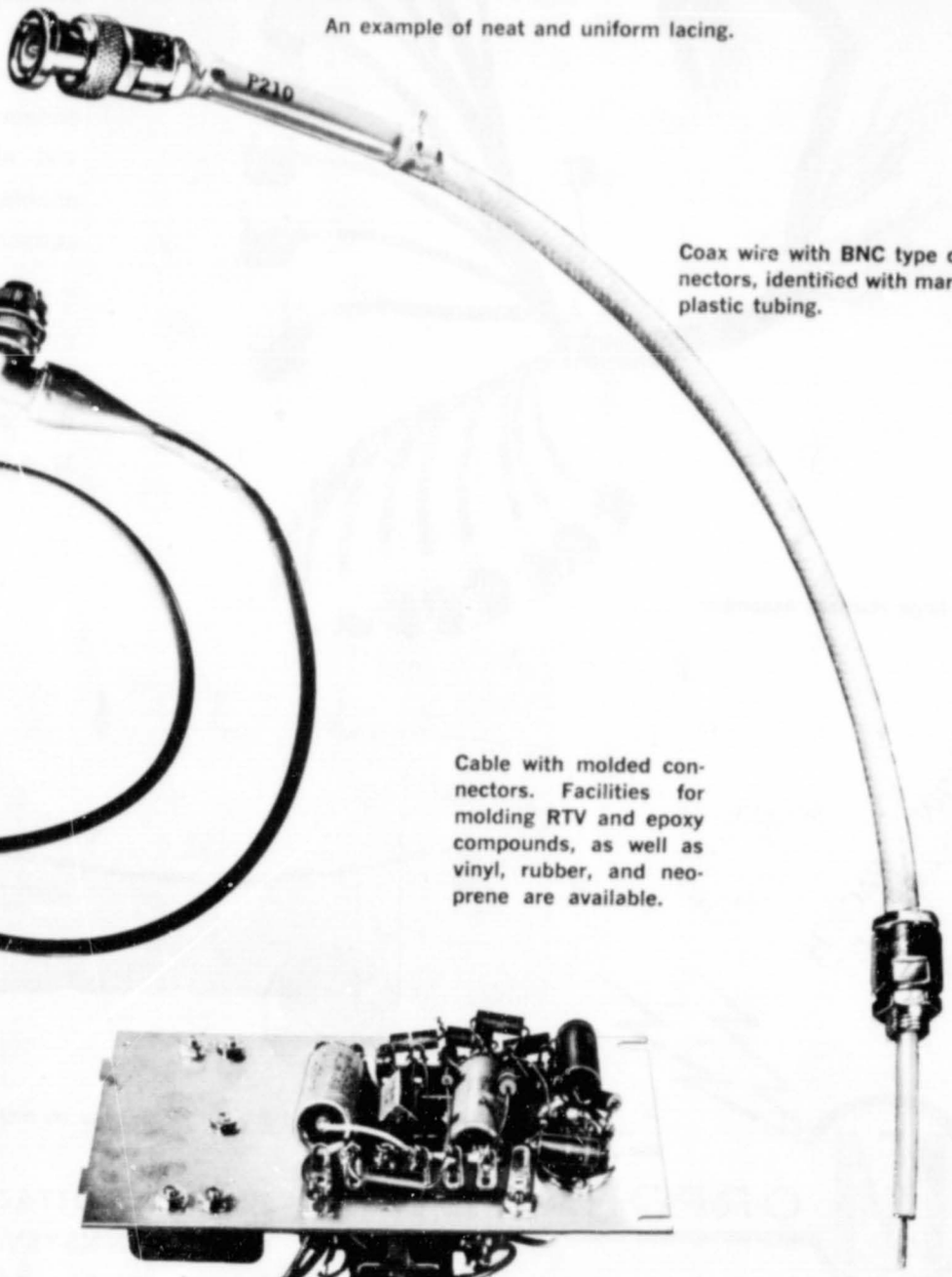
339 EAST COTTAGE PLACE
YORK, PENNSYLVANIA. 17403
AREA CODE 717-854-9557

339 EAST COTTAGE PLACE, YORK, PENNSYLVANIA 17403
AREA CODE 717 854-9557

Mercury can furnish your exact requirements



An example of neat and uniform lacing.



Coax wire with BNC type connectors, identified with marked plastic tubing.

Cable with molded connectors. Facilities for molding RTV and epoxy compounds, as well as vinyl, rubber, and neoprene are available.

Vast experience in mounting and soldering of capacitors, resistors, diodes, etc. enable us to produce electronic assemblies of the highest quality.

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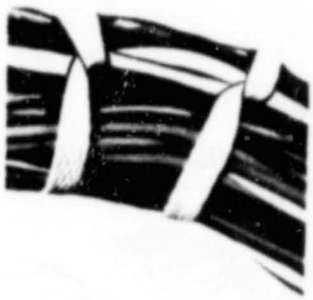
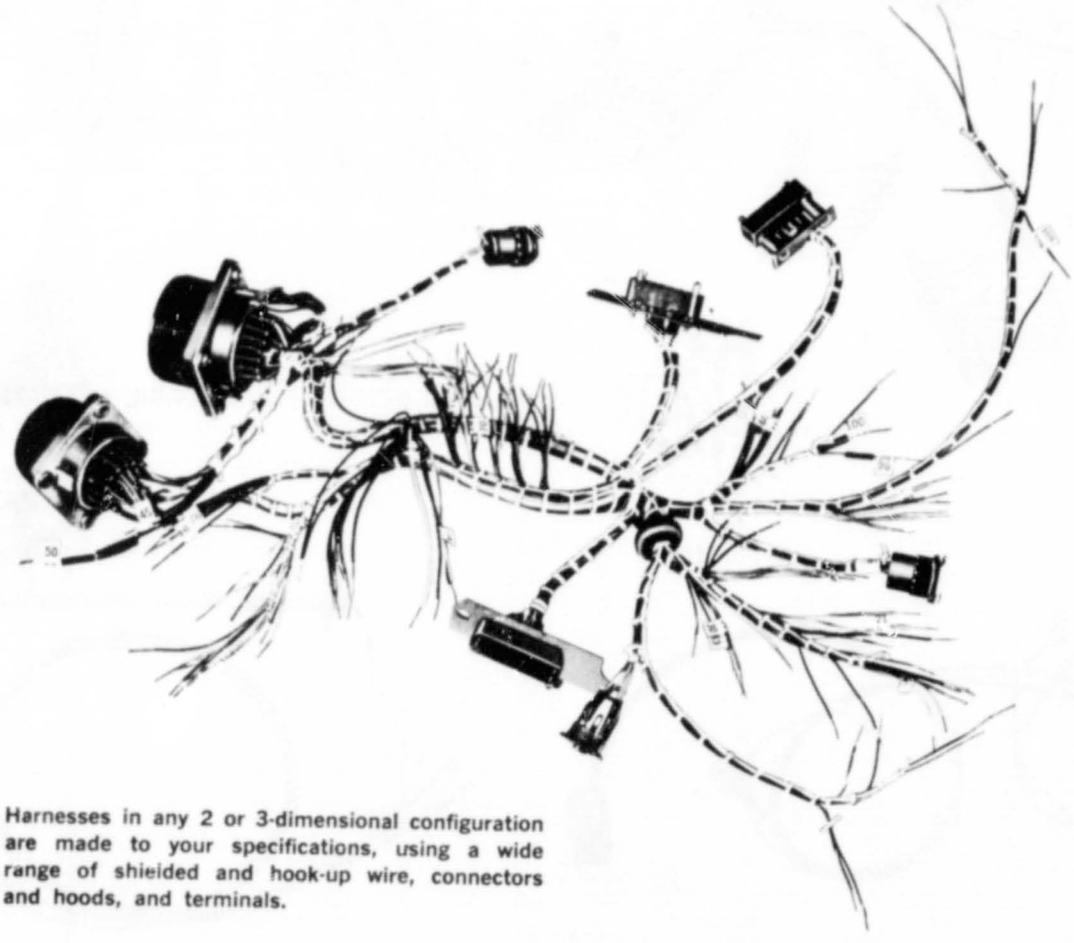
Mercury can furnish your exact requirements





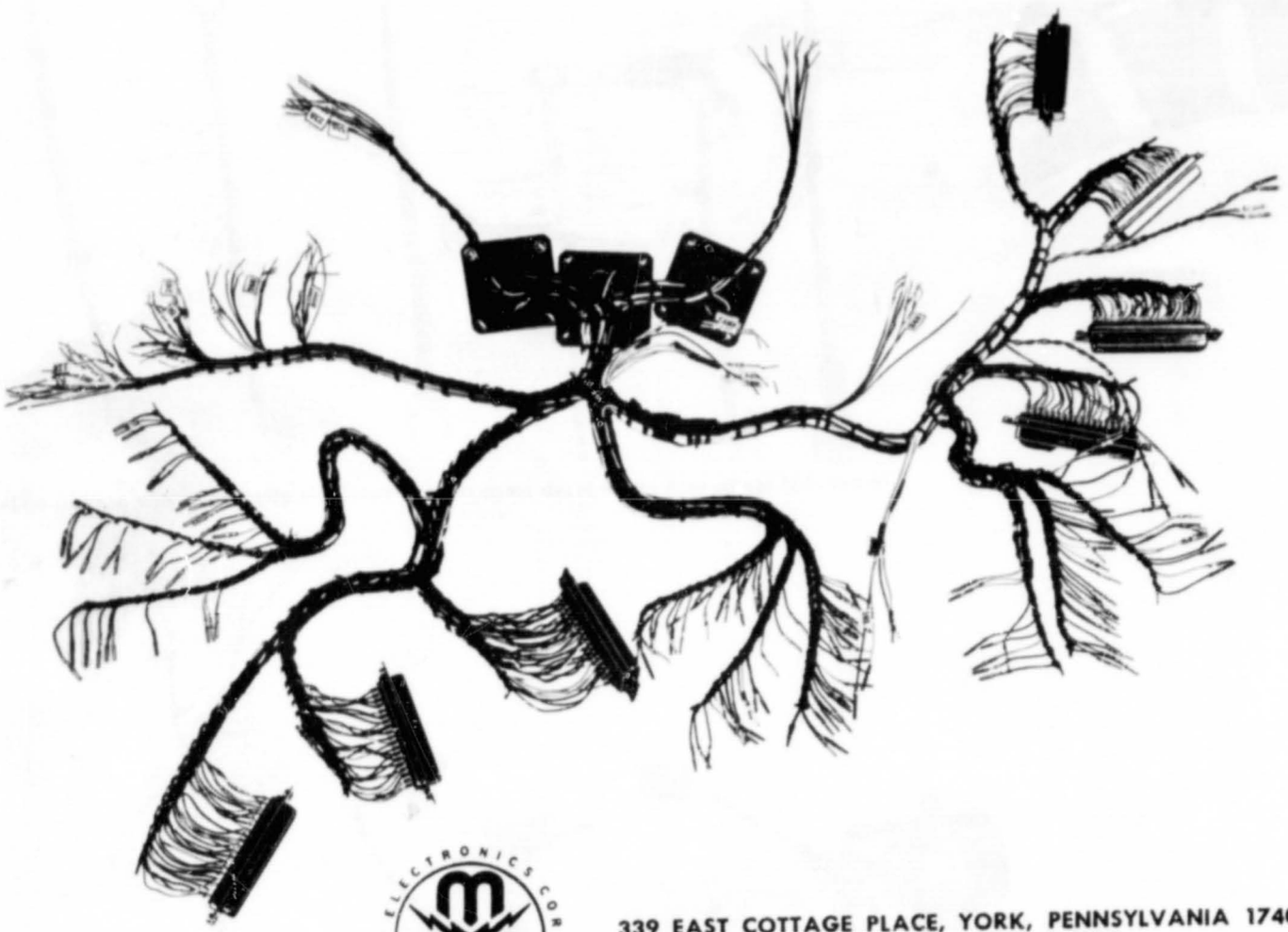
Terminated leads, with either loose piece or strip terminals attached to one or both ends.



Harnesses in any 2 or 3-dimensional configuration are made to your specifications, using a wide range of shielded and hook-up wire, connectors and hoods, and terminals.

Mercury can furnish your exact requirements

- TERMINATED WIRES • BRAIDING • SHIELDING
- ELECTRICAL WIRING HARNESSES • CABLE ASSEMBLIES
- WIRE CUT AND STRIPPED TO SPECIFICATIONS
- POTTING • MOLDING • ELECTRONIC ASSEMBLY



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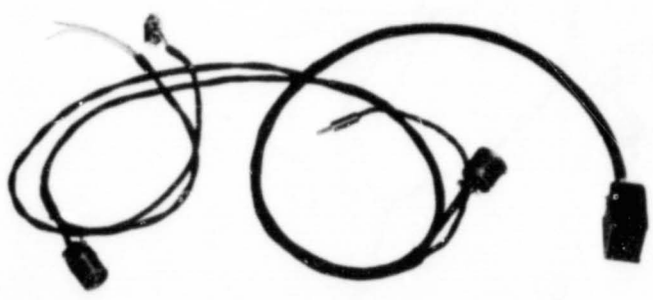
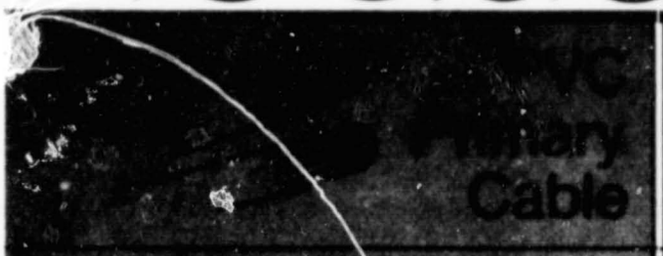




Packard Electric

Division of General Motors Corporation
P.O. Box 431 Warren, Ohio 44486
Tel. 216-373-2633

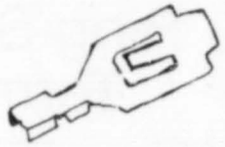
Product Index

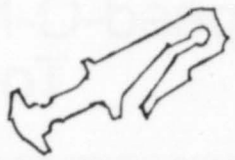

PVC Primary Cable

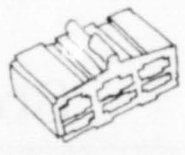

Pack-X Primary Cable


PVC Battery Cable

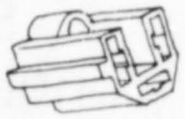

Pack-X Battery Cable

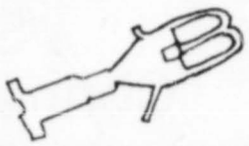

56 Series Female Terminals


56 Series Male Terminals

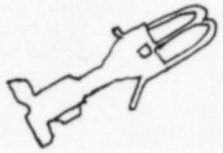

56 Series Connectors

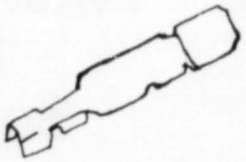

59 Series Female Terminals

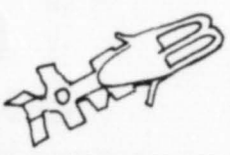

59 Series Connectors


Pack Con Female Terminals


Pack Con Male Terminals


Pack Con Female-H.D. Terminals


Pack Con Male-H.D. Terminals


Pack Con II Female Terminals

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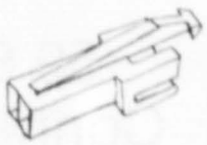
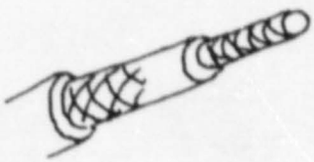
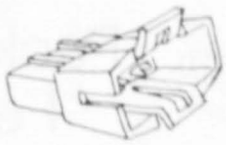
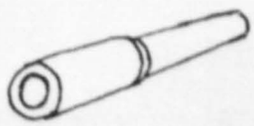
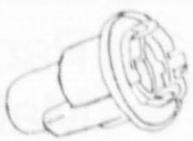
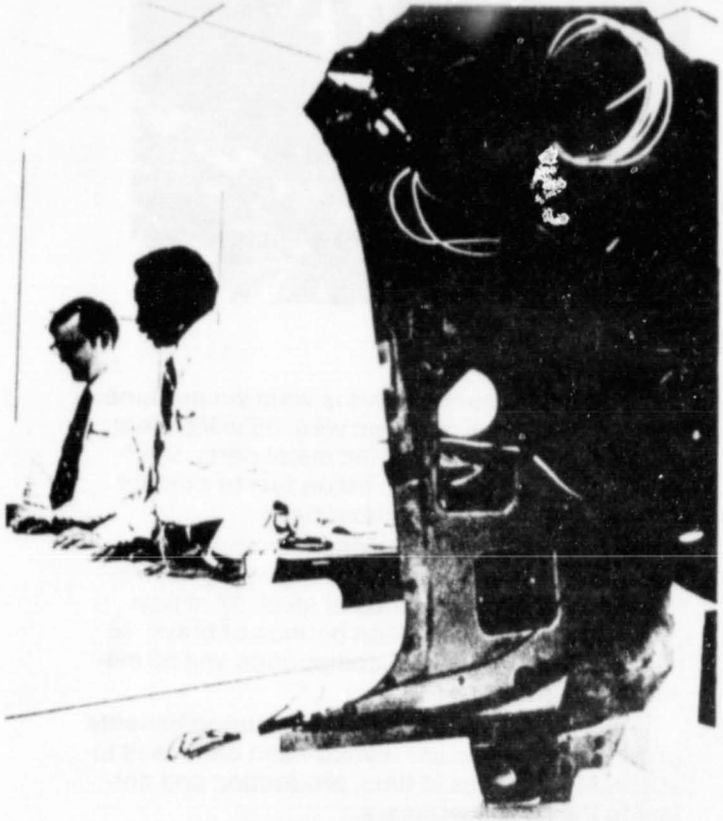
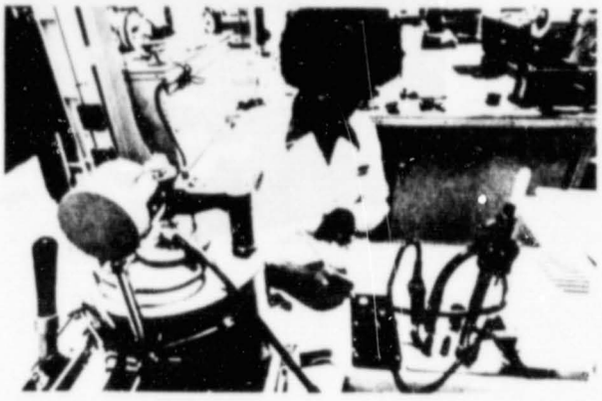
Product Index

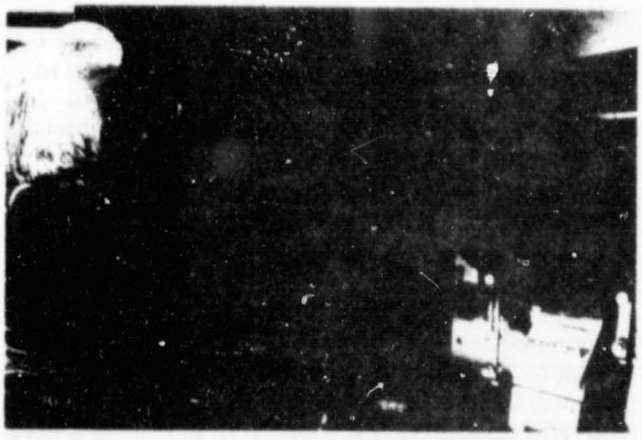
 Pack Con Series Connectors	 Ignition Cable
 Pack Con II Series Connectors	 Ignition Terminals
 Auto Fuseblocks	 Ignition Boots and Nipples
 Auto Fuseblock Terminals	 Punch-Pack Ring-Spade Terminals
 Twist Lock Lamp Sockets	 Speed-O-Matic Tooling
 Wedge Base Lamp Sockets	 Low Profile Lamp Sockets

PACKARD ELECTRIC...

remarkable capability at your call.







In engineering, in design and in manufacturing capacity, few if any producers of automotive energy distribution systems can match Packard Electric.

Or offer you the servicing, counseling, technical knowledge, and broad experience of the Packard team.

Your own task force

The task force concept gives you the best of both worlds: manufacturing, testing and engineering facilities combined with a responsive, no-red-tape capability usually found only in smaller companies.

A qualified Packard sales engineer is available to answer questions, supply additional data and provide the basis for a relationship that results in substantial savings in time, production and dollars.

Testing Facilities

When you choose Packard, you'll also acquire testing facilities that include engineering labs, a fleet of vehicles that log over a quarter of a million miles per year, and access to all General Motors proving grounds and test facilities.

PACKARD ELECTRIC

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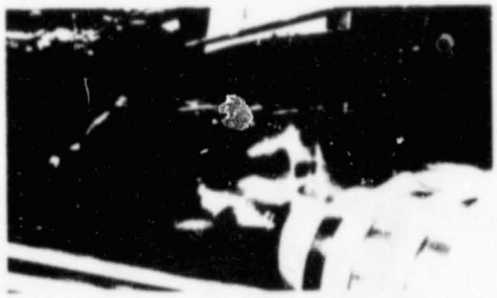
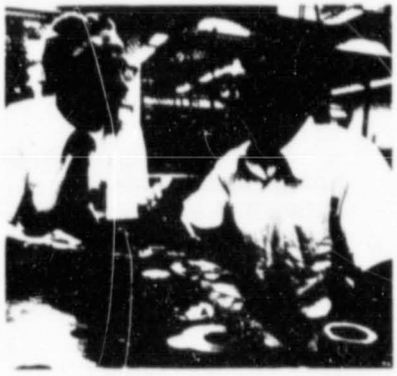
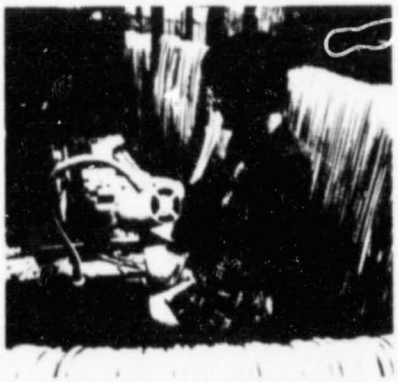
remarkable capability at your call.









Manufacturing capacity

Judge for yourself—this is what we produce daily: 98,000 miles of drawn wire, 35 million feet of cable extrusion, 16 million metal parts, 5 million molded parts, over a million feet of conduit extrusion and 820,000 rubber parts.

We process more silicone compound than any facility in the world and annually use 58 million fuses, 5 million pounds of steel, 57 million pounds of copper, 9 million pounds of brass, 46 million pounds of plastic compounds and 53 million automotive lamps.

The engineering and manufacturing benefits of Packard Electric are myriad—and can result in substantial savings in time, production and dollars to Packard customers.

Innovation is our tradition.

Our leadership in vehicle wiring is widely acknowledged. Packard was among the first to use plastic insulation, nylon jacketing, cross-linked polyethylene and aluminum core cable in automotive applications.

We pioneered the use of electronic modules in wiring harnesses, the use of special wiring in place of block resistors, and printed circuits on mylar.

Fiber optics, High Energy Ignition wiring, side terminals for batteries, fuse blocks, convoluted conduit, high performance connectors—this is but a small sampling of the innovation, the progressiveness and leadership of Packard and its people.

PACKARD ELECTRIC

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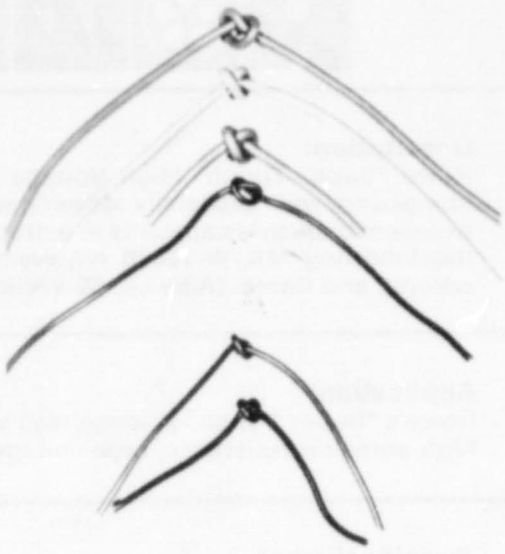
P.O. Box 431 Warren, Ohio 44486

Tel. 216-373-2633

ROWE



"SUPER TOUGH" HIGH VOLTAGE SILICONE LEAD WIRE

FEATURES

- "Super Tough" Insulation
- Thru 60 KVDC Voltage Ratings
- 22 Thru 12 AWG Conductor
- 65°C to 200°C Temperature Rating (250°C Intermittant)
- Excellent Ozone & Corona Resistance
- High Flexibility
- Radiation Resistance

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ROWE INDUSTRIES
CONNECTORS • CABLE ASSEMBLIES • ELECTRONIC PRODUCTS
6225 BENORE ROAD • TOLEDO, OHIO 43612 • (419)729-9761
WEST COAST OFFICE: (213) 235-2070 AND (415) 969-4831

SPECIALISTS IN CORONA-FREE HIGH VOLTAGE INTERCONNECTIONS

ROWE TECHNICAL DATA

Description:
Rowe "Super Tough" High Voltage Silicone Lead Wire uses Rowe Silicone compound R790. This compound was especially developed for high abrasion resistance requirements and also exhibits excellent dielectric capability in extreme environments. Silicone Compound R790 also meets or exceeds the following MIL-W-16878 requirements: Abrasion resistance, fungus, ozone, chemical, moisture, corona, and flame. (Also UL 62 Vertical flame test)

Application:
Rowe's "Super Tough" silicone lead wire has been used in military, space, and industrial areas where high abrasion resistance, high voltage, and flexibility are major requirements.

Specifications:*

Wire Construction	See Table Below
Conductor	Silver Plated Copper Stranding
Insulation	Rowe Compound R790 Extruded Silicone White
Temperature Rating	200° (250°C Intermittent)
Voltage Ratings	DC as shown

Rowe Cat. No.	AWG Size	Strand	Nom. Wall Thick-ness (Inches)	O.D. Nom.	Max Volt. Rating
R790-1522	22	7/30	.040	.110	15KV
R790-2022	22	7/30	.050	.130	20KV
R790-1520	20	10/30	.040	.120	15KV
R790-2020	20	10/30	.055	.150	20KV
R790-3020	20	10/30	.075	.190	30KV
R790-2518	18	19/30	.060	.160	25KV
R790-2016	16	41/32	.050	.161	20KV
R790-3516	16	41/32	.100	.265	35KV
R790-4516	16	19/29	.118	.300	45KV
R790-6016	16	26/30	.160	.380	60KV
R790-3014	14	7/22	.090	.256	30KV
R790-6014	14	19/27	.155	.385	60KV
R790-2012	12	65/30	.055	.205	20KV
R790-3012	12	65/30	.090	.275	30KV
R790-4012	12	65/30	.120	.335	40KV
R790-5012	12	65/30	.160	.414	50KV

*Please consult factory for variation in conductor stranding, plating, AWG Size, Insulation Color, and Voltage rating (AC or pulse). Rowe stocks a number of special configurations.

ROWE INDUSTRIES
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West Coast Office:
(213) 235-2070 and (415) 969-4831

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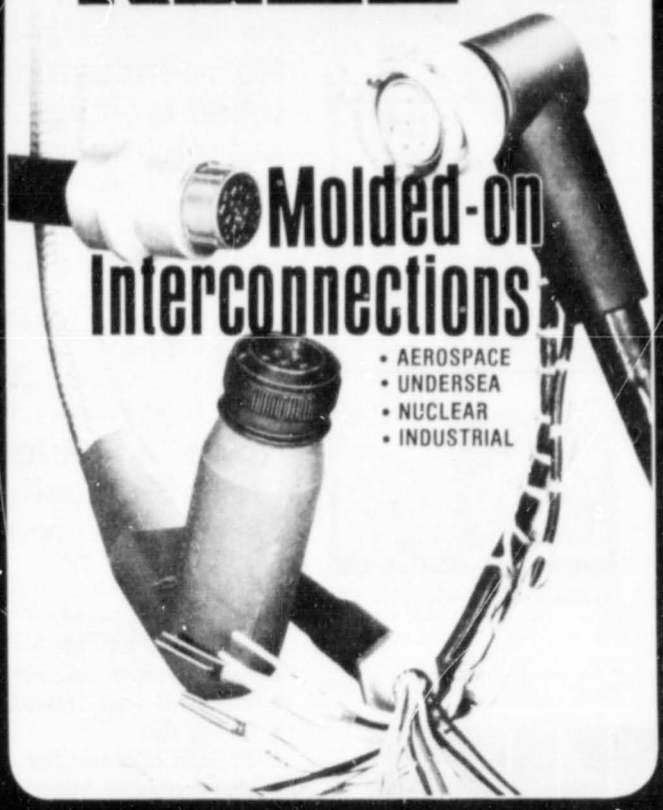

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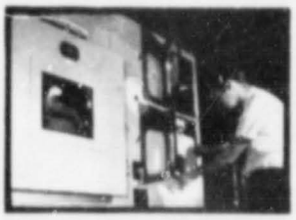
• Design • Development • Manufacturing • Testing of



Life testing facilities.



High-altitude pressure chamber.



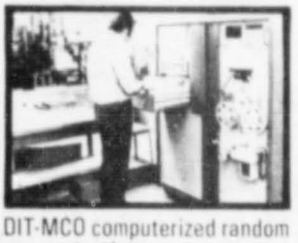
RFI-EMI-EMP test chamber.



High-voltage, corona and dielectric test chamber.



Humidity chamber.



DIT-MCO computerized random access testing.



X-Ray Equipment



Hydrostatic pressure testing.

Specialized Connectors and Cable Assemblies

Since 1947, Rowe Industries has been foremost in the design and manufacture of specialized connectors and cable assemblies. To date, Rowe engineers have enhanced the state-of-the-art by designing and perfecting over 700 specialized interconnections for which tooling is available.

Rowe Industries offers these facilities:

- Complete design capability
- Engineering staff
- Complete tooling and machining capability
- Complete wire and cable manufacturing/cabling
- Automated and sophisticated production techniques
- Inspection to Mil-I-45208, Naval Nuclear and High Production

Rowe Industries offers these test facilities:

- Six hydrostatic pressure chambers
- Altitude chamber
- Five temperature chambers
- Humidity chamber
- DIT-MCO computerized circuit testing
- Two random access circuit analyzers
- RFI-EMI test chamber
- X-Ray lab
- Optical comparitor
- Metalurgical microscope
- Four high-voltage test sets
- Two AC corona test sets
- Two DC corona test sets
- Life testing

ROWE INDUSTRIES

CONNECTORS • CABLE ASSEMBLIES • ELECTRONIC PRODUCTS

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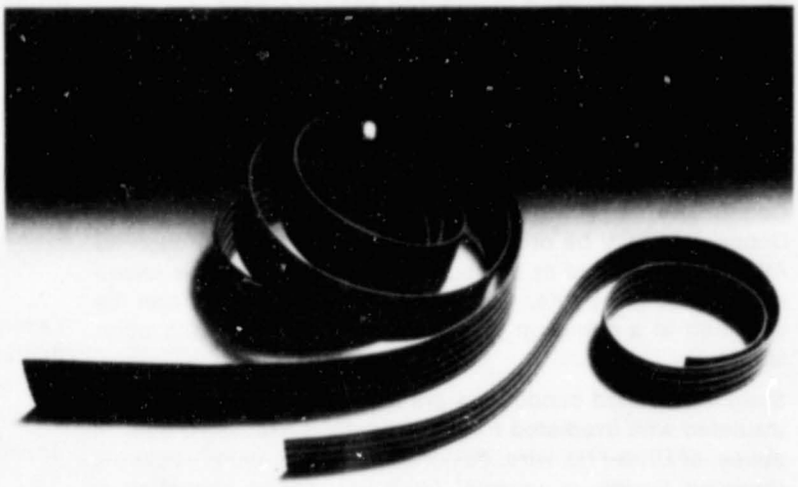
SPECIALISTS IN CORONA-FREE HIGH VOLTAGE INTERCONNECTIONS

SPECTRA-STRIP

SPECTRA-BOND™ PLANAR CABLE SERIES SS

FEATURES

- Low-cost planar cable for point-to-point wiring
- Up to 30 conductors, color coded for positive identification
- Highly flexible PVC insulation, easily separated for circuit routing
- UL style or CSA certification available



CHARACTERISTICS

PHYSICAL:

Conductors:	22-30 AWG 7 and 19 strand, Tinned copper
Conductor insulation:	.010 nom. wall, flame retardant PVC
Number of conductors:	10-30
Color code:	brown, red, orange, yellow, green, blue, violet, gray, white, black (repeat)

ELECTRICAL:

Voltage rating:	.010" nom. wall: 150V per UL 1568 300V per UL 1061 600V per MIL-W-16878D, Type B .016" nom. wall: 300V per UL 1007 1000V per MIL-W-16878D, Type C
Temperature rating:	+80°C per UL −55° C to +105° C per MIL-W-16878D
Impedance:	(see chart, next page)
Capacitance:	(see chart, next page)
Insulation resistance:	10^{10} ohms/10 ft
UL style number:	Cable Style 2697 (80°C, 300V) Cable Style 2713 (80°C, 150V)

Cable Style 2697 may be certified under Canadian Standards Association (CSA) Appliance Wiring Material Program (specify UL Style or CSA at time of order).

DESCRIPTION

Bonded planar cable was originally developed, patented and introduced by Spectra-Strip. It is used today in a great variety of interconnective systems and point-to-point wiring applications. Bonded flat ribbon cables reduce both cost and packaging volume because they can be contour-formed, are self-supporting with minimum clamping, and dissipate heat faster than round multi-conductor cable. Bonded cable is fully-compatible with standard termination techniques, such as soldering, crimping and wire wrapping.

Spectra-Strip Type SS bonded cable consists of stranded round conductors insulated with color-coded PVC and bonded together by a patented process* to form a flat ribbon. Standard Type SS sizes are stocked and packaged in 100-foot lengths.

A wide range of specially designed and produced constructions can be obtained by consulting the factory, including Ultra-Flex™ (see page 27), Irradiated PVC, Twisted Pairs, special striping and color coding, intermix of wire sizes, as well as coaxial cable.

*U.S. patents—3,005,730; 3,208,869

SPECTRA-STRIP
7100 LAMPSON AVENUE · GARDEN GROVE, CALIFORNIA 92642
TELEPHONE (714) 892-3361

HOW TO ORDER:

SS – 1022 – 19B – X

- SS — Prefix for bonded cable type
- 1022 — Number of conductors
- 22 — Size of conductors (AWG)
- 19 — Number of strands per conductor
- B — Type of insulation
- X — Special features (color code, etc.)

Special 3C Cable Design Guide

SPECTRA·STRIP
7100 LAMPSON AVENUE · GARDEN GROVE, CALIFORNIA 92642
TELEPHONE (714) 892-3361

3C Custom-Designed Laminated Planar Cable

Spectra-Strip 3C (Controlled Characteristics Cable) has broad versatility. Cables can be customized precisely to application requirements.

Conductors
Conductors may be ordered in any size from 30 through 16 AWG, pre-insulated or uninsulated, and sizes can be mixed within a single cable. Any number of conductors can be specified in a cable up to 8" cable width, depending upon layout.

Special insulated conductors are available, such as XL wires insulated with irradiated PVC to withstand excessive heat or abuse, or Ultra-Flex wire, designed for applications requiring repeated flexing or unusual flexibility. Teflon insulation is available for its superior electrical properties.

Color Codes
In addition to the standard ten-color code, Spectra-Strip also offers a choice of color sequence, special colors or stripes.

Spacing
Spectra-Strip can furnish any desired spacing between conductor centers, including varied spacing within a single cable.

Insulations

Insulating Material	Dielectric* Constant
Air	1.0
Teflon	2.1
Polyethylene	2.5
Polyester	3.2
PVC	3.4

*Smaller Dielectric Constant has smaller propagation delay (faster signal speed).

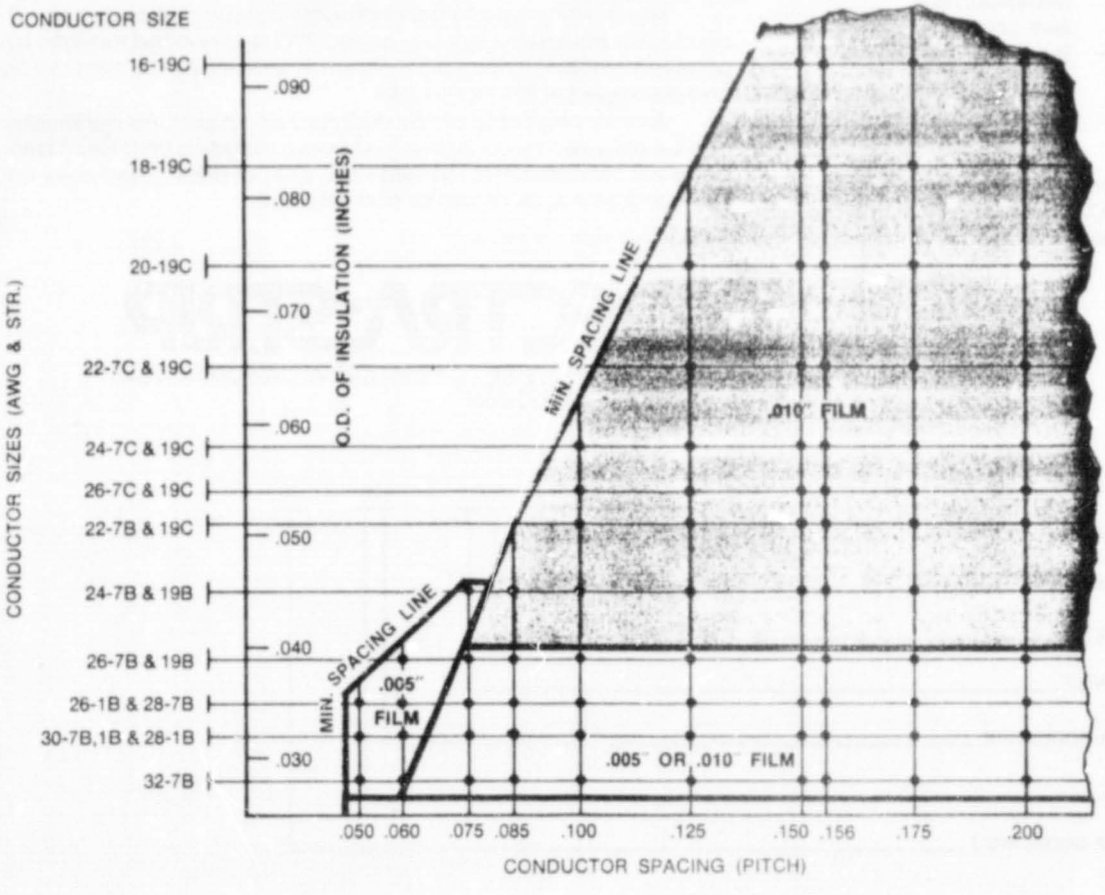
Laminate Films
In addition to standard .005" and .010" PVC film, a variety of laminate film materials and thicknesses are available. See laminate film selection charts.

Special Designs
Also available to meet special crosstalk requirements of customer applications are ground plane shields with or without drain wires, twisted pairs, coaxial cable or other special techniques.

Spectra-Strip twisted pairs may also be mixed in a single cable with straight conductors.

Please consult the catalog technical sections for assistance with special cable designs for crosstalk reduction. Contact Spectra-Strip for additional design assistance.

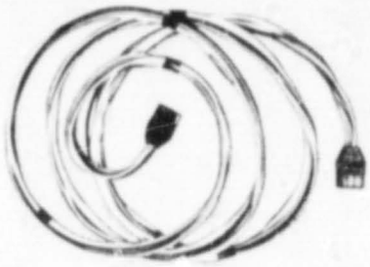
SPECTRA-STRIP 3C LAMINATED FILM THICKNESS SELECTION GRAPH

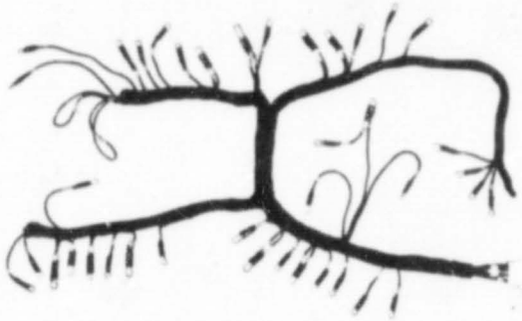


Minimum conductor spacing and PVC film thickness selection graph for 3C laminated cable using pre-insulated conductors. Uninsulated wire should have .010" film minimum.

Wiring Harnesses and Custom Panels

Teleflex offers on a custom-built basis a wide selection of wiring harnesses. These include assemblies of standard gauge wire, as well as an assembly housed in convoluted tubing. Harnesses can be supplied with or without Teleflex gauges.





Teleflex INCORPORATED
industrial

Electrical systems:
1816 57th Street, Sarasota, Florida 33580
Telephone (813) 355-7721

Mechanical systems:
640 North Lewis Road, Limerick, Pennsylvania 19468
Telephone (215) 495-7011

CIRCUIT BREAKERS

(CODE **CB**)

Circuit Breakers
Ordering Information

PLUG-ON CIRCUIT BREAKERS


RC38


R38

SYLVANIA
GTE
Electrical Equipment Group
GTE Sylvania Incorporated
One Stamford Forum
Stamford CT 06904
203 357 2000

TYPE "R" 2-SINGLE POLE BREAKERS IN ONE ¾" SPACE-10,000 AIC

AMPERE RATING	TWO-1 POLE BREAKERS 120/240 Volts	ONE-1 POLE BREAKER 120 Volts	2 POLE BREAKER Use For Appliance Circuits-Common Trip 120/240 Volts	LOAD TERMINAL WIRE RANGE CU/AL
	CATALOG NO.	CATALOG NO.	CATALOG NO.	
25	—	— —	RC38-25	#14-#8
30	R38-30	— —	RC38-30	
40	R38-40	— —	RC38-40	#8-#4
50	R38-50	— —	RC38-50	#8-#4
60	—	— —	RC38-60	#8-#4
70	—	— —	RC38-70	CU ONLY
CARTON QNTY	24	24	24	
CARTON WEIGHT	10 lbs	10 lbs	10 lbs	


Q

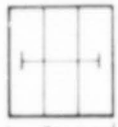

¾"

QC & VQC




1½"


Q2430


2¼"

TYPE Q, QC AND VQC BREAKERS

AMPERE RATING	1 POLE 120/240 V 10,000 AIC	2 POLE 120/240 V 10,000 AIC Common Trip	2 POLE 120/240 V 22,000 AIC Common Trip	3 POLE 240 V 10,000 AIC Common Trip	LOAD TERMINAL WIRE RANGE CU/AL
	CATALOG NO.	CATALOG NO.	CATALOG NO.	CATALOG NO.	
	❶		—		
	❶		—		
30	Q-30	QC-30	—	Q2430-30	
40	Q-40	QC-40	—	Q2430-40	#14-#3 ❷
50	Q-50	QC-50	—	Q2430-50	
60	Q-60	QCAL-60	VQC-60 ❶	Q2430-60	
70	—	QCAL-70	VQC-70 ❶	Q2430-70	
90	—	QCAL-90 ❷	VQC-90	Q2430-90	#6-#1/0
100	—	QCAL-100 ❸	VQC-100	Q2430-100	
125	—	QC-125	VQC-125	—	#6-#1/0 ❺
CARTON QNTY	24	12	12	8	
CARTON WEIGHT	10 lbs	10 lbs	10 lbs	10 lbs	

❶ DISCONTINUED WHEN STOCK IS DEPLETED
❷ Q2430-60 — #6-#0 CU/AL
❸ U.L. LISTED FOR USE WITH 75°C. WIRE
❹ SWITCHING DUTY BREAKERS — MEET SWITCH APPLICATION AS DEFINED BY U.L. STANDARD 489
❺ SUITABLE FOR # 1/0 AL WHEN USED AS MAIN IN SERVICE ENTRANCE APPLICATION ON 1 Ø, 3W RESIDENTIAL SERVICE.

Sylvania quality is based on innovation, integrity and reliability.

PLUG-ON CIRCUIT BREAKERS





QFP24-200-2

SYLVANIA
GTE

Electrical Equipment Group
GTE Sylvania Incorporated
One Stamford Forum
Stamford CT 06904
203 357 2000

TYPE QFP AND VQFP USED AS FIELD INSTALLED
MAINS, BRANCH & INDIVIDUALLY ENCLOSED BREAKERS

AMPERE RATING	2-Pole 10,000 AIC 240 Volt	2-Pole ❷ 22,000 AIC 240 Volt	3-Pole 10,000 AIC 240 Volt	LOAD TERMINAL WIRE RANGE CU/AL
	CATALOG NO.	CATALOG NO.	CATALOG NO.	
125	QFP24-125-2		QFP24-125-3	
150	QFP24-150-2	VQFP24-150	QFP24-150-3	
175	QFP24-175-2		QFP24-175-3	#1-300 MCM
200	QFP24-200-2	VQFP24-200	QFP24-200-3	
225	QFP24-225-2		QFP24-225-3	
CARTON QTY	5	5	5	
CARTON WEIGHT	11 lbs.	11 lbs.	16 lbs.	

❷ U.L. LISTED FOR USE AHEAD OF 10,000 AIC BREAKERS TO PERMIT THEIR APPLICATION AT 22,000 AMPERE FAULT LEVELS.



QL2436-400
USED IN SEPARATE BREAKER ENCLOSURES, OR AS MAINS IN HEAVY DUTY LOADCENTERS OR MULTI-METERING MAINS

TYPE QL 240 VOLT

AMPERE RATING	2-Pole 6" Wide 25,000 AIC	3-Pole 9" Wide 25,000 AIC	LOAD TERMINAL WIRE RANGE CU/AL
	CATALOG NO.	CATALOG NO.	
300	QL2424-300	QL2436-300	2/Phase ❸ 3/0-350 MCM cu or 3/0-500 MCM al
400	QL2424-400	QL2436-400	
600	QL2424-600	QL2436-600	
CARTON QTY	1	1	
CARTON WEIGHT	12 lbs.	17 lbs.	

❸ FOR SINGLE 350-800 MCM CU/AL LUGS PER PHASE USE QLL 350-800.

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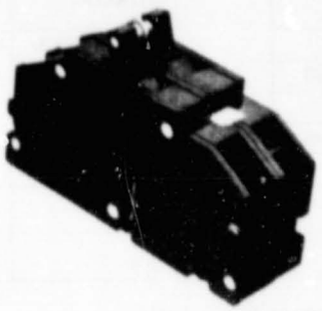
GTE
Electrical Equipment Group
GTE Sylvania Incorporated
One Stamford Forum
Stamford CT 06904
203 357 2000



QCP-15

FEED-THRU BREAKERS-TYPE QP & QCP

AMPERE RATING	1-POLE 120/240 Volts 10,000 AIC CATALOG NO.	2-POLE 120/240 Volts 10,000 AIC CATALOG NO.	LOAD TERMINAL WIRE RANGES CU/AL
30	QP-30	QCP-30	#14-#3
40	QP-40	QCP-40	
50	QP-50	QCP-50	
60	QP-60	QCP-60	
CARTON QTY	24	8	
CARTON WEIGHT	10 lbs.	10 lbs.	
LUG KIT	L-1570 (2 lugs per kit)		#14-#4

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COUPLINGS; POWER TRANSMISSION FLUID

(CODE **CF**)

Link-Belt® Silicone Fluid Drive

FMC

FMC Corporation

Drive Division

2045 West Hunting Park Avenue
Philadelphia, Pennsylvania 19140 •
(215) 225-6000

- Fractional to 20 HP.
- Sheave and coupling types.
- Allows motor sizing according to running rather than starting requirements.
- Permits motor to accelerate rapidly regardless of load.
- Smoothly accelerates heavy loads without motor damage.
- Conserves electrical energy.
- Prevents motor overheating, even during stalls.
- Protects both motor and driven equipment from overloads.



How the Silicone Fluid Drive works

FMC Corporation
Drive Division
2045 West Hunting Park Avenue
Philadelphia, Pennsylvania 19140 •
(215) 225-6000

The Link-Belt Silicone Fluid Drive provides remarkable starting, running, overload, and stall characteristics by actually controlling torque transfer in response to driven load speed.

Its function depends upon two vital factors:

1. A unique mechanical application of the fundamental principles of viscous flow.

The Silicone Fluid Drive transfers torque through the natural shear resistance of silicone fluid in the space between input and output members.

Simply stated, an important element of the viscous flow principle maintains that torque transferred is dependent on the width of this fluid filled space. Wide space – less torque; narrow space – more torque.

The Silicone Fluid Drive takes advantage of this principle by using a mechanical centrifugal speed sensor to automatically adjust the space between input and output members according to output speed.

Silicone fluid fills the space between a flat inner surface of the housing (connected to the input) and a flat transfer plate (connected to the output).

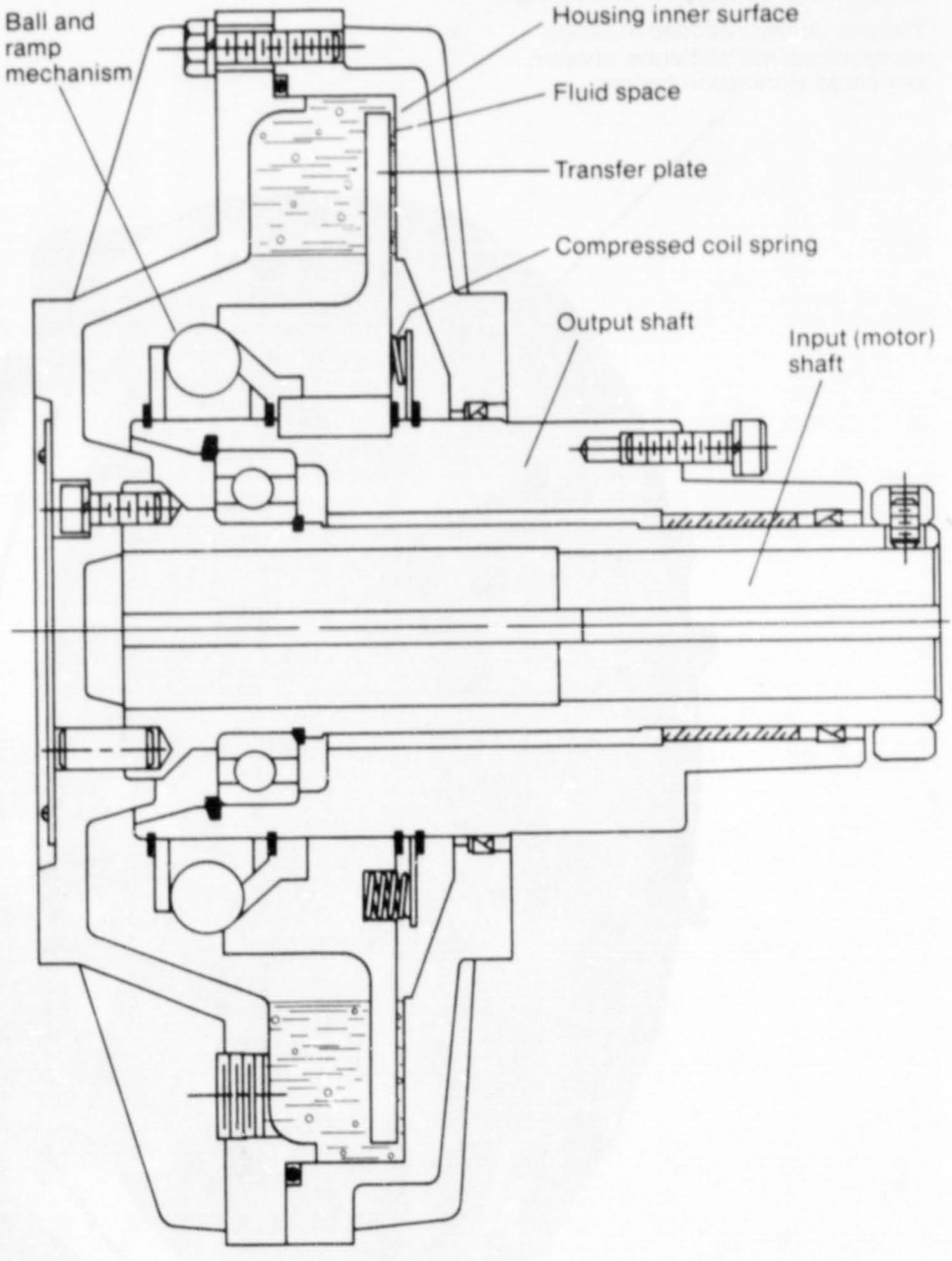
The axially sliding transfer plate is part of a force balance assembly with compressed coil springs opposing a component of centrifugal force generated in a ball and ramp mechanism.

At rest and during initial acceleration, spring force maintains a wide fluid space between plate and housing.

As output speed increases, steel balls equally spaced in a circular carrier move radially outward against a ramped surface on the transfer plate. At a predetermined point the spring force is overcome; the plate is cammed inward to narrow the fluid space; and the load is brought to operating speed.

The reverse takes place when the load stalls. Decreasing output speed activates the fluid space adjusting assembly, reducing torque transferred by widening the fluid space between plate and housing.

Thus, the Silicone Fluid Drive automatically assures minimum strain on motors during start or stall yet maximum torque transmission at full operating speed.



2. The "nearly perfect" properties of silicone fluid as a force transfer medium.

Silicone fluid is virtually indestructible.

It is readily available in unlimited viscosities for varying torque transfer applications.

It resists viscosity changes at high shear rates and temperatures up to 300° F.

And it possesses the rare capability of regaining its original viscosity after removal of excessively high shear rates and/or temperatures.

In practical terms, it eliminates many of the limitations imposed by other force transfer medium, allowing maximum flexibility and adaptability to the most demanding applications.

Designed for easy, dependable operation

FMC Corporation
Drive Division
2045 West Hunting Park Avenue
Philadelphia, Pennsylvania 19140 •
(215) 225-6000

Statically balanced housing

Weights internally added in flange recesses maintain balance, prevent unwanted vibration in system.

Self-lubrication

Long life is assured by low friction coatings on all sliding surfaces, the lubricating qualities of silicone fluid, "lubricated for life" ball bearings, and self-lubricating bushings in areas away from fluid.



Large filler/drain hole

Oversized hole in housing side allows easy filling or draining and quick visual determination of fluid level.

Immediately adaptable to a wide variety of applications

The Silicone Fluid Drive is designed for direct drive or belt and sheave applications, in vertical as well as horizontal positions.

Silicone Fluid Drives

The Link-Belt Silicone Fluid Drive is available in models for both sheave and direct coupling applications rated from 1 to 20 HP.

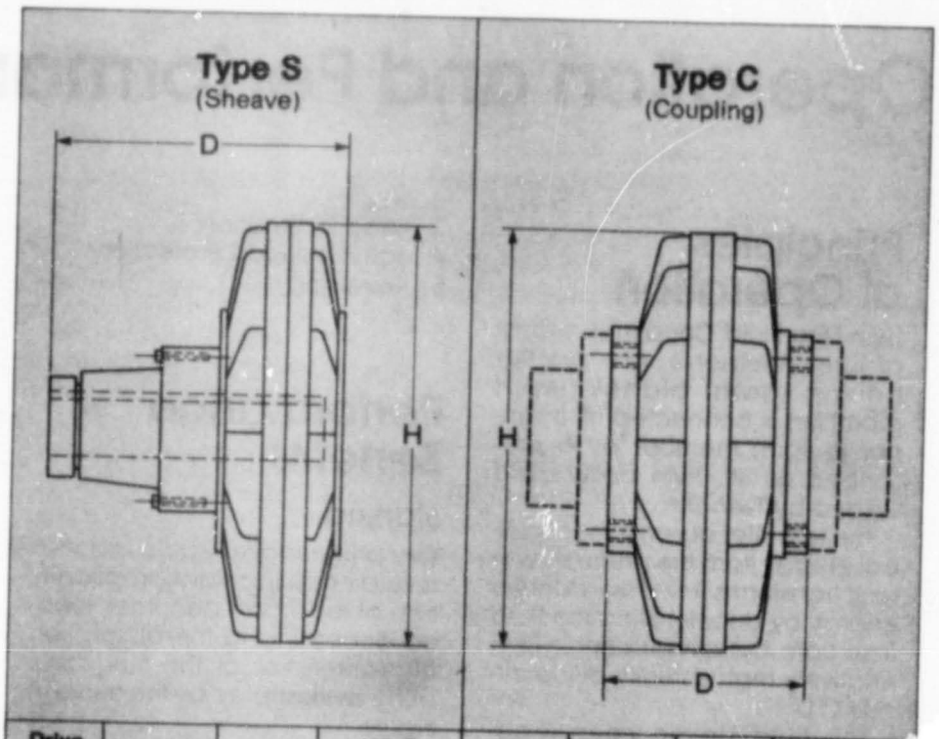
The sheave type output shaft has a built-in OD taper identical to a QD type sheave, allowing quick and easy mounting of sheaves of different diameters and widths.

The direct coupling model will accept geared flexible couplings (similar to Link-Belt XR Standard Couplings) on either side.

For the most demanding of applications, wherever motors encounter shock starts or potential overloads, the Silicone Fluid Drive offers maximum protection with maximum flexibility.

Nationwide availability and service

Link-Belt® Silicone Fluid Drives are available through an extensive network of distributors and service centers to provide better delivery and fast response to your needs.



Drive Size	H (in.)	D (in.)	HP @ 1750 RPM	Drive Size	H (in.)	D (in.)	HP @ 1750 RPM
S 140	7.40	6.54	1, 1.5 & 2	C 140	7.40	4.59	1, 1.5 & 2
S 180	9.25	6.77	3 & 5	C 180	9.25	4.59	3 & 5
S 210	10.35	7.68	7.5 & 10	C 210	10.35	5.50	7.5 & 10
S 250	*	*	15 & 20	C 250	*	*	15 & 20

*Refer to FMC Corporation, Drive Division

FMC Corporation

Drive Division

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Philadelphia, Pennsylvania 19140 •
(215) 225-6000

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Atlanta 30336 • 6125 Xavier Drive S.W. •
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Chicago 60007 • 1255 Tonne Road • Elk Grove
Village, Illinois • (312) 593-8200

Columbus, Ohio 43228 • 4040 Fondorf Drive •
Box 28212 • (614) 276-7235

Dallas 76011 • 1217 Corporate Drive West •
Box 6308 • Arlington, Texas • (817) 640-3332

Fresno, CA 93747 • 5326 East Pine Avenue •
Box 7863 • (209) 252-3311

Philadelphia 19154 • 10965 Decatur Road
(215) 677-5600

Portland, Oregon 97210 • 3030 N.W. Industrial
Street • (503) 226-2601

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FMC Corporation

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Indianapolis, Indiana 46206 • (317) 241-9201

European Service Center & Regional Office

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1930 Zaventem, Belgium (02) 720 91 62

International Regional Offices

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Notting Hill, Victoria, 3168 • 544-2311

Brazil • Av Paulista 1274 • 9th Floor
01310 São Paulo, S.P., Brazil 287-7325

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(212) 697-3317/18

FMC of Canada Limited

Power Transmission Group

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Group Box 12
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Markham, Ontario L3R 2W4
2700 John Street • (416) 495-9522

Montreal, Quebec H9P 1B3 • 11475 Cote de
Liesse Road • (514) 631-8505

Winnipeg, Manitoba R3G 3J6
203-656 St. James Street • (204) 774-0437

West Vancouver, British Columbia V7T 1E1
636 Clyde Avenue • Suite 1 • (604) 926-4717

FMC South Africa (Pty) Limited

Material Handling & Power Transmission Group
Industry Road, New Era • Box 287
Springs 1560 Transvaal • Republic of South
Africa • 56-1411

FMC/Link-Belt Mexicana S.A. de C.V.

Km 14 Antigua Carretera Mexico—Pachuca
Apartado postal no. 74
Santa Clara, Edo. de Mexico, Mexico
5-69-23-22

Stock-carrying Distributors and Representatives throughout the world

FMC

For full details, write
FMC Corporation
Drive Division
2045 West Hunting Park Avenue
Philadelphia, PA 19140

TWIN DISC, INCORPORATED • RACINE, WISCONSIN U.S.A.
TEL: 414-634-1981

Fluid Couplings

Operation and Performance Benefits

Principles of Operation

Twin Disc Fluid Couplings consist of three elements. An impeller having radial blades (input member) is connected to a runner (output) member by a prescribed oil fill. Twin circuits are utilized by Twin Disc.

The impeller absorbs mechanical energy from the prime mover and transforms it into fluid kinetic energy by accelerating the fluid flow from the circuit center to a relatively high velocity at the circuit O.D.

This fluid kinetic energy becomes available to and is released at the runner where the fluid in turn loses velocity as it is re-directed back to the circuit center.

Since this increase and decrease in velocity of the fluid is equal, the torque ratio—input to output—is always 1:1.

In general, the Twin Disc Fluid Coupling follows the basic absorption laws of a centrifugal pump.

In summary, it is the transfer of horsepower or torque from input to output by means of the fluid medium along with the basic absorption characteristics that combine to result in the operating benefits obtained by use of Fluid Couplings.

Motor Benefits

1. Starting
2. Acceleration
3. Reduced Current Draw
4. Overload Protection
5. Power Factor
6. Sizing

Drive Benefits

1. Starting
2. Shock Cushioning
3. Load Distribution
4. Jam/Overload Protection
5. Reversing

Performance Benefits

Starting

Any prime mover equipped with a fluid coupling starts practically free of load and becomes loaded according to the absorption characteristics of the fluid coupling as illustrated by the curve in Figure 1.

The 100% slip or drag torque curve shows the torque absorption of the fluid couplings at various input speeds. A "typical" range of drag torques is shown in Figure 1. Note that the slope can be altered by change of fluid fill or addition of blade blocks.

Thus, it may be possible to obtain up to 100% or more starting torque with a NEMA B motor and fluid coupling than the motor can deliver when mechanically connected. See Figure 2. Similarly, an engine is free of lugging because it is allowed to operate in a more efficient range.

Figure 3 illustrates the reduction in motor current draw that results from the free-of-load starts offered by fluid couplings. This approximates 1/3 less current draw after initial inrush with cross-the-line starting and can improve power factor as well as motor protection.

Better starting performance can provide reduced acceleration time and improve motor life whenever high inertia starts or repetitive cycles are inherent.

Running

Fluid cushioning best describes the running benefits that result from the use of fluid couplings.

Starts may be faster but they are softer than when mechanically connected and soft enough to protect the most delicate of products being processed or transferred.

Motors can fight each other on compound drives both starting and running because of unequal loading. Fluid couplings, because of their ability to slip, improve load distribution by allowing separate motors to operate independently.

A fluid coupling, because of its unloading characteristics, protects the motor and drive on reversing applications, and smooth load reversal results. The motor actually reverses before the load does and the fluid coupling cushions both the deceleration and reacceleration in the opposite direction.

Shock or cyclic loading is prevalent in many installations. With fluid couplings, the shock is absorbed in fluid rather than in the other drive components.

The possibility of jam or severe overloads usually results in oversizing of other machine components or additional drive protective devices to eliminate expensive downtime. A Twin Disc Fluid Coupling distributes the magnitude of the shock over a longer period of time by fluid cushioning. Thus, other drive components are protected and the motor is protected as shown in Figure 4 because the motor is not stalled. It is only decelerated to the 100% slip point which results in 75% lower current draw.

TWIN DISC, INCORPORATED • RACINE, WISCONSIN U.S.A.
TEL: 414-634-1981

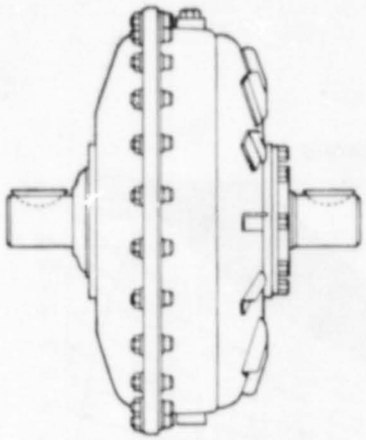
Large Fluid Couplings 10 to 850 hp

HM Series

A basic coupling with selected input and output groups to meet customer requirements.

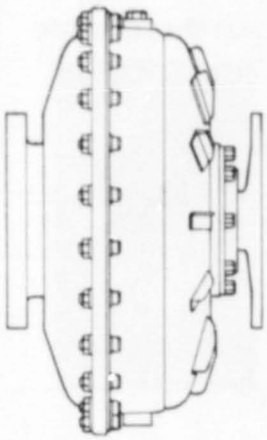
Model HBM

A standard coupling with straight input and output shafts. Mounts between two single engagement flexible couplings. Sizes 14.5, 17.5 and 21".



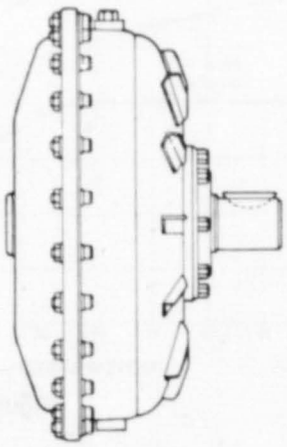
Model HCM

A standard coupling with input flange and flanged output shaft. Designed for installation between two halves of a double engagement gear tooth flexible coupling. Sizes 14.5, 17.5 and 21".



Model HEM

A standard coupling with a stub shaft output. Mounts between a specially adapted gear tooth flexible coupling on the input and a single engagement gear tooth flexible coupling on the output. Sizes 14.5, 17.5, 21 and 27".



Selection Chart

NEMA B SIZE	900 RPM		1200 RPM		1800 RPM	
	Coupling Size	Blade Blocks	Coupling Size	Blade Blocks	Coupling Size	Blade Blocks
10	14.5	32	–	–	–	–
15	17.5	48	14.5	48	–	–
20	17.5	48	14.5	48	–	–
25	17.5	16	14.5	16	–	–
30	17.5	–	17.5	48	–	–
40	21	48	17.5	48	–	–
50	21	48	17.5	48	14.5	48
60	21	48	17.5	16	14.5	48
75	21	16	17.5	–	14.5	48
100	21	–	21	48	14.5	–
125	27	48	21	48	17.5	48
150	27	48	21	48	17.5	48
200	27	48	21	–	17.5	16
250	27	32	27	48	21	48
300	–	–	27	48	21	48
350	–	–	27	48	21	32

Recommended sizes for standard NEMA B integral hp motors based on normal operating conditions. Consult your Twin Disc Distributor for engineering assistance on heavy-duty applications (large inertial loads and/or high cycle rates), and applications with NEMA B size motor larger than 350 hp.

Installation Dimensions

COUPLING SIZE	RUNNING DIAMETER (INCHES)	HCM LENGTH (INCHES)	HBM LENGTH (INCHES)	HEM LENGTH (INCHES)
14.5	16.75	9.85	13.82	10.20
17.5	19.56	9.85	13.82	10.20
21	24.19	12.59	18.50	12.63
27	30.34	–	–	15.90

COUPLING SIZE	HBM SHAFT DIAMETER (INCHES)	HEM BOLT CIRCLE (INCHES)	HCM BOLT CIRCLE (INCHES)
14.5	2	5.25	7
17.5	2	5.25	7
21	3-1/2 , 2-3/4	6.50	7
27	–	7.63	–

Notes:

(1) Flexible couplings supplied by customer.

(2) Dimensions shown are nominal. See the installation drawings.

(3) Sub-assemblies of HC and HM fluid couplings are available on special order.

(4) Blade blocks to restrict fluid flow and alter torque absorption characteristics can be ordered in groups of 16, 32, or 48.

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Starting Torque

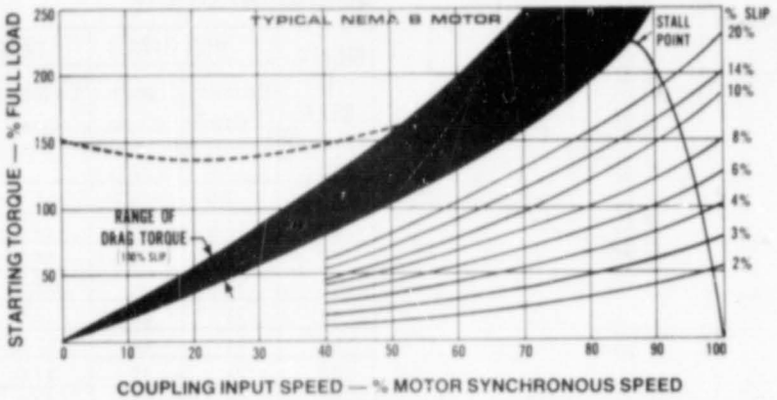


Figure 1

100% More Motor Starting Torque with Fluid Coupling

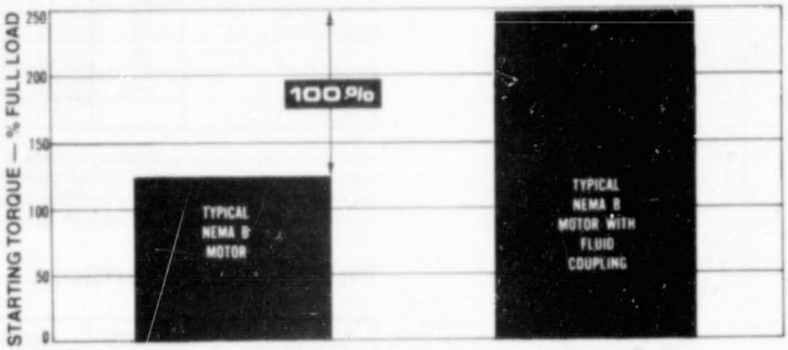


Figure 2

Start-up Burnout Protection

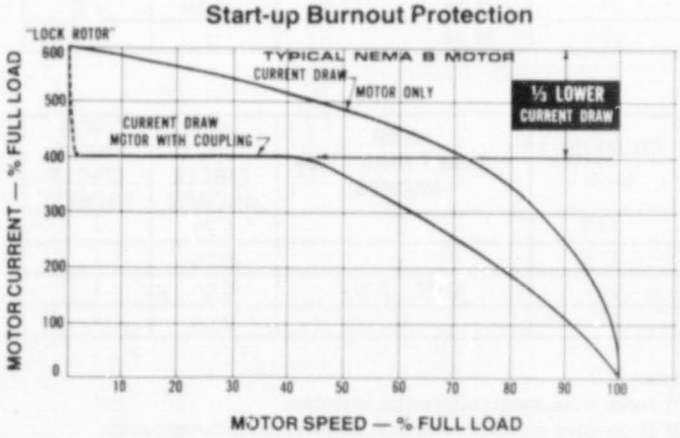


Figure 3

Jam Load Burnout Protection

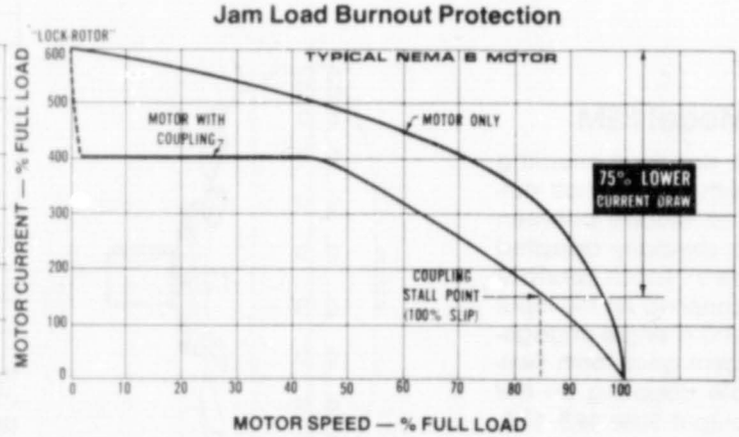
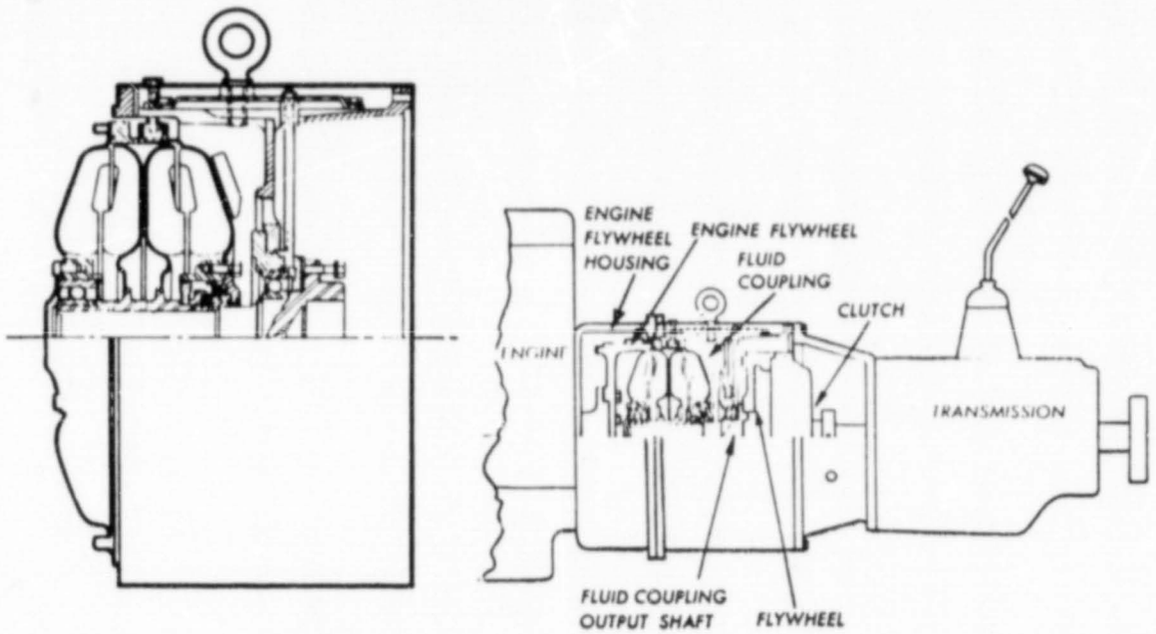


Figure 4

Another version of the Fluid Power Take-Off. The housing of the Model HUC is designed with an SAE flange at both ends. One flange connects to the engine flywheel housing, and the other to mating equipment such as a friction power take-off, reduction gear, transmission, etc. Sizes available are 17.5 and 21".



TWIN DISC, INCORPORATED

Administrative Offices,
Racine, Wisconsin 53403 U.S.A.

Twin Disc International S.A., Nivelles, Belgium • British Twin Disc Limited, Rochester, Kent, England • Twin Disc (Far East) Ltd., Singapore and Hong Kong • Twin Disc (Pacific) Pty., Albury, N.S.W., Australia • Twin Disc (South Africa) (Pty) Ltd., Johannesburg, South Africa

IMPORTANT NOTICE: Twin Disc, Incorporated reminds users of these products that their safe operation depends on use in compliance with engineering information provided in this catalog. Users are also reminded that safe operation depends on proper installation, operation and routine maintenance and inspection under prevailing conditions. It is the responsibility of users (and not Twin Disc, Incorporated) to provide and install guards or safety devices which may be required by recognized safety standards or by the Occupational Safety and Health Act of 1970 and its subsequent provisions.

CLUTCHES

(CODE **CL**)

LIPE-ROLLWAY

Lipe-Rollway Corporation Tel: 315 • 488-5411
806 Emerson Ave., Syracuse, N. Y. 13221

LIPE Hydraseal®

TAKES ALL THE PUNISHMENT YOU CAN PUSH ON IT

New from concept to hardware, Hydraseal has no equal. Vehicles that stop as much as they go need Hydraseal—the self-contained wet clutch of the future, available today.

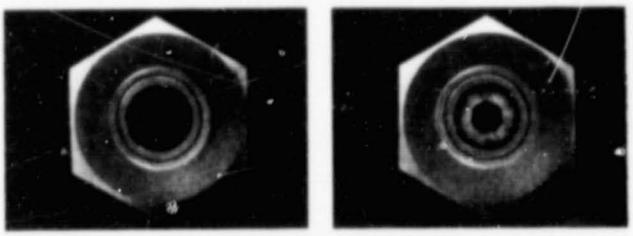
Hydraseal will tolerate more slippage and inching than any other clutch. Yet, when used with standard transmission, it costs far less and is much lighter than an automatic transmission/ torque converter combination. Hydraseal is the perfect alternative for all extra tough clutch applications. Sizes range from 12" to 15½" with both push and pull release.

Hydraseal discs, faced with a new heat resistant material, operate in a bath of Lipe Fluid—a special heat dissipating medium. With this unique combination of facing material and fluid, the Hydraseal has nearly double the temperature tolerance of a conventional oil spray clutch.

The Hydraseal needs no circulating pump or external plumbing required by oil spray clutches yet it lasts up to five times longer than conventional heavy duty dry clutches, which burn up quickly when subjected to abusive service.

A release bearing carrier sleeve mates the Hydraseal to the spline shaft. Special high reliability seals maintain the assembly's integrity where the sleeve joins the cover and the backplate. Backplate and cover form the Hydraseal container, enabling the unit to be bolted directly to conventional flywheels.

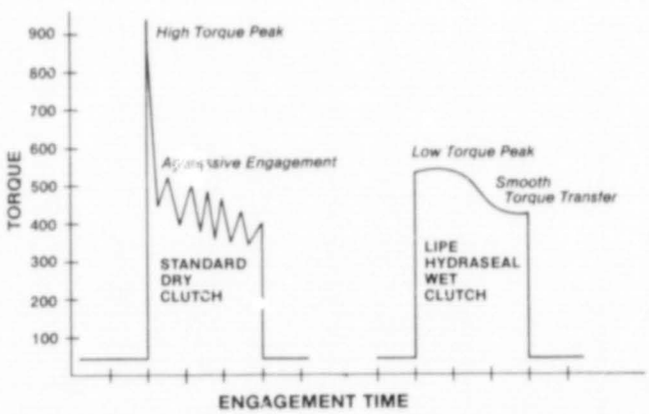
After the Hydraseal has been installed, it can almost be forgotten. The only maintenance required is a periodic look at the sight glass in the cover to check the fluid level. Should additional Lipe Fluid be required, the one liter capacity can be topped off through a quick disconnect fitting in the Hydraseal housing.



Lipe Fluid level may be checked quickly through a special fiber optics sight glass. Located in the Hydraseal cover and visible through the bell housing access cover, the left photo indicates normal level. The white ring in the right photo indicates low level.

An optional transmission brake is an integral part of the release bearing assembly. Both operate within the Hydraseal's constantly lubricated environment.

Hydraseal clutches engage and disengage smoothly, putting you in complete control of your vehicle, even when inching. While it feels good to you, the operator, it also feels good to the transmission, driveshaft and differential. The Hydraseal will reduce shock loadings 80% over dry clutches. Reduced shock loading extends the life of drive line components as well as the clutch.



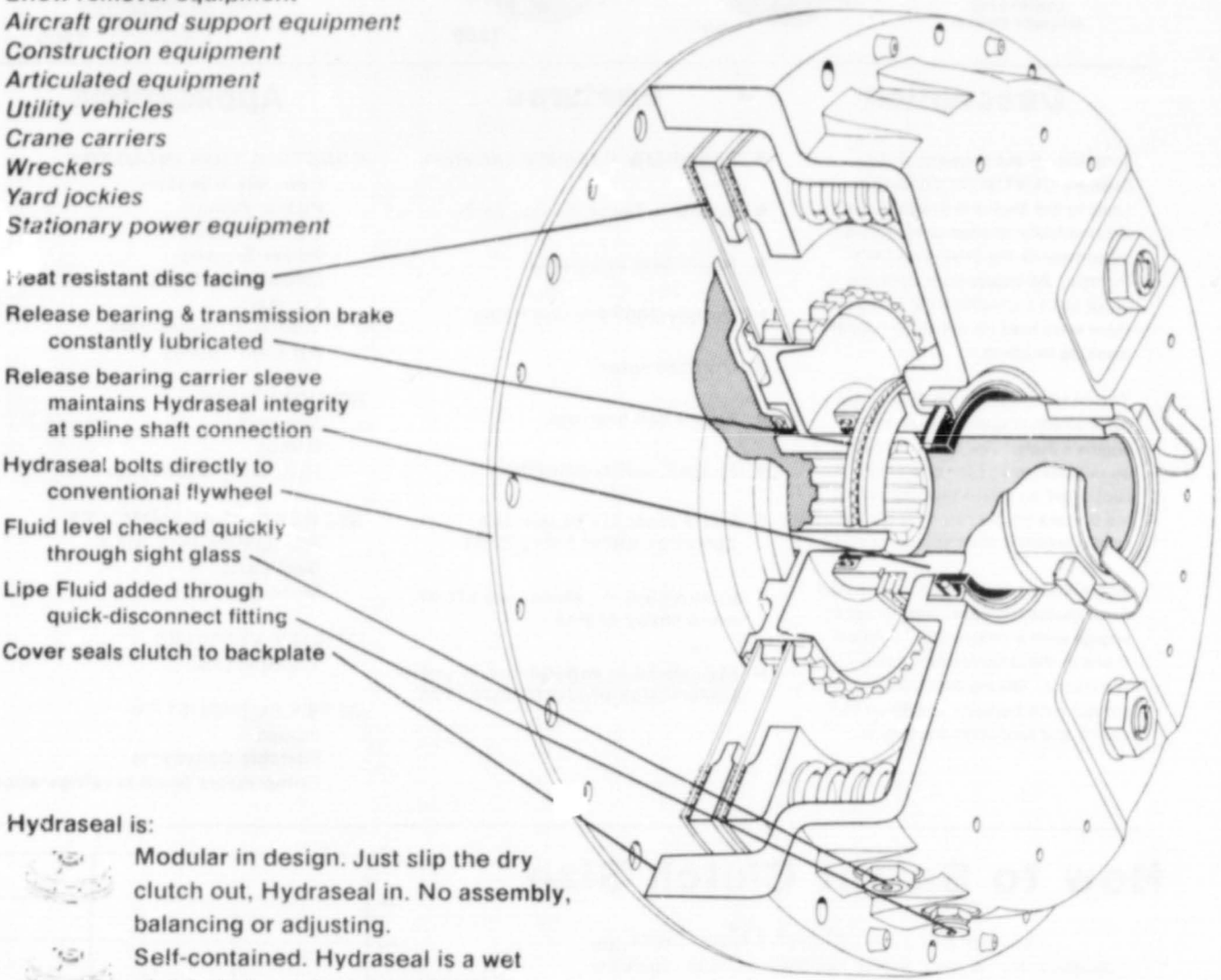
Comparison of dry clutch and Hydraseal engagement characteristics. Dry clutch exhibits high shock peak followed by irregular torque transfer pattern. Viscous shear phenomenon smooths out Hydraseal engagement.

Typical Hydraseal applications:

School buses
Pick-up and delivery trucks
Farm tractors
Sanitation vehicles
Fork lifts
Straddle carriers
Log skidders
Cane loaders
Line haul tractors
Dump trucks
Fire fighting apparatus
Transit-mixers
Snow removal equipment
Aircraft ground support equipment
Construction equipment
Articulated equipment
Utility vehicles
Crane carriers
Wreckers
Yard jockies
Stationary power equipment

HYDRASEAL SIZES

CLUTCH SIZE	MAX. TORQUE	AVAILABILITY STATUS
8-1	85 FT-LB.	Designs Only
12-1	130 FT-LB.	Prototype Hardware
13-2	350 FT-LB.	Production Units
13-3	450 FT-LB.	Prototype Hardware
15½-3	1000 FT-LB.	Designs Only



Hydraseal is:

- Modular in design. Just slip the dry clutch out, Hydraseal in. No assembly, balancing or adjusting.
- Self-contained. Hydraseal is a wet clutch that requires no additional plumbing, pumps or coolers for the fluid.
- Economical. Low cost to purchase, operate and maintain.
- Forgiving of drive line abuse.
- Long lasting. Can last the life of the vehicle.

LIPE-ROLLWAY

Lipe-Rollway Corporation Tel: 315 • 488-5411
806 Emerson Ave., Syracuse, N. Y. 13221

ORIGINAL PAGE IS
OF POOR QUALITY

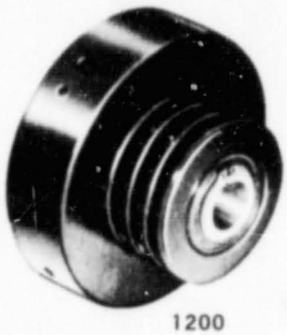
CENTRI-DYNE

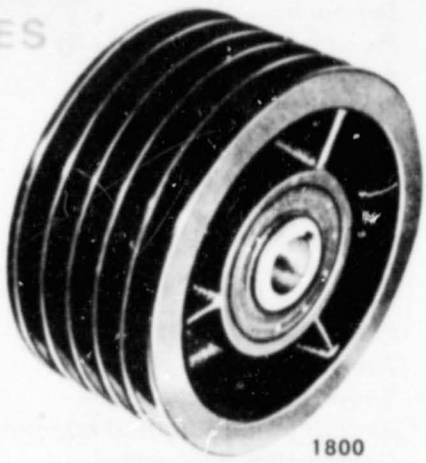
AUTOMATIC CLUTCHES

Series
600
1200
1800

SALSBURY
CENTRI-DYNE
Automatic Clutches


600


1200


1800

Description

Simplicity is the keynote of the Salsbury CENTRI-DYNE Clutch. Load to the engine is smoothly and automatically applied (and released) by control of the driving engine's throttle. As engagement does not occur until a specific RPM is reached, there is no load on the engine during cranking or idling.

The clutch consists of a heavy, cast rotor which is supported on the engine's shaft. The drum portion is an integral part of the clutch and is supported on sealed bearings which are pressed on the rotor's shaft (or on the engine's shaft in smaller sizes).

At a predetermined RPM, centrifugal force causes the heavy, cast shoes to engage with a unique 360° friction lining in the drum/pulley portion of the clutch. During deceleration, return springs automatically disengage the clutch and load from the engine.

Features

- Completely automatic operation
- Simple — fewer moving parts
- Rapid heat dissipation
- Unique 360° friction lining
- Unitized rotor
- Sealed ball bearings
- Rugged, cast construction
- Extra capacity for non-slip operation under heavy loads
- Economical — extends the life of more costly engine
- Manufacturer experienced in power transmission products since 1936

Applications

CONSTRUCTION INDUSTRY
- Concrete-Vibrators
- Plaster Pumps
- Cement Buggies
- Power Trowels
- General Use Pumps
- Crushers
- Vibrating Compactors
- Air Compressors

AGRICULTURE
- Sprayers
- Pumps
- Harvesting Equipment

RECREATIONAL VEHICLES
- Amusement Park Rides
- Golf Carts
- Motor Scooters

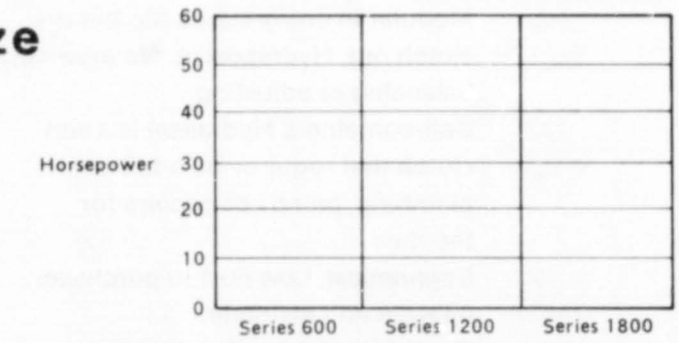
UTILITY VEHICLES
- Transporters

GENERAL INDUSTRY
- Pumps
- Portable Conveyors
- Compressors (such as refrigeration)

How to Select Clutch Size

SALSBURY CENTRI-DYNE CLUTCHES are designed for 4-cycle engine applications with operating speeds up to a nominal 4000 r.p.m.

The dimensions and rating information given here are basic standard and intended for preliminary estimating purposes only. Salsbury works closely with many major Original Equipment Manufacturers to provide special products for singular size requirements, engagement speeds, and connection methods.



SALSBURY INDUSTRIES

A DIVISION OF INSTRUMENT SYSTEMS CORPORATION
1010 EAST 62nd STREET,
LOS ANGELES, CALIFORNIA 90001
(213) 232–6181

GRIPMASTER SERIES

AUTOMATIC CLUTCH

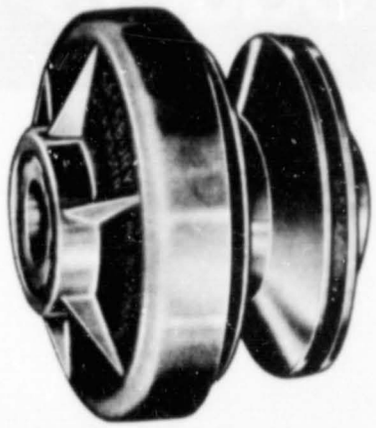
LOW Cost - HIGH Quality

Rugged and Dependable for Gasoline Engines

(3 to 6 HP)

Electric Motors

(1/4 to 1 1/2 HP)-1750 RPM)



- The **SALSBURY GRIPMASTER AUTOMATIC CLUTCH** has proven its dependability to give superior performance over many years of satisfactory service.

- Now a new and improved design is available incorporating still more desirable features to meet the severe demands of present day installations.

- Particular attention has been paid to supplying the need for light weight but extremely husky construction, extra capacity, exceptionally long wear, ease of adjustment, simplicity in servicing and a reasonable price.

- The **GRIPMASTER** is unequalled in a low cost but completely dependable automatic clutch for installations in the lower horsepower range.

OUTSTANDING FEATURES

1. Simple but sturdy construction — few parts
2. Small in size, light in weight
3. Can be installed without altering present shaft extension
4. Simple adjustments without removing clutch from engine
5. Performance proved by years of dependable service on wide variety of applications
6. Highly recommended by users
7. Approved by engine manufacturers
8. Operates efficiently in either direction

For Electric Motors 1/4 to 1-1/2 HP — 1750 RPM, the Gripmaster provides:

- Reduced starting current demand.
- Cushioned start.
- Overload protection.

For Gasoline Engines from 1 to 6 HP with 1/2" to 1" diameter shafts, the Gripmaster provides:

- Load-free cranking and idling.
- Smooth application or release of load by throttle control only.
- No-slip transmission of power at operating speeds.
- Extended useful life of engine, belts and other transmission components.
- Insurance against stalling or damage from sudden overloads.

Complete Design Capability

When it comes to automatic clutches and belt drive torque converters, Salsbury wrote the book. We have complete in-house design capabilities. As an engineer-oriented company, we can adapt, revise or innovate depending on your transmission needs. Over the years, Salsbury Industries has designed and applied transmissions for use in:

- **Agricultural equipment**
- **All terrain vehicles**
- **Concrete pumps**
- **Snowmobiles**
- **Utility trucks**
- **Electrical generators**
- **Hydraulic lifts**
- **Gas and electric town cars**

Call us direct, or return our reply card with your transmission requirements TODAY. Let our experienced team of design engineers and technical salesmen demonstrate what forty years of experience in power transmission design can do for you.

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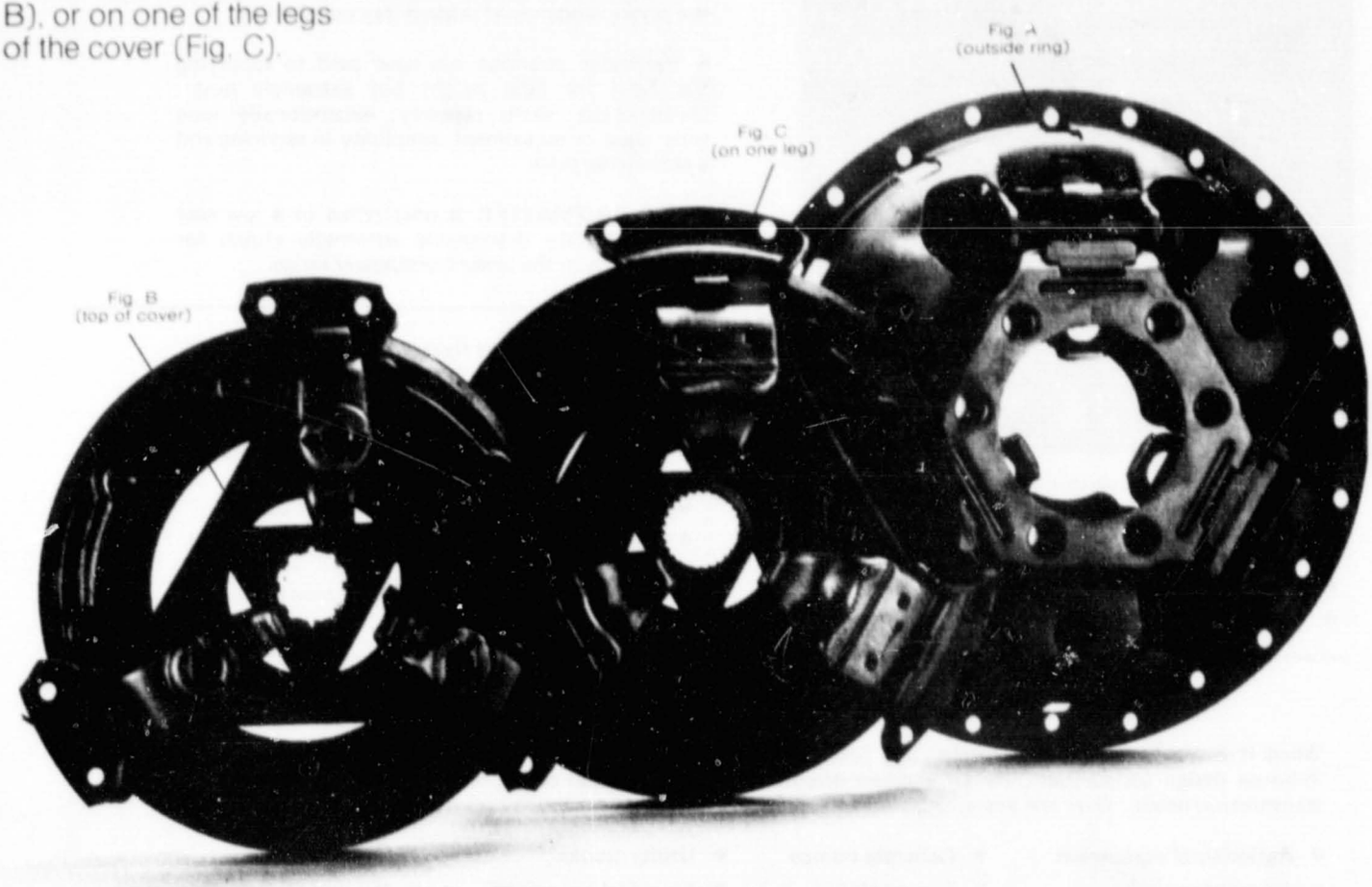
LOS ANGELES, CALIFORNIA 90001
(213) 232–6181

Spicer Clutch Products

How to Identify a Spicer Clutch.
All Spicer clutches are stamped with a complete part number. These numbers appear on the outside ring (Fig. A) of a full ring bracket, on the top of the cover (Fig. B), or on one of the legs of the cover (Fig. C).



Spicer DANA
DANA CORPORATION • SPICER CLUTCH Division
Fifth and Brandon Streets • Auburn, Indiana 46706
Phone: (219) 925-3800

Shown on right of page are the design configurations available in Spicer clutch cover assemblies. Each type has the same open rigid bracket which minimizes cover deflection and provides maximum ventilation of the entire assembly . . . so essential for adequate cooling.

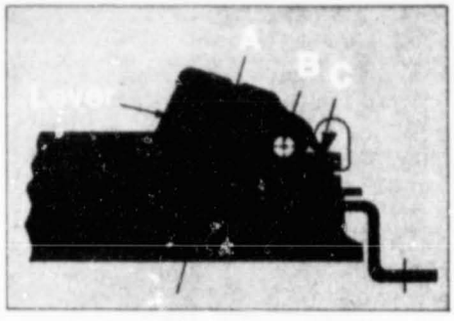
Cover assemblies are available for 3-bolt and 6-bolt mountings, providing excellent rigidity and stability. Six-bolt designs are available in the full range of covers (6½" through 12") (165.1 mm through 304.8 mm) while 3-bolt covers are made in 8½" (215.9 mm) through 10½" (266.7 mm) sizes. Single or two-spring levers (depending on clutch size and application requirements) provide equalized, three-point pressure on the clutch plates assuring retention of parallelism throughout the life of the clutch.

Exclusive Spicer Design Features Assure Longer Life!

Because the pressure springs do not come in direct contact with the pressure plate, they are not subjected to excessive heat—a major cause of clutch wear and subsequent failure. The springs remain cooler, maintaining a more constant pressure throughout the greatly-extended clutch service life.

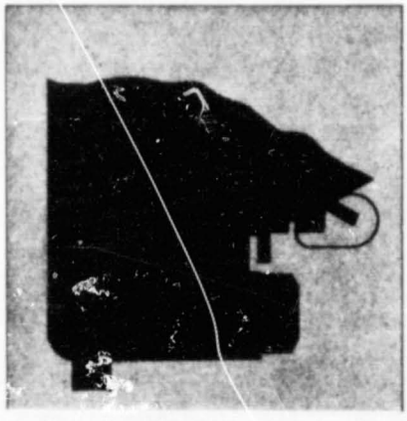
Spring load is transferred to the pressure plate through release levers. Because the spring load is multiplied through a lever ratio, a lesser number of springs are required. This Spicer feature results in more pressure, less weight, and much longer life.

The upward force of the spring along line "A" forces the lever to pivot around point "B", exerting a downward pressure at point "C". Distance "A-B" being greater than "B-C" multiplies the pressure in proportion to the relative distances.

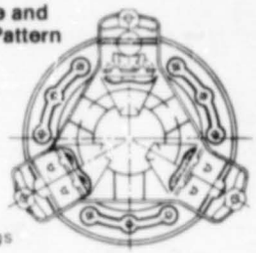


Flat or Pot Type Flywheel Mounting

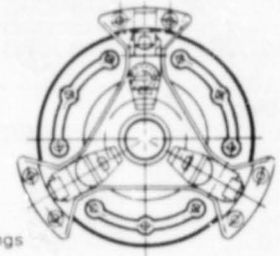
Spicer clutch cover assemblies are available in 6½" (165.1 mm) through 12" (304.8 mm) diameters for flat flywheels and in most diameters for pot type flywheels.



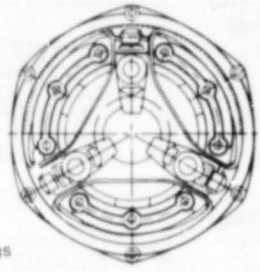
Cover Style and Bolt Hole Pattern



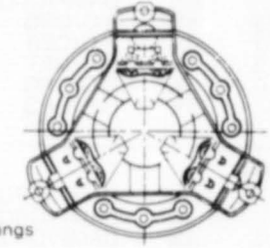
3 Bolt
Single Springs



3 Pairs
Single Springs



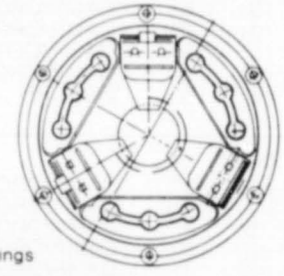
6 Holes
Single Springs



3 Bolt
Double Springs



3 Pairs
Double Springs



6 Holes
Double Springs

Spicer DANA

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Fifth and Brandon Streets • Auburn, Indiana 46706
Phone: (219) 925-3800

Discs

Spline	I.D.	Type	Disc
6½" Disc			
15/16"-10	4½"	RIG/ORG	100156-1
15/16"-10	4½"	RIG/ORG	100229-1
15/16"-10	4½"	RIG/ORG	100420-1
8" Disc			
1"-20	6"	DAMP/ORG	100403-1
1"-20	6"	DAMP/ORG	100482-1
1⅜"-20	6"	DAMP/ORG	100738-1
8 11/16" Disc			
1⅛"-10	5 11/16"	DAMP/ORG	8502-16
1⅛"-10	5 11/16"	RIG/ORG	100139-1
1⅛"-10	5 11/16"	RIG/ORG	100188-1
1¼"-10	5 11/16"	RIG/CER	100750-1
1¼"-10	5 11/16"	RIG/ORG	100198-1
1⅜"-10	5 11/16"	RIG/ORG	8502-14
8½" Disc			
⅜"-13	5⅜"	DAMP/ORG	100257-2
15/16"-10	5⅜"	DAMP/ORG	100781-1
15/16"-10	5⅜"	DAMP/ORG	100292-2
15/16"-10	5¾"	DAMP/ORG	100042-1
1"-10	5⅜"	DAMP/ORG	100159-1
1"-10	5½"	DAMP/ORG	100445-1
8¾" Disc			
1⅛"-10	5 31/64"	RIG/CER	101427-1
1⅛"-10	5¾"	RIG/ORG	100360-1
1¼"-6	5¾"	DAMP/ORG	9002-30
1⅜"-25	5¾"	RIG/ORG	101274-1
1¾"-10	5⅜"	RIG/CER	101428-1
1¾"-10	5¾"	RIG/MET	100705-1
1¾"-10	5¾"	RIG/ORG	100179-1
1¾"-27	5¾"	RIG/ORG	100160-1
9⅛" Disc			
1"-10	6⅛"	DAMP/ORG	100470-1
1"-23	6⅛"	DAMP/ORG	100301-1
1⅛"-10	6⅛"	DAMP/ORG	100431-2
1⅛"-10	6⅛"	DAMP/ORG	100404-1
1⅛"-10	6⅛"	DAMP/ORG	9002-15
9¼" Disc			
15/16"-10	6"	DAMP/ORG	100345-1
15/16"-10	6"	DAMP/ORG	100485-1
1"-10	6"	DAMP/ORG	100143-2
1"-10	6"	RIG/ORG	100085-5
1"-10	6"	DAMP/ORG	100900-1
1"-23	6"	DAMP/ORG	100339-1
1 1/16"-10	6"	DAMP/ORG	101316-1
1⅛"-10	6"	DAMP/ORG	100162-1
1⅛"-10	6"	DAMP/ORG	100295-1
1⅛"-10	6"	DAMP/CER	101429-1
1 9/64"-17	6"	DAMP/ORG	100323-1
1½"-19	6"	RIG/ORG	100008-1
9½" Disc			
1"-10	6"	DAMP/ORG	9502-4
1"-23	6½"	DAMP/ORG	100391-1
1 1/16"-10	6"	DAMP/ORG	100465-1
1 1/16"-10	6"	DAMP/ORG	100398-1
1⅛"-10	6"	DAMP/ORG	100329-1
1⅛"-10	6⅛"	DAMP/ORG	100214-1
9⅝" Disc			
15/16"-10	5⅜"	DAMP/CER	100855-1
15/16"-10	6¼"	DAMP/ORG	100480-2
15/16"-15	6¼"	RIG/ORG	100918-1
1"-17	6⅜"	RIG/ORG	101478-1
1⅛"-10	6⅜"	DAMP/CER	101479-1
1¼"-10	5⅜"	RIG/CER	100762-2
1¼"-10	5⅜"	DAMP/CER	100724-1
1¼"-10	6⅛"	RIG/ORG	100297-3
1¼"-10	6⅛"	RIG/ORG	100201-2
1⅛"-10	5⅜"	DAMP/CER	101418-1
1¼"-10	6¼"	DAMP/ORG	100486-1
1¼"-10	6¼"	DAMP/ORG	100058-2
1¼"-10	6⅜"	RIG/ORG	10002-41
1⅜"-10	4⅛"	RIG/CER	100710-1
1⅜"-10	6⅛"	RIG/ORG	100090-1
1⅜"-10	6⅛"	RIG/ORG	100148-1
1⅜"-10	6⅛"	RIG/ORG	100719-1
10" Disc			
1"-10	6"	DAMP/ORG	100121-1
1"-10	6"	RIG/ORG	100168-1
1 1/16"-10	6¼"	DAMP/ORG	100464-1
1⅛"-10	6"	DAMP/ORG	100075-1
1⅛"-10	6"	DAMP/ORG	100176-1
1⅛"-10	6"	DAMP/ORG	100410-1
1⅛"-10	6"	RIG/ORG	100406-1
1⅛"-10	6"	DAMP/ORG	100175-1
1⅛"-10	6"	DAMP/ORG	100393-1
1⅛"-17	6"	RIG/MET	100357-1
1⅛"-10	6½"	DAMP/ORG	100400-1
1 9/64"-17	6"	DAMP/ORG	100324-1
1 9/16"-19	6"	RIG/ORG	100013-1
1¾"-27	6"	RIG/MET	100358-1
10 13/32" Disc			
1 1/16"-10	6½"	DAMP/ORG	100560-1
1⅛"-10	6½"	DAMP/ORG	100555-1
10½" Disc			
1"-23	6½"	DAMP/ORG	100631-1
1 1/16"-10	6½"	DAMP/ORG	101462-1
1⅛"-10	6½"	DAMP/ORG	100348-1
10⅞" Disc			
1⅛"-10	5⅜"	DAMP/CER	100434-1
1⅛"-10	6⅜"	DAMP/CER	100794-1
1⅛"-10	6⅜"	DAMP/CER	100795-1
1⅛"-10	6⅜"	DAMP/CER	101309-1
1⅛"-10	6¾"	DAMP/MET	100197-1
1⅛"-10	6¾"	DAMP/ORG	100170-1
1⅛"-10	6⅜"	DAMP/CER	101491-1
1⅛"-17	6⅜"	DAMP/CER	101423-1
1⅛"-10	6⅜"	DAMP/CER	101501-1
1⅛"-10	8½"	RIG/ORG	100134-1
1⅛"-17	8½"	RIG/ORG	100161-1
1 9/64"-17	6⅜"	DAMP/CER	101422-1
1 9/64"-17	6¾"	DAMP/ORG	100325-1
1 9/64"-17	6¾"	DAMP/ORG	100481-1
1¼"-10	6⅜"	RIG/CER	101434-1
1¼"-10	6¾"	RIG/ORG	100291-1
1¼"-10	6¾"	DAMP/ORG	100440-1
1⅜"-10	6¾"	RIG/ORG	100424-1
1⅜"-21	6⅜"	DAMP/CER	101420-1
1⅜"-21	6¾"	DAMP/CER	101421-1
1⅜"-21	6¾"	DAMP/ORG	100483-1
1⅜"-21	6¾"	DAMP/ORG	100484-1
1⅜"-10	7 1/16"	RIG/ORG	100458-1
1½"-10	6⅜"	RIG/ORG	11002-16
11" Disc			
1"-10	6½"	RIG/CER	100759-1
1"-10	6½"	RIG/CER	100757-1
1"-10	7"	DAMP/ORG	100142-1
1"-23	7"	DAMP/ORG	100468-1
1 1/64"-15	6½"	RIG/ORG	100919-1
1 1/64"-15	6½"	RIG/ORG	100920-1
1 1/16"-10	7"	DAMP/ORG	100466-1
1⅛"-10	6½"	RIG/MET	100447-1
1⅛"-10	6½"	RIG/ORG	100354-2
1¼"-10	6½"	DAMP/ORG	101148-1
1¼"-10	6½"	DAMP/ORG	100731-1
1⅜"-10	6½"	RIG/CER	100704-1
1⅜"-10	6½"	DAMP/ORG	11002-7
1⅜"-10	6 37/64"	RIG/CER	100733-1
1⅜"-21	6½"	RIG/ORG	100448-1
1 13/32"-19	6½"	RIG/ORG	100250-1
1½"-10	6⅛"	RIG/ORG	11002-14
1½"-10	6½"	RIG/ORG	100411-1
1⅝"-10	6½"	RIG/CER	100758-1
4⅛"-38	6½"	RIG/CER	101425-1
4⅞"-38	6½"	RIG/CER	101424-1
11⅛" Disc			
1¼"-19	7⅜"	RIG/CER	100753-1
1⅜"-10	7¼"	DAMP/ORG	100467-1
1⅜"-21	7¼"	RIG/ORG	101067-1
1 13/32"-23	7⅜"	DAMP/CER	101396-1
1¾"-10	7⅜"	DAMP/CER	101241-1
12" Disc			
1¼"-10	7"	DAMP/ORG	100945-1
1¼"-19	7½"	RIG/CER	101269-1
1⅜"-10	7"	RIG/CER	101293-2
1⅜"-21	7"	RIG/ORG	100450-1
1⅜"-10	7½"	RIG/CER	101292-9
1⅜"-21	7"	RIG/CER	101426-1
1½"-10	7"	RIG/CER	100846-1
4⅛"-38	7"	RIG/CER	100722-1
12⅛" Disc			
1⅛"-10	7"	DAMP/ORG	101408-1
1⅛"-10	7 5/32"	DAMP/CER	101437-1
1¼"-10	7"	DAMP/ORG	101243-1
1¼"-10	7 5/32"	DAMP/CER	101438-1
1⅜"-10	7"	DAMP/ORG	101296-1
1⅜"-10	7 5/32"	DAMP/CER	101439-1
1½"-10	7"	DAMP/ORG	101193-1
1½"-10	7 5/32"	DAMP/CER	101440-1
1½"-10	8⅜"	RIG/CER	101336-1

Spicer

DANA

DANA CORPORATION • SPICER CLUTCH Division

Fifth and Brandon Streets • Auburn, Indiana 46706

Phone: (219) 925-3800

Cover Assembly	Pressure Plate I.D.	Style	Plate Load
6¼" Single Plate			
6501-13	4⅜"	AU	696
100163-2	4⅜"	AU	435
100163-3	4⅜"	AU	690
100163-4	4⅜"	AU	875
8 17/32" Single Plate			
8501-29	5⅝"	AU	970
8501-30	5⅝"	AU	773
100000-1	5"	AU	1349
100000-2	5"	AU	1140
100140-1	5"	AU ST 1⅝"-24	964
100187-2	5"	AU	1185
100187-3	5"	AU	1354
100233-2	5⅝"	AU	1495
100233-3	5⅝"	AU	1795
8 15/16" Single Plate			
100066-1	5 1/16"	AU	1170
9" Single Plate			
100418-1	6 1/16"	AU	1850
9⅛" Single Plate			
100084-1	5⅜"	AU ST 1⅝"-19	1600
100105-1	5⅜"	AU ST 1⅝"-24	1600
100150-3	5⅜"	AU	1455
100207-3	5⅜"	AU	1400
100207-4	5⅜"	AU	1120
100342-2	5⅜"	AU	1450
100859-1	5⅜"	AU	1600
9⅜" Single Plate			
100459-1	5⅜"	AU	1680
9 43/64" Single Plate			
10001-1	6"	AU	1175
10001-14	6"	AU	1490
100089-1	6"	AU	1180
100258-2	5¼"	AU ST 1 49/64"-27	1550
100294-1	7"	AU	1780
100455-1	6½"	AU	1315
100455-2	6½"	AU	1700
100709-1	5¼"	AU	1765
10 1/16" Single Plate			
100012-1	5⅜"	AU	1700
100012-2	5⅜"	AU	1500
100167-1	5⅜"	AU ST 1⅝"-19	1700
100184-2	5⅜"	AU	1500
100252-2	5⅜"	AU	1750
100302-1	5⅜"	AU	1482
100375-1	5⅜"	AU	1020
100421-1	6⅛"	AU ST 1⅝"-24	1500
100454-1	5⅜"	AU	1305
100456-1	5⅜"	AU	1020
100456-2	5⅜"	AU	1450
100456-3	5⅜"	AU	1690
100853-1	5⅜"	AU	1020
10 43/64" Single Plate			
100446-1	6¾"	AU	885
100740-1	6¾"	AU	1000
101377-1	6⅜"	AU ST 1⅜"-10	1450

Cover Assembly	Pressure Plate I.D.	Style	Plate Load
11" Single Plate			
1101-8	6⅜"	AU	2200
1101-10	6⅜"	AU	1260
1101-12	6⅜"	AU	1630
100369-1	6⅜"	AU ST 1 49/64"-27	1450
100370-1	6⅜"	AU	1450
100370-2	6⅜"	AU	1450
100370-3	6⅜"	AU	1630
100370-4	6⅜"	AU	2030
100370-5	6⅜"	AU	2030
100387-1	6⅜"	AU ST 1⅝"-24	1450
100430-2	8⅛"	AU	2200
100474-1	6⅜"	AU ST 1⅜"-29	1450
100716-2	6 1/64"	AL	2000
100716-4	6 1/64"	AL	2200
100732-1	6 1/64"	AL	2000
100732-3	6 1/64"	AL	2400
100732-4	6 1/64"	AL	1800
100742-1	6⅜"	AU	1450
100755-1	6 1/64"	AL	1325
100755-2	6 1/64"	AL	850
100755-3	6 1/64"	AL	1050
100755-6	6 1/64"	AL	2450
100756-1	6 1/64"	AL ST 1⅛"-29	1055
100761-1	6⅜"	AU	1940
100763-1	6 1/64"	AL	2100
100763-2	6 1/64"	AL	1600
100816-1	6 1/64"	AL	1200
101061-1	6 1/64"	AL ST 1⅛"-29	1600
101407	6⅜"	AL ST 1 17/32"-23	1800
101489	6⅜"	AL	1800
101160-2	6 1/64"	AL ST 1¾"-27	2400
101164-2	6⅜"	AL ST 1 17/32"-23	1800
110086-1X	7¾"	DD 1¾"-10	1000
110133-X	7¾"	DD 1¾"-27	1000
110201-1X	7¾"	DD 1¾"-27	1000
110348-2X	7¾"	DD 1¾"-10	1200
110383-1X	6⅜"	DD 1¾"-27	1000
110684-1X	6⅜"	DD 1¾"-10	1600
110684-4X	6⅜"	DD 1¾"-10	1600
110728-1X	6⅜"	DD 1¾"-10	1400
110728-2X	6⅜"	DD 1¾"-10	1000
110728-3X	6⅜"	DD 1¾"-10	1400
110728-4X	6⅜"	DD 1¾"-10	1000
110784-1X	7¾"	DD 1⅝"-25	1600
110784-2X	7¾"	DD 1⅝"-25	1600
110785-1X	7¾"	DD 1⅝"-25	1400
110785-2X	7¾"	DD 1⅝"-25	1000
110785-3X	7¾"	DD 1⅝"-25	1400
110785-4X	7¾"	DD 1⅝"-25	1000
12" Single Plate			
100730-2	9½"	AU	2600
100735-4	6½"	AL	2400
100735-6	6½"	AL	1600
100746-1	6½"	AU 1 49/64"-27	1610
100747-1	6½"	AU	1610
100754-1	7"	AU	2310
100765-2	6½"	AL	2200
100890-1	6½"	AL	2600
13" Single Plate			
101227-1	6⅝"	AL	2600
101227-3	6⅝"	AL	2200

Spicer DANA

DANA CORPORATION • SPICER CLUTCH Division
Fifth and Brandon Streets • Auburn, Indiana 46706
Phone: (219) 925-3800

1/ Clutches
Bulletin 326

TWIN DISC, INCORPORATED • RACINE, WISCONSIN U.S.A.
TEL: 414-634-1981

Small Mechanical Clutches

Model "V" Clutches are designed for use in various types of applications requiring cut-off or service clutches up to 20 hp capacity. Available in 3½ and 4½" sizes with gear-tooth type driving plates.

Medium Mechanical Clutches

Model CL Clutches are available in sizes 5, 6, 8, 10 and 11". Most sizes available in 1, 2 and 3-plate construction. Working horsepower per 100 rpm ranges from 1.9 to 19.3. Working torques range from 97 to 1014 lbs.-ft. Torque capacity can be increased 33% by use of heavy-duty driving plates on 8 through 11" sizes.

Large Mechanical Clutches

Models E and EH Clutches are over-center type clutches for extra heavy-duty, high-horsepower, high-torque operations. Sizes include 14, 16 and 18" diameter. The 18" model is available in 1, 2 or 3-plate construction. Working horsepower per 100 rpm ranges from 17.5 to 108. Working torques range from 915 to 5655 lbs.-ft. Maximum engine horsepower recommended includes 170 to 740 hp for light-duty; 130 to 430 hp for normal-duty and 95 to 250 hp for heavy-duty. Complete range of optional driving rings, throwout forks and hand levers available.

Medium Air Clutches

Medium Model PO Air Clutches are available in sizes of 8, 10 and 11⅜" diameters and in 1, 2 or 3-plate construction. Horsepower per 100 rpm ranges from 3.7 to 33.3. Slip torque (130 psi) ranges from 390 to 3480 lbs.-ft. . . . torque capacity can be increased 33% by use of heavy-duty plates.

Large Air Clutches

Large Model PO Air Clutches are available in sizes 14, 18, 24, 30, 36 and 42" diameters, with most sizes available in 1, 2 or 3-plate construction. Horsepower per 100 rpm ranges from 35.7 to 2630. Slip torque (130 psi) ranges from 3750 up to 276,000 lbs.-ft.

Spider Drives

For customers able to purchase in quantity requirements, complete spider drives (spider flange plus hub) can be made available for some Model CL, E, EH and PO Clutches. Both bronze-bushed type spider drives and ball bearing type spider drives are available.

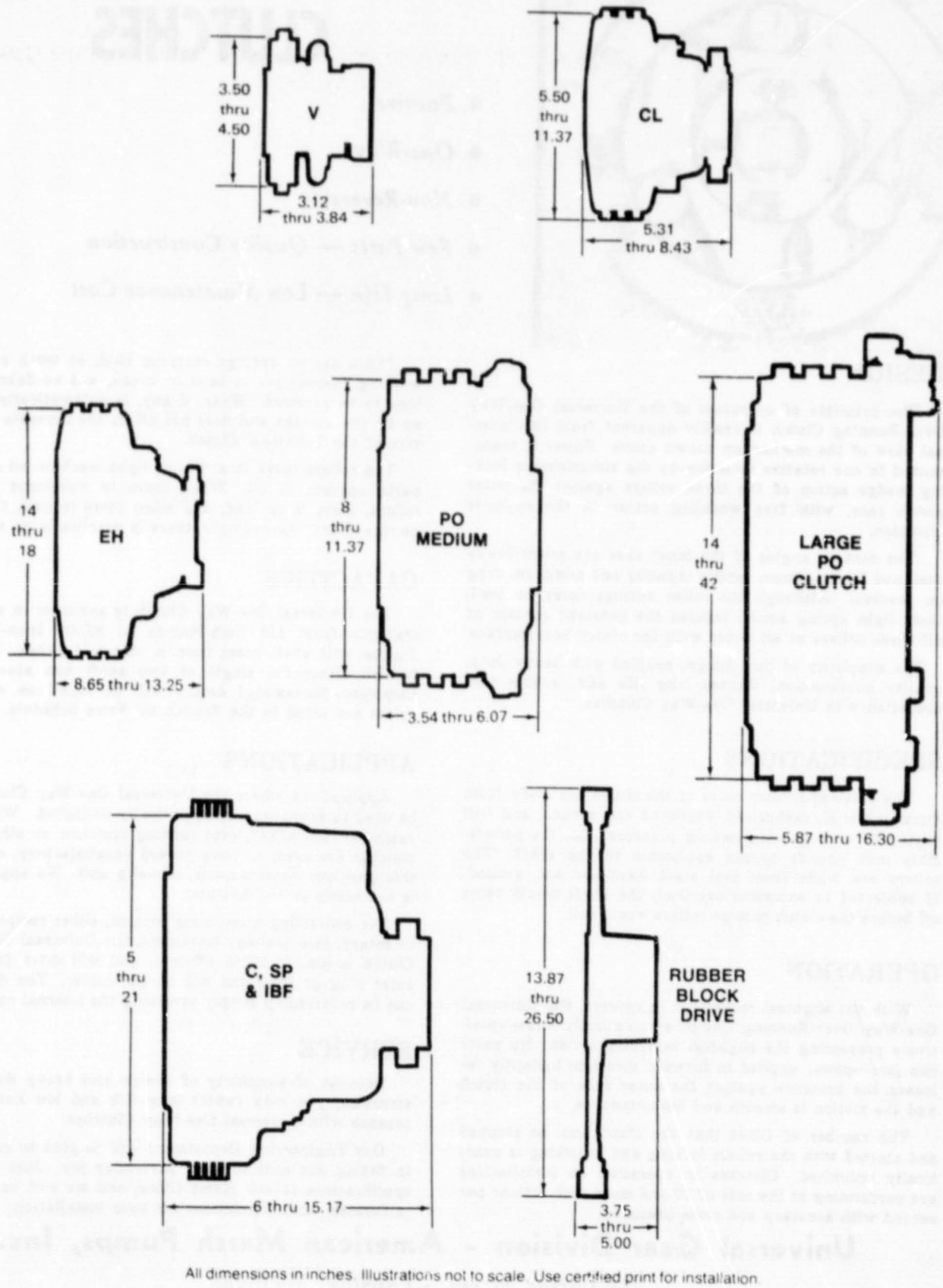
C, SP and IBF Clutches

These model Twin Disc clutches are offered in a wide range of configurations for specific OEM requirements. Sizes include 6 through 21" with an optional number and type of plates. These dry clutches feature over-center construction. Normal duty capacities range from 28 to 1255 hp. Request Bulletin 339.

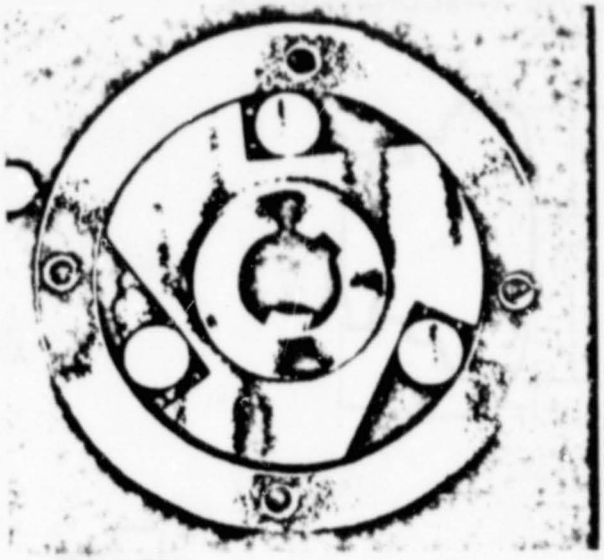
Rubber Block Drives

Twin Disc offers Rubber Block Drives for internal combustion engine power transmission applications that do not require a disconnect clutch. These are excellent for installations such as pumps, compressors, and single and double bearing generator drives. Standard sizes available include an 11, 14, 18 and two 21" units. One 21" unit has a single-row of blocks, the other 21" unit contains a double-row of blocks. Other sizes can be purchased in production quantities only. Request Bulletin 313.

TWIN DISC, INCORPORATED • RACINE, WISCONSIN U.S.A.
TEL: 414-634-1981



All dimensions in inches. Illustrations not to scale. Use certified print for installation.



UNIVERSAL ONE-WAY CLUTCHES

- *Positive*
- *One-Way*
- *Non-Reversing*
- *Few Parts — Quality Construction*
- *Long Life — Low Maintenance Cost*

DESIGN

The principle of operation of the Universal One-Way Over-Running Clutch is readily apparent from the internal view of the mechanism shown above. Power is transmitted in one rotative direction by the simultaneous locking wedge action of the three rollers against the outer clutch race, with free wheeling action in the opposite direction.

The contour angles of the inner race are scientifically designed for maximum torque capacity and minimum drag on reversal. Although the roller springs carry no load, their light spring action insures the constant contact of all three rollers at all times with the clutch race surface.

The simplicity of this design, coupled with heavy duty, quality construction, insures long life and trouble free operation with Universal One-Way Clutches.

SPECIFICATIONS

The outer and inner races of the clutch are made from finest material, carburized, hardened and ground, and will withstand even greater locking pressure than the permissible inch pounds torque applicable to the shaft. The rollers are made from tool steel, hardened and ground. If subjected to excessive overload, the shaft would twist off before the clutch race or rollers would fail.

OPERATION

With the slightest movement in reverse, the Universal One-Way Over-Running Clutch automatically locks—positively preventing the slightest reversing action. No parts can jam—power applied in forward direction instantly releases the pressure against the outer race of the clutch and the motion is smooth and instantaneous.

The number of times that the clutch can be stopped and started with the rollers locking and unlocking is practically unlimited. Clutches in operation on installations are performing at the rate of 20 and more such actions per second with accuracy and close precision.

There are no springs carrying load, no teeth or light working mechanism to bend or break, and no fabric facings to be renewed. Wear, if any, is automatically taken up by the springs and does not affect the accurate operation of the Universal Clutch.

The rollers move in a film of light machine oil and all parts operate in oil. When there is movement of the rollers, there is no load, and when there is load, there is no movement. Accordingly, there is practically no wear.

CAPACITIES

The Universal One-Way Clutch is available in sizes to transmit from 125 Inch-Pounds to 83,000 Inch-Pounds Torque, with shaft bores from ⅛ inch to 4 inches. We can furnish either the single or two shaft hub assemblies. Complete dimensional details will be found on Page 3. Prices are listed in the Section 9B Price Schedule.

APPLICATIONS

Applications where the Universal One-Way Clutch can be used to advantage are practically unlimited. Wherever ratchets, "no-backs", over-running clutches, or other type clutches are used, or have proved unsatisfactory, consider this positive, instantaneous, non-slip unit. No application is too heavy or too delicate.

For converting alternating motion, either reciprocating or rotary, into one-way movement, the Universal One-Way Clutch is almost 100% efficient, and will drive from the outer ring or from the hub at the center. The direction can be reversed by simply reversing the internal assembly.

SERVICE

Because of simplicity of design and heavy duty construction, you may expect long life and low cost maintenance with Universal One-Way Clutches.

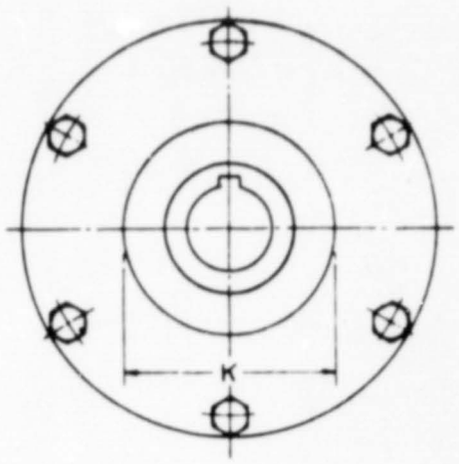
Our Engineering Department will be glad to cooperate in fitting our unit to your particular job. Just forward specifications to our Home Office, and we will be pleased to furnish recommendations for your installation.

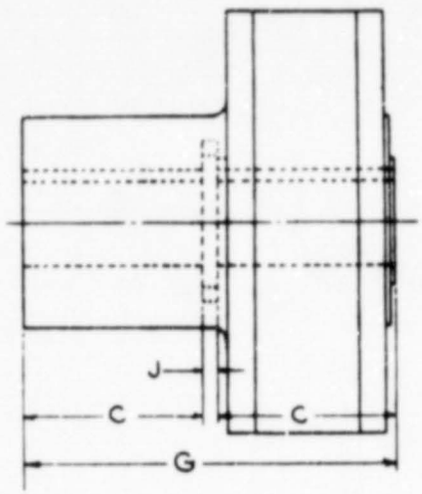
Universal Gear Division - American Marsh Pumps, Inc.

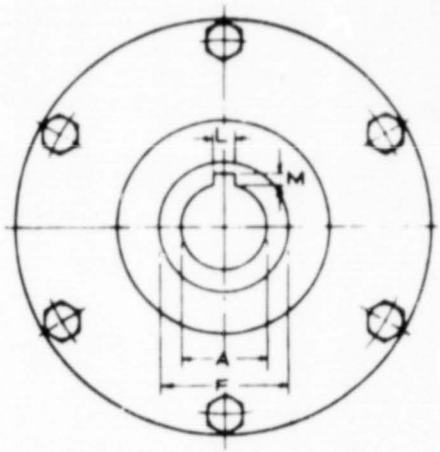
722 Porter Street, - Lansing, Michigan

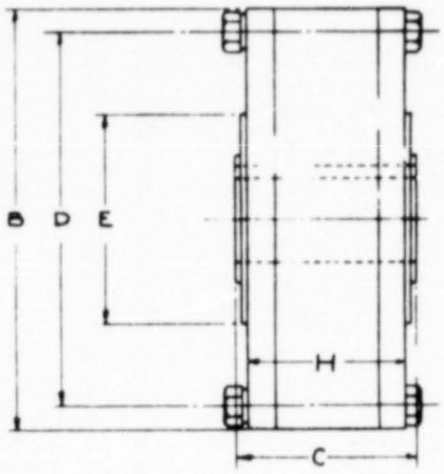
Tel. 517-489-1471

UNIVERSAL ONE-WAY OVER-RUNNING CLUTCHES









DIMENSIONS

Model No.	Max. Torque In. Lbs	Bore A	O.D. B	Width C	Bolt Circle D	No. & Dia. Bolt	Hub Dia. E	Hub Dia. F	Hub Length G	Width H	Relief J	Hub Dia. K	Keyway L X M	Set Screw
50	125	1/2	2 7/8	1 1/4	2 1/8	4 - #5	1 1/8	3/4	2 15/16	1 1/8	1/16	1	1/8 x 1/16	#10-24
75	562	3/4	3 3/8	1 3/8	3 3/16	4 - #10	1 5/8	1 3/8	3 5/16	1 1/2	1/16	1 1/2	3/16 x 3/32	#10-24
100	1,350	1	5	2 3/8	4 1/16	6 - 1/4	2 1/2	1 1/2	4 11/32	1 11/16	1/16	2	1/4 x 1/8	1/4-20
150	4,600	1 1/2	6 1/2	2 3/4	5 1/4	6 - 5/16	3 1/2	2 1/4	5 13/32	2 3/8	5/32	2 1/2	3/8 x 3/16	1/4-20

Bore Tolerances From 1/2 to 1 1/2 D. Inclusive +.000 to +.001

UNIVERSAL GEAR DIVISION - AMERICAN MARSH PUMPS, INC. - 722 Porter St., Lansing, Mich.

Tel. 517-489-1471

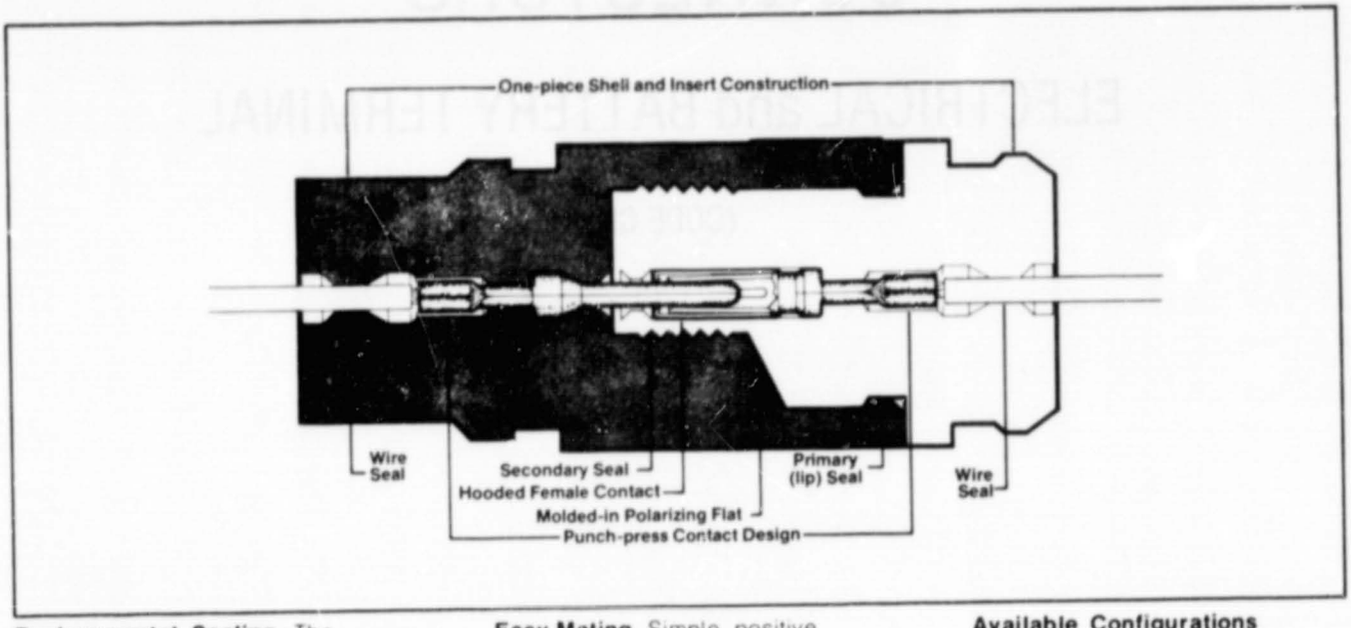
CONNECTORS

ELECTRICAL and BATTERY TERMINAL

(CODE **CN**)

BUNKER RAMO **AMPHENOL NORTH AMERICA**
A Division of Bunker Ramo Corporation
AMPHENOL NORTH AMERICA Division Headquarters: 2122 York Road • Oak Brook, Illinois 60521
(Tel. 312-986-2300)

construction features



Environmental Sealing. The mating seals (Primary and Secondary), as well as the discrete wire seals, resist entry of liquid into the connector, causing electric or electronic circuit failures (not intended for submersible applications).

High Reliability. Hooded female contacts plus a molded-in polarizing flat for proper contact/connector alignment.

Durable. The resilient connector body is highly abrasion resistant and highly impervious to water, lubricants, fuel, ozone and road salts.

Long Service. The unique one-piece shell and insert construction minimizes the number of parts and failure modes for predictably long service life.

Low Installed Cost. Punch-press contacts permit the use of automated stripping and crimping equipment for lower on-line production and installed assembly costs.

Low Maintenance Cost. 44 Series Connectors can easily be field-serviced using inexpensive hand crimp and contact insertion/removal tools, minimizing equipment downtime and maintenance time.

Easy Mating. Simple, positive push-pull mating and disconnect require no special assembly instructions. Obvious visual and mechanical mating indicators help avoid damage to components that could result in lost or intermittent circuits.

Panel Mounting. 44 Series receptacles can be panel mounted, in addition to being used in cable-to-cable applications. Contact the sales office nearest you listed on the back cover for recommendations on panel mounting of the 44 Series for your application.

Materials. The resilient material used in the Amphenol 44 Series connectors allows the insulator to be molded as one complete unit. This material has proved to be the most resistant to salt spray, shock and vibration. Amphenol Poke-Home® contacts are made of a copper alloy with electrotin plating. This combination of materials provides a highly waterproof connector at a low cost.

Operational Characteristics
Voltage Rating: Limiting operating voltage at sea level, 250 volts AC RMS.
Current Rating: 8 amps continuous.
Temperature Range: Continuous operation from -40°C to + 105°C.

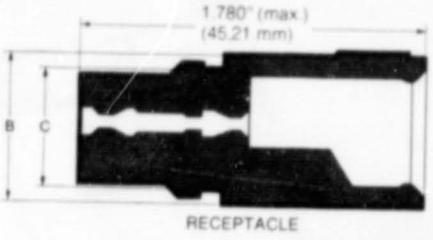
Available Configurations
Amphenol 44 Series connectors are available now in 1, 2, 3, 4, 5, and 6 contact configurations. We can design and manufacture custom or special connectors to solve your unique interconnection problems. Consult the sales office nearest you listed on the back cover for information.

Test Data. Environmental and performance test data on connectors and contacts is available upon request.

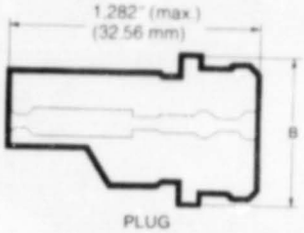
Terminations
- Punch press contacts can be crimped on automatic, semi-automatic or manual equipment.
- Contacts accept wire sizes of 14, 16 and 18 AWG with an overall wire insulation diameter range of .080 to .130 inches (2.03 to 3.30mm).
- Standard contact packaging is reels of 5000 units for automatic, semi-automatic machine crimping.
- Contacts are also available individually packaged for hand tool crimping in bags of 100, 500 or 1000 pieces.

BUNKER RAMO **AMPHENOL NORTH AMERICA**
A Division of Bunker Ramo Corporation
AMPHENOL NORTH AMERICA Division Headquarters: 2122 York Road • Oak Brook, Illinois 60521 (Tel. 312-986-2300)

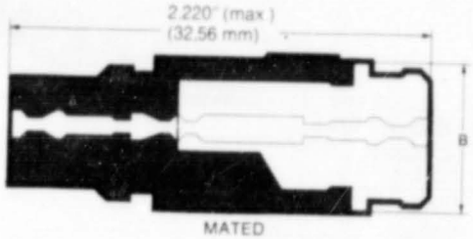
dimensions & part numbers



RECEPTACLE



PLUG



MATED

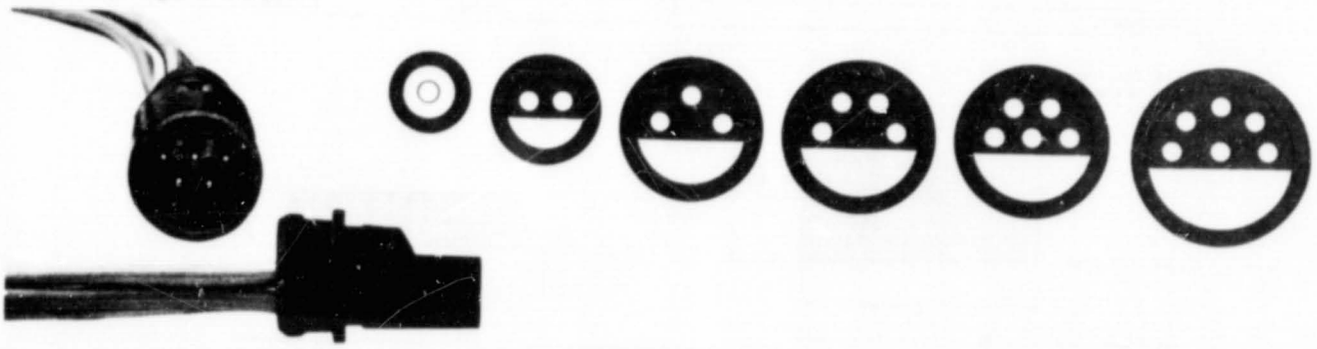
Connector Dimensions

Number of Contacts	B Max.		C ± 005 in. (± 13 mm)	
	Inches	mm	Inches	mm
1	500	12.70	445	11.30
2	620	15.75	470	11.94
3	721	18.31	571	14.50
4	832	21.13	682	17.32
5	832	21.13	682	17.32
6	946	24.03	796	20.22

Connector Part Numbers

No. of Contacts	Part Numbers	
	Receptacles	Plugs
1	44-104-10001-02	44-103-10001
2	44-104-10002-02	44-103-10002
3	44-104-10003-02	44-103-10003
4	44-104-10004-02	44-103-10004
5	44-104-10005-02	44-103-10005
6	44-104-10006-02	44-103-10006

Insert Configurations

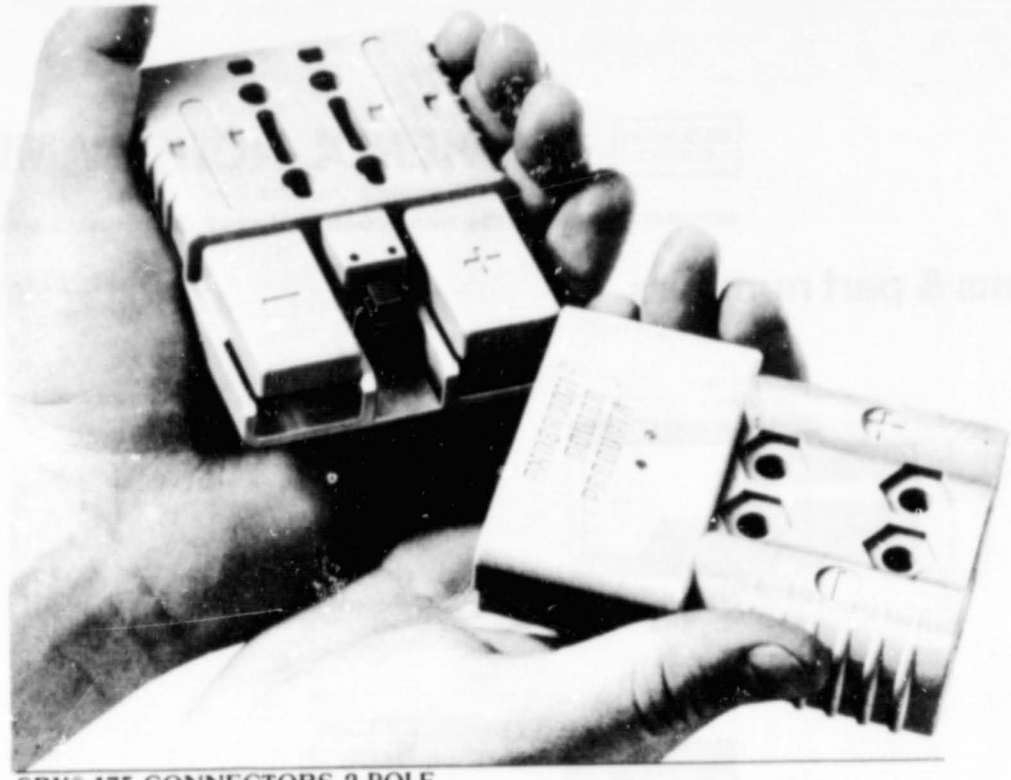


Contact Part Numbers

Pin Contact — Used in Receptacles Only. **Socket Contact** — Used in Plugs Only.

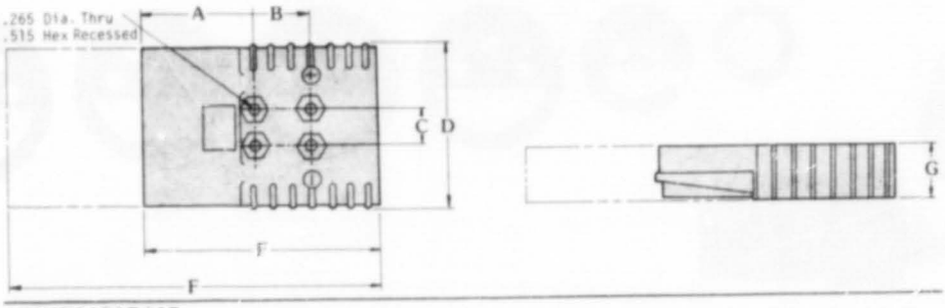
Pin Contacts	Socket Contacts	Termination
44-100-1414P-5000	44-102-1414S-5000	Reel of 5000 contacts shipped on carrier strips for use with semi-automatic crimping machine.
44-100-1414P-100(101) 44-100-1414P-500(101) 44-100-1414P-1000(101)	44-102-1414S-100(101) 44-102-1414S-500(101) 44-102-1414S-1000(101)	(101) deviation specifies contacts removed from reels and individually packaged in bags of 100, 500, or 1000 for hand tool crimping applications.

Note: Connector assembly instruction sheet packaged with contacts.



SBX® 175 CONNECTORS 2-POLE

DESCRIPTION	HOUSING COLOR	WIRE SIZE AWG	WIRE SIZE SQ. mm	CATALOG NUMBER
Housing with springs 2 contacts & auxiliary contact kit	Gray	1/0	53.50	6370G1
	Blue			6371G1
	Orange			6372G1
	Yellow			6373G1
	Red			6378G1
Housing with springs	Gray	1/0	53.50	6380G1
	Blue			6381G1
	Orange			6382G1
	Yellow			6383G1
	Red			6385G1
Housing with springs & 2 contacts	Gray	1/0	53.50	6374G1
	Blue			6375G1
	Orange			6376G1
	Yellow			6377G1
	Red			6379G1
2 contacts		1/0	53.50	6384G1

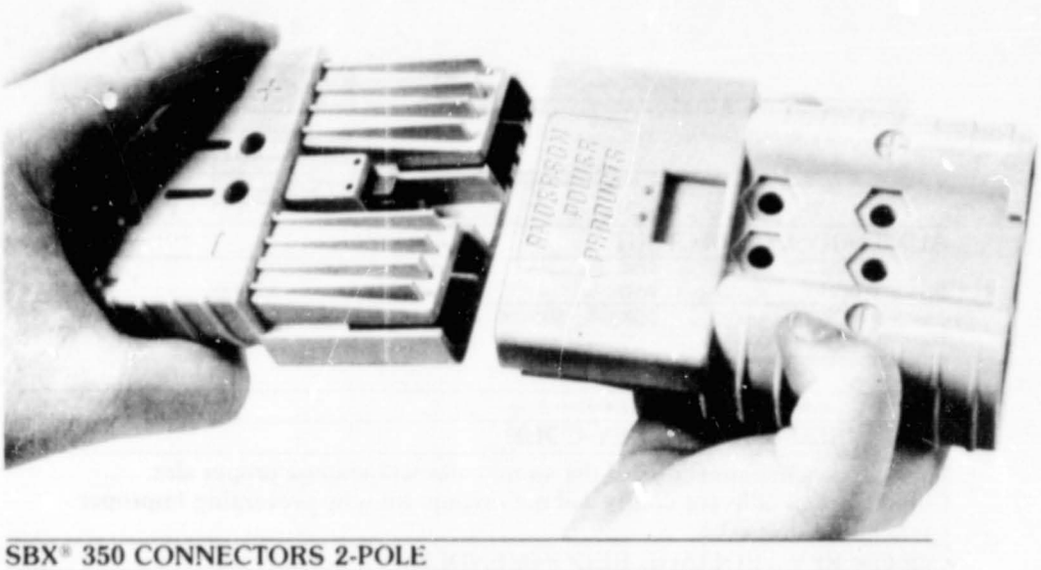


DIMENSIONS

All dimensions are for reference only; they are not intended for specification purposes. Specific details will be furnished on request.

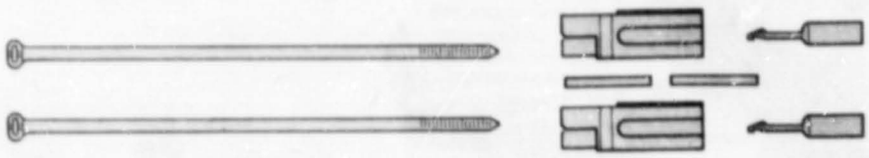
MODEL	A in.	A mm	B in.	B mm	C in.	C mm	D in.	D mm
SBX 175	1.937	049.2	1.125	028.5	0.625	015.9	2.802	071.2
SBX 350	2.437	061.9	1.125	028.5	0.625	015.9	3.374	085.7

	E in.	E mm	F in.	F mm	G in	G mm
SBX 175	3.630	085.3	5.760	146.3	1.000	025.4
SBX 350	4.937	125.4	7.875	200.0	1.312	033.3



SBX® 350 CONNECTORS 2-POLE

DESCRIPTION	HOUSING COLOR	WIRE SIZE AWG	WIRE SIZE SQ. mm	CATALOG NUMBER
Housing with springs 2 contacts & Auxiliary Contact Kit	Gray	2/0	67.43	6340G1
		3/0	85.01	6340G2
		4/0	107.20	6340G3
		300 MCM	152.00	6340G5
	Blue	2/0	67.43	6341G1
		3/0	85.01	6341G2
		4/0	107.20	6341G3
		300 MCM	152.00	6341G5
	Red	2/0	67.43	6342G1
		3/0	85.01	6342G2
		4/0	107.20	6342G3
		300 MCM	152.00	6342G5
	Green	2/0	67.43	6343G1
		3/0	85.01	6343G2
		4/0	107.20	6343G3
		300 MCM	152.00	6343G5
Housing with springs	Gray		67.43	6350
	Blue		85.01	6351
	Red		107.20	6352
	Green		152.00	6353
Housing with springs & 2 contacts	Gray	2/0	67.43	6345G1
		3/0	85.01	6345G2
		4/0	107.20	6345G3
		300 MCM	152.00	6345G5
	Blue	2/0	67.43	6346G1
		3/0	85.01	6346G2
		4/0	107.20	6346G3
		300 MCM	152.00	6346G5
	Red	2/0	67.43	6347G1
		3/0	85.01	6347G2
		4/0	107.20	6347G3
		300 MCM	152.00	6347G5
	Green	2/0	67.43	6348G1
		3/0	85.01	6348G2
		4/0	107.20	6348G3
		300 MCM	152.00	6348G5
2 Contacts		2/0	67.43	6354
		3/0	85.01	6355
		4/0	107.20	6356
		300 MCM	152.00	6358



AUXILIARY CONTACT KIT

DESCRIPTION	FOR USE WITH	WIRE SIZE AWG	WIRE SIZE SQ. mm	CATALOG NUMBER
2 each of: POWERPOLE* housing with springs contacts retaining pins & cable ties	SBX 175 SBX 350	18 to 12	0.82 to 3.31	6344

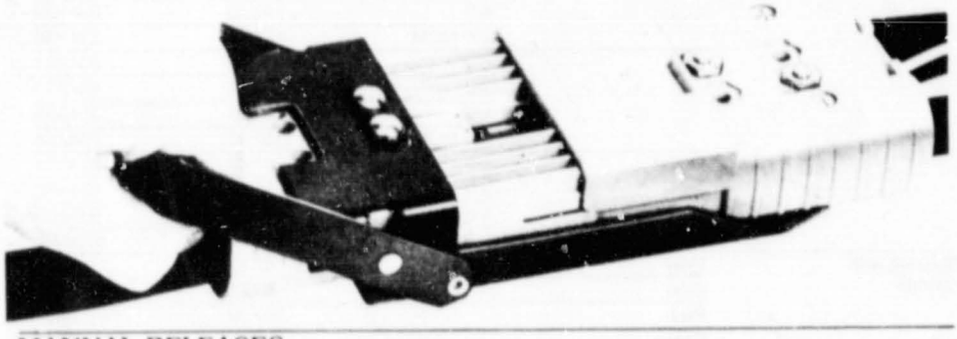
*POWERPOLE modular connector: 30 ampere, 600 volt rating.

NUMBERED VOLTAGE KEY CODE

Voltage keys in connectors of the same color will engage proper slot. Connectors of different colors will not engage thereby preventing improper connection.

COLOR KEY – VOLTAGE RECOMMENDED:

Yellow	12V	Gray	36V
Orange	18V	Blue	48V
Red	24V	Green	72V



MANUAL RELEASES

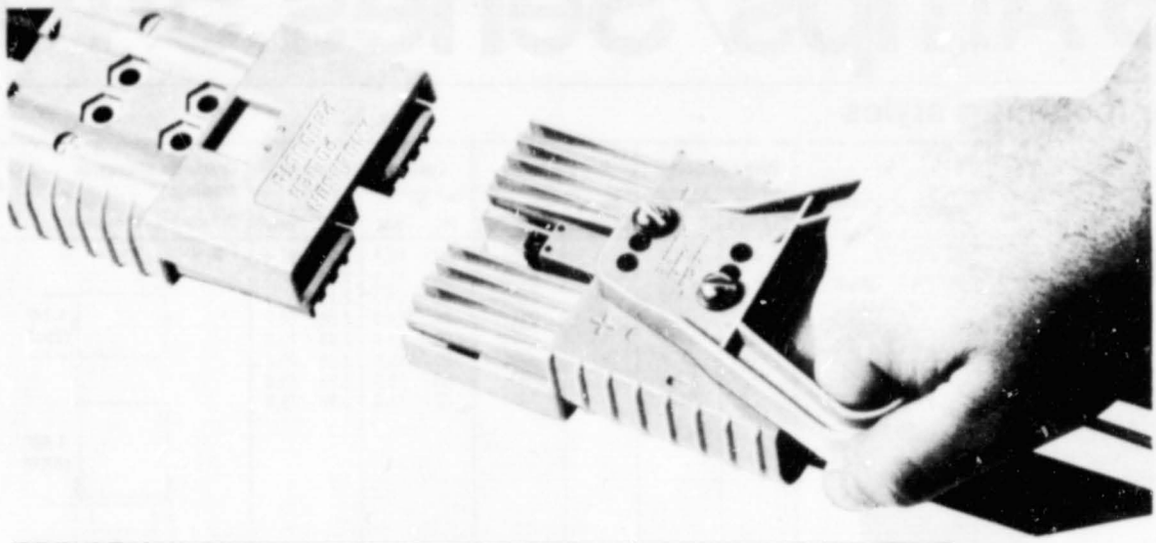
Insulated non-corrosive steel structure. Provides smooth and efficient power connection/disconnection, maintains connector alignment.

DESCRIPTION	HARDWARE KIT INCLUDES	CATALOG NUMBER
Battery bracket with hardware	2 screws 2 nuts 2 lockwashers	993G1
Charger/Truck bracket with hardware	2 screws 2 nuts 2 lockwashers	994G1

CABLE CLAMPS

Underwriters Laboratories Inc.® requires use of cable clamps when contacts are soldered to unsupported leads.

DESCRIPTION	FOR USE WITH	HARDWARE KIT INCLUDES	CATALOG NUMBER
Use alone or with "A" Frame Handle	SBX 175	1 screw 1 nut 1 lockwasher	945G2
Use alone, with manual release or "A" Frame Handle	SBX 350	1 screw 1 nut 1 lockwasher	911G2



"A" FRAME HANDLES

Polycarbonate Lexan* handle relieves unnecessary strain on cables when disconnecting.

FOR USE WITH	DESCRIPTION	HARDWARE KIT INCLUDES	CATALOG NUMBER
SBX 175	One handle with hardware	2 screws 2 nuts 2 lockwashers	995G1
SBX 350	One handle with hardware	2 screws 2 nuts 2 lockwashers	995G2

*Reg. TM General Electric Co.

REDUCING BUSHINGS Assures proper fit for smaller cable sizes. For crimping purposes only.

FOR USE WITH	AWG WIRE SIZE	CATALOG NUMBER
SBX 175	1	5687
	2	5690
	4	5693
	6	5663
	10	5648
SBX 350	2/0 to 1/0	5918

CRIMPING TOOLS

Use recommended crimping tool. Crimping by other means may disturb contact position in housing and/or produce high resistance joints.

FOR USE WITH	WIRE SIZE	CATALOG NUMBER
SBX 175	1/0	1368*
SBX 350 Auxiliary Contact Kit (POWERPOLE)	2/0	1351**
	3/0	
	4/0	
	300 MCM	

*Anderson Electric Corp. VC-7 Bench mountings available.
**Manual non-cycle controlled quadradent crimp

Consult your Anderson Representative for details on other available crimping tools.

EXTRACTION TOOLS

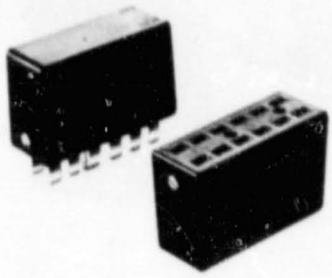
To simplify disassembly procedures when removing contacts from housings.

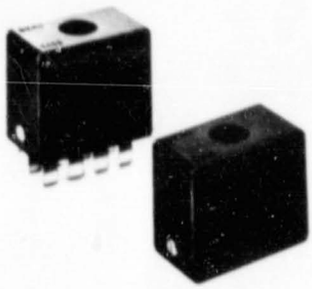
FOR USE WITH	DESCRIPTION	CATALOG NUMBER
SBX 175	Extraction tool with insulated handle	969P1
SBX 350		970P1
Auxiliary Contact Kit (POWERPOLE)	Contact insertion/ extraction tool	111038G2

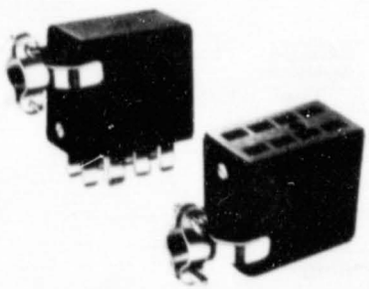
15 Amps/Series 5400

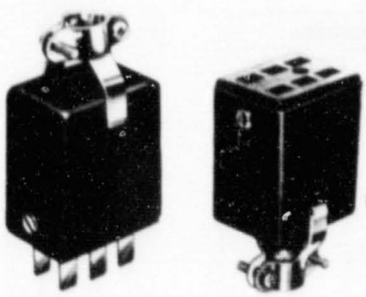
Cable mounting styles

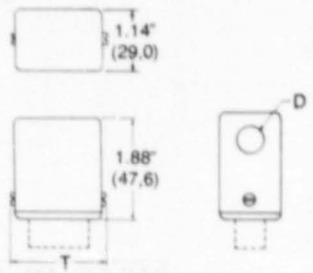
Mounting hardware	Plug and Socket		Pre-grounding		Connector dimensions				Connector dimension drawings
					D		T		Dimensions: inches (mm)
	No. of Contacts	Cat. No. (P- or S-)	No. of Contacts	Cat. No. (PG- or SG-)	in.	mm	in.	mm	
FHE Flared Hole End	4	5404	5	5405	.44	11,1	1.23	31,4	Fig. J
	6	5406	7	5407	.44	11,1	1.67	42,5	
	8	5408	9	5409	.56	14,3	2.11	53,6	
	10	5410	11	5411	.56	14,3	2.55	64,7	
	12	5412	13	5413	.63	15,9	2.98	75,8	
	14	5414	—	—	.63	15,9	2.98	75,8	
	15	5415	—	—	.63	15,9	2.98	75,8	
	16	5416	—	—	.63	15,9	2.98	75,8	
FHT Flared Hole Top	4	5404	5	5405	.44	11,1	1.23	31,4	Fig. K
	6	5406	7	5407	.44	11,1	1.67	42,5	
	8	5408	9	5409	.56	14,3	2.11	53,6	
	10	5410	11	5411	.56	14,3	2.55	64,7	
	12	5412	13	5413	.63	15,9	2.98	75,8	
	14	5414	—	—	.63	15,9	2.98	75,8	
	15	5415	—	—	.63	15,9	2.98	75,8	
	16	5416	—	—	.63	15,9	2.98	75,8	
CCE Cable Clamp End	4	5404	5	5405	.44	11,1	1.23	31,4	Fig. L
	6	5406	7	5407	.44	11,1	1.67	42,5	
	8	5408	9	5409	.56	14,3	2.11	53,6	
	10	5410	11	5411	.56	14,3	2.55	64,7	
	12	5412	13	5413	.63	15,9	2.98	75,8	
	14	5414	—	—	.63	15,9	2.98	75,8	
	15	5415	—	—	.63	15,9	2.98	75,8	
	16	5416	—	—	.63	15,9	2.98	75,8	
CCT Cable Clamp Top	4	5404	5	5405	.44	11,1	1.23	31,4	Fig. M
	6	5406	7	5407	.44	11,1	1.67	42,5	
	8	5408	9	5409	.56	14,3	2.11	53,6	
	10	5410	11	5411	.56	14,3	2.55	64,7	
	12	5412	13	5413	.63	15,9	2.98	75,8	
	14	5414	—	—	.63	15,9	2.98	75,8	
	15	5415	—	—	.63	15,9	2.98	75,8	
	16	5416	—	—	.63	15,9	2.98	75,8	

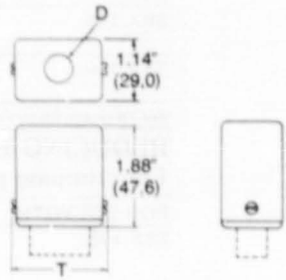


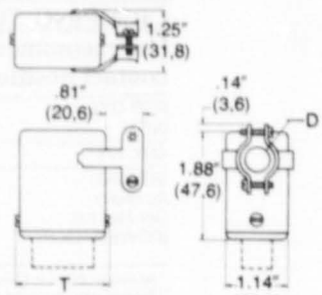


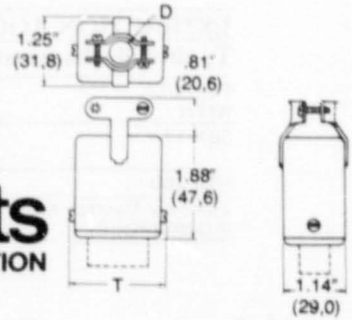












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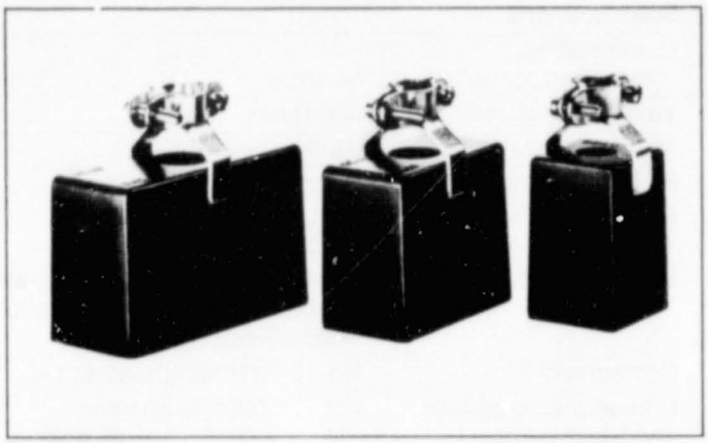
†For non-standard hole sizes, consult factory.

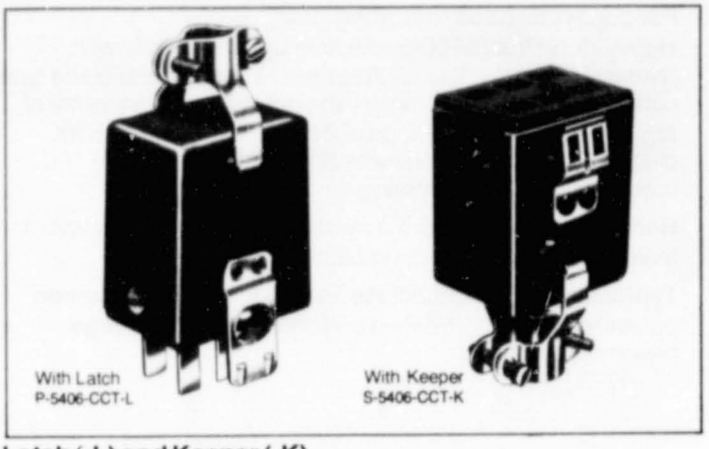
Cable mounting hardware



Backshells

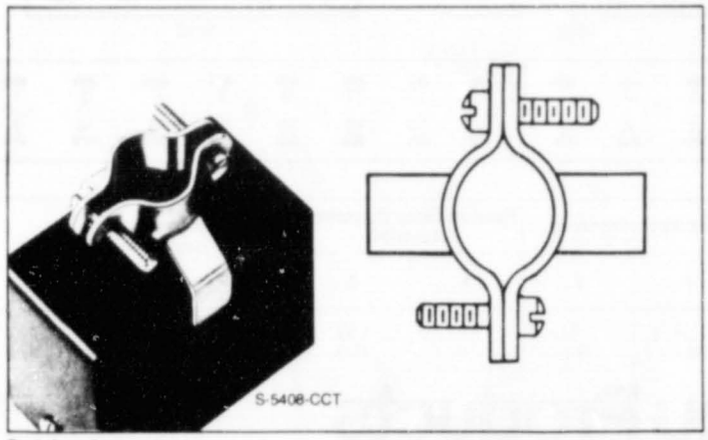
Thermoplastic (standard). These molded thermoplastic backshells, exclusively from Vernitron, provide greater dielectric strength — and greater safety than metal backshells. They are also highly resilient, non-denting, non-rusting, acid resistant. U.L. recognized. CSA certified. Color, black.

Metal (option -M). Available upon request. Made of zinc plated steel, chromate dipped and painted with baked black wrinkle enamel finish. Furnished with insulating paper liners. U.L. recognized, CSA certified.



Latch (-L) and Keeper (-K)

For connecting two cable-mounted connectors. Plug and socket can be equipped with either a latch (-L) or keeper (-K).

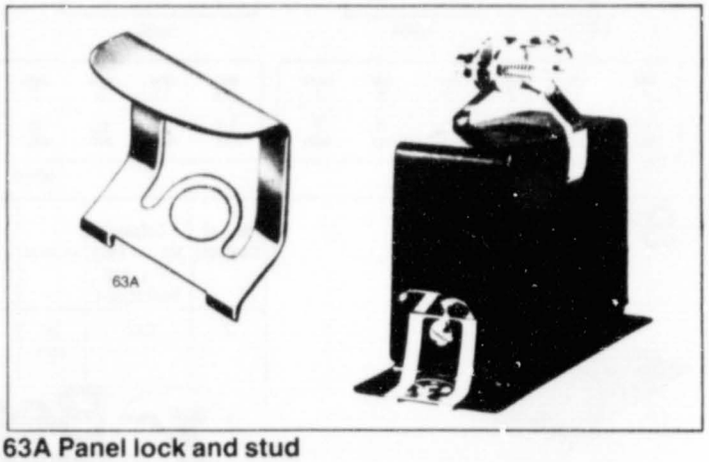


Cable clamps

Strain relief cable clamps, used with round cable. For top mounting (-CCT) or end mounting (-CCE).

For connector size	Clamp opening diam, in. (mm) min	max	Clamp Cat. No.
STANDARD CLAMP SIZES			
5404 thru 5406	.38" (9,7)	.72" (18,3)	36*
5408 thru 5416	.38" (9,7)	.84" (21,3)	36A*
CLAMP OPTIONS			
5404 thru 5416	.45" (11,4)	.91" (23,1)	78
5404 thru 5416 for CCE mating DB	.38" (9,7)	.72" (18,3)	47

*Order number not required. This clamp size automatically furnished when ordering -CCT or -CCE.



63A Panel lock and stud

For locking a cable-mount[illegible]or to a panel-mounted connector. In p[illegible] applications, the 63A lock mounts with th[illegible]ed to secure the bracket. The stud is bu[illegible]nell; to order, add dash number to connector [illegible]mber (two types available; see table below). [illegible]cks are ordered separately: Catalog No. 63A [illegible]pecify panel mounting style SB or DB).

Mounting hardware	Connector sizes	Stud Cat. No.
SB Shallow bracket	5404 thru 5416	-63A-SB
DB Deep bracket	5404 thru 5416	-63A-DB

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50 Amps/Series 5500

For panel interface mounting
Heavy-duty Beau 5500 connectors are compatible with "Series 500 type." The 5500 series is a rectangular blade type connector rated at 50 amps — the only 50 amp connector of any kind with the wide range of 2 to 16 contacts. The 5500 plug and socket are made with Shallow Bracket (-SB) hardware for panel mounting.

Hermaphroditic option: Available with any combination of male and female contacts in both halves.

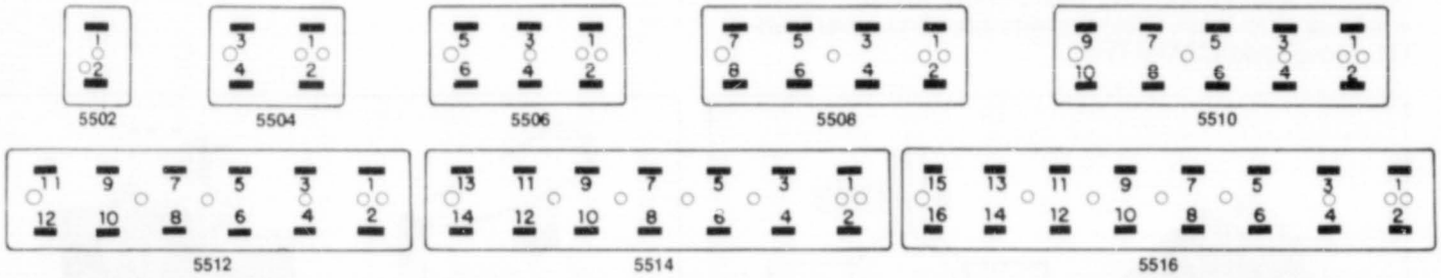
Typical applications include heavy-duty battery powered equipment, lighting, heating and cooling systems, large power supplies, etc.

Specifications

Current rating, individual contacts	50 amps
Voltage rating, rms	600 volts
No. of contacts	2 to 16
Plug contact material	Brass, cadmium plated
Plug contact dimensions (exposed contact surface)	.72"L x .32"W x .09" thick (18,3 x 8,1 x 2,3 mm)
Socket contact	Phosphor bronze, cadmium plated Double-wipe socket engages both sides of plug contacts
Contact tails	No. 10-32 binding head screw
Contact plating options (add dash number to catalog number)	-03: .0003" (8μm) silver -04: .000015" (0,4μm) gold over .0002" (5,0 μm) nickel -05: .00001" (0,3μm) rhodium over .0002" (5μm) nickel
Base insulating material	High-grade phenolic, black
Shallow bracket material	Steel, baked black wrinkle enamel finish over zinc chromate plating

Contact orientation
The polarization arrangement numbers shown are for *sockets*, as viewed from the wiring side. Plug numbering is the opposite.

○ = polarizing position



SB Shallow Bracket

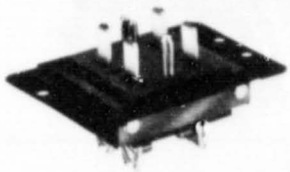
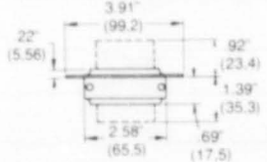
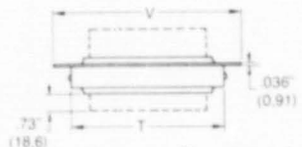




Fig. D





Dimensions: inches (mm)

No. of Contacts	Catalog No. — Plug (P-), and Socket (S-)	in./mm	Connector dimensions T	Connector dimensions V	Panel mounting dimensions (suggested) A	Panel mounting dimensions (suggested) C
2	5502	in.	1.33	1.94	—	1.63
		mm	33,7	49,2	—	41,3
4	5504	in.	2.14	2.75	.81	2.44
		mm	54,4	69,8	20,6	61,9
6	5506	in.	2.95	3.56	1.62	3.25
		mm	75,0	90,5	41,1	82,6
8	5508	in.	3.75	4.38	2.44	4.06
		mm	95,3	111	62,0	103
10	5510	in.	4.56	5.19	3.25	4.88
		mm	116	132	82,6	124
12	5512	in.	5.38	6.00	2.03	5.69
		mm	137	152	51,6	144
14	5514	in.	6.19	6.81	2.44	6.50
		mm	157	173	62,0	165
16	5516	in.	7.00	7.63	2.84	7.31
		mm	178	194	72,1	186

Panel dimension drawings (suggested)
Dimensions: inches (mm)

Fig. E

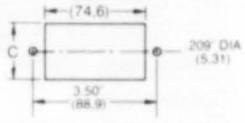


Fig. F

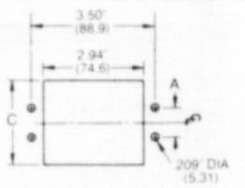
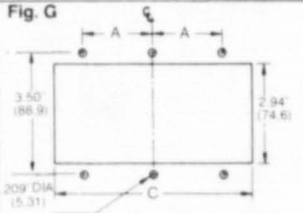


Fig. G



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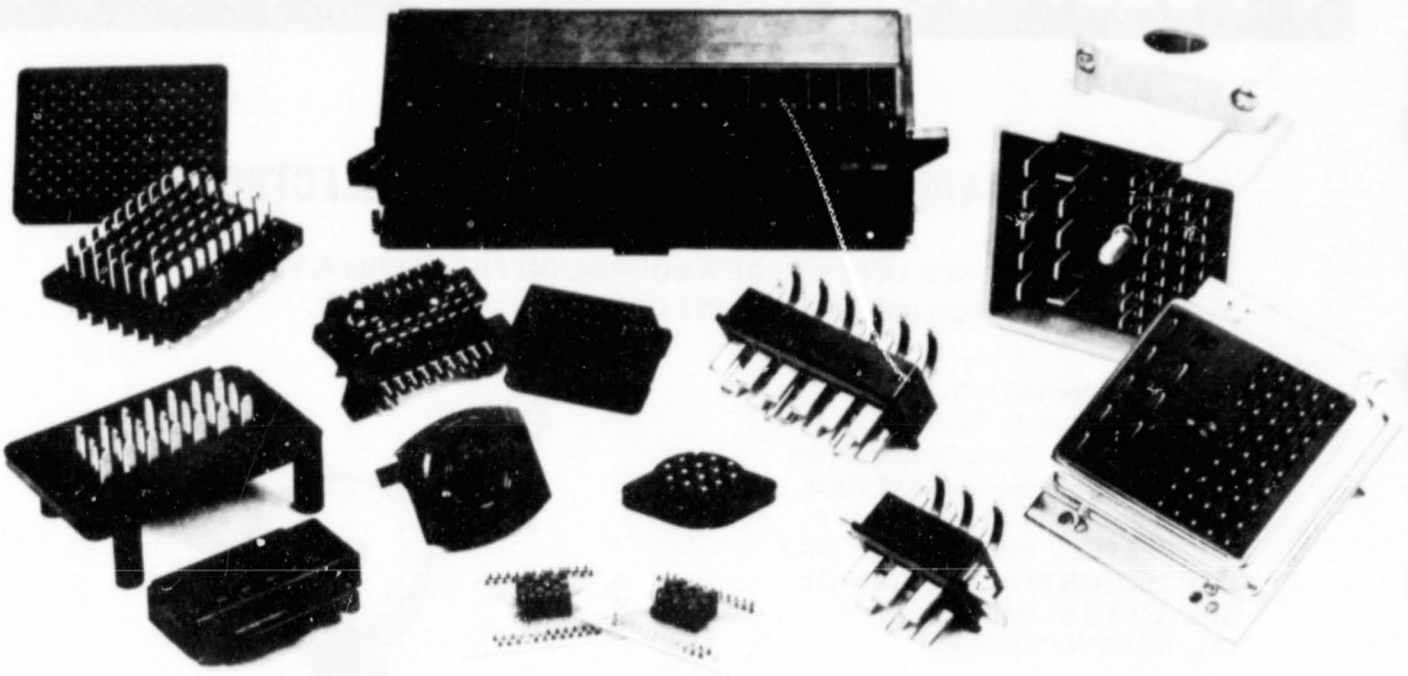
TEL (603) 524-5101

Custom Designs



Solving difficult interconnection problems is a Vernitron specialty

You have a special interconnection problem. Standard components don't solve the particular requirements of your application. There is one place you can go where you will find a top management commitment to solving special design problems: Vernitron Corporation.

Specials get the involvement of our most experienced design engineers — including the President of the Beau Products Division. What makes our design capabilities unique is a two-fold talent:

(1) the ability to conceive interconnection designs that effectively solve the application problems, and,

(2) the ability to relate the design to standard manufacturing capabilities — or to rethink the manufacturing processes to fit the needs of the new component.

Because Vernitron's top engineers spend as much time designing our manufacturing and assembly equipment as they do designing new components, they have developed a very practical approach. An overdesigned part is a taboo — we automatically relate our designs to cost saving.

Interconnection components are typically labor intensive, because of the number and variety of metal inserts. At the Vernitron plant, the degree of automation is unusually high. This engineering ingenuity translates into lower unit costs for you.

The result: our specials may be more cost-effective than you would expect. So, tell us about your interconnection problems. You'll also find that our turn around time is usually faster than you'd expect. Pick up the phone and see.

Beau Products
DIVISION OF VERNITRON CORPORATION

BOX 10, LACONIA, NEW HAMPSHIRE 03246
TEL. (603) 524-5101

Another Bilfro First!

BILFRO HEAVY DUTY 3-WAY FULLY INSULATED CONNECTORS

FOR

FLEET, MARINE, PLANT MAINTENANCE, ELECTRONIC

AND OTHER USES WHERE A CORROSION FREE TERMINATION FOR MORE THAN ONE CONNECTION IS NEEDED.

For years a corrosion-free connection for Running Lights, Turn Signals, and Stop Lights for Heavy Duty over-the-road trailers has been needed. Now BILFRO is the first to introduce a COMPLETELY INSULATED 3-WAY CONNECTOR SPECIFICALLY DESIGNED TO ELIMINATE THIS CORROSION PROBLEM.



This is the ideal connection for FLEETS, MARINE and PLANT MAINTENANCE where Multiple-connections are needed.

Strip the wire and insert it into the barrel, then crimp with any Quality crimping tool. (Crimping provides the best electrical connection.) No more frayed wires; no more exposed wires.

These terminals are molded with an electrolytic copper insert, and covered with Dupont Nylon. Resistance to cold is 85° below zero without becoming brittle, and will with-stand up to 185° above zero.

Three sizes are provided: 22–18, 16–14 and 12–10 Wire Gauges.

Part Numbers are as follows:	For 22–18 Wire	Y-2218	Color: Red
	For 16–14 Wire	Y-1614	Color: Blue
	For 12–10 Wire	Y-1210	Color: Yellow

Write or phone for further information.

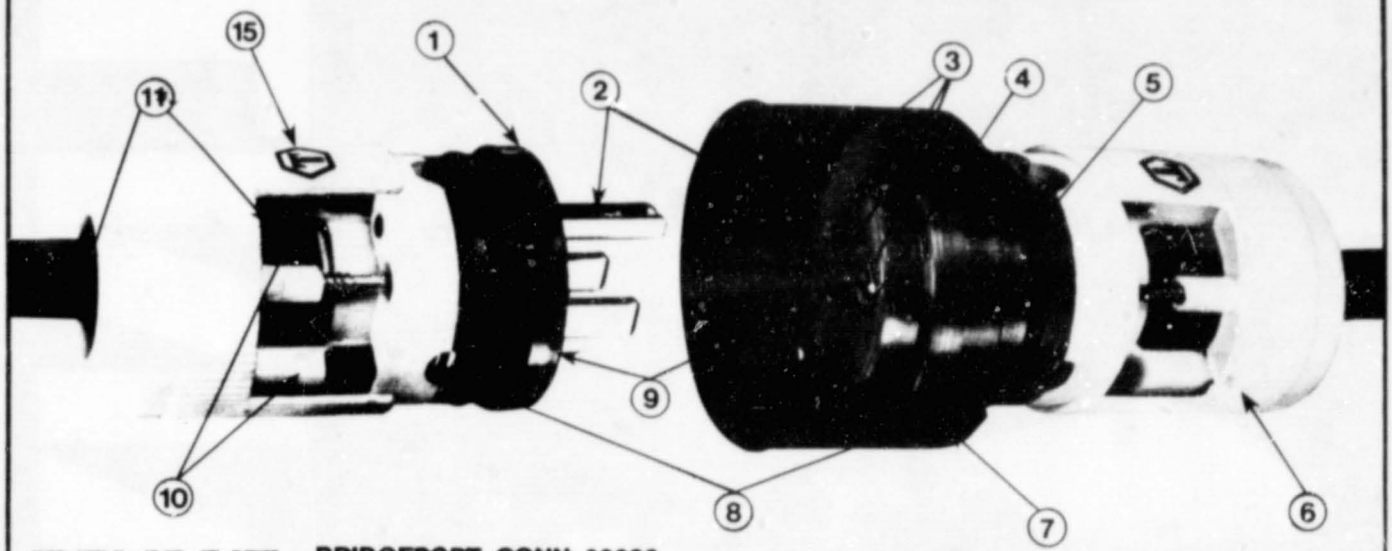
BILFRO CORPORATION

P.O. BOX 39265
SOLON, OHIO 44139
(216) 248-0729


BRYANT
TECH·SPEC™
Water Tight/Dust Tight
Plugs and Connectors
Division of Westinghouse
BRYANT
BRIDGEPORT, CONN. 06602
1421 State Street
(203) 334-5561

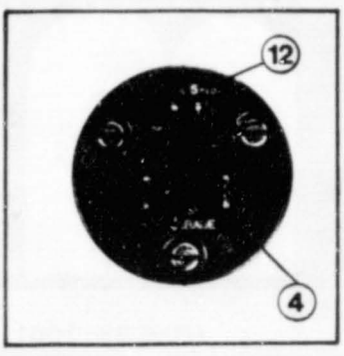
Beyond SPEC Grade

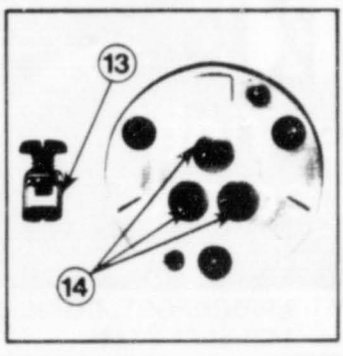
FEATURES AND SPECIFICATIONS

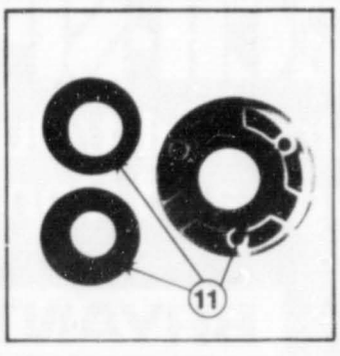


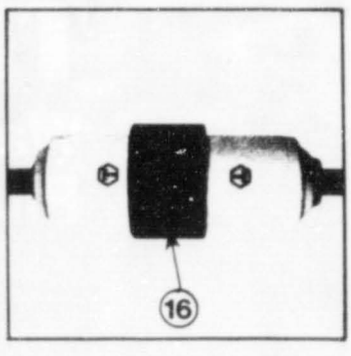
BRYANT BRIDGEPORT, CONN. 06602
1421 State Street (203) 334-5561

1. Dead front construction prevents accidental contact with live parts, meets NEC article 410-56(d).
2. Current carrying blades and contacts are made of high conductivity copper alloy and are nickel plated to resist corrosion.
3. Stainless steel pre-waxed assembly screws tighten quickly and withstand high torque.
4. Green Dot ● signifies U.L. hospital grade listing, assures maximum toughness in high-abuse applications.
5. Neoprene "O" ring between face and cover of plug and connector prevents moisture, lint, conductive dust, etc., from entering the interior (wiring chamber) of the device.
6. Ribbed nylon exterior provides firm grip.
7. Neoprene sealing sleeve on connector seals out moisture, lint, dust and foreign particles when plug and connector are mated.
8. Captive terminal screws are color coded for easy identification and meet NEC Article 200-10.
9. Devices are color coded (blue face - 15A); (red face - 20A) for easy amperage identification.
10. Triple-gripper cord grip tightens against outside of neoprene cord sealer for secure cord retention.
11. Neoprene cord sealer prevents moisture and foreign matter from entering cord grip of plug and connector. Three sealers packaged with product to fit cord diameters .300-.655.
12. NEMA line number and rating on device makes product identification easy.
13. Lug type terminals with spring maintain constant pressure on wire which provides low resistance and trouble free connection.
14. Individual wire pockets help prevent flash overs.
15. Entire device meets or exceeds U.L. and CSA standards. (8369-TSC and 8469-TSC not CSA Listed)
16. Devices fully assembled provide Water Tight/Dust Tight connection.









The Proof Is In The Performance. But Don't Take Our Word For It.

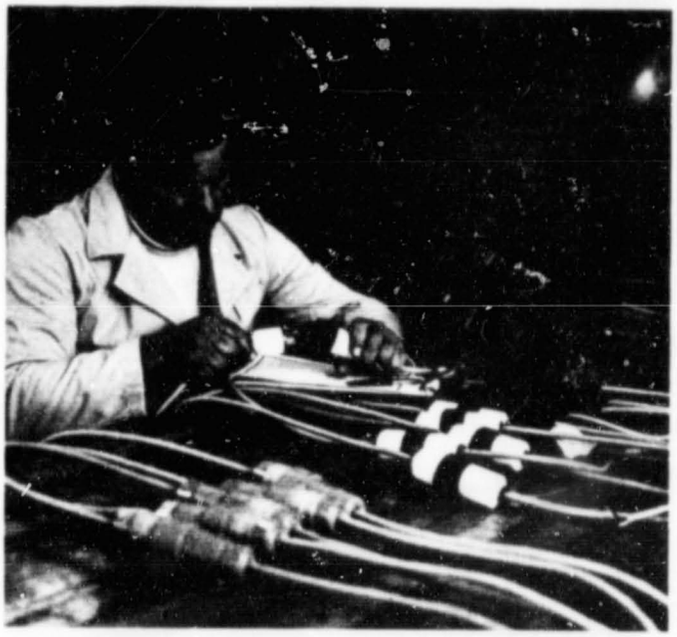
TECH-SPEC Testing Data Synopsis of Procedures and Results.

All tests were conducted and verified by an Independent Testing Laboratory.

Independent tests conducted by Stanford Technology Corporation confirm that TECH-SPEC Plugs and Connectors perform reliably in high abuse applications. Mated assemblies were subjected to five environmental tests as described below. Each of these tests simulated accelerated service conditions capable of causing electrical or mechanical failure as defined below:

1. *Physical Failure Criteria:*
   Any corrosion, cracking, deformation or degradation
2. *Electrical Failure Criteria:*
   Any current leakage greater than 2.0 milliamperes at line voltage.

Instrumentation and equipment calibration conformed to MIL-C-45662A and was traceable to the National Bureau of Standards. The following are the test procedures and results:



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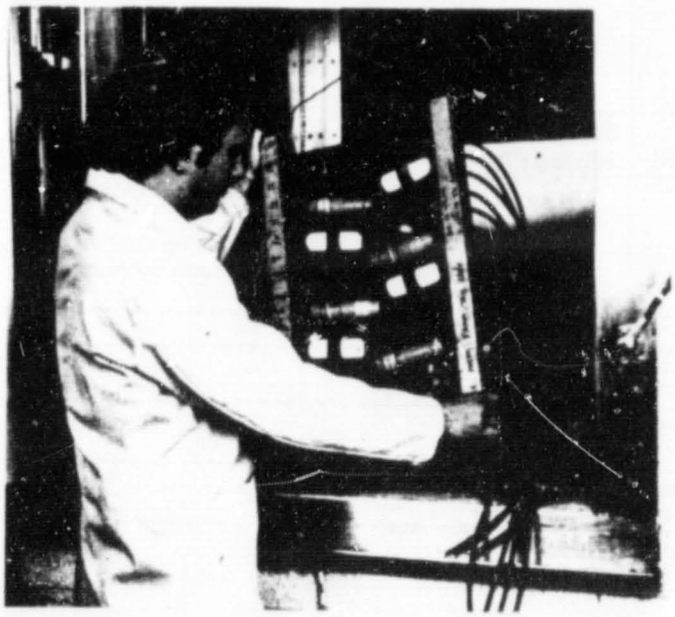


THERMAL SHOCK TEST (MIL-STD-202E, Method 107D)

Procedure: Mated TECH-SPEC Plugs and Connectors were placed in chamber at a temperature of −55°C. After two-hours, the devices were transferred, within five-minutes, to a chamber stabilized at +85°C and soaked for two-hours. This cycle was repeated five times. At the completion of this test, Insulation Resistance Measurements were compared to pre-test measurements and current leakage was determined.

Result: No visible damage or current leakage greater than 2.0 millamperes was noted.

MOISTURE RESISTANCE TEST (MIL-STD-202E, Method 106D)

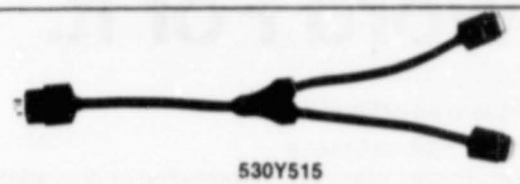
Procedure: Mated TECH-SPEC Plugs and Connectors were initially conditioned at +50°C for 24 hours. The assemblies were then placed in a temperature-humidity chamber and subjected to 10 continuous 24-hour cycles of temperature-humidity conditions with the temperature varying between 25°C and 65°C and the relative humidity varying between 80% and 98% during each 24-hour cycle. The assemblies were removed from the chamber and conditioned at −10°C (±2°C) (relative humidity uncontrolled) for three-hours, and vibrated between 10 and 55 Hz at 0.06 inches displacement for 15 minutes at room ambient conditions, during any five (5) of the first nine (9) days.

Result: No evidence of deterioration, corrosion, physical damage or current leakage greater than 2.0 milliamperes was noted.

I-10

Corrosion-Resistant Adapters And Power Cord

BRYANT
Division of Westinghouse



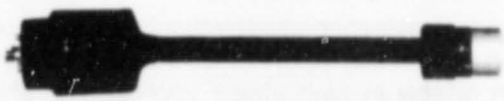
530Y515



3015



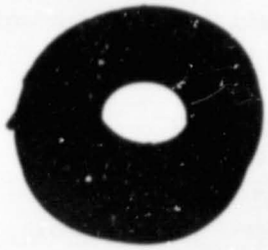
1032-MAC



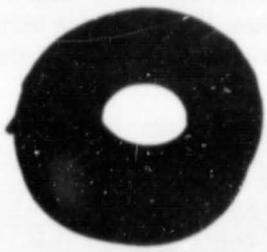
1530



250MC10-3



250MC6-3



250MC6-4

BRYANT **BRIDGEPORT, CONN. 06602**
1421 State Street (203) 334-5561

CAUTION:
THE USE OF ADAPTERS RECOMMENDED ONLY WITHIN THE FOLLOWING CONDITIONS:

A. When the supply and equipment are of the same voltage rating.
B. When the total amperage drawn does not exceed the lowest amperage rated device of the adapter.
C. When the grounding continuity and polarity are maintained.

PRE-ASSEMBLED ADAPTERS

ATTACHMENT PLUG LOCKING NEMA L5-30P / CONNECTOR BODIES STRAIGHT BLADE NEMA 5-15R	CATALOG NUMBER	DESCRIPTION
	530Y515	Y Adapter Permits the use of two 15A 125V straight blade caps in one 30A 125V locking receptacle
CONNECTOR BODY LOCKING NEMA L5-30R / ATTACHMENT PLUG STRAIGHT BLADE NEMA 5-15P	**CATALOG NUMBER**	**DESCRIPTION**
	3015	Emergency adapter for temporary dockside power Adapts 30A 125V locking plug to 15A 125V straight blade plug 12" long
ATTACHMENT PLUG LOCKING NEMA L5-30P / CONNECTOR BODY STRAIGHT BLADE NEMA 5-15R	**CATALOG NUMBER**	**DESCRIPTION**
	1530	Emergency adapter for temporary dockside power Adapts 30A 125V locking connector to 15A 125V straight blade connector 12" long.

CATALOG NUMBER	DESCRIPTION
1032-MAC	2 ft. adapter cord, pre-stripped, 10 AWG, 3 Conductor STO, yellow
250MC10-3	250 ft. power cord, coil only, 10 AWG, 3 Conductor STO, yellow
□ 250MC6-3	250 ft. power cord, coil only, 6 AWG, 3 Conductor STO, yellow
□ 250MC6-4	250 ft. power cord, coil only, 6 AWG, 4 Conductor STO, yellow

2200 Series Connector

The plug and socket are of robust design suitable for battery electric vehicles and welding applications where a long mechanical life and a high current rating are of prime importance.

Features

* Low contact resistance due to silver tipped contacts operating with 18 kilogrammes pressure.
* Steel cases provide a strong long life enclosure.
* Main contacts may be fixed to the cable by crimp or soldered joint.
* Complete custom built connector/cable assemblies can be provided.
* Stringent quality control checks are applied throughout manufacture.

Mounting

Normally 22-1X is attached to the chassis. If an alternative method of fixing is required, please consult Cableform.

Connection

A crimp connection is available for 25, 35 and 50 mm^2 cable. A specific contact is used depending on cable size.

It is recommended that when crimping, a Hellerman tool is used.

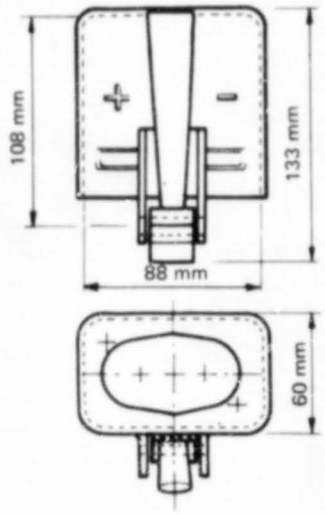
CABLE	DIE	TOOL
25 sq millimetres	HM 25 or 6H	12 TC or 15 TD
35 sq millimetres	HM 35 or 7H	12 TC or 15 TD
50 sq millimetres	HM 50 or 8H	12 TC or 15 TD

A solder joint may be made for cables up to 70 mm^2 and one solder type contact is specified for all cable sizes.

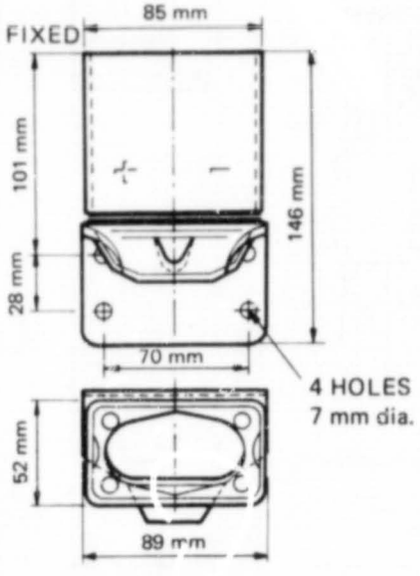
Full assembly instructions are included with every connector supplied.

Installation

MODEL 22-2X
LOCKING



MODEL 22-1X FIXED



Performance Specification

		CONTACTS		TEST CONDITIONS
		Pilot	Main	
Operating voltage	Up to 250			
Current rating:	Continuous	20 amps	320 amps	40°C Ambient
	1 hour	30 amps	450 amps	50 mm^2 cable (main)
				2.5 mm^2 (pilot)
Temperature range:	−10°C to +40°C			
Mechanical life:	Not less than 10,000 make and break operations			No load
Optional:	Additional sleeving to protect the power cabling from short circuits			

Cableform Inc.
ZION CROSS ROADS
TROY, Va 22974
Tel: (804) 589-8224

2100 Series Battery Connector

The compact and virtually unbreakable construction make this 2 pole connector particularly suitable for the electric truck and welding industry.

Features

* A strong high impact acid resistant material is used in constructing the body moulding
* Colour coded halves are used for ease of identification.
* Only the moulding changes, the contact springs and fingers are the same for both fixed and free halves.
* Complete custom built connector/cable assemblies can be provided.
* The competitive price makes it possible to fit a generously rated connector to applications having lower current requirements.
* Cableform's stringent quality control checks are applied throughout manufacture.

Mounting

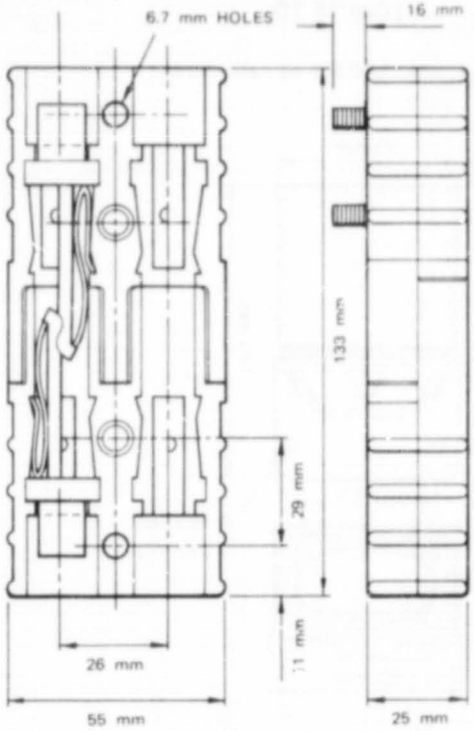
The ¼ UNF screws supplied with the fixed (black) connector, i.e. model 2I-I-I projects 16 m.m. from the moulding to allow attachment to the chassis etc.

Connection

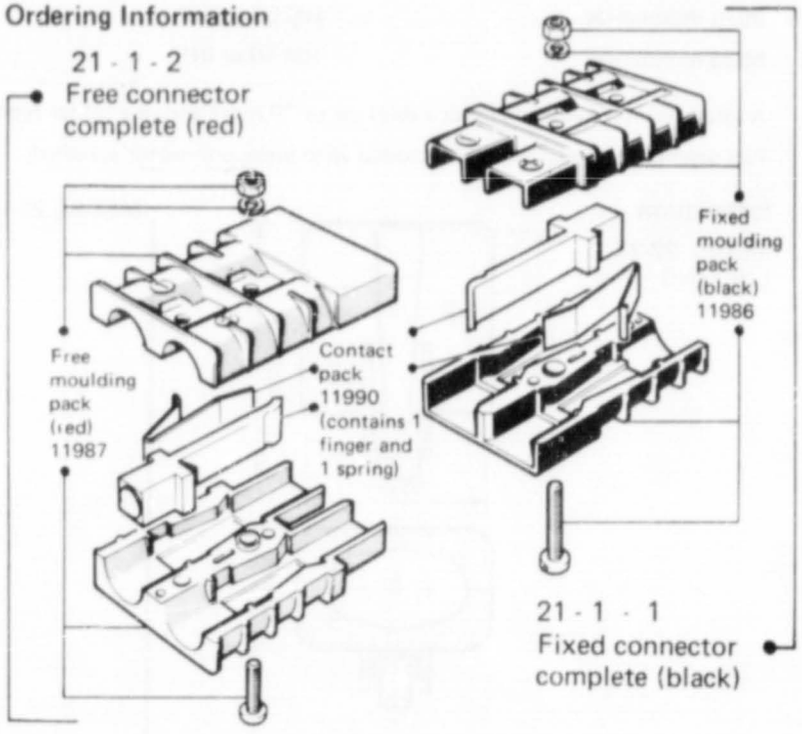
Power cables up to 50 mm^2 may be used and the joint should be soldered as detailed in the instructions which are included with every connector.

Installation Details

MODEL 2I FIXED AND FREE



Ordering Information



Performance Specification

Operating voltage up to 160

Current rating: Continuous 178 amps, 40°C ambient using 50 m.m ^{2} cable
5 minute 295 amps, 40°C ambient using 50 m.m.^{2} cable.
continuous 60 amps 40°C ambient using 35 m.m. cable

Temperature range:– 40°C + 40°C

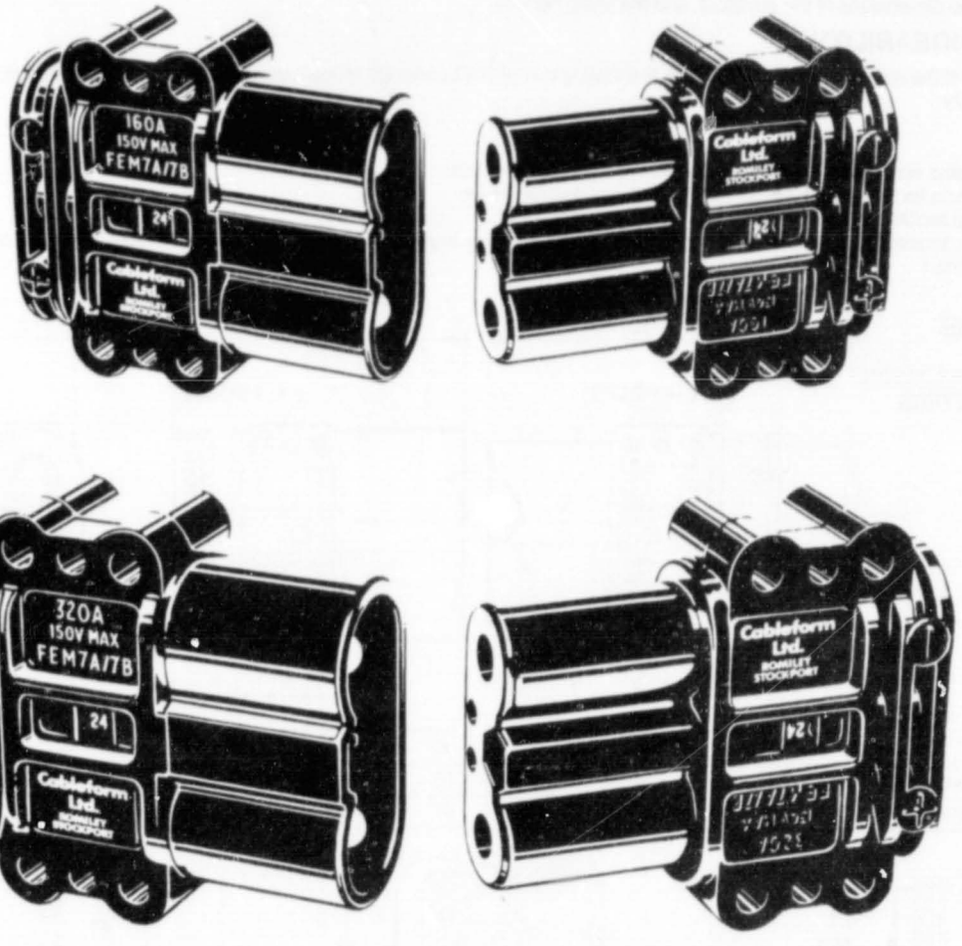
Mechanical life: Not less than 10,000 make and break operations under no load conditions

Cableform Inc.

ZION CROSS ROADS
TROY, Va 22974
Tel: (804) 589–8224

2300 series Connectors

cableform



This Series of battery connectors has been designed to meet the standards required by British and Continental manufacturers of battery-powered vehicles. The salient features of the connectors are as follows :

- Pin-and-tube multiple segment contacts ensure a very low order of contact resistance.
- Live parts of the connector are fully shrouded.
- High-strength single-piece moulded cases.
- Choice of 160 amps or 320 amps rating.
- Compliance with the latest European Standards (FEM).
- Optional features include: auxiliary contacts; grab handle; connector lock; and cable clamps.
- Easy separation is achieved without the use of complicated lever mechanisms.
- Voltage keys pre-set by the user.

Cableform Inc.

ZION CROSS ROADS
TROY, Va 22974
Tel: (804) 589-8224

SAFETY

Provided that the socket (i.e. the tube contacts) are connected to the battery, then the requirements of IP.23 (I.E.C. 1971) are fully met: i.e. personnel are protected against accidental contact with the supply voltage, and the battery is protected against accidental short-circuits.
The voltage-selector keys (one on the plug and one on the socket) must be set to the same voltage before they can be mated.
Assymetrical cross-section of the connector cases prevents mating of the connectors in reverse polarity.
Disconnects with minimum force.

RELIABILITY

Silver-plated pin-and-tube contacts provide an efficient and highly reliable electrical connection.
All metal parts are heavily protected against corrosion.
The single-piece casings are moulded from a high-strength material, which is non-absorbent, and is resistant to shock, heat, arcing, battery gases, acids and dilute alkalis.

EASE OF ASSEMBLY

Single-piece mouldings.
All contacts, and also the voltage keys, snap into position. No special tools are required.
Each contact is individually replaceable.
Contact-to-cable connections are crimped.
Polarity indicators are moulded into the cases.

Cableform Inc.
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TROY, Va 22974
Tel: (804) 589-8224

STANDARDISATION

These connectors comply with the requirements of the DIN Specifications and of the FEM (Federation Europeene de la Manutention) which define the performance, the dimensions of the contacts, and the fixing centres.

INTERCHANGEABILITY

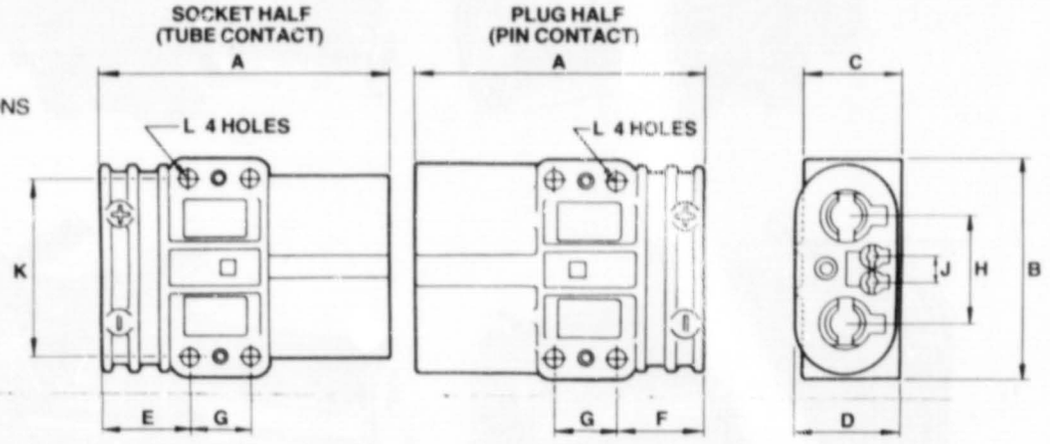
Both the plug and the socket are compatible with the mating half of any connector manufactured to the FEM Specification, giving complete interchangeability.

OPTIONS

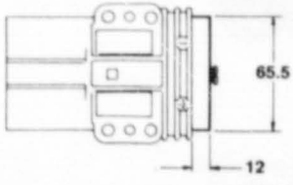
The following items are available as optional extras to the basic connector :
Auxiliary contacts for operating charger relays, or other control device.
Grab handle, to facilitate disconnection.
Connector lock, to prevent accidental disconnection without impeding emergency disconnection. (N.B. Grab handle and connector lock are mutually exclusive options.)
Cable clamps.

DIMENSIONS

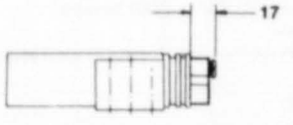
NOTE : ALL DIMENSIONS ARE IN MILLIMETRES.

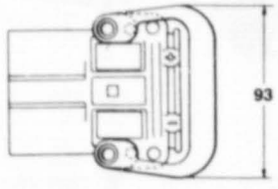


	A	B	C	D	E	F	G	H	J	K	L Dia
160 amp Connector	93	84	30.5	35.2	28	32	24	38	10	69	6.6
320 amp Connector	102	84	38	41.9	46	46	24	41	10	69	6.6

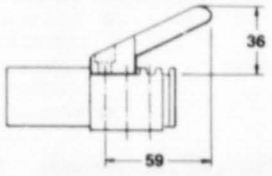


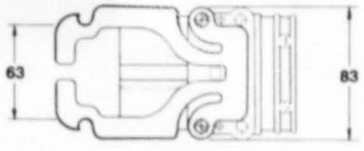
CABLE CLAMP



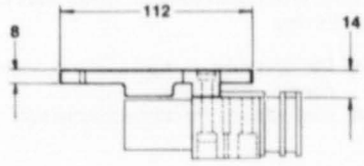


GRAB HANDLE





CONNECTOR LOCK



MOUNTING

In the interests of safety, the socket — with its fully shrouded tube connections — should always be connected to the battery. Both the socket (tube half) and the plug (pin half) are provided with 6mm clearance holes for fixing. Cable clamps may be fitted to both the plug and the socket. The grab handle and the connector lock, which are mutually exclusive options, may be fitted to either half, but it is preferable to fit them to that half which is left free.

ARROW HART DIVISION

NEMA GENERAL-PURPOSE NONLOCKING PLUGS AND RECEPTACLES

			15 AMPERE		20 AMPERE		30 AMPERE		50 AMPERE		60 AMPERE	
			▲ RECEPTACLE	▲ PLUG	▲ RECEPTACLE	▲ PLUG	▲ RECEPTACLE	▲ PLUG	▲ RECEPTACLE	▲ PLUG	▲ RECEPTACLE	▲ PLUG
2-POLE 2-WIRE	125V	1	D/ 5714 1-15R	C/ 3486 1-15P								
	250V	2		2-15P	A/ 8243 D/ 8283 2-20R	C/ 7667* 2-20P	A/ 8345 2-30R	C/ LH* 2-30P				
2-POLE 3-WIRE GROUNDING	125V	5	A/ 5361 B/ 5361-S or 6300 Hosp. Grade D/ 5259 F/ 5246 5-15R	C/ 6766 or 6766 H.G. Hosp. Grade E/ 5278 5-15P	A/ 5361 B/ 5361-S or 6300 Hosp. Grade D/ 6763 F/ 5787 5-20R	C/ 6766 or 6766 H.G. Hosp. Grade E/ 5278 5-20P	A/ 5726 D/ 6726 5-30R	C/ 5727 5-30P	A/ 5711 D/ 6711 5-50R	C/ 5712 5-50P		
	250V	6	A/ 5661 B/ 5662-S D/ 6669 6-15R	C/ 6666 E/ 5678 6-15P	A/ 5531 B/ 5862-S D/ 6865 6-20R	C/ 6866 E/ 5878 6-20P	A/ 5700 D/ 6700 6-30R	C/ 5701 6-30P	A/ 5709 D/ 6709 6-50R	C/ 5710 6-50P		
	277VAC	7	B/ 5718 7-15R	C/ 5766 7-15P	A/ 7621 D/ 7675 7-20R	C/ 7626* 7-20P	A/ 5795 D/ 6795 7-30R	C/ 5703 7-30P	A/ 5796 D/ 6796 7-50R	C/ 5705 7-50P		
3-POLE 3-WIRE	125/250V	10			A/ 8140 D/ 9168 10-20R	C/ 9151* 10-20P	A/ 9344 D/ 9341 10-30R	C/ 9337 10-30P	A/ 7901 D/ 4526 10-50R	C/ 4524 10-50P		
	3φ 250V	11	11-15R	11-15P	11-20R	11-20P	11-30R	11-30P	11-50R	11-50P		
3-POLE 4-WIRE GROUNDING	125/250V	14	14-15R	14-15P	A/ 5739 14-20R	C/ 5757* 14-20P	A/ 5744 14-30R	C/ 5746 14-30P	A/ 5754 14-50R	C/ 5745 14-50P	A/ 9460 14-60R	C/ 9462 14-60P
	3φ 250V	15	15-15R	15-15P	A/ 5781 15-20R	C/ 5783* 15-20P	A/ 8430 15-30R	C/ 8432 15-30P	A/ 8450 15-50R	C/ 8457 15-50P	A/ 8460 15-60R	C/ 8462 15-60P
4-POLE 4-WIRE	3φY 120/208V	18	18-15R	18-15P	A/ 7250 18-20R	C/ 7251* 18-20P	18-30R	18-30P	18-50R	18-50P	A/ 5515 18-60R	C/ 5517 18-60P

ARROW HART LOCKING TYPE PLUGS AND RECEPTACLES

	RATINGS	▲ RECEPTACLE	▲ PLUG
2-POLE 3-WIRE GROUNDING	20A. 250V DC. 30A 600V AC	A/ 20350 D/ 20354	C/ 20356
	20A. 125V AC-DC	A/ 23030 D/ 23032	C/ 23035
	50A. 250 V.D.C. 600 V. A.C.	A/ 7381 D/ 7762	C/ 7763 E/ 7961
	50A. 250 V.D.C. 600 V.A.C.	A/ 3771 D/ 3762	C/ 3763 E/ 3777
	50A. 125V. Marine Devices	A/ 63CR70 D/ 63CR60	C/ 63CR61 E/ 63CR72
	50A. 250V. Construction Site Devices	A/ CS8268 D/ CS8264	C/ CS8265 E/ CS8275
3-POLE 3-WIRE	10A. 250V DC. 480V AC. 20A 125V AC-DC	A/ 23000 D/ 23002	C/ 23005
	20A. 125/250V	A/ 7310-B D/ 6314 F/ 3326	C/ 6312 F/ 7327
	30A 250V	A/ 3330 D/ 3333	C/ 3331* E/ 3337
	50A. 250 V. D.C. 600 V. A.C.	A/ 3770 C/ 3760	C/ 3761 E/ 3776
	50A. 250 V. D.C. 600 V. A.C.	A/ 7380 D/ 7760	C/ 7761 E/ 7960

	RATINGS	▲ RECEPTACLE	▲ PLUG
3-POLE 4-WIRE EQUIP. GROUND	20A. 250V DC. 30A 600V AC	A/ 20403 D/ 20414	C/ 20415 E/ 20418
	30A. 480V AC	A/ 20443 D/ 20444	C/ 20445
	50A. 250 V. D.C. 600 V. A.C.	A/ 3769 D/ 3764	C/ 3765 E/ 3775
	50A. 250 V. D.C. 600 V. A.C.	A/ 7379 D/ 7764	C/ 7765 E/ 7958
	50A. 125/250V. Marine Devices	A/ 63CR69 D/ 63CR64	C/ 63CR63 E/ 63CR74
	50A. 480V. 3φ Construction Site Devices	A/ CS8169 D/ CS8164	C/ CS8165 E/ CS8175
	50A. 125/250V. Construction Site Devices	A/ CS8369 D/ CS8364	C/ CS8365 E/ CS8375
	60A. 600V AC	A/ 26420 D/ 26414 F/ 26414 A	C/ 26415 E/ 26415-A
4-POLE 4-WIRE	20A. 250V AC-DC. 10A 600V AC	A/ 7410-B D/ 6414 F/ 7409	C/ 6418 E/ 7408
	30A. 250V AC-DC. 30A 600V AC	A/ 3430 D/ 3433	C/ 3431 E/ 3434
4-POLE 5-WIRE EQUIP. GROUND	20A. 250V DC. 30A 600V AC	A/ 25250 D/ 25414 F/ 25401	C/ 25415 E/ 25418
	60A. 600V AC	A/ 26320 D/ 26514 F/ 26514 A	C/ 26515 E/ 26515-A

* FRONT WIRED CAPS. ALL OTHER CAPS ARE BACK WIRED "DEAD FRONT" DESIGN

NEMA LOCKING TYPE PLUGS AND RECEPTACLES

15 AMPERE ▲ RECEPTACLE	15 AMPERE ▲ PLUG	20 AMPERE ▲ RECEPTACLE	20 AMPERE ▲ PLUG	30 AMPERE ▲ RECEPTACLE	30 AMPERE ▲ PLUG			
A/7531 B/7540 D/7688	C/7546 E/7521					L1	125V	2-POLE 2-WIRE
		A/7210-B D/7101	C/7107* E/7808			L2	250V	
A/4710 B/4700 D/4731 F/4725	C/4721 E/4716					L5	125V	2-POLE 3-WIRE GROUNDING
A/4560 B/4580 D/4668 F/4585	C/4563 E/4586					L6	250V	
A/4760 B/4790 D/4772 F/4785	C/4771 E/4786					L7	277VAC	
						L8	480VAC	
						L9	600VAC	
						L10	125/250V	3-POLE 3-WIRE
						L11	3φ 250V	
						L12	3φ 480V	
						L13	3φ 600V	
						L14	125/250V	3-POLE 4-WIRE GROUNDING
						L15	3φ 250V	
						L16	3φ 480V	
						L17	3φ 600V	
						L18	3φY 120/208V	4-POLE 4-WIRE
						L19	3φY 277/480V	
						L20	3φY 347/600V	
						L21	3φY 120/208V	4-POLE 5-WIRE GROUNDING
						L22	3φY 277/480V	
						L23	3φY 347/600V	

Features you can't get from our competition!

Nylon shell—stands up to heavy abuse and rough handling

Neoprene safety seal—blocks dust, moisture, metal chips and foreign matter from causing a short circuit in the terminal area



Lexan terminal body—tough, superior electrical qualities

NEMA MIGET LOCKING TYPE PLUGS AND RECEPTACLES

15 AMPERE ▲ RECEPTACLE	15 AMPERE ▲ PLUG			
		ML1	125V	2-POLE 2-WIRE
		ML2	125V	2-POLE 3-WIRE GROG
		ML3	125V 250V	3-POLE 3-WIRE

▲ HOW TO USE THESE CHARTS

NEMA configuration number (6-20R, L16-20P, etc.), where applicable, is shown below and to the left of diagram. Arrow Hart catalog numbers are shown above the NEMA number. Preceding the catalog number is a "product classification" code, indicated by a letter and slash:
A/ = SINGLE RECEPTACLE; B/ = DUPLEX RECEPTACLE; C/ = CAP;
D/ = CONNECTOR; E/ = FLANGED INLET; F/ = FLANGED OUTLET.

EXAMPLE

Arrow Hart catalog numbers → A/ 5261, B/ 5262-S or 8200 Hosp. Grade, D/ 6269, F/ 5246

NEMA configuration → 5-15R

ORIGINAL PAGE IS OF POOR QUALITY

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ELECTRICAL INTERCONNECTIONS FOR HEAVY DUTY EQUIPMENT

FIGURE 1 CONTACT INSERTION PROCEDURE

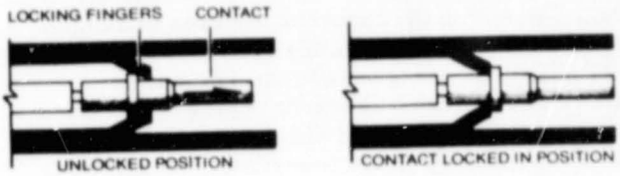


FIGURE 2 CONTACT REMOVAL PROCEDURE

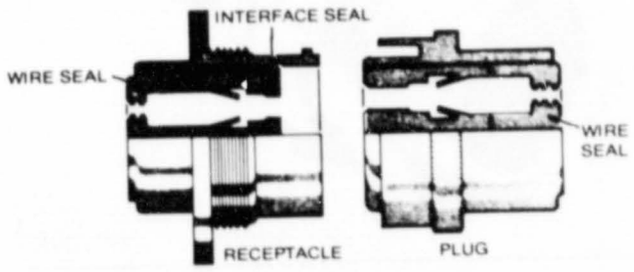


This general purpose manual provides technical information on the Deutsch HD Series connector, developed to meet the needs of the heavy duty equipment and transportation industries for rugged, multi-pin, sealed connector systems. The following pages discuss the design features of the HD Series, describe part numbers, specifications, and provide detail drawings of plugs, receptacles, contacts, accessories, and insert configurations.

Electrical Connectors: Critical to System Reliability and Maintainability

Recent studies indicate that electrical system failures are a common and constant source of equipment malfunction. A major area of electrical system failure is in electrical interconnections. Typical problems include loose and miswired terminals, corrosion, and contamination of terminals. Coupled with these problems, the impact of sophisticated safety devices, automated check-out systems, and other increased use of electronics, calls for a re-examination of traditional termination techniques. To the operator,

FIGURE 3



SEALED CONNECTORS

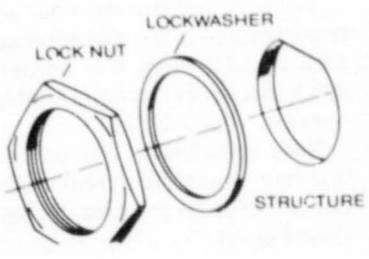
FIGURE 4

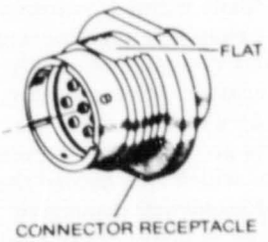


VISUALLY INSPECTABLE FOR PROPER MATING

FIGURE 5

SINGLE HOLE MOUNTING FOR FAST INSTALLATION





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termination failures mean excessive down time and maintenance costs. This adds up to slipped production schedules, cost over-runs, and user problems. The end result: decreased profits and a loss of share of the market. In today's competitive arena, improved electrical connectors can make the difference between a growing, profitable operation or a losing one.

The HD Series: Decreases Costs and Up-Grades Performance

The Deutsch HD Series was developed to provide a solution to today's system problems found in the heavy duty trucking, equipment, and transportation industries. The HD is a cylindrical, multi-pin sealed device utilizing crimp type contacts that are quickly and easily inserted or removed. Use of the HD Series eliminates several other common connector problems.

Problems associated with assembly and rework time; operational breakdowns requiring costly repairs; and lengthy out of service time in the field have all been reduced or eliminated by the judicious application of the HD Series.

Some of the benefits of the Deutsch HD Series include:

- Quick, fool-proof assembly, decreasing time on the assembly line and eliminating miswiring.
- Simple and easy to rework, decreasing down time and increasing profits to the operator.
- Sealed against moisture and contaminants, eliminating open wiring systems.
- Operation under severe shock and vibration, reducing break down and out of commission loss due to rugged operating conditions.
- Performance over a wide temperature range (−55° C to + 125°) meaning continuous operation in all environments, from arctic to desert conditions.
- Human factors engineered to assure that assembly and rework can be reliably handled by unskilled personnel.

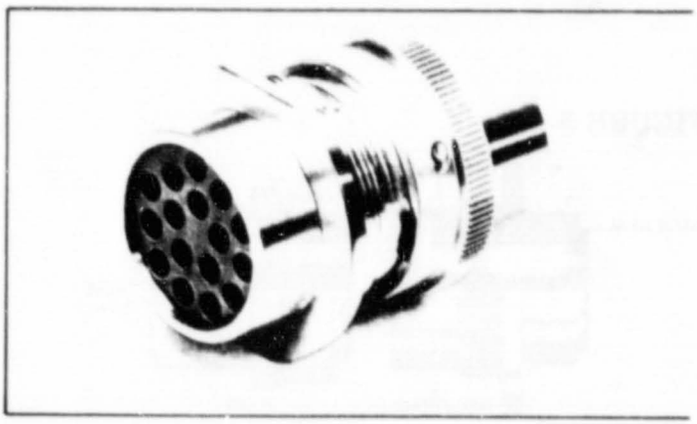
Contact Retention Decreases Installation Costs and Increases Reliability

The HD Series uses crimp type, solid copper alloy contacts for damage proof performance, and the ability to carry continuous high operating current loads without overheating. The contacts or terminals are crimp terminated using automatic tooling for production, and inexpensive readily available hand tools for field maintenance. After crimping, these contacts are easily installed by simply pushing the contact into place by hand. Contacts are positively secured by use of "fingers" in the connector which lock behind the shoulder of the contact, preventing accidental dislodging. (See Fig. 1) Although securely locked in place, these contacts can be quickly and easily removed by the use of an inexpensive, non-conductive removal tool. (See Fig. 2)

Sealed Against Moisture and Contaminants

Unlike terminal strips, binding posts, and other open-wiring systems, the Deutsch HD Series is a completely sealed unit. The rear of the connector features an integral grommet wire seal that automatically seals each contact as it is locked into place during installation. There is no extra hardware to fasten or tighten or potting operation to achieve this seal. To further seal this connector, a silicone rubber blanket is located on the face of the connector to prevent moisture and other contaminants from reaching the contacts. (See Fig. 3)

Fabricated from tear resistant, high temperature silicone, this grommet protects the contacts from moisture, sand, dust, lubricating oils, fuel, road salt, hydraulic fluid, grease, mud, and other contaminants encountered in heavy duty use. The elimination of open-wiring systems does away with such common hazards as short circuits due to metallic objects across the terminals. This is especially important during loading or refueling operations when a spark could cause a serious explosion. Closed wiring also protects maintenance personnel against accidental shock, yet can be easily checked for circuit continuity.



Rugged Metal Shell Withstands Years of Abuse

Deutsch HD Series features a lightweight, yet compact and rugged shell to protect contacts and sealing grommets. This shell provides a multiple keying system that positively prevents mismating and makes plug and receptacle coupling quick and easy.

The HD Series uses a bayonet coupling system that provides a positive vibration resistant locking mechanism with visual indication of proper mate and lock. This quick disconnect system requires only a quarter turn to operate. (See Fig. 4)

Easy installation to structure is provided by a single one-hole mounting system using a "flat" to prevent the connector from rotating during assembly or service. (See Fig. 5)

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Specification, Ordering Information HD 50 Series

DEUTSCH PART NUMBERING SYSTEM

HD 54 - 18 - 8 P N - XXX

- HD — Designates Deutsch Heavy Duty Cylindrical Connector
- 54 — Type
  - 5 = Standard Commercial—Bulk packed without contacts or accessories
  - 6 = Kit—Individually packaged with contacts, sealings plugs, mounting hardware and removal tool
- 18 — Shell size and insert layout (See facing page for available arrangements)
- 8 — Contact Style
  - P = Pin (Male) type
  - S = Socket (Female) type
- P — Style
  - 4 = Receptacle—Jam nut type mounting
  - 6 = Plug
- N — Standard Clocking Position
- XXX — Special Modifications

MATERIAL SPECIFICATIONS

PLUG

Shell:	Aluminum-plating is available for special applications
Coupling Ring:	Aluminum
Insert:	Retainer—Thermoplastic Grommet—Silicone rubber

RECEPTACLE

Shell:	Aluminum-plating is available for special applications
Insert:	Retainer—Thermoplastic Grommet—Silicone rubber
Panel Nut:	Aluminum
Lockwasher:	Spring steel—cadmium plate with clear chromate finish

CONTACTS

Pin:	Copper alloy
Socket:	Copper alloy
Finish:	Nickel Plating

SEALING PLUGS

Thermoplastic: size 16 thru size 8
Silicone: size 4

GENERAL SPECIFICATIONS FOR DEUTSCH HD CONNECTORS

DIELECTRIC WITHSTANDING VOLTAGE (Test Voltage):
Sea Level—1500 VAC (rms)

CURRENT RATING (MAXIMUM):

No. 4	100 amps
No. 8	60 amps
No. 12	35 amps
No. 16	13 amps

SILICONE INSERT:
Front and rear silicone inserts are devoid of all organic matter.

ARC RESISTANCE:
All dielectric materials withstand a minimum of 130 seconds per ASTM D-495.

PHYSICAL SHOCK:
No unlocking, unmating or other unsatisfactory result after 50g's in each of three mutually perpendicular planes.

DIELECTRIC STRENGTH:
350 volts per mil. minimum.

MOISTURE RESISTANCE:
Insulation resistance in excess of 50 megohms after exposure to moisture.

VIBRATION:
Maintains continuity and exhibits no mechanical or physical damage after vibration.

TEMPERATURE:
Operative At Temperatures From −55° to +125°C.

CONTACT RETENTION:
Contacts withstand a minimum load of

35 lbs. for size 4
35 lbs. for size 8
30 lbs. for size 12
25 lbs. for size 16

THERMAL SHOCK:
No cracking, chipping or leaking after 5 test cycles from −55° to +125°C.

INSULATION RESISTANCE:
1000 megohms minimum at 25°C.

USABLE WIRE SIZE:
No. 4 contacts—receive conductor AWG 6. Rear insert will seal on smooth insulation from .280" to .292" O.D.
No. 8 contacts—receive conductor AWG 8 thru 10. Rear insert will seal on smooth insulation from .190" to .240" O.D.
No. 12 contacts—receive conductor AWG 12 thru 14. Rear insert will seal on smooth insulation from .134" to .170" O.D.
No. 16 contacts—receive conductor AWG 16 thru 18. Rear insert will seal on smooth insulation from .100" to .130" O.D.

DURABILITY:
No electrical or mechanical defects after 100 cycles of engagement and disengagement.

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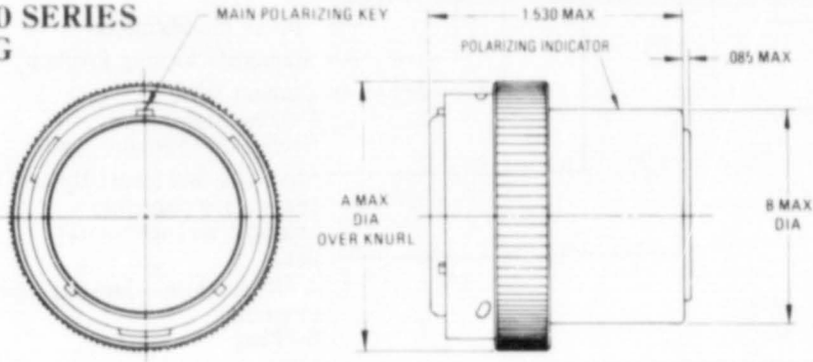
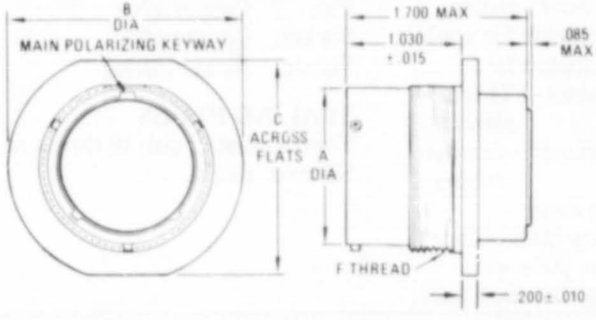
HD50 SERIES PLUG

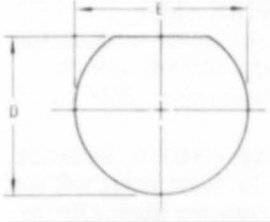


SHELL SIZE	A MAX DIA	B MAX DIA
18	1.692	1.222
24	1.942	1.477

HD50 SERIES RECEPTACLE

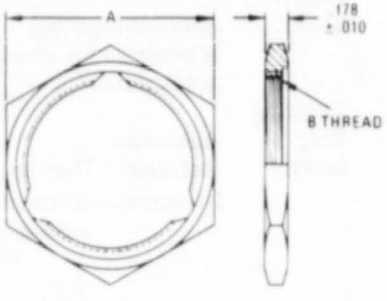


SHELL SIZE	A ± .010	B ± .015	C MAX.	D ± .005	E + .010 − .000	F THREAD
18	1.329	1.750	1.625	1.442	1.507	1 1/2 18 UNEF
24	1.579	2.000	1.875	1.632	1.696	1 11/16 18 UNEF



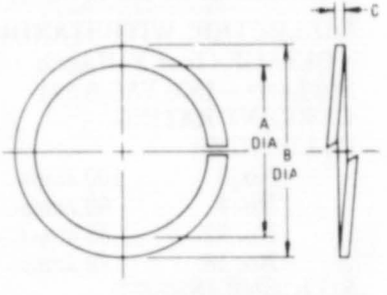
RECOMMENDED PANEL MOUNTING HOLE

PANEL NUT



PART NUMBER	SHELL SIZE	A DIA ± .030	B THREAD
114020-90	18	1.678	1 1/2 18 UNEF 2B
112263-90	24	1.875	1 11/16 18 UNEF 2B

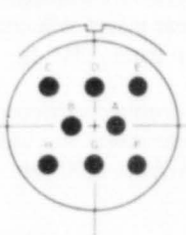
LOCKWASHER



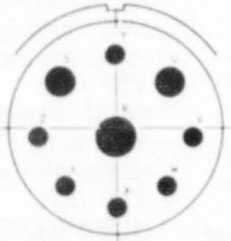
PART NUMBER	SHELL SIZE	A DIA ± .015	B DIA ± .030	C REF
114021	18	1.512	1.886	062
112264	24	1.700	2.074	062

INSERT LAYOUTS

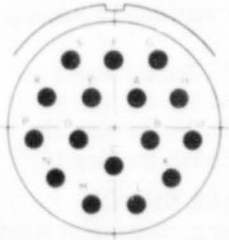
MARKINGS SHOWN ARE FOR FRONT FACE OF PIN INSERT. (SOCKET INSERT REVERSE.)



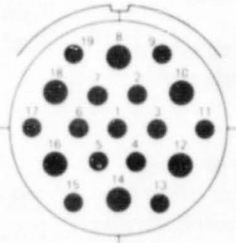
18-8PN
8 No. 12 CONTACTS



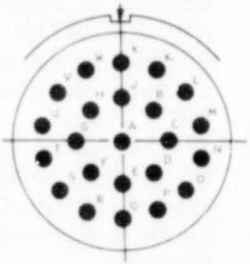
24-9PN
6 No. 12, 2 No. 8, 1 No. 4 CONTACTS



24-16PN
16 No. 12 CONTACTS



24-19P
13 No. 16, 6 No. 12 CONTACTS



24-23PN
23 No. 16 CONTACTS

645 WEST 11th STREET • ERIE, PA 16512
PHONE (814) 453-5611

ERIE UNSURPASSED RELIABILITY

ERIE TECHNOLOGICAL PRODUCTS, INC.

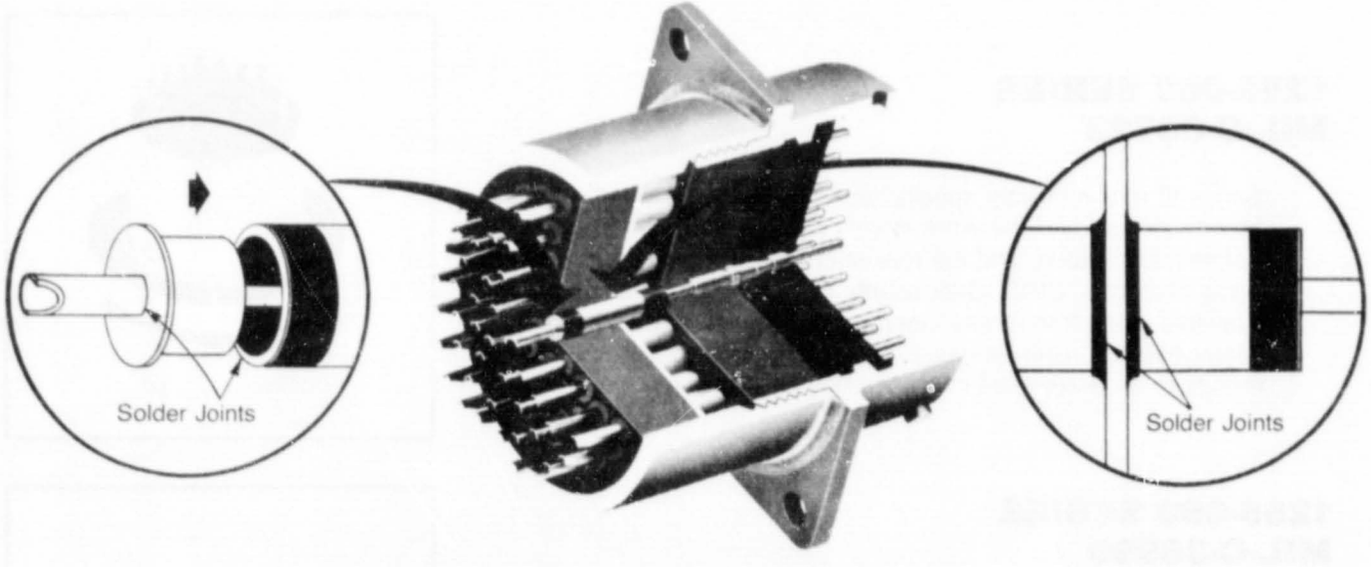
Heart of the filter connector is the EMI Filter itself

The more sophisticated and intricate electronic equipment becomes, the greater is the necessity for it to be free from Electro Magnetic Interference (EMI) in order that it can perform its delicately balanced functions correctly. Filter connectors are ever increasingly playing a part in achieving this freedom from EMI. More and more engineers realize that it is at the very input of the equipment being protected that filtering should be applied and connectors are usually the only component interfacing with the inside shielded electronics and the outside world. ERIE having been the leader in the EMI filter industry for 50 years, has now expanded its filter-connector line in order to offer you the same unsurpassed high quality product in many connector packages. Because of ERIE's unique position in this market, that of being the only filter connector house having complete in-house ceramic capability, we can offer combinations of capacitance values and voltage ratings available no where else in the industry.

Unlike most filter-connector houses, ERIE does not usually manufacture the connector itself but procures a fully qualified connector and adds the filter elements to it. This "Piggy-Back" construction offers the best of two worlds, a connector manufactured by experts in their field and filters manufactured by ERIE who are also experts in their field, a tough combination to beat.

ERIE's mechanical and electrical engineering teams have developed this product line with two main goals in mind. First to offer you a package that is as electrically efficient as possible and secondly to environmentally protect this package by completely encapsulating it in a specially formulated epoxy, developed and tested over many years.

ERIE achieves its first goal of electrical efficiency by soldering every junction between all active components. This results in the absolute best grounding technique available to you. Just as one would not rely on a capacitor mounted on a PC Board by mechanical means to maintain its electrical integrity in a critical circuit, we, at ERIE, do not rely on mechanical grounding as others do to provide the various insertion loss characteristics required. The solder construction and complete encapsulation results in a filter connector that is more than capable of withstanding the many complex electrical and environmental requirements that have become commonplace in our sophisticated electronic society.



It can be readily seen in the above drawings of a typical ERIE filter-connector how ERIE utilizes an existing qualified connector assembly and then adds to it a completely soldered filter assembly. This assembly is then housed in a metal backshell that has been soldered to the existing connector shell. The internal ground plane is then soldered not only to the individual filter elements but also the backshell extension. This type of construction results in the absolute optimum grounding of the filters. Finally this package is totally encapsulated resulting in a rugged environmentally resistant unit custom made for your application.

ERIE TECHNOLOGICAL PRODUCTS, INC.

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PHONE (814) 453-5611

CYLINDRICAL FILTER CONNECTORS

Erie Technological Products has been involved in the filter connector marketplace for over 12 years, our product can be found in numerous military, aerospace and commercial programs, from the latest sophisticated fighter aircraft to electronic weigh scales, our connectors have many times proven to be of the highest reliability. On the following two pages you will find a few of the circular connector series ERIE is actively involved with. Again, because of ERIE's endless ceramic capability, we do not limit you to three or four standard filter values but would rather have you tell us exactly what is required in your circuit, and we will custom design a filter connector to fill the requirement.

1255-070 SERIES MIL-C-5015

Since World War II this series of power connectors has been used and now with the introduction of crimp contacts will certainly remain with us for many years to come. ERIE has the capability of filtering any connector in this series having No. 12 or 16 contact sizes. The finished filter assembly mates with M83723 Series II connectors. It must be remembered that because of ERIE's solder construction, only solder terminations are available as once installed the filter elements cannot be removed.



1255-080 SERIES MIL-C-83723

Series III of this military specification has replaced MIL-C-26500 for new design and therefore is very much in demand. Both the hermetically sealed, and the rear release crimp contact style are being filtered by ERIE. Over twenty filter variations are readily available in the 2 to 61 line insert arrangements. ERIE's flexibility allows filters of different types capacitance values and voltage ratings to be assembled into one complete package.



1255-090 SERIES MIL-C-38999

With its low silhouette, scoop proof, options this extremely popular high density series has become the most widely used in the industry today. However, because of its very compact pin to pin spacing, not all of the standard high capacitance filter assemblies can be readily incorporated in this package size. Filter connectors from 3-128 lines employing number 12 through number 22 contact sizes are available, including the hermetically sealed variations. ERIE offers their environment resistant "Piggy-Back" alternatives to the ITT "KJJ" series and the Bendix "FJT" Series of filter connectors.



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PHONE (814) 453-5611

CYLINDRICAL FILTER CONNECTORS

1255-100 SERIES MIL-C-26482

The capacitance values of the tubular capacitors are limited by both voltage and physical size. Since this series of connector displays relatively liberal pin to pin spacing, the capacitance range available is virtually limited by voltage only. With the exception of insert arrangements that include coaxial contacts, all of the remaining arrangements incorporating number 12 thru number 20 contact sizes can be readily filtered. ERIE will design direct replacements for the ITT "PVJ" and Bendix "FPT" series using our "Piggy-Back" construction technique.



1240-010 SERIES UG/U TYPES

Audio signal lines are quite often terminated with TNC and BNC type connectors. For this reason ERIE has designed a unique in-line filter assembly that effectively eliminates troublesome EMI from entering delicate circuits. As well as these two popular series, ERIE also offers filtering in the various other U/U audio connectors which mate with the many MIL-C-10544 arrangements.



CUSTOM VARIATIONS

When tubular filter elements cannot satisfy unusually high insertion loss requirements, ERIE's flexibility allows the use of discrete components (wound coils and discoidal capacitors) in various filter-connector packages. This option, available only at ERIE, offers a possible solution to what might appear to be an unsolvable EMI problem.



For additional information or variations, contact the nearest ERIE Sales Office or the Customer Engineering Department 613-392-2581.

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FILTER "D" CONNECTORS

In the field of compact, lightweight mass termination for the electronics industry, perhaps the most widely used devices are the "D" connectors. In keeping with the demands of the industry, ERIE has developed filter "D" connectors ideally suited for applications where EMI protection is required without sacrificing their unique characteristics.

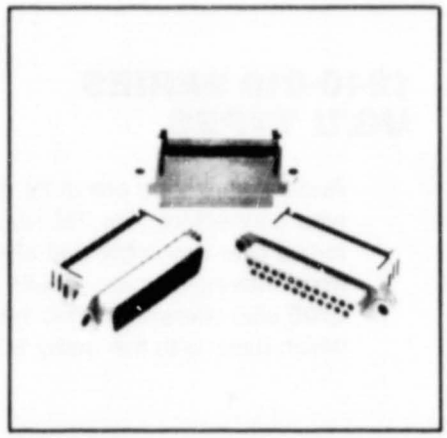
1255-030 SERIES
MIL-C-24308

A complete line of high quality filtered subminiature rectangular connectors is now available in 9, 25, 15, 37 and 50 contact arrangements, per MIL-C-24308. Capable of withstanding MIL-F-15733 testing including vibration and moisture resistance, these rugged assemblies are of a complete solder construction, thereby delivering the highest possible insertion loss at frequencies up to 10 GHz. The rear termination is available in solder-cup .025" square wire wrap or round PC board variations.



1255-040 SERIES
FLAT RIBBON TERMINATION

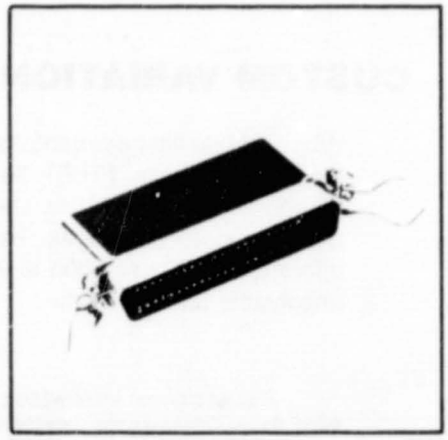
This series of filter connectors offers the advantage of mass termination using flat ribbon cable and EMI protection all within the same package. Except for the ground tab located around the screw mounting hole, ERIE has incorporated filters while maintaining the external dimensions and configurations. This series of low cost filter connector has been designed primarily for the digital and data communication field where capacitance values must be held to a minimum (typically 500 pF). Both Pi and feed-thru filter configurations are available.



1255-050 SERIES
CABLE TO CHASSIS CONNECTORS

Utilizing the ribbon contact principle, these subminiature connectors provide increased reliability so often required for airborne and computer applications. This series, similar in appearance to the standard "D" connectors is constructed of diallylphthalate housed in a brass backshell. An additional backshell is then added to the connector to accommodate the filters, ground plate, and epoxy potting.

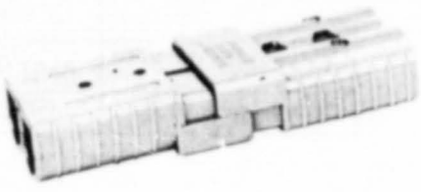
14, 24, 36 and 50 line filter connectors are available with various capacitance and voltage ratings. See chart on page 8.

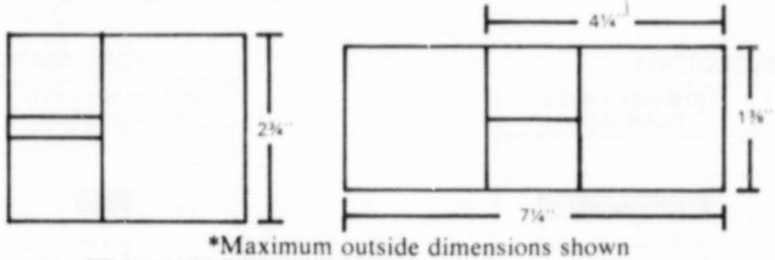


BATTERY CABLE CONNECTORS

These connectors allow easy and quick connection or disconnection between the batteries and the EV.

Simplicity and performance are the key reasons to use Anderson SB connectors. Only the SB has identical halves, reducing confusion in ordering and hookup. Each consists of high physical and dielectric strength Lexan housing; integral stainless steel leaf springs; and two silver plated copper contacts. Add "A" frame handles to reduce cable strain during disconnect operations. Order a pair of connector halves for a complete coupling. Nominal voltage rating: 600 VDC.





*Maximum outside dimensions shown

Part No.	Description	Amp Rating	Cable Size
23-6325-250	SB175 Battery Connector	175	1/0
23-6320-250	SB350 Battery Connector	350	2/0
24-995G1-250	SB175 "A" Frame Handle		
24-995G2-250	SB350 "A" Frame Handle		

ELECTRIC VEHICLE COMPONENTS
FLIGHT SYSTEMS
HEADQUARTERS
P.O. BOX 25, MECHANICSBURG, PA 17055
PHONE (717) 697-0333

GVI®

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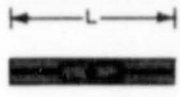
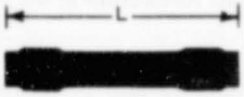
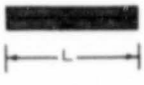
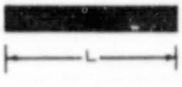
26-24 wire range

STOP CONNECTORS

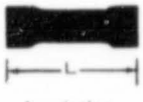
NON-INSULATED BUTTED SEAM		NON-INSULATED WITH INSUL. SUPPORT		NYLON INSULATED WITH INSUL. SUPPORT	
					
PART NO.	LENGTH L	PART NO.	LENGTH L	PART NO.	LENGTH L
BS2624-SC	.38	EB2624-SC	.61	NPC2624-SC	.88

22-16 wire range

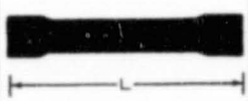
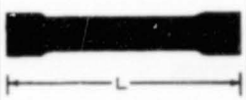
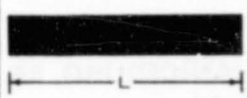
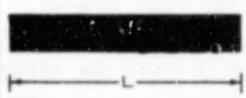
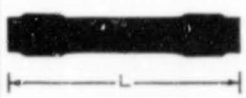
STOP CONNECTORS

NON-INSULATED BUTTED SEAM		NON-INSULATED SEAMLESS	
			
PART NO.	LENGTH L	PART NO.	LENGTH L
BS2216-SC	.56	B2216-SC	.63

HORIZONTAL CONNECTORS

NON-INSULATED BUTTED SEAM		VINYL INSULATED	
		 Insulation Diameter .145 max.	
PART NO.	LENGTH L	PART NO.	LENGTH L
BS2216-HC	.31	C2216-HC	.67

STOP CONNECTORS

VINYL INSULATED BUTTED SEAM		VINYL INSULATED SEAMLESS		NYLON INSULATED BUTTED SEAM		NYLON INSULATED SEAMLESS		NYLON INSULATED WITH INSUL. SUPPORT	
 Insulation Diameter .145 max.		 Insulation Diamter .145 max.		 Insulation Diameter .125 max.		 Insulation Diameter .125 max.		 Insulation Diameter .145 max.	
PART NO.	LENGTH L	PART NO.	LENGTH L	PART NO.	LENGTH L	PART NO.	LENGTH L	PART NO.	LENGTH L
C2216-SC	1.00	C2216-SCS	1.05	NC2216-SC	.94	NC2216-SCE	1.05	NPC2216-SC	1.00

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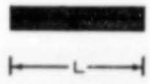
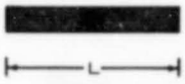
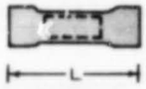
16-14 wire range

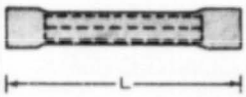
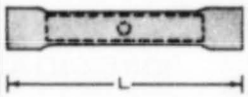
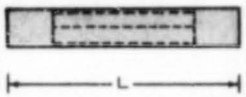
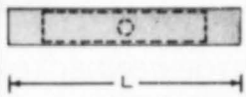
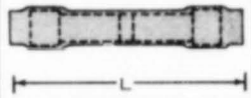
STOP CONNECTORS

NON-INSULATED BUTTED SEAM		NON-INSULATED SEAMLESS	
			
PART NO.	LENGTH L	PART NO.	LENGTH L
BS1614-SC	.56	B1614-SC	.66

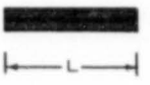
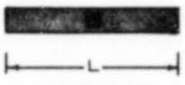
HORIZONTAL CONNECTORS

NON-INSULATED SEAMLESS		VINYL INSULATED	
		 Insulation Diameter .175 max.	
PART NO.	LENGTH L	PART NO.	LENGTH L
B1614-HC	.31	C1614-HC	.67

STOP CONNECTORS

VINYL INSULATED BUTTED SEAM		VINYL INSULATED SEAMLESS		NYLON INSULATED BUTTED SEAM		NYLON INSULATED SEAMLESS		NYLON INSULATED WITH INSUL. SUPPORT	
 Insulation Diameter .175 max.		 Insulation Diameter .175 max.		 Insulation Diameter .155 max.		 Insulation Diameter .155 max.		 Insulation Diameter .175 max.	
PART NO.	LENGTH L	PART NO.	LENGTH L	PART NO.	LENGTH L	PART NO.	LENGTH L	PART NO.	LENGTH L
C1614-SC	1.00	C1614-SCS	1.05	NC1614-SC	1.03	NC1614-SCE	1.05	NPC1614-SC	1.00

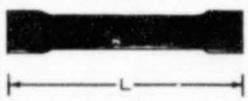
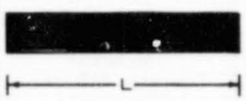
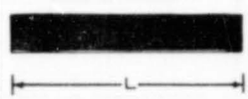
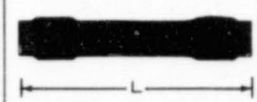
STOP CONNECTORS

NON-INSULATED BUTTED SEAM		NON-INSULATED SEAMLESS	
			
PART NO.	LENGTH L	PART NO.	LENGTH L
BS1210-SC	.56	B1210-SC	.81

HORIZONTAL CONNECTORS

NON-INSULATED SEAMLESS		VINYL INSULATED	
		 Insulation Diameter .255 max.	
PART NO.	LENGTH L	PART NO.	LENGTH L
B1210-HC	.34	C1210-HC	.67

STOP CONNECTORS

VINYL INSULATED BUTTED SEAM		VINYL INSULATED SEAMLESS		NYLON INSULATED BUTTED SEAM		NYLON INSULATED SEAMLESS		NYLON INSULATED WITH INSUL. SUPPORT	
 Insulation Diameter .255 max.		 Insulation Diameter .255 max.		 Insulation Diameter .218 max.		 Insulation Diameter .218 max.		 Insulation Diameter .255 max.	
PART NO.	LENGTH L	PART NO.	LENGTH L	PART NO.	LENGTH L	PART NO.	LENGTH L	PART NO.	LENGTH L
C1210-SC	1.04	C1210-SCS	1.20	NC1210-SC	1.06	NC1210-SCE	1.20	NPC1210-SC	1.15

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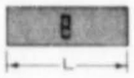
8 gauge

STOP CONNECTORS

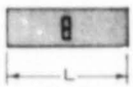
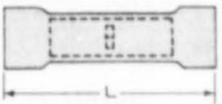
NON-INSULATED BRAZED SEAM		VINYL INSULATED		NYLON INSULATED	
		 Insulation Diameter .385 max.		 Insulation Diameter .300 max.	
PART NO.	LENGTH L	PART NO.	LENGTH L	PART NO.	LENGTH L
B8-SC	.84	C8-SC	1.54	NC8-SC	1.44

HORIZONTAL CONNECTORS

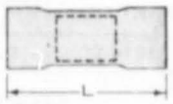
NON-INSULATED BRAZED SEAM		VINYL INSULATED	
		 Insulation Diameter .385 max.	
PART NO.	LENGTH L	PART NO.	LENGTH L
B8-HC	.43	C8-HC	.97

6 gauge

STOP CONNECTORS

NON-INSULATED BRAZED SEAM		VINYL INSULATED		NYLON INSULATED	
		 Insulation Diameter .440 max.		 Insulation Diameter .380 max.	
PART NO.	LENGTH L	PART NO.	LENGTH L	PART NO.	LENGTH L
B6-SC	1.04	C6-SC	1.69	NC6-SC	1.75

HORIZONTAL CONNECTORS

NON-INSULATED BRAZED SEAM		VINYL INSULATED	
		 Insulation Diameter .440 max.	
PART NO.	LENGTH L	PART NO.	LENGTH L
B6-HC	.49	C6-HC	1.21

4 & 2 gauge

STOP CONNECTORS

NON-INSULATED BRAZED SEAM		VINYL INSULATED	
		 Insulation Diameter .515 max.	
PART NO.	LENGTH L	PART NO.	LENGTH L
B4-SC	1.15	C4-SC	2.15

HORIZONTAL CONNECTORS

NON-INSULATED BRAZED SEAM	
	
PART NO.	LENGTH L
B4-HC	.54

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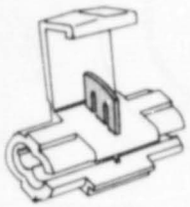
solderless terminals

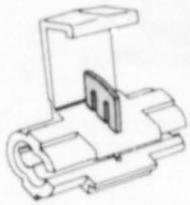
TAP CONNECTORS



C2218-TC
Low voltage applications



C1814-TC
UL listed for 600 volts on tap connection only



C1814-TCWNS
Allows parallel connection of two wires



C1210-TC
UL listed for 600 volts on tap connection only

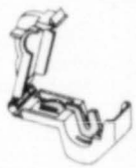


C1610-TC
UL listed for 600 volts on tap connection only



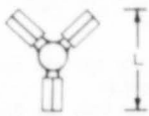
C1814-TSPR
Designed for use with snap plugs for quick connection or quick disconnection of trailers

NEW!

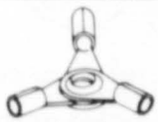


NC1814-TC-FFFMP
This new tap connector forms a *fully insulated* connection when mated with any male quick connect terminal with a part number ending in "MP" which is of the same wire range and with a tab width of .250.
This part will be available in mid 1980.

3-WAY CONNECTORS



Basic Dimensions



Non-Insulated Butted Seam



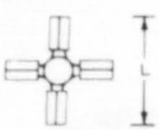
Vinyl Insulated



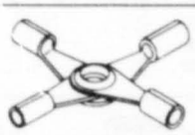
Nylon Insulated With Insulation Support

Wire Range	Stock Thickness	PART NO.	LENGTH L	PART NO.	LENGTH L	PART NO.	LENGTH L
22-18	.030	BS2218-3W	.89	[illegible]	[illegible]	[illegible]	[illegible]
16-14	.030	BS1614-3W	.89	C1614-3W	1.23	PC1614-3W	1.23
12-10	.040	BS1210-3W	.89	C1210-3W	1.39	PC1210-3W	1.39

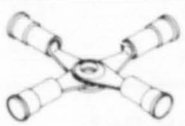
4-WAY CONNECTORS



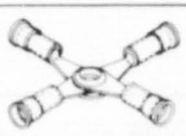
Basic Dimensions



Non-Insulated Butted Seam



Vinyl Insulated



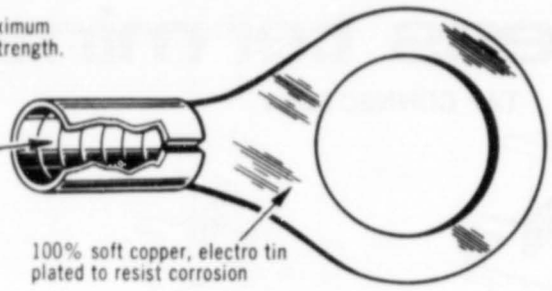
Nylon Insulated With Insulation Support

Wire Range	Stock Thickness	PART NO.	LENGTH L	PART NO.	LENGTH L	PART NO.	LENGTH L
22-18	.030	BS2218-4W	1.08	[illegible]	[illegible]	[illegible]	[illegible]
16-14	.030	BS1614-4W	1.08	C1614-4W	1.48	PC1614-4W	1.48
12-10	.040	BS1210-4W	1.08	C1210-4W	1.67	PC1210-4W	1.67

NON-INSULATED SOLDERLESS TERMINALS & CONNECTORS

One piece construction for maximum current capacity and greater strength.

Terminal barrel grooved for maximum holding power & electrical contact



100% soft copper, electro tin plated to resist corrosion

TERMINALS ILLUSTRATED FULL SIZE

IMPORTANT: Pres-Pak unit quantity varies by terminal size.

PRES-PAK — see-thru plastic reusable bags. Package 10 to a box (See Assortment Display on page 41)



BULK PACKAGE 100 Terminals to a Box



RING TONGUE TYPE



2105

2105C . . . Bulk 100 per Box
2105P (Pres-Pak) 10 Pres-Paks per Box

Wire Size	22-16
Stud Size	8-10
Hole Size	13/64"



2106

2106C . . . Bulk 100 per Box
2106P (Pres-Pak) 10 Pres-Paks per Box

Wire Size	16-14
Stud Size	4-6
Hole Size	5/32"



2107

2107C . . . Bulk 100 per Box
2107P (Pres-Pak) 10 Pres-Paks per Box

Wire Size	16-14
Stud Size	8-10
Hole Size	13/64"



2108

2108C . . . Bulk 100 per Box
2108P (Pres-Pak) 10 Pres-Paks per Box

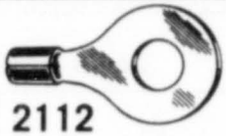
Wire Size	16-14
Stud Size	12¼
Hole Size	9/32"



2111

2111C . . . Bulk 100 per Box
2111P (Pres-Pak) 10 Pres-Paks per Box

Wire Size	12-10
Stud Size	8-10
Hole Size	13/64"



2112

2112C . . . Bulk 100 per Box
2112P (Pres Pak) 10 Pres-Paks per Box

Wire Size	12-10
Stud Size	12¼
Hole Size	9/32"

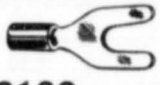


2113

2113C . . . Bulk 100 per Box
2113P (Pres-Pak) 10 Pres-Paks per Box

Wire Size	12-10
Stud Size	3/8"
Hole Size	3/8"

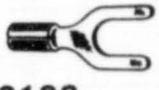
SPADE TONGUE TYPE



2132

2132C . . . Bulk 100 per Box
2132P (Pres-Pak) 10 Pres-Paks per Box

Wire Size	16-14
Stud Size	4-6
Hole Size	5/32"



2133

2133C . . . Bulk 100 per Box
2133P (Pres-Pak) 10 Pres-Paks per Box

Wire Size	16-14
Stud Size	8-10
Hole Size	13/64"



2134

2134C . . . Bulk 100 per Box
2134P (Pres-Pak) 10 Pres-Paks per Box

Wire Size	12-10
Stud Size	8-10
Hole Size	13/64"



2150

SLIDE TERMINAL MALE

2150C . . Bulk 100 per Box
2150P (Pres-Pak) 10 Pres-Paks per Box

Wire Size 18-14



2151

SLIDE TERMINAL FEMALE

2151C . . Bulk per 100 Box
2151P (Pres-Pak) 10 Pres-Paks per Box

Wire Size 18-14

TEL: 315-568-5844

Guaranteed Parts Company - Seneca Falls, New York 13148

NON-INSULATED SOLDERLESS TERMINALS & CONNECTORS (Continued)



2152

STOPLIGHT SWITCH CONNECTOR

2152C .. Bulk 100 per Box
2152P (Pres-Pak) 10 Pres-Paks per Box

Wire Size 16-14



2153
2154
2155

BUTT CONNECTOR

2153C .. Bulk 100 per Box
2153P (Pres-Pak) 10 Pres-Paks per Box
Wire Size 22-18

2154C .. Bulk 100 per Box
2154P (Pres-Pak) 10 Pres-Paks per Box
Wire Size 16-14

2155C .. Bulk 100 per Box
2155P (Pres-Pak) 10 Pres-Paks per Box
Wire Size 12-10



2156
2157

SNAP PLUG MALE

2156C .. Bulk 100 per Box
2156P (Pres-Pak) 10 Pres-Paks per Box used with 2258 Connector
Wire Size 16-14

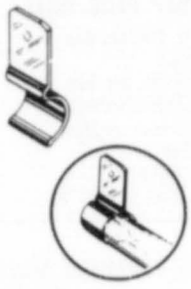
2157C .. Bulk 100 per Box
2157P (Pres-Pak) 10 Pres-Paks per Box used with 2259 Connector
Wire Size 16-14



2158

ADAPTER TERMINAL MALE

2158-25 ..... Package 25 per Box
For adapting studs to slide Terminal Connections



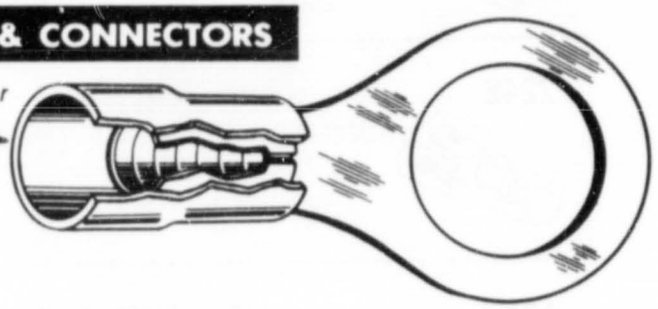
2159

FUSE CLIP ADAPTER—MALE

2159-25 ..... Package 25 per Box
For convenient connections at fuse block. Quick connect and disconnect. Ideal for CB radios, tape decks etc. Can be used with 2151 and 2249 female connectors.

INSULATED SOLDERLESS TERMINALS & CONNECTORS

Extra long insulation with molded shoulder to overlap wire insulation



RING TONGUE TYPE

RED INSULATION

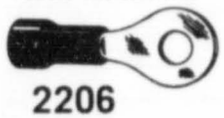


2205

2205C....Bulk 100 per Box
2205P (Pres-Pak) 10 Pres-Paks per Box

Wire Size 22-16
Stud Size 8-10
Hole Size ..... 13/64"

BLUE INSULATION

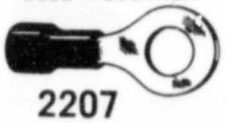


2206

2206C....Bulk 100 per Box
2206P (Pres-Pak) 10 Pres-Paks per Box

Wire Size 16-14
Stud Size 4-6
Hole Size ..... 9/32"

BLUE INSULATION



2207

2207C....Bulk 100 per Box
2207P (Pres-Pak) 10 Pres-Paks per Box

Wire Size 16-14
Stud Size 8-10
Hole Size ..... 13/64"

BLUE INSULATION



2208

2208C....Bulk 100 per Box
2208P (Pres-Pak) 10 Pres-Paks per Box

Wire Size 16-14
Stud Size 12¼
Hole Size ..... 9/32"

YELLOW INSULATION



2211

2211C....Bulk 100 per Box
2211P (Pres-Pak) 10 Pres-Paks per Box

Wire Size 12-10
Stud Size 8-10
Hole Size ..... 13/64"

YELLOW INSULATION



2212

2212C....Bulk 100 per Box
2212P (Pres-Pak) 10 Pres-Paks per Box

Wire Size 12-10
Stud Size 12¼
Hole Size ..... 9/32"

YELLOW INSULATION



2213

2213C....Bulk 100 per Box
2213P (Pres-Pak) 10 Pres-Paks per Box

Wire Size 12-10
Stud Size ..... 3/8"
Hole Size ..... 3/8"

TEL: 315-568-5844

Guaranteed Parts Company - Seneca Falls, New York 13148

INSULATED SOLDERLESS TERMINALS & CONNECTORS (Continued)

SPADE TONGUE TYPE

BLUE INSULATION



2232

2232C . . . Bulk 100 per Box
2232P (Pres-Pak)
10 Pres-Paks per Box
Wire Size 16-14
Stud Size 4-6
Hole Size . . . . . $\frac{5}{32}$"

BLUE INSULATION



2233

2233C . . . . Bulk 100 per Box
2233P (Pres-Pak)
10 Pres-Paks per Box
Wire Size 16-14
Stud Size 8-10
Hole Size . . . . . $\frac{13}{64}$"

YELLOW INSULATION



2234

2234C . . . . Bulk 100 per Box
2234P (Pres-Pak)
10 Pres-Paks per Box
Wire Size 12-10
Stud Size 8-10
Hole Size . . . . . $\frac{13}{64}$"

2240
2241



SNAP PLUG MALE

2240C . . Bulk 100 per Box
2240P (Pres-Pak)
10 Pres-Paks per Box
Used with 2259 Connector
Wire Size 16-14

2241C . . Bulk 100 per Box
2241P (Pres-Pak)
10 Pres-Paks per Box
Used with 2258 Connector
Wire Size 16-14

2248



SLIDE TERMINAL MALE

2248-25 Package 25 per Box
Used with female terminal 2249. Makes excellent fully insulated connections for CB radios and other accessories.

2249



SLIDE TERMINAL FEMALE

2249-25 Package 25 per Box
Fully insulated. Companion part to 2248 terminal. Can also be used with 2159 or 2250.

2250



SLIDE TERMINAL MALE

2250C . . Bulk 100 per Box
Wire Size 18-14
2250P (Pres-Pak)
10 Pres-Paks per Box

2251



SLIDE TERMINAL FEMALE

2251C . . Bulk 100 per Box
Wire Size 18-14
2251P (Pres-Pak)
10 Pres-Paks per Box

2253
2254
2255



BUTT CONNECTORS

2253C . . Bulk 100 per Box
2253P (Pres-Pak)
10 Pres-Paks per Box
Wire Size 22-18
RED INSULATION

2254C . . Bulk 100 per Box
2254P (Pres-Pak)
10 Pres-Paks per Box
Wire Size 16-14
BLUE INSULATION

2255C . . Bulk 100 per Box
2255P (Pres-Pak)
10 Pres-Paks per Box
Wire Size 12-10
YELLOW INSULATION

2258
2259



CONNECTORS

2258C . . . . . Bulk 100 per Box
2258P (Pres-Pak) . . . . . 10 Pres-Paks per Box
$\frac{3}{16}$" Diam. used with 2156 Male Terminal

2259C . . . . . Bulk 100 per Box
2259P (Pres-Pak) . . . . 10 Pres-Paks per Box
$\frac{5}{32}$" Diam. used with 2157 Male Terminal

2260



BAKELITE CONNECTOR

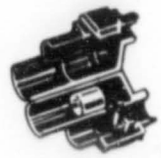
2260-10 Package 10 per Box
3 wire connector



2261

TAP CONNECTORS
(Scotch lock)

2261-25 . . for General Purpose Splicing of 14, 16 & 18 gauge wire.
Package 25 per Box



2262

2262-25 . . . . . Bullet Tap Connector for Trailer and Accessory Hookups of 14, 16 & 18 gauge wire.
Package 25 per Box

BUTT CONNECTOR PIGTAIL SPLICE

2268



2268-50 Package 50 per Box
Wire Size 22-14

2269



2269-25 Package 25 per Box
Wire Size 18-10

2270
2271
2272



THREE WAY "Y" CONNECTORS

2270-25 . . . . . Package 25 per Box
Wire Size 22-18
RED INSULATION

2271-25 . . . . . Package 25 per Box
Wire Size 16-14
BLUE INSULATION

2272-25 . . . . . Package 25 per Box
Wire Size 12-10
YELLOW INSULATION

TEL: 315-568-5844
Guaranteed Parts Company - Seneca Falls, New York 13148

BATTERY TERMINALS

FEATURES—All Battery Terminals use Bolt and Nut for tight connections to Battery Posts for solid electrical contact. Fit positive or negative Battery Posts. Bolt locks firmly from either right or left side.



900 Universal Solderless fits 0 Ga. to 14 Ga. cable. Reversible clamp with two bolts for securing cable.

900-5 Package 5 per box or 900D display card of 10—see page 40.



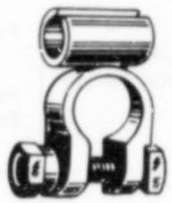
902 Universal Type w/⅜" Wing Nut for Neg. Posts.

902-5 Package 5 per box or 902-903D display card with (5) 902 & (5) 903—see page 40.



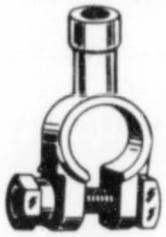
903 Universal Type w/⅜" Wing Nut for Pos. Posts.

903-5 Package 5 per box or 902-903D display card with (5) 902 & (5) 903—see page 40.



904 Universal Swedge-Solder Type fits to 00 Ga. cable.

904-5 Package 5 per box.



905 Straight Swedge-Solder Type for 4 & 6 Ga. cable.

905-5 Package 5 per box.



909 Positive adapter terminal for conversion from post type batteries to side/terminal cables.

909-5 Package 5 per box



910 Negative adapter terminal w/bolt, for conversion from post type batteries to side/terminal cables.

910-5 Package 5 per box



911 Universal Side Terminal Solderless Emergency Terminal. For replacing corroded O.E. Terminals or converting conventional terminals to side terminals.

911-5 Package 5 per box

BATTERY CABLE LUG



906 Copper Lug. Solder Type 4 Ga. ¼" Diam. hole.

906-20 Package 20 per box.

907 Copper Lug. Solder Type to 00 Ga. ⅜" Diam. hole.

907-10 Package 10 per box.

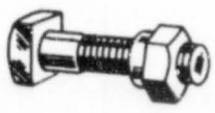
BATTERY POST SHIM



850 Lead Post Shim for Pos. & Neg. Terminals.

850-20 Package 20 per box.

BATTERY BOLT



908 Battery Bolt and Shoulder Nut ⅜" for all Battery Terminals.

908-25 Package 25 per box.

TEL: 315-568-5844

Guaranteed Parts Company - Seneca Falls, New York 13148

Gulf+Western Manufacturing Company

Eagle Signal Industrial Controls Division

736 Federal St.
Davenport, IA 52803
Telephone: 319/326-8111

Interval (Reset) Time Delay Relays	**Push Button**	**191**	8 Sec. to 16 Hrs.	1½% of Full Scale	Push Button	120, 240V 50/60 Hz	10 Amp 120, 240VAC
	Push Button Pneumatic	**86**	0.5 Sec. to 60 Sec.	+15%	Push Button	120, 240V	1 SPDT Switch, 15 Amp ½ HP 120V

	DESCRIPTION	SERIES
Control Unit Non-Illuminated	Round Momentary Pushbuttons	AF, AE, AH, AS
	Square Momentary Pushbuttons	BF, BE
	Special Pushbuttons	AP, AL, AK, BT
	Mushroom Momentary Operators	AM, AD, AB, AR, AJ
	Maintained Operators	WV, WG, WC, WT, WW
	Single Rod Selectors	SK; SL, SY
	Twin Rod Selectors	TK, TL
Control Unit Illuminated	Pushbuttons	LO, SO, MO
	Maintained Operators	LB
	Pilot Lights	PA, PB, PJ, PK
		PF, PG

CONTACT BLOCKS
N.C. 3BT N.O. Early Make 3BM
N.C. 3BC N.C. Early Break 3BL

TRANSFORMER WITH 6V LAMP
120V 3LT-A
240V 3LT-C
480V 3LT-F

LENS AND CAP COLORS

Red	White	Gray
Green	Clear	Blue
Amber	Black	Orange

LEVER, TOGGLE, KNOB COLORS
Black, Red

ALUMINUM LEGEND PLATES
Natural Legend on Black Anodized
46 Standard Legends
4 Styles - 8 Sizes

Elco Corporation

2250 Park Place
El Segundo, CA 90245
Telephone: 213/675-3311

Electrical Connectors

PC Board Card Edge
- For 1/16" PC card
- Bifurcated Bellows Contact
- Ten series available with current ratings from 3 to 5 amps
- Contacts on .100 x .200, .125 x .250, .156 x .200 spacings
- Gold plating 10 microinches over nickel of 30 to 100 microinches
- Phosphor bronze contacts
- Diallyl Pthalate, polyester and phenolic insulators available MIL-M-14F and UL 94V0 where applicable

Crimp PC Card Edge
PC Varicon Connectors
- 6 to 10 amperes current rating
- Tuning fork design
- Wire wrap, wire crimp and solder type tails
- Meets MIL-E-5400, MIL-E-8189, MIL-T-21200, MIL-E-19600 specifications
- Various configurations and custom designs

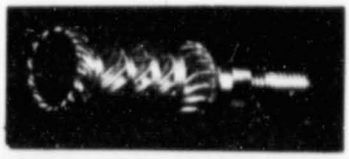
2 Piece Metal to Metal Connectors
- 3 to 5 amperes rating

Rack and Panel Connectors
High Density Metal to Metal PC Connectors
Military Weather and Moisture Proof Pin Connectors
Transistor PC Sockets

ICORE international
180 No. Wolfe Rd.
P.O. Box 8005
Sunnyvale, Calif. 94088
Phone (408) 732-5400

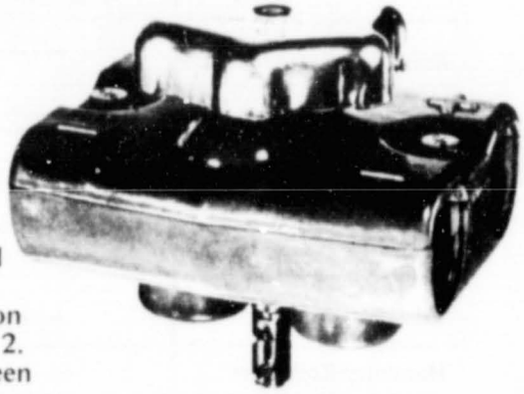
BATTERY DISCONNECT SYSTEMS

The Elcon System



The key element of the BD disconnect is a helical wire contact. This design provides many contact points with the mating male pin and gives a correspondingly low contact resistance. The helix also has a high surface to volume ratio, so that losses associated with skin effect in high frequency alternating or pulsed currents are minimized. Made of silver plated soft copper, the helix is flexible and compensates automatically for any wear at the mating surface. Thus, mechanical and electrical characteristics are maintained over thousands of insertion / removal cycles.

BD 6-3



The Elcon BD 6 - 3 Battery Disconnect was designed in 1946 for military aircraft use. This two plug, 4 - wire disconnect has since been used on commercial aircraft, ground support equipment and missiles. The high impact, long glass fibre filled molded casting is resistant to both battery acid and alkaline electrolites. The Elcon BD 6 - 3 disconnect is listed under Military Standard MS 25182 - 2. It has been tested by the Naval Air Systems Command and has been placed on the Qualified Products List (QPL) under military specification Mil - P - 18148 C, "Connector, Plug, Electrical, Quick Disconnect, Battery".

BD 16-1, -2, -3

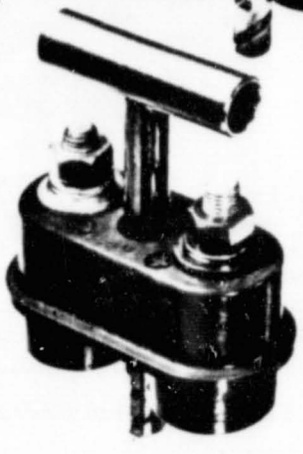


BD 16 - 1 shown

The Elcon BD 16 Battery Disconnect was developed to meet the needs of a lighter weight, compact unit which would still maintain the high current capacity as the BD 6 - 3. The BD 16 is a two plug, 2 - wire disconnect which also uses the Elcon helical connectors. The BD 16 - 1 features a T - handle. The BD 16 - 2 uses a handwheel and the BD 16 - 3 incorporates a handwheel with a locking tab.

BD 13-1

The Elcon BD 13 - 1 Battery Disconnect was originally developed for use on helicopters, where its lightweight and compact features were essential. This disconnect offers the same rugged construction and quality workmanship which characterises the Elcon Disconnect System. Accordingly, the users of Elcon have the satisfaction of knowing that the Elcon link from battery to load has been rigorously tested for thermal and mechanical shock, vibration and corrosion resistance.



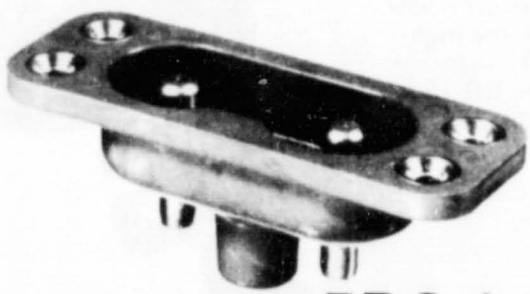
Components shown half actual size

ICORE international
180 No. Wolfe Rd.
P.O. Box 8005
Sunnyvale, Calif. 94088
Phone (408) 732-5400

BATTERY DISCONNECT SYSTEMS

Operating Characteristics

Characteristics	BR 8	BD 6	BD 13	BD 16
Weight	Nom. .26 lbs.	Nom. 1.2 lbs.	Nom. .5 lbs.	Nom. .75 lbs.
Mating Characteristics	Mates with either a two or four wire plug per Mil-P-18148 C	———		
Power Capabilities	———	2000 amps / 1 min. 75 Millivolt drop 750 amps / 5 min. 26 Millivolt drop		
Dielectric Strength	Withstands 2500 volts / 1 min. applied between contact pins and mounting plate	Withstands 2500 volts / 1 min. applied between electrical connections of the plugs.		
Mechanical Strength	Mating socket withstands 500 pound tension and 10 ft. / lbs. applied torque	———		
Insulation Resistance	———	5 Gigohms @ 500 volts / 1 min. applied between electrical connections of the plugs.		
Engagement Torque	———	Nom. 10 in. - lbs.		
Mechanical Shock	———	Withstands repeated shocks of 50 G intensity		
Salt Fog	Unaffected by 50 hour exposure to a 5% salt fog @ 95° F.	Unaffected by 168 hour exposure to a 5% salt fog @ 95° F.		
Vibration	———	Withstands vibrational stresses at magnitudes of + 10 G acceleration and frequencies up to 500 cps.		
Humidity Resistance	———	Unaffected by exposures to 95% R.H. for 240 hours.		
Temperature Resistance	- 65° F to + 185° F			
Fluid Resistance	Resistant to the following fluids : Mil-H-5056 Hydraulic Fluid Mil-L-23699 Lubrication Oil Sulfuric Acid Sp. Gr. 1.10 Potassium Hydroxide Sp. Gr. 1.10			
Fungus	Does not support fungus growth			



BR 8 - 1 shown

BR 8-1, -2

The Elcon Battery Receptacle has provided industry with a dependable means of insuring a reliable system of electrical connection. Elcon's BR 8 - 2 meets or exceeds all the requirements of MS 3509 and Mil - E - 81099 A.



BR 23

The BR 23 was designed to meet the demand for an external receptacle that performs with the same reliability as the BR 8 series receptacles. For additional information on the BR 23, contact Icore Electrosystems.

For Source Control drawings covering specifications and package dimensions, Contact Icore Electrosystems.

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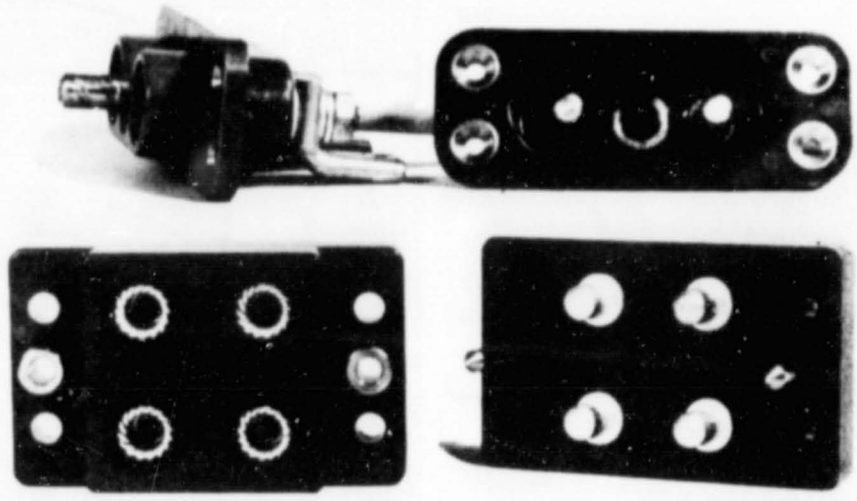
The Elcon System: PD series power disconnects for modular electronics



Elcon PD connectors are quick disconnects (non-circuit-breaking) designed for medium to high current interconnection of modular electronic components. They feature extremely low voltage drop, ease of insertion and extraction, high reliability, mechanical ruggedness and long service life.

The key element of the PD disconnect is a helical wire contact. This design provides many contact points with the mating male pin and gives a correspondingly low contact resistance. The helix also has a high surface to volume ratio, so that losses associated with skin effect in high frequency alternating or pulsed currents are minimized. Made of silver plated soft copper, the helix is flexible and compensates automatically for any wear at the mating surface. Thus, mechanical and electrical characteristics are maintained over thousands of insertion-removal cycles.

For maximum utilization, the disconnect bodies are molded in glass-filled diallyl phthalate resin. With this material, the UL temperature index is 130° C. The adjacent chart shows the time / temperature relationship for various current levels.

Current PD models have been designed particularly for rack mounted electronic modules. In a number of instances, they have been chosen because they permit rapid removal from and reconnection to energized circuits without the use of tools. For example, in telephone electronic switching centers, PD disconnects are used on dc "bulk power supplies" which are installed in parallel on a common output power bus. To remove an individual supply module for inspection or repair, it is simply turned off and then pulled out from the front of the rack. Similar applications include:

Rectifiers, inverters, and solid state switching elements in uninterruptable power supply (UPS) systems.

Switching regulators in computer peripheral equipment.

Radar SCR modulators.

Pulse generators in LORAN ground stations.

Standard 2 and 4 pin disconnect models are currently available. Additional configurations are under development. Customer inquiries concerning new applications and new designs are solicited.

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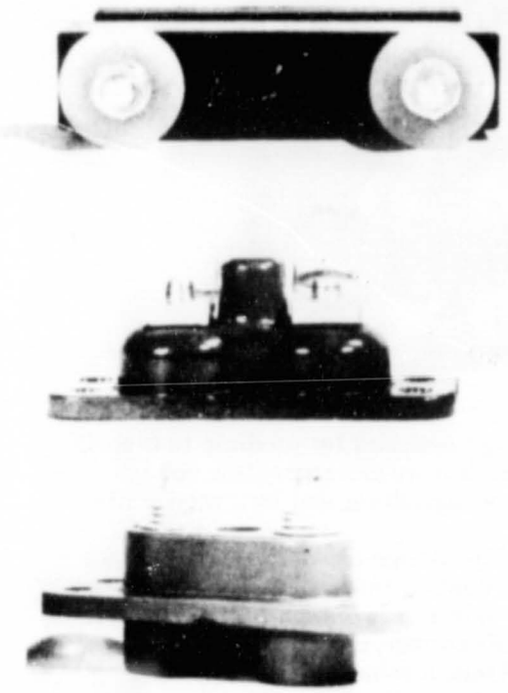
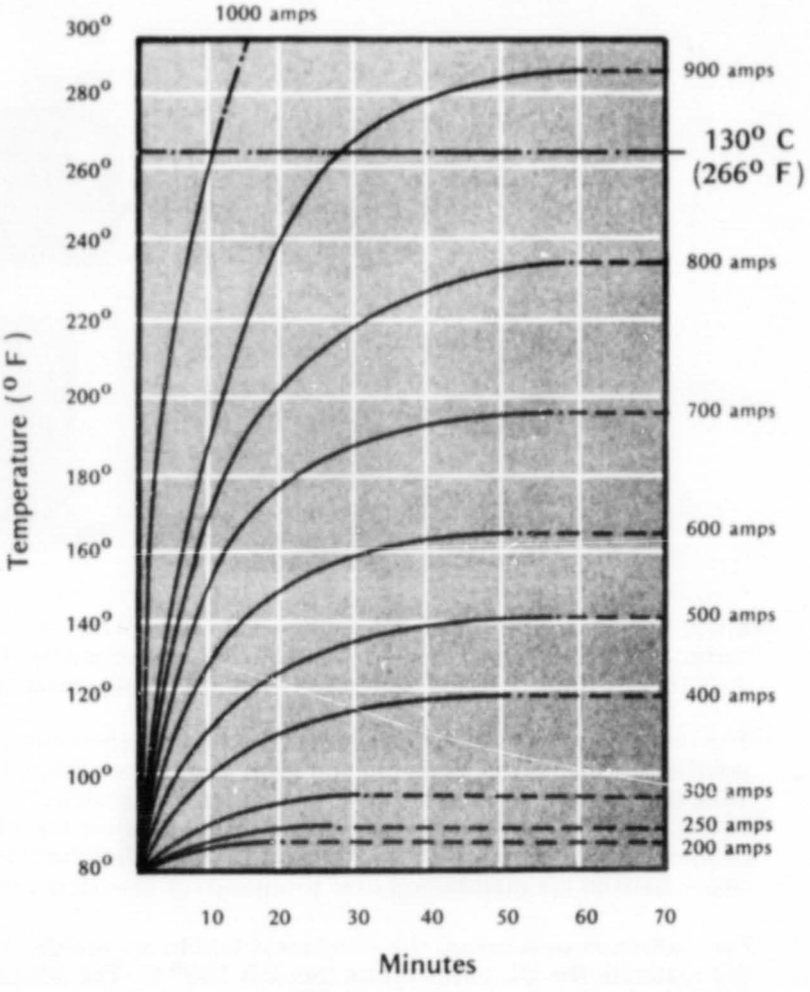
The Elcon System: PD series power disconnects for modular electronics



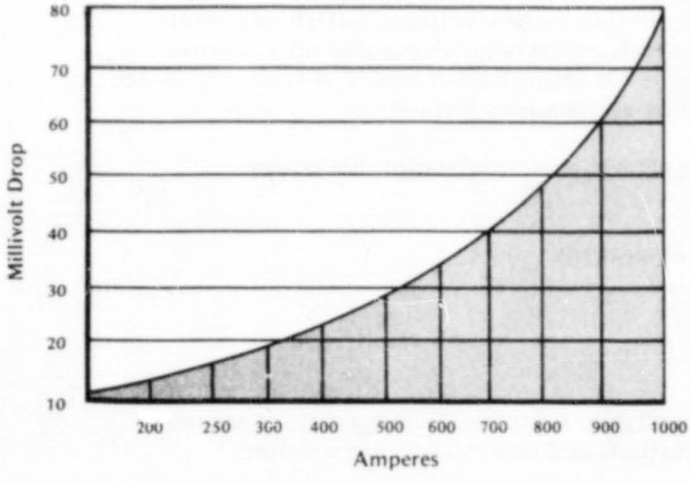
Components shown half actual size

CHART A



The Elcon helix and pin assembly is designed to handle a wide range of continuous operating currents, depending on ambient conditions and the particular application of the disconnect. For lower power requirements, where temperature is not a major concern, Icore possesses the capability to design and manufacture Elcon systems from alternative materials. Chart A is intended as a guide in designing a system where either continuous or short duration power is required.

CHART B



Icore's helical contacts offer a low millivolt drop. Chart B shows the corresponding "steady-state" millivolt drop for typical current levels.

K-D TOOLS®
K-D MANUFACTURING COMPANY
3575 HEMPLAND ROAD
LANCASTER, PENNSYLVANIA 17604
TELEPHONE (717) 285-4581

AUTOMOTIVE ELECTRICAL TERMINALS & CONNECTORS



1508
BUTT SPLICE
22-16 AWG



1500
#10 STUD
16-14 AWG



1501
5/16" STUD
16-14 AWG



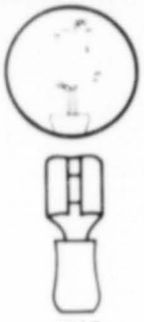
1503
1/4" STUD
16-14 AWG



1502
3/8" STUD
16-14 AWG



1528
#10 STUD
16-14 AWG



1537
PIGGY BACK
.250 FASTON
RECEPTACLE
16-14 AWG



1540
.180 DIA.
SHUR-PLUG*
16-14 AWG



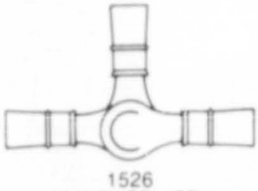
1530
FULLY INS.
.156 DIA.
SHUR-PLUG
RECEPTACLE
16-14 AWG



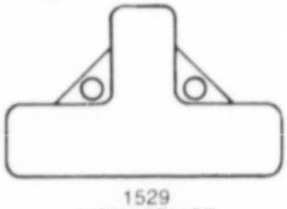
1544
SHUR-PLUG
BUTT SPLICE
FOR .156 PLUG



1509
BUTT SPLICE
16-14 AWG



1526
3 WAY SPLICE
16-14 AWG



1529
3 WAY SPLICE
INSULATOR
22-14 AWG



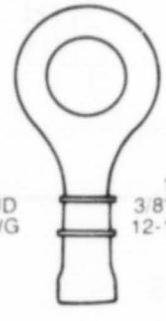
1504
#8 STUD
12-10 AWG



1543
#10 STUD
12-10 AWG



1505
1/4" STUD
12-10 AWG



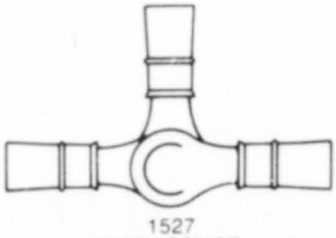
1506
3/8" STUD
12-10 AWG



1507
1/2" STUD
12-10 AWG



1510
BUTT SPLICE
12-10 AWG



1527
3 WAY SPLICE
12-10 AWG



1547
1/4" STUD
8 AWG



1538
3/8" STUD
8 AWG



1541
1/2" STUD
8 AWG

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AUTOMOTIVE ELECTRICAL TERMINALS & CONNECTORS



1524
CLOSED END
SPLICE
22-14 AWG



1525
CLOSED END
SPLICE
22-10 AWG



1545
#10 STUD
16-14 AWG



1546
#10 STUD
12-10 AWG

Ignition Terminals



1535
DISTRIBUTOR
TERMINAL
7mm



1539
SPARK PLUG
TERMINAL
7mm



1534
SPARK PLUG
TERMINAL
7mm

Uninsulated FASTON* Terminals



1533
250 FASTON TAB
RECEPTACLE ADAPTOR



1532
250 FASTON TAB
STUD MOUNTED
ADAPTOR

Crimp Type Alligator Clips

INSULATED
22-16 AWG
1536



*Trademark of AMP Incorporated

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3575 HEMPLAND ROAD
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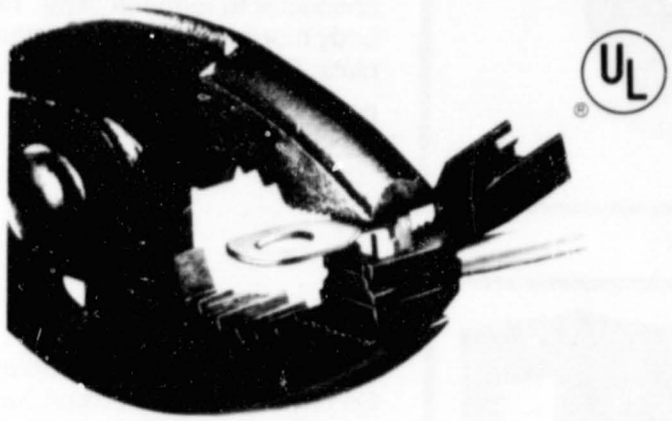
AUTOMOTIVE ELECTRICAL TERMINALS & CONNECTORS

Plyr-Tap Terminals and Butt Splice



	MULTI-STUD	SPADE	250 FASTON* TAB	187 FASTON* RECEPTACLE	250 FASTON* RECEPTACLE	BUTT SPLICE
PART NO.	1517	1519	1515	1511	1513	1531
WIRE SIZE	22-18	22-18	22-18	22-18	22-18	16-14
STUD SIZE	6-8-10	#10	—	—	—	—
PART NO.	1518	1520	1516	1512	1514	
WIRE SIZE	16-14	16-14	16-14	16-14	16-14	
STUD SIZE	6-8-10	#10	—	—	—	

In-Line Fuse Holder

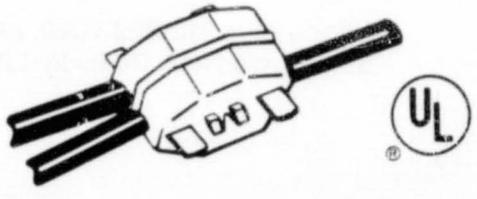
32 VOLT, 24-14 AWG, FOR FUSE .250 DIA. — .625-1.25 L.

No Tool Required

1542

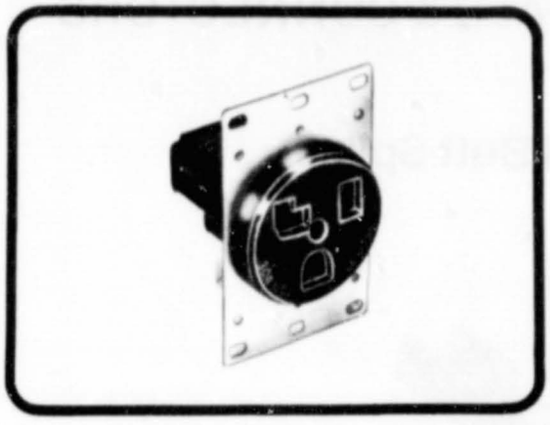


ELECTRO TAP* Connectors



1522 — 22-18 AWG (RED)
1521 — 18-14 AWG (BLUE)
1523 — 12-10 AWG (YELLOW)

Electrical Connectors

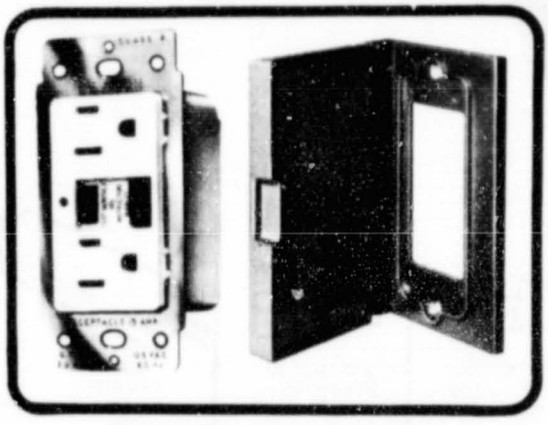


No. 5371

30A-125V **NEMA 5-30R**

2-pole, 3-wire flush receptacle. Pressure-type terminals; plated steel terminal screw clamps conductor to terminal plate. Two-piece molded body mounted on rust-resistant steel mounting plate. Fits single-gang opening in outlet box.

Dimensions: $2^{7}/_{64}$" dia. x $1^{49}/_{64}$" D x $1^{13}/_{16}$" W.
U.L. Listed, Meets Fed. Spec. W-C-596C.



No. 6196 cover No. 6198 with

SURE-GARD III GFCI 2-pole, 3-wire receptacle. Compact $1^{3}/_{8}$" body design, with nylon high-abuse face. Exclusive LED indicator light on certain models. Available with UL Listed Hospital-Grade, High-Abuse receptacle; certified corrosion-resistant, with cupro-nickel exposed metal parts.

Optional die-cast aluminum weatherproof cover.

Call on Leviton's Custom Design Capability Team for personal attention to your requirements.

Whatever you need—be it a consultation with the engineering-wise Marketing Manager of our Appliance Products Division, or a full-scale meeting between your staff and ours, including the Chief Engineer of our Design Capability Team—you'll find that the session is more like a think-tank experience than the usual cut-and-dried "what-do-we-have-that-we-can-sell-you?" Not that we don't have a vast product line to show you. We do. We offer a complete line of wiring devices, power supply cords, wire and specialty cable, which is what we mean by "Total Capability from a Single Source".

Phone us at 212-229-4040, ext. 532. Or write Mr. Lou Vlismas, Marketing Manager, Leviton, 59-25 Little Neck Parkway, Little Neck, N.Y. 11362.

LEVITON

Affiliates:
AMERICAN INSULATED WIRE • PACIFIC ELECTRICORD

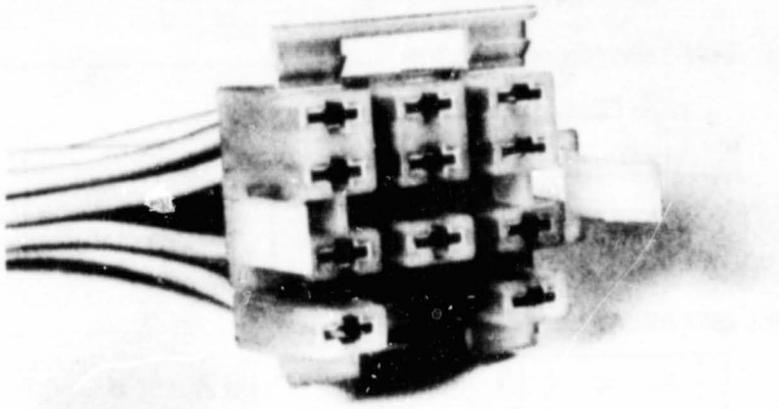
GM-2 77/J80

Relay and Switch Connectors

1852, 2211, 2191, 2507 & 2177 Models

features/dimensions

- 7 circuit leaf spring relay version (2507)
- 11 circuit standard relay version (2177)
- 14 circuit miniature relay version 1852
- 94 V-2 nylon
- 1 & 3 circuit switch connectors (2211 & 2191)
- U.L. approved

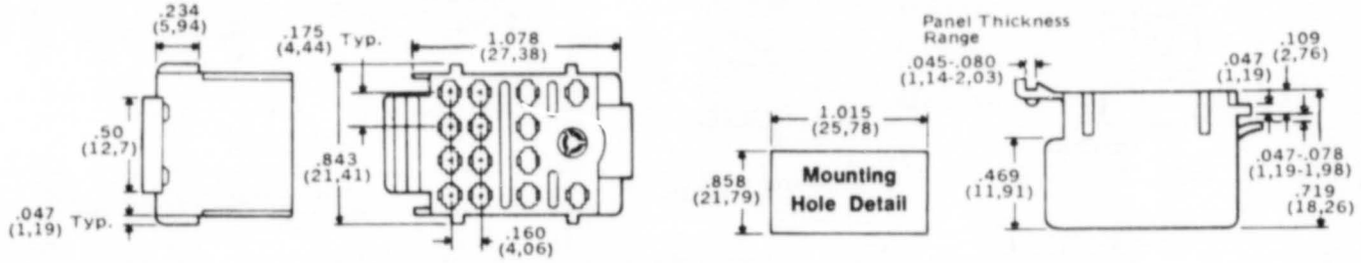


These connectors utilize Molex open end terminals. These terminals will accept 14 through 28 AWG wire and an optional detent for increased holding action is available.

Molex relay connectors are designed to lower assembly, testing and service cost.

Dimensions & Ordering Information:

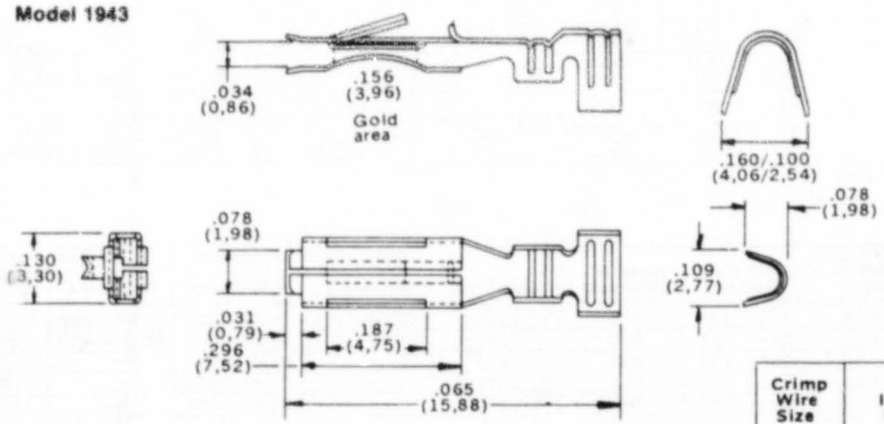
MODEL 1852 RELAY CONNECTOR



No. of Circuits	With Mtg. Ears		Without Mtg. Ears	Uses Terminal
	for .08" (2,03) Max. Panel Thickness	for .50" (1,3) Max. Panel Thickness		
14	06-02-3141	06-02-3143	06-02-3142	1943

5 amps per circuit 250 VAC

Model 1943



Crimp Wire Size	Insulation Diameter	Chain Form	Loose Form
18-24	.060 - .105 (1,52 - 2,67)	05-06-0200	05-06-0201

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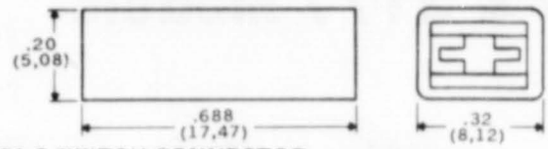
Relay & Switch Connectors

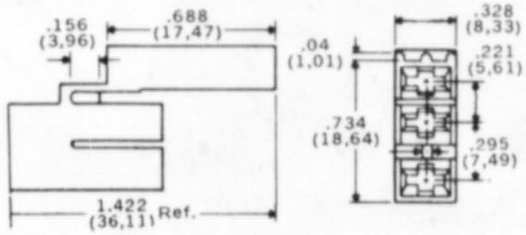
MODEL 2211 SWITCH CONNECTOR



Circuits	Order No.	Electrical	
		Max. Amps	Max. Volts
1	06-02-3011	10	250

Uses 2176, 2328, 2576, 2698, and 2799 terminals.

MODEL 2191-3 SWITCH CONNECTOR



Circuits	Order No.	Electrical Per Circuit	
		Max. Amps	Max. Volts
3	06-02-3031	10	250

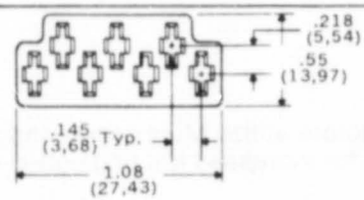
Uses 2176, 2328, 2576, 2698, and 2799 terminals.

MODEL 2507 RELAY CONNECTOR

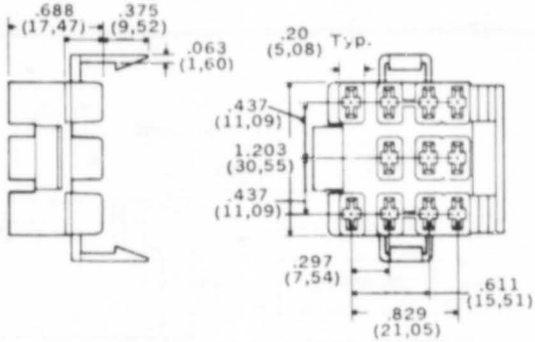


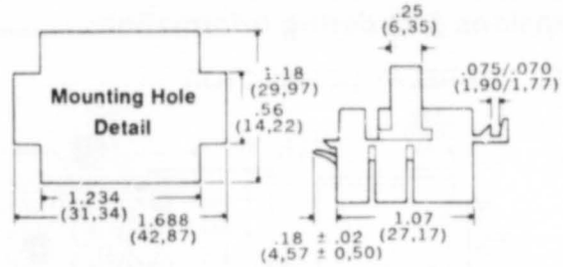
Circuits	Order No.
7	15-04-0209

5 Amps/250 VAC
Uses 2176, 2328, 2576, 2618, and 2799 terminals.



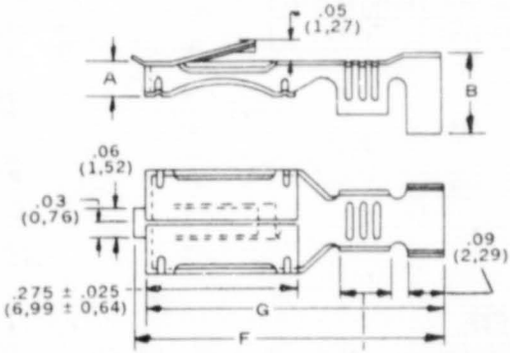
MODEL 2177-1 RELAY CONNECTOR



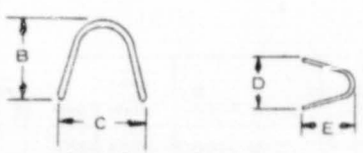


Circuits	Order No.	Electrical Per Circuit		With Mtg. Ears
		Max. Amps	Max. Volts	
11	06-02-3111	8	125	.50" Panel

MODELS 2176, 2328, 2576, 2698, and 2799 TERMINALS.



Model	DIMENSIONS						
	A	B	C	D	E	F	G
2176	.074 (1,88)	.187 (4,75)	.210 ± .035 (5,33 ± 0,09)	.120 ± .025 (3,05 ± 0,64)	.13 (3,3)	.625 (15,88)	.610 ± .015 (15,49 ± 0,38)
2388	.074 (1,88)	.156 (3,96)	.165 ± .030 (4,19 ± 0,76)	.120 ± .025 (3,05 ± 0,64)	.13 (3,3)	.640 (16,26)	.620 (15,75)
2576	.080 (2,03)	.156 (3,96)	.210 ± .035 (5,33 ± 0,09)	.120 ± .025 (3,05 ± 0,64)	.13 (3,3)	.625 (15,88)	.610 ± .015 (15,49 ± 0,38)
2698	.080 (2,03)	.156 (3,96)	.165 ± .030 (4,19 ± 0,76)	.120 ± .025 (3,05 ± 0,64)	.13 (3,3)	.625 (15,88)	.610 ± .015 (15,49 ± 0,38)
2799	.080 (2,03)	.090 (2,29)	.100 (2,54)	.085 (2,16)	.07 (1,8)	.620 (15,75)	.610 ± .015 (15,49 ± 0,38)



Crimp Wire Size	Insulation Diameter	Material Thickness	Model No.	Chain Form Order No.		Loose Form Order No.	
				W/Detent	W/O Detent	W/Detent	W/O Detent
14-22	.085 - .135	.010	2176	05-06-0301	05-06-0303	05-06-0302	05-06-0304
14-22	.085 - .125	.010	2328	05-06-0401	05-06-0403	05-06-0403	05-06-0404
14-22	.085 - .135	.012	2576	—	05-06-0305	—	05-06-0306
14-22	.085 - .125	.012	2698	—	05-06-0405	—	05-06-0406
24-28	.034 - .060	.012	2799	—	05-06-0307	—	05-06-0308

Reel Quantities: Models 1943 and 2799-6,000; Models 2328-4,000; Models 2176 and 2698-3,000; and Model 2576-2,500. All chain form orders rounded to the nearest full reel.

All Terminals are brass alloy, tin plated

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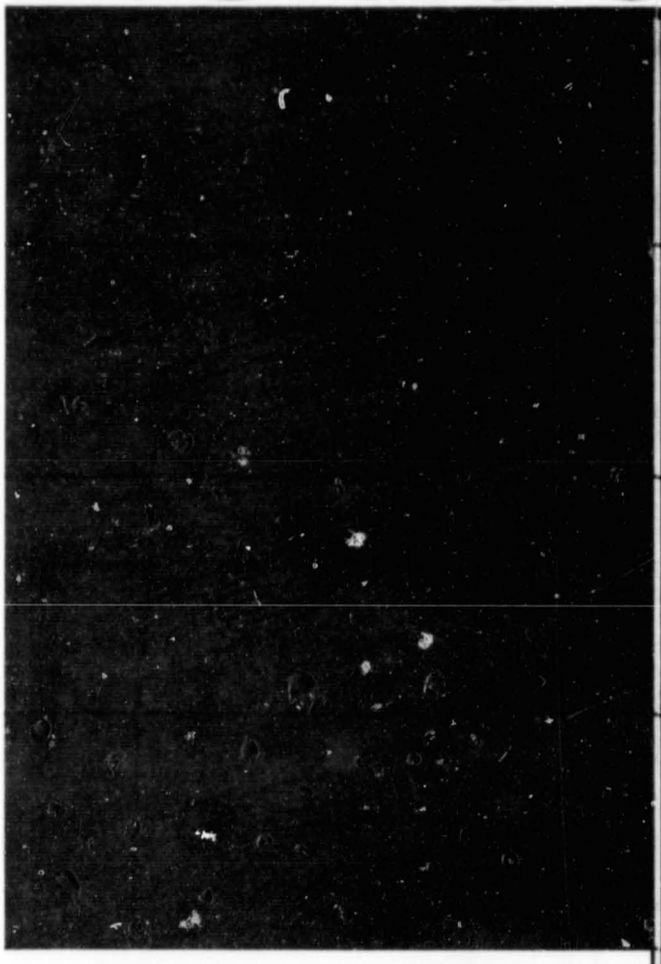
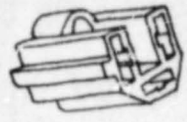
Packard Electric

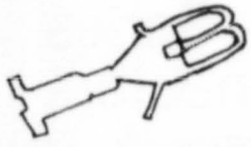
Division of General Motors Corporation
P.O. Box 431 Warren, Ohio 44486
Tel. 216-373-2633

Product Index

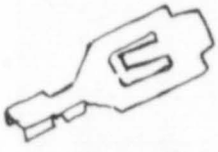


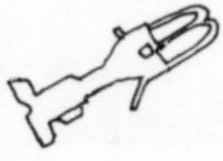

59 Series Female Terminals

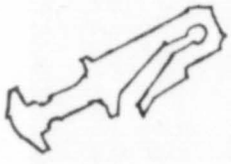

59 Series Connectors

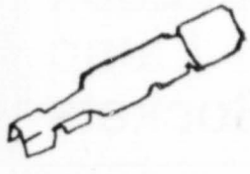

Pack Con Female Terminals


Pack Con Male Terminals


56 Series Female Terminals


Pack Con Female-H.D. Terminals


56 Series Male Terminals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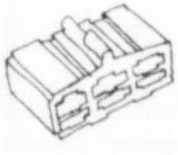
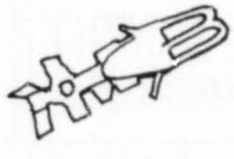
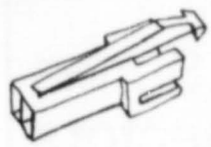

56 Series Connectors

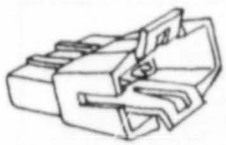

Pack Con II Female Terminals

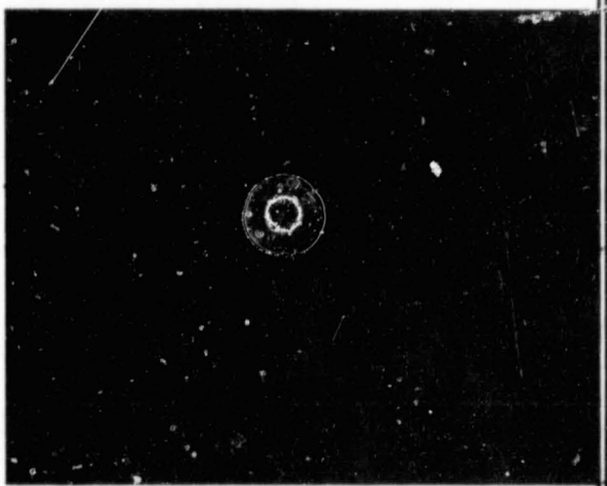
Packard Electric

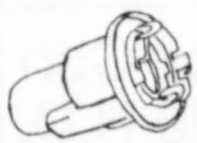
Division of General Motors Corporation
P.O. Box 431 Warren, Ohio 44486
Tel. 216-373-2633

Product Index

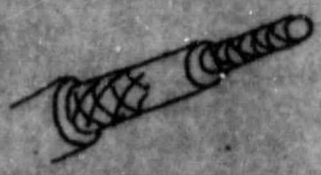

Pack Con Series Connectors


Pack Con II Series Connectors

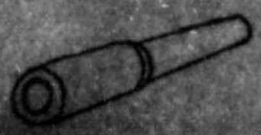



Twist Lock Lamp Sockets


Wedge Base Lamp Sockets

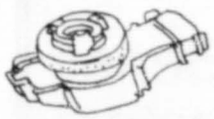

Ignition Cable


Ignition Terminals


Ignition Boots and Nipples


Punch-Pack Ring-Spade Terminals


Speed-O-Matic Tooling


Low Profile Lamp Sockets

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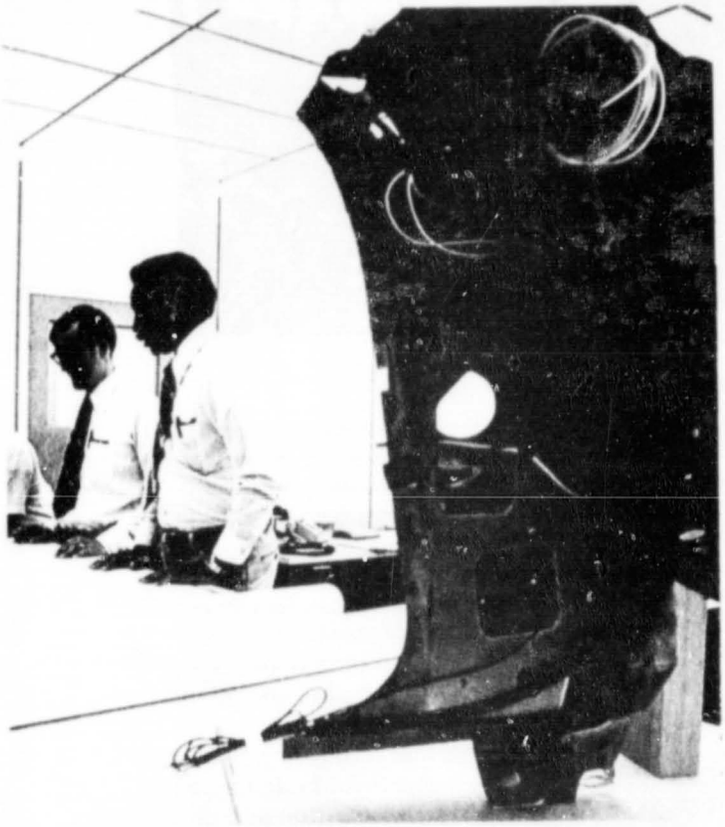
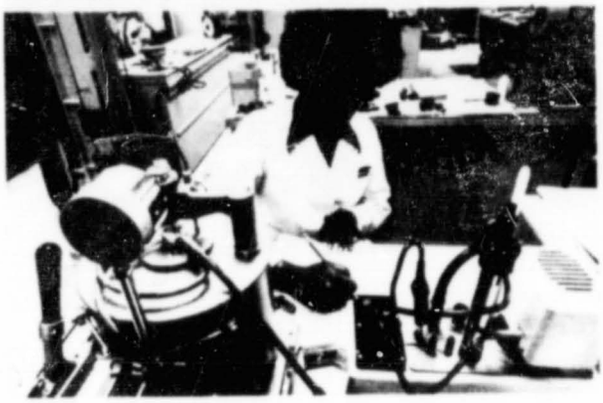
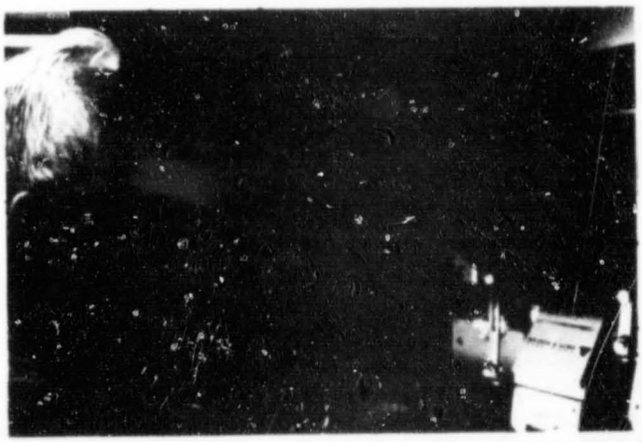
remarkable capability at your call.







In engineering, in design and in manufacturing capacity, few if any producers of automotive energy distribution systems can match Packard Electric.

Or offer you the servicing, counseling, technical knowledge, and broad experience of the Packard team.

Your own task force

The task force concept gives you the best of both worlds: manufacturing, testing and engineering facilities combined with a responsive, no-red-tape capability usually found only in smaller companies.

A qualified Packard sales engineer is available to answer questions, supply additional data and provide the basis for a relationship that results in substantial savings in time, production and dollars.

Testing Facilities

When you choose Packard, you'll also acquire testing facilities that include engineering labs, a fleet of vehicles that log over a quarter of a million miles per year, and access to all General Motors proving grounds and test facilities.

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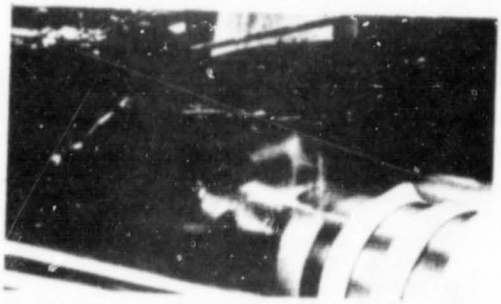



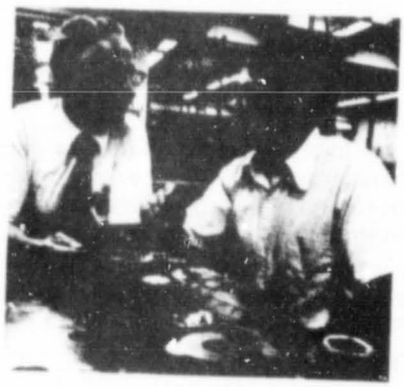

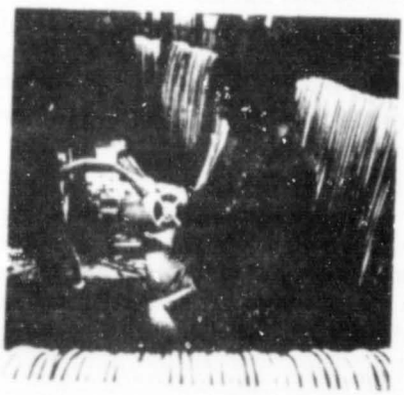

Manufacturing capacity

Judge for yourself—this is what we produce daily: 98,000 miles of drawn wire, 35 million feet of cable extrusion, 16 million metal parts, 5 million molded parts, over a million feet of conduit extrusion and 820,000 rubber parts.

We process more silicone compound than any facility in the world and annually use 58 million fuses, 5 million pounds of steel, 57 million pounds of copper, 9 million pounds of brass, 46 million pounds of plastic compounds and 53 million automotive lamps.

The engineering and manufacturing benefits of Packard Electric are myriad—and can result in substantial savings in time, production and dollars to Packard customers.

Innovation is our tradition.

Our leadership in vehicle wiring is widely acknowledged. Packard was among the first to use plastic insulation, nylon jacketing, cross-linked polyethylene and aluminum core cable in automotive applications.

We pioneered the use of electronic modules in wiring harnesses, the use of special wiring in place of block resistors, and printed circuits on mylar.

Fiber optics, High Energy Ignition wiring, side terminals for batteries, fuse blocks, convoluted conduit, high performance connectors—this is but a small sampling of the innovation, the progressiveness and leadership of Packard and its people.

PACKARD ELECTRIC

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CN-54

RMC CONNECTOR SERIES

ROWE INDUSTRIES
6225 Benore Road, Toledo, Ohio 43612,
(419) 729-9761.
West Coast Office:
(213) 235-2070 and (415) 969-4831



...HIGH-VOLTAGE CONNECTORS

APPLICATIONS: Designed for use wherever high reliability, low cost, multi-contact connectors are required:
• ECM Gear • Power Supplies • Laser • Radar • X-Ray • Displays • Many Others

OPERATION: Rowe RMC Series, through the use of our exclusive tapered silicone rubber mating interfaces, offers corona-free, weathertight operation at high altitude and in a temperature range of −55°C to 200°C.

SPECIFICATIONS: Shell body and related hardware is aluminum per Federal Specification QQ-A-591. Inserts are silicone rubber per ZZ-R-765 and in all styles except where noted, socket contacts are used in male insert and pin contact in female insert. (See photo above). Pin contacts are brass half hard and sockets are beryllium copper.

HOW TO ORDER:

ROWE RMC Connector Series are normally supplied unassembled with simple instructions which cover soldering or crimping contacts, assembly, potting, etc. If the customer wishes, Rowe will supply connectors terminated and tested to your specifications: please specify cable type and length, connector type and testing parameters.

CATALOG PART NUMBER EXPLANATION:

3 RMC 2406P 1/10/-/-

SHELL STYLE
(See section on shell styles)
1 = Cable mounting connector (Female threaded coupling)
2 = Panel mounting connector (male threaded coupling
3 = Cable mounting connector (male threaded coupling)
4 = Panel mounting connector with potting boot (male threaded coupling)

INSERT STYLE
(See section on insert styles.) Insert Style determines shell size, number of contacts, contact type (pin or socket) and gage pin.

OPTIONS (Omit for standard)
SHELL PLATING: Cadmium per QQ-P-416, Type I, is standard
1 = Olive drab chromate per QQ-P-416, Type II, Class C
2 = Black cadmium plate per QQ-P-416, Type II, Class C
3 = Iridite, Per MIL-C-5541
CONTACT PLATING: Gold plated per MIL-G-45204 is standard
10 = Silver plated per QQ-S-365
11 = Tin plated per MIL-T-10727
STRAIN RELIEF:
20 = Cable Clamp
20A = Cable Clamp W/Rubber Bushing
SPECIAL
CS = See customer drawing or specifications for special termination, etc.

INSERT STYLES

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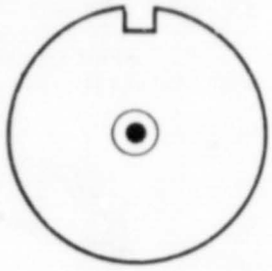
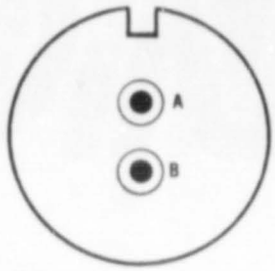


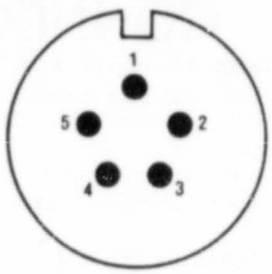
SINGLE CONTACT

1001P insert style	16 KVDC	#20 P	#10 shell size
1001S insert style	16 KVDC	#20 S	#10 shell size
1802P insert style	30 KVDC	#20 P	#18 shell size
1802S insert styl.	30 KVDC	#20 S	#18 shell size
1803P insert style	30 KVDC	#14 P	#18 shell size
1803S insert style	30 KVDC	#14 S	#18 shell size
2204P insert style	50 KVDC	#16 P	#22 shell size
2204S insert style	50 KVDC	#16 S	#22 shell size
2405P insert style	30 KVDC	#12 P	#24 shell size
2405S insert style	30 KVDC	#12 S	#24 shell size



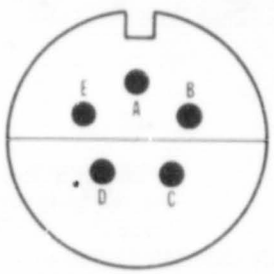
TWO CONTACT

2406P insert style	25 KVDC (pin to pin and pin to shell)	#12 P	#24 shell size
2406S insert style	25KVDC (socket to socket and socket to shell)	#12 S	#24 shell size



FIVE CONTACT

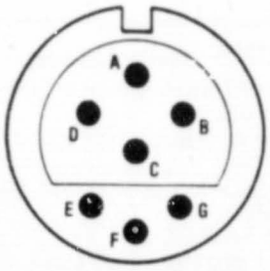
1211P insert style	15 KVDC (pin to pin and pin to shell)	#20 P	#12 shell size
1211S insert style	15 KVDC (socket to socket and socket to shell)	#20 S	#12 shell size



FIVE CONTACT

2812P insert style	25 KVDC (pin C to pin D, pin C, D to A, B, E and to shell) 5 KVDC (pin A, B, E to pin A, B, E and to shell)	#12 P	#28 shell size

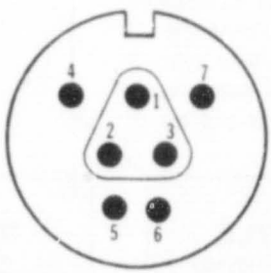
2812S insert style — above ratings apply



SEVEN CONTACT

4016P insert style	15 KVDC (pin A, B, C, D to pin A, B, C, D, to pin E, F, G and to shell) 600 VDC (pin E, F, G to pin E, F, G and to shell)	#6 P (A,B,C,D) #14 P (E,F,G)	#40 shell size

4016S insert style — above ratings apply



SEVEN CONTACT

(Contacts 1, 2, 3 are sockets and 4, 5, 6, 7 are pins in plug ("S") type insert; contacts 1, 2, 3 are pins and 4, 5, 6, 7 are sockets in receptacle ("P") type insert)

2417P insert style	600 VDC (pin 1, 2, 3 to pin 1, 2, 3) 15 KVDC (pin 1, 2, 3 to pin 4, 5, 6, 7 and to shell) 750 VDC (pin 4, 5, 6, 7 to pin 4, 5, 6, 7 and to shell)	#14 P	#24 shell size MOD

2417S insert style — above ratings apply

NOTE: INSERTS SHOWN ARE NOT ACTUAL SIZE. SEE SHELL STYLE FOR SIZE. INSERT CONTACT LAYOUTS SHOWN ARE OF PIN CONTACT CONFIGURATION.

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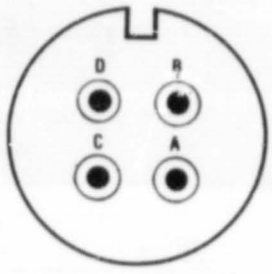
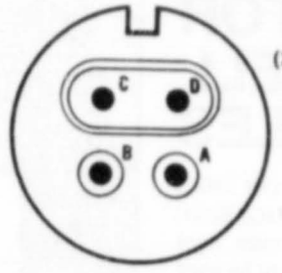


FOUR CONTACT

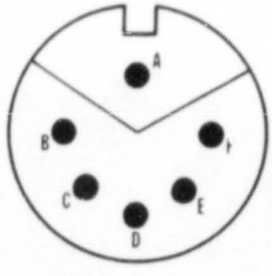
1809P insert style	15 KVDC (pin to pin and pin to shell)	#16 P	#18 shell size MOD
1809S insert style	15 KVDC (socket to socket and socket to shell)	#16 S	#18 shell size MOD



FOUR CONTACT

2810P insert style	20 KVDC (pin A and B to pin C and D and Shell) 500 VDC (pin A to pin B) 500 VDC (pin C to pin D; pin C, D to shell)	#8 P (A, B) #16 P (C, D)	#28 shell size

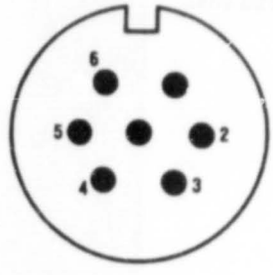
2810S insert style — above ratings apply



SIX CONTACT

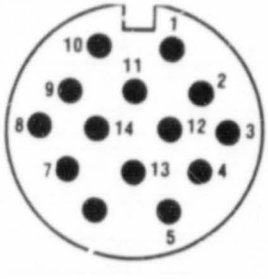
2814P insert style	25 KVDC (pin A to other pins and to shell) 5 KVDC (pin B, C, E, F to other pins and to shell) 115 VDC (pin D to shell)	#12 P	#28 shell size

2814S insert style — above ratings apply



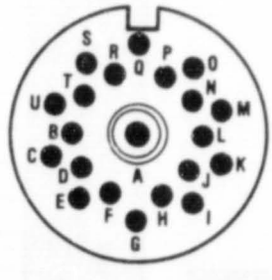
SEVEN CONTACT

1615P insert style	15 KVDC (pin to pin and pin to shell)	#20 P	#16 shell size
1615S insert style	15 KVDC (socket to socket and socket to shell)	#20 S	#16 shell size



FOURTEEN CONTACT

3219P insert style	15 KVDC (pin to pin and pin to shell)	#20 P	#32 shell size
3219S insert style	15 KVDC (socket to socket and socket to shell)	#20 S	#32 shell size



TWENTY-ONE CONTACT

4020P insert style	25 KVDC (pin A to other pins and to shell) 10 KVDC (all other pins to pins) 5 KVDC (all other pins to shell)	AWG P #16 AWG P (all others) #16 AWG P	#40 shell size

4020S insert style — above ratings apply

RMC CONNECTOR SERIES

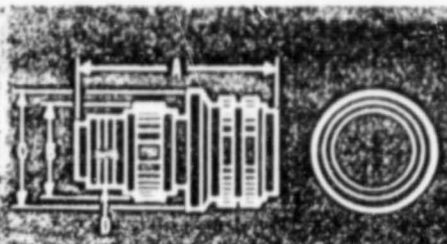
CONNECTOR SHELL STYLES

The ROWE RMC Connector Series hardware, such as mechanical strain relief, split shell bodies, right angle adapters, etc., may be used with shell bodies noted here.

Right angle adapter available:

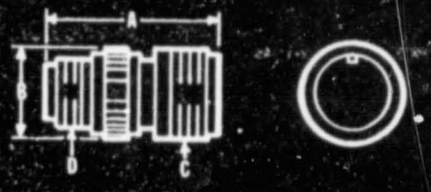
Shell style 5 is equivalent to MS 3108B-split shell

Shell style 6 is equivalent to MS 3108A-solid shell



SHELL STYLE 1 — CABLE MOUNTING CONNECTOR (FEMALE THREADED COUPLING)

Shell Size	A	B	C	D Fitting Threads
8	1¼	17/32	¾	½-28
10	1⅜	⅝	⅞	½-28
12	1⅜	23/32	1	⅝-24
14	1⅜	⅞	1⅛	¾-20
16	1 57/64	1	1¼	⅞-20
18	2	1⅛	1 11/32	1 -20
20	2⅛	1¼	1 13/32	1⅛-18
22	2⅛	1⅜	1 15/32	1⅛-18
24	2¼	1½	1 23/32	1⅛-18
28	2¼	1¾	1 31/32	1⅜-18
32	2⅜	2 1/32	2 3/32	1¾-18
36	2⅜	2¼	2 15/32	2 -18
40	2⅜	2½	2 23/32	2¼-16



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SHELL STYLE 3 — CABLE MOUNTING CONNECTOR (MALE THREADED COUPLING)

Shell Size	C Coupling Threads	A	B	D Fitting Threads
8	½-28	1¼	17/32	½-28
10	⅝-24	1⅜	⅝	½-28
12	¾-20	1 27/32	23/32	⅝-24
14	⅞-20	1 27/32	⅞	¾-20
16	1 -20	1 57/64	1	⅞-20
18	1⅛-18	2	1⅛	1 -20
20	1⅛-18	2⅛	1¼	1⅛-18
22	1⅜-18	2⅛	1⅜	1⅛-18
24	1½-18	2¼	1½	1⅛-18
28	1¾-18	2¼	1¾	1⅜-18
32	2 -18	2⅜	2 1/32	1¾-18
36	2¼-16	2⅜	2¼	2 -18
40	2½-16	2⅜	2½	2¼-16

ROWE INDUSTRIES
6225 Benore Road, Toledo, Ohio 43612,
(419) 729-9761.
West Coast Office:
(213) 235-2070 and (415) 969-4831

SPECTRA·STRIP™

An Elco Company



SPECTRA·STRIP

7100 LAMPSON AVENUE · GARDEN GROVE, CALIFORNIA 92642
TELEPHONE (714) 892-3361

FLAT CABLE & CONNECTORS

IDC SOCKET CONNECTORS
802 SERIES

SPECTRA·STRIP

7100 LAMPSON AVENUE • GARDEN GROVE, CALIFORNIA 92642
TELEPHONE (714) 892-3361



FEATURES:

- Mass terminates up to 64 lines at a time with no prestripping
- Design allows visual inspection of cable termination
- Dual-Cantilever contacts assure positive electrical connection to square and round male posts
- Available with or without external polarization feature
- Optional strain relief cover available

CHARACTERISTICS

PHYSICAL:

Contact spacing:	.100" grid. Mates with .050" planar cable
Contact material:	Phosphor Bronze
Contact plating:	*Gold 30 micro-inches over 50 micro-inches nickel
Insulator material:	Thermoplastic, glass-reinforced, black UL 94 V-O
Number of contacts:	10 thru 64
Wire accommodation:	AWG 26 stranded, AWG 28 stranded and solid, AWG 30 solid on .050" centers

*Available with other platings and thicknesses—consult factory.

ELECTRICAL:

Current rating:	1 Amp
Dielectric withstanding voltage:	>500 VAC RMS
Insulation resistance:	>1 x 10^9 ohms
Operating temperature range:	−55°C to +105°C.

APPLICATION TOOLING:
Bench Press P/N 200-100
Applicator Base Plate P/N: 200-101

Polarizing Pin P/N: 800-0211-002 fits in contact

DESCRIPTION

Spectra-Strip 802 Series socket connectors terminate planar cables to P/C boards and backpanel posts, and mate with Spectra-Strip Series 800, 801 and 803 headers.

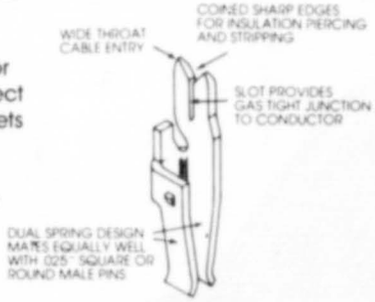
Socket connectors are available from 10 thru 64 positions. The individual socket contacts feature a dual cantilever beam design that assures a positive electrical connection to the male posts.

Spectra-Strip IDC's are used to terminate round-conductor planar cables whenever a low cost quick disconnect/reconnect capability is desired. Typical applications include input/output interconnections within computers, peripheral equipment, instrumentation and communication equipment.

802 Series connectors are available with or without an external center polarizing key molded into the insulator. The polarizing key assures positive connector orientation at every disconnect/reconnect cycle and eliminates mismating of sockets and headers.

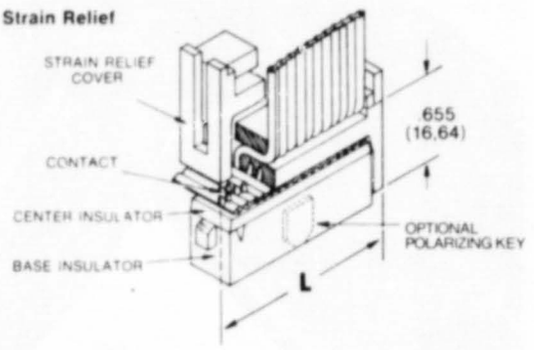
Spectra-Strip central polarized socket connectors are interchangeable and intermateable with competitive IDC headers.

Connectors are available with optional full strain relief covers.

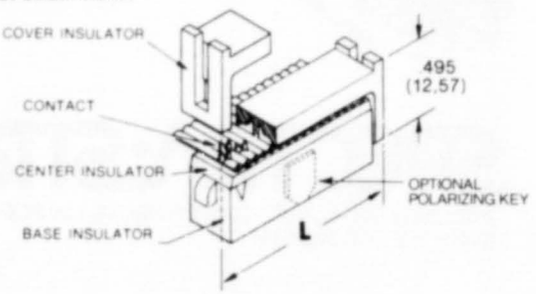


CONTACT

With Strain Relief



Without Strain Relief



STANDARD IDC SIZES

No. of Contacts	Non-Polarized With Strain Relief	Non-Polarized Without Strain Relief	Polarized With Strain Relief	Polarized Without Strain Relief	Overall Length L Inches (mm)
10	802-110-002	802-010-002	802-110-009	802-010-009	.690(17,53)
14	802-114-002	802-014-002	802-114-009	802-014-009	.890(22,61)
16	802-116-002	802-016-002	802-116-009	802-016-009	.990(25,15)
20	802-120-002	802-020-002	802-120-009	802-020-009	1.190(30,23)
26	802-126-002	802-026-002	802-126-009	802-026-009	1.490(37,85)
34	802-134-002	802-034-002	802-134-009	802-034-009	1.890(48,01)
40	802-140-002	802-040-002	802-140-009	802-040-009	2.190(55,63)
50	802-150-002	802-050-002	802-150-009	802-050-003	2.690(68,33)
60	802-160-002	802-060-002	802-160-009	802-060-009	3.190(81,03)
64	802-164-002	802-064-002	802-164-009	802-064-009	3.390(86,11)

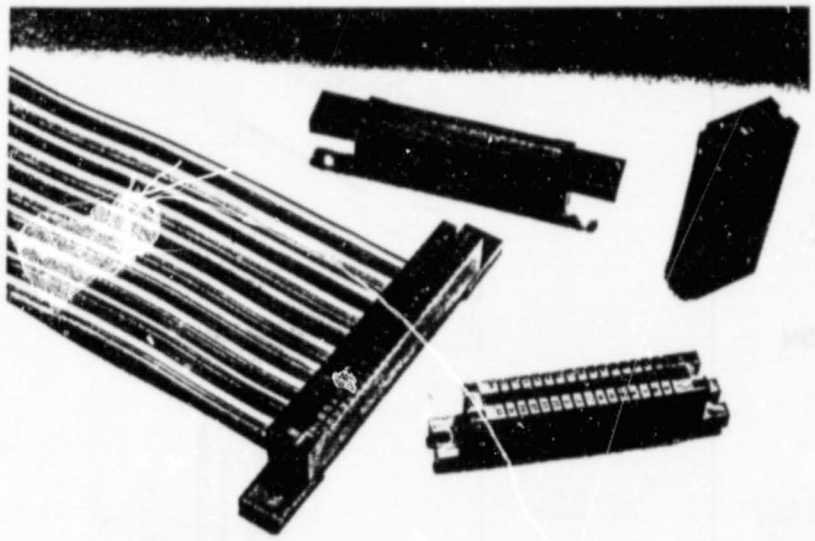
ORIGINAL PAGE IS OF POOR QUALITY

Dimensions and characteristics subject to change without notice.

IDC CARD-EDGE CONNECTORS
807 SERIES

SPECTRA-STRIP

7100 LAMPSON AVENUE · GARDEN GROVE, CALIFORNIA 92642
TELEPHONE (714) 892-3361



FEATURES:

- Mass terminates up to 60 lines at one time
- Available pre-assembled (one-piece) or with body and cover separate (specify at time of order)
- Provides flat cable I/O access to P/C boards on .100" (2,54 mm) centers
- Fully bifurcated, gold plated P/C contact provides 2 points of contact with each pad on the P/C board
- Choice of three mounting configurations and an optional polarizing key

DESCRIPTION

Spectra-Strip IDC card-edge connectors are available in sizes 10, 20, 26, 34, 40, 50 and 60 positions. Connector housings are loaded with 2 rows of contacts on .100" (2,54 mm) centers.

P/C contacts are fully bifurcated for reliability. Independent cantilever spring contact design provides excellent contact pressure to board without requiring high insertion forces. Closed-entry insulator design protects contacts from damage.

Unique design allows removal of connector from cable. Use cover removal tool.

Card-edge connectors are available in three configurations: with a slot; with a thru-hole; and with no ears. Pre-assembled construction of all configurations permits positive cable alignment and speeds assembly time.

Polarizing key: fits in slots between contacts, glass filled nylon.

Connectors meet applicable portions of MIL-C-21097.

CHARACTERISTICS

PHYSICAL:

Contact spacing:	.100" centers Terminates .050" planar cable
Contact material:	Beryllium Copper
Contact plating:	*Gold 30 micro-inches over 50 micro-inches nickel
Insulator material:	Thermoplastic, glass-reinforced, black UL 94 V-O
Number of contacts:	10, 20, 26, 34, 40, 50 and 60
Wire accommodation:	AWG 26 stranded, AWG 28 stranded and solid, AWG 30 solid on .050" centers
PCB accommodation:	.062" nominal thickness

- Available with other platings and thicknessess—consult factory

ELECTRICAL:

Current rating:	1 Amp
Dielectric withstanding voltage:	>500 VAC RMS
Insulation resistance:	>1 x 10^9 ohms.
Operating temperature range:	−55°C to +105°C

APPLICATION TOOLING:

Bench Press: P/N 200-100
Applicator Base Plate: P/N 322-0702-004
Cover Removal Tool: P/N 322-0702-009
Polarizing Key P/N 800-0711-001

ORDERING INFORMATION

No. of Contacts	Part Number	A	B	C	D	E	F	G
10	807-1005-001	4	.400(10,16)	.605(15,37)	.960(24,38)	—	—	.595(15,11)
	807-1005-002	4	.400(10,16)	.605(15,37)	.960(24,38)	1.300(33,02)	1.500(38,10)	.595(15,11)
	807-1005-003	4	.400(10,16)	.605(15,37)	.960(24,38)	1.400(35,56)	1.900(48,26)	.595(15,11)
20	807-2005-001	9	.900(22,86)	1.105(28,07)	1.460(37,08)	—	—	1.095(27,81)
	807-2005-002	9	.900(22,86)	1.105(28,07)	1.460(37,08)	1.800(45,72)	2.000(50,08)	1.095(27,81)
	807-2005-003	9	.900(22,86)	1.105(28,07)	1.460(37,08)	1.900(48,26)	2.400(60,96)	1.095(27,81)
26	807-2605-001	12	1.200(30,48)	1.405(35,69)	1.760(44,70)	—	—	1.395(35,43)
	807-2605-002	12	1.200(30,48)	1.405(35,69)	1.760(44,70)	2.100(53,34)	2.300(58,42)	1.395(35,43)
	807-2605-003	12	1.200(30,48)	1.405(35,69)	1.760(44,70)	2.200(55,88)	2.700(68,58)	1.395(35,43)
34	807-3405-001	16	1.600(40,64)	1.805(45,85)	2.160(54,36)	—	—	1.795(45,59)
	807-3405-002	16	1.600(40,64)	1.805(45,85)	2.160(54,86)	2.500(63,50)	2.700(68,58)	1.795(45,59)
	807-3405-003	16	1.600(40,64)	1.805(45,85)	2.160(54,86)	2.600(66,04)	3.100(78,74)	1.795(45,59)
40	807-4005-001	19	1.900(48,26)	2.105(53,47)	2.460(62,48)	—	—	2.095(53,21)
	807-4005-002	19	1.900(48,26)	2.105(53,47)	2.460(62,48)	2.800(71,12)	3.000(76,20)	2.095(53,21)
	807-4005-003	19	1.900(48,26)	2.105(53,47)	2.460(62,48)	2.900(73,66)	3.400(86,36)	2.095(53,21)
50	807-5005-001	24	2.400(60,96)	2.605(66,17)	2.960(75,18)	—	—	2.595(65,91)
	807-5005-002	24	2.400(60,96)	2.605(66,17)	2.960(75,18)	3.300(83,82)	3.500(88,90)	2.595(65,91)
	807-5005-003	24	2.400(60,96)	2.605(66,17)	2.960(75,18)	3.400(86,36)	3.900(99,06)	2.595(65,91)
60	807-6005-001	29	2.900(73,66)	3.105(78,87)	3.460(87,88)	—	—	3.095(78,61)
	807-6005-002	29	2.900(73,66)	3.105(78,87)	3.460(87,88)	3.800(96,52)	4.000(101,60)	3.095(78,61)
	807-6005-003	29	2.900(73,66)	3.105(78,87)	3.460(87,88)	3.900(99,06)	4.400(111,76)	3.095(78,61)

C-4

SPECTRA-STRIP
7100 LAMPSON AVENUE · GARDEN GROVE, CALIFORNIA 92642
TELEPHONE (714) 892-3361

IDC CARD-EDGE CONNECTORS
807 SERIES (CONTINUED)

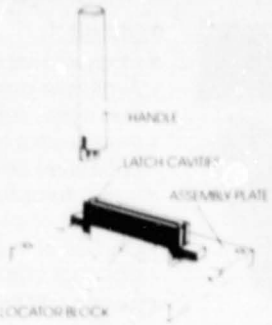
POLARIZING KEY



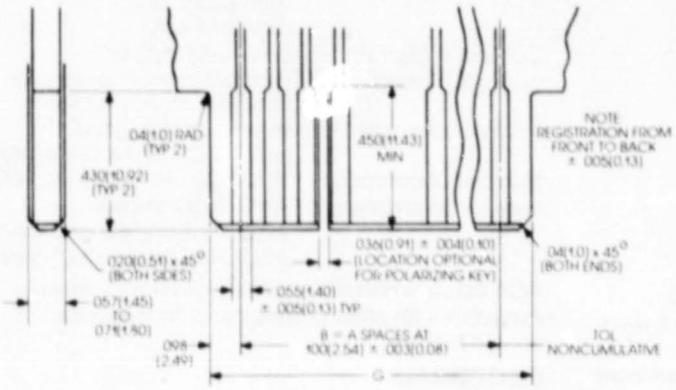
CONTACT



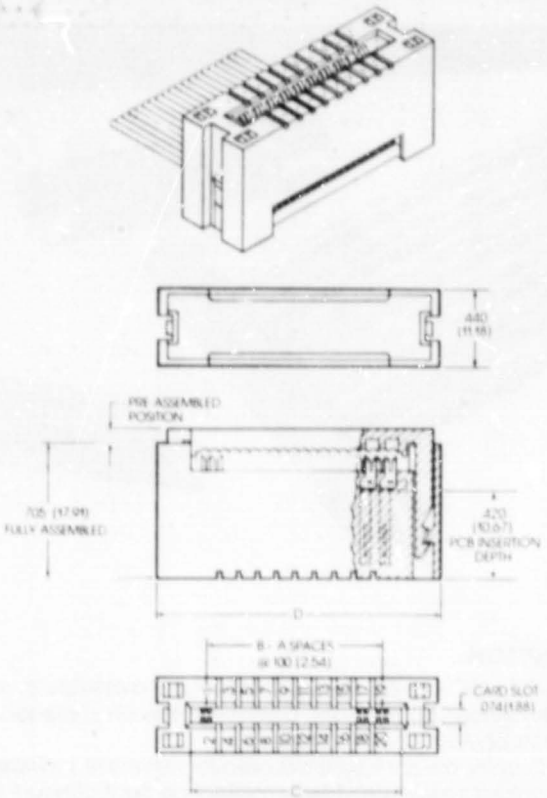
COVER REMOVAL TOOL



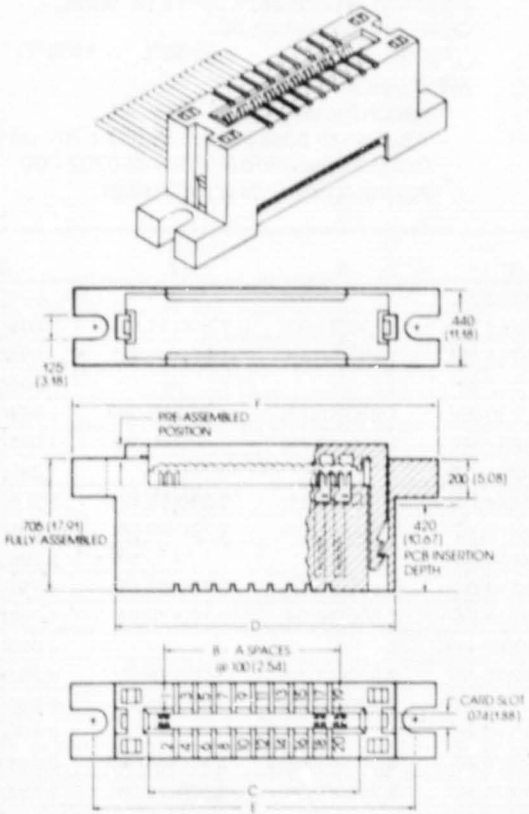
RECOMMENDED P.C. BOARD CONFIGURATION



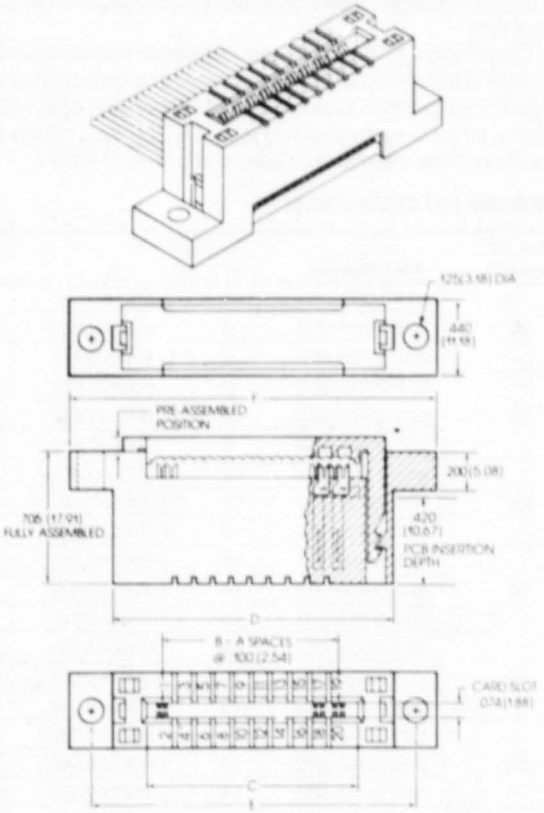
NO EARS (–001)



SLOT (–002)



THRU HOLE (–003)



Dimensions in: inches (millimeters) Dimensions and characteristics subject to change without notice.

T&B/ Thomas & Betts

T&B Heavy Duty Automotive Products

Thomas & Betts Corporation
920 Route 202, Raritan, NJ 08869
(201) 685-1600

(T&B Logo)

Connectors, Electrical and Battery

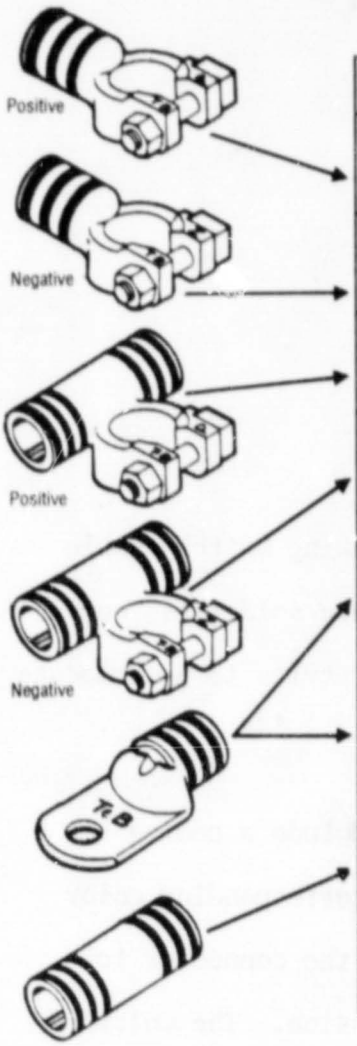
T&B battery cable connectors provide quick, easy means of making battery cable assemblies in the factory, the shop, or on the road. They are solderless compression type connectors in straight, flag, lug, and splice styles to accommodate cable sizes from #1 AWG to 4/0 AWG.

Part of T&B's COLOR-KEYED® connector line, the connectors include a coding system which matches color bands on the connector with the corresponding color on the correct installing die. The bands are positioned on the connector to indicate where the tool should be placed to make the compression. The color of the bands also indicates the cable size accommodated.

These compact connectors provide high pullout strength and are easily installed with a convenient, highly maneuverable hand tool which develops up to 4-1/2 tons of compression force. The tool is available with the SHURE STAKE® mechanism which does not release the connector until the proper amount of force has been applied.

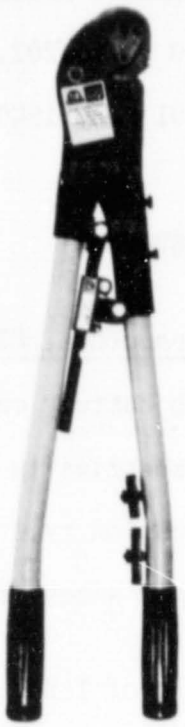
Cat. Series: BAC Straight and Flag Connectors
BAL Lugs
BAS Splices

COLOR-KEYED® Connectors and Lugs for Battery Cables



Cat. No.	Battery Cable Size	Stud Size	Connector Color Key	Installing Tool Die Color	Unit Quan.	Std. Pkg.
BAC10SP	1/0	—	Black	Black	10	50
BAC20SP	2/0	—	Orange	Orange	10	50
BAC30SP	3/0	—	Purple	Purple	10	50
BAC10SN	1/0	—	Black	Black	10	50
BAC20SN	2/0	—	Orange	Orange	10	50
BAC30SN	3/0	—	Purple	Purple	10	50
BAC10FP	1/0	—	Black	Black	10	50
BAC20FP	2/0	—	Orange	Orange	10	50
BAC30FP	3/0	—	Purple	Purple	10	50
BAC10FN	1/0	—	Black	Black	10	50
BAC20FN	2/0	—	Orange	Orange	10	50
BAC30FN	3/0	—	Purple	Purple	10	50
BAL112	1	1/2	Pink	Pink	10	50
BAL1012	1/0	1/2	Black	Black	10	50
BAL2012	2/0	1/2	Orange	Orange	10	50
BAL3012	3/0	1/2	Purple	Purple	10	50
BAL4012	4/0	1/2	Yellow	Yellow	10	50
BAL138	1	3/8	Pink	Pink	10	50
BAL1038	1/0	3/8	Black	Black	10	50
BAL2038	2/0	3/8	Orange	Orange	10	50
BAL3038	3/0	3/8	Purple	Purple	10	50
BAL4038	4/0	3/8	Yellow	Yellow	10	50
BAS1	1	—	Pink	Pink	10	50
BAS2	2	—	Green	Green	10	50
BAS10	1/0	—	Black	Black	10	50
BAS20	2/0	—	Orange	Orange	10	50
BAS30	3/0	—	Purple	Purple	10	50
BAS40	4/0	—	Yellow	Yellow	10	50

INSTALLING TOOLS: TBM5V and TBM5SV



UL File No. E 9809

COLOR-KEYED® Connectors for Copper Cables

C-TAPS



INSTALLING TOOLS—
TBM5 or TBM8
Install all sizes.

Cat. No.	Ins.* Cover Code	Color Key	Cable Combinations		Std. Pkg.
			Main	Branch	
54735	2	Black	1 2 3	5-6-8-10-12 4-5 3-4	100
54740	2	Orange	1/0 1 2	4-5-6-8-10-12 3-4 2-3	50
54745	2	Purple	2/0 1/0 1	3-4-5-6-8-10-12 2-3 1-2	25
54750	2	Yellow	3/0 2/0 1/0	2-3-4-5-6-8-10-12 1-2 1/0-1	25

*Ins. Cover Code refers to proper size insulating cover shown on page 9.

T&B/Thomas & Betts, Division of Thomas & Betts Corporation
920 Route 202 Raritan, New Jersey 08869 (201) 685-1600

COLOR-KEYED® Connectors for Copper Cables

T&B

T&B/Thomas & Betts, Division of Thomas & Betts Corporation
920 Route 202 Raritan, New Jersey 08869 (201) 685-1600

C-TAPS LARGE SIZE



Cat. No.	Ins. Cover Code*	Wire Size Main	Wire Size Branch	Inst. Tool No.	Die Cat. No.	Die Code No.	Color Code	Std. Pkg.
54755	4	1	1	TBM8	13467	—	Blue	25
		1/0	1/0-2	13642	11744	76H		
		2/0	2/0-4					
		3/0	1/0-6	TBM15	15512	76		
		4/0	1-8					
54760	4	1/0	1/0	TBM6 TBM8	13468	—	Brown	25
		2/0	2/0-1	13642	11746	87H		
		3/0	3/0-3					
		4/0	4/0-4	TBM15	15506	87H		
		250	1/0-8					

*Ins. Cover Code refers to proper size insulating covers shown on page 9.

ONE-HOLE LUGS



INSTALLING TOOLS—
TBM2 installs #8 to #2.
TBM5 installs #8 to 250 MCM.
TBM8 installs #8 to 500 MCM.
TBM15 installs #8 to 1000 MCM.
13642 installs #8 to 750 MCM.
Some cat. no's. available in blank tongue. Consult factory.

Cat. No.	Ins. Cover Code	Cable Size	Color Key	Installing Head Die Code No. 12 Ton	Installing Head Die Code No. 15 Ton	Bolt Size	Unit Quan.	Std. Pkg.
54130	2	#8 Str. or #8 Weld	Red	21	21	¼	50	500
*54105	2	#6 Str. or #6 Weld	Blue	24	24	¼	50	500
*54106	2	#4 Str. or #4 Weld	Grey	29	29	¼	50	500
*54107	2	#2 Str.	Brown	33	33	¼	25	250
*54108	2	#1 Str. or #2 Weld	Green	37	37	¼	20	200
X 54150	2		Green	37	37	½	20	200
*54109	2	1/0 AWG or #1 Weld	Pink	42	42H	⅜	10	100
X 54155	2		Pink	42	42H	½	10	100
*54110	2	2/0 AWG or 1/0 Weld	Black	45	45	⅜	10	100
X 54160	2		Black	45	45	½	10	100
*54111	2	3/0 AWG or 2/0 Weld	Orange	50	50	⅜	10	100
X 54165	2		Orange	50	50	½	10	100
*54112	2	4/0 AWG or 3/0 Weld	Purple	54	54H	⅜	10	100
†X 54170	2		Purple	54	54H	½	10	100
† 54174	4	250 MCM	Yellow	62	62	⅜	10	100

X Available with undrilled tongues. Consult local warehouse for price, delivery and minimum ordering quantities.
1. COLOR-KEYED® connectors are available with special tongue angles, consult your local warehouse for price, delivery, and minimum ordering quantity.
2. Large quantity price on application.
Ins. Cover Code refers to proper size insulating covers shown on page 9.
*NEMA drilling.
†Not CSA certified.

FOR COPPER CABLES ONLY

2-way connectors for 600V applications



INSTALLING TOOL—
TBM5V or TBM5SV install #8 to 250 MCM

Cat. No.	Ins. Cover Code	Cable Size	Color Key	Installing Head Die Code No. 12 Ton	Installing Head Die Code No. 15 Ton	Unit Quan.	Std. Pkg.
54504	2	#8 Str. or #8 Weld	Red	21	21	50	500
54505	2	#6 Str. or #6 Weld	Blue	24	24	50	500
54506	2	#4 Str. or #4 Weld	Grey	29	29	50	500
54507	2	#2 Str.	Brown	33	33	25	250
54508	2	#1 Str. or #2 Weld	Green	37	37	20	200
54509	4	1/0 AWG or #1 Weld	Pink	42	42H	10	100
54510	4	2/0 AWG or 1/0 Weld	Black	45	45	10	100
54511	4	3/0 AWG or 2/0 Weld	Orange	50	50	10	100
54512	4	4/0 AWG or 3/0 Weld	Purple	54	54H	10	100
54513	4	250 MCM	Yellow	62	62	10	100

When installed with recommended tooling, two-way connectors provide high pull-out values, are easy to insulate, and have less resistance than an equal length of the same size wire. Compactness, permanent compressions and lowest installed cost make these connectors superior to other splicing methods.

T&B/Thomas & Betts, Division of Thomas & Betts Corporation
920 Route 202 Raritan, New Jersey 08869 (201) 685-1600

Available at authorized T&B Heavy Duty Automotive Products distributors.

Other T&B COLOR-KEYED® compression connectors will terminate, tap, or splice copper cables from 12 AWG to 250 MCM.

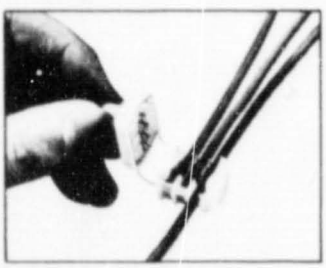
When installed with recommended tooling, these compact connectors provide high pull-out values, are easy to install and insulate, and have less resistance than an equal length of the same size wire.

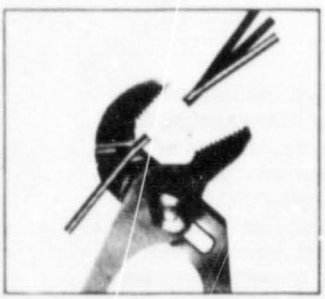
Cat. Series:	54735	C-Taps
	54755	C-Taps
	54105	One-hole lugs (NEMA drilling)
	54130	One-hole lugs
	54504	Splices

Availabe at authorized T&B Heavy Duty Automotive Products distributors.

UL File No. E 9809

CLAM® Connector





CLAM® Connector Eliminates Stripping

- Insulation displacing
- Has internal wire grip
- Permits visual inspection
- Rugged nylon rated at 600V; 1000V for signs and fixtures
- One connector has range of two old-style connectors
- Temperature range 105°C

Cat. No.	Wire Range	Unit Quan.	Std. Pkg.
LT1410	Three Conductors; Any Wire Combination of 14 and 12 CU Solid and Stranded and/or 12-10 AL Solid	100	500
LT1810	Two Outer Conductors; Any Wire Combination of 12 and 14 Cu Solid and Stranded and/or 12-10 AL Solid Center Conductor; 1 or 2-#18 or 1-#16AWG Solid CU; or 1-#18 or 1-#16AWG Stranded CU	100	500

USE IN ALL VEHICLES FOR POWER TAPPING, SPLICING, AND MODIFICATIONS

The insulation displacing contacts make the connection without need to strip insulation from wires. They grip each wire conductor at four points as the connector is closed. All contacts become fully enclosed. All wires are securely and safely locked within the nylon plastic connector.

It may be used on aluminum as well as copper conductors.

Performs well under vibration conditions.

U.S. Patent Nos. 3,892,460, 3,890,029

Solderless Connectors

UNCONDITIONALLY WARRANTED

for quick, positive terminations or connections of wire . . . solid or stranded

Vaco Terminals and Connectors are produced from the finest materials to give you unequalled accuracy at the lowest possible cost. Ample use of materials means that the current carrying capacity of the devices exceeds that of the wire size they are designed to accept. Uniform, positive connections are made every time with no special skill required.

Your choice of insulated or non-insulated styles.

Pure electrolytic copper is carefully annealed to assure perfect crimp and permanent grip.



Inside barrel serrations bite into wire for superior grip.

Pure tin plating provides excellent corrosion resistance and electrical conductivity.

PACKAGED 3 CONVENIENT WAYS

The Vaco "V" Pak is a self closing bubble pak card for the small quantity user. Available in 26 popular sizes and two assortment paks. Standard package 5.





The Vaco "D" Pak holds larger quantity in plastic box for on-the-job use. Standard package 5 per shelf carton.



The Vaco "C" Pak features 100 terminals in individual see-through plastic bags. 5 bags (500 pieces) to master carton.

10000 SERIES

Non-Insulated, Single Grip

Ring Tongue



Stock No.	Wire Size	Stud Size	Hole Dia.	Length	Width
11204	22-18	4	7/64	19/32	15/64
11205	22-18	5-6	9/64	19/64	15/64
11206	22-18	5-6	9/64	21/32	19/64
11208	22-18	8	11/64	43/64	21/64
11210	22-18	10	13/64	43/64	21/64
11214	22-18	12-1/4	17/64	59/64	15/32
11238	22-18	3/8	25/64	1-1/16	17/32
11304	16-14	4	7/64	9/16	1/4
11305	16-14	5-6	9/64	9/16	1/4
11306	16-14	5-6	9/64	43/64	21/64
11308	16-14	8	11/64	23/32	21/64
11310	16-14	10	13/64	23/32	21/64
11314	16-14	12-1/4	17/64	59/64	15/32
11338	16-14	3/8	25/64	1-1/16	35/64
11406	12-10	5-6	9/64	23/32	25/64
11408	12-10	8	11/64	23/32	25/64
11410	12-10	10	13/64	23/32	25/64
11414	12-10	12-1/4	17/64	63/64	17/32
11438	12-10	3/8	25/64	1-3/32	39/64

Spade Tongue



13204	22-18	4	7/64	17/32	19/64
13206	22-18	5-6	9/64	5/8	19/64
13208	22-18	8	11/64	23/32	13/32
13210	22-18	10	13/64	23/32	13/32
13306	16-14	4-6	9/64	5/8	19/64
13308	16-14	8	11/64	23/32	13/32
13310	16-14	10	13/64	23/32	13/32
13406	12-10	4-6	9/64	11/16	23/64
13408	12-10	8	11/64	11/16	23/64
13410	12-10	10	13/64	23/32	13/32

Spade Tongue With Flange



14206	22-18	4-6	9/64	11/16	19/64

Hook Tongue



15408	12-10	8	11/64	43/64	23/64
15410	12-10	10	13/64	23/32	13/32
15206	22-18	4-6	9/64	43/64	23/64
15208	22-18	8	11/64	43/64	23/64
15210	22-18	10	13/64	43/64	23/64
15306	16-14	4-6	9/64	19/32	5/16
15308	16-14	8	11/64	21/32	23/64
15310	16-14	10	13/64	45/64	13/32

Flag Tongue



16210	22-18	8-10	13/64	41/64	3/8
16310	16-14	8-10	13/64	5/8	3/8
16410	12-10	8-10	13/64	3/4	3/8

Butt Connectors



Stock No.	Wire Size	Stud Size	Hole Dia.	Length	Width
17202	22-18	—	—	5/8	9/64
17302	16-14	—	—	5/8	5/32
17402	12-10	—	—	11/16	7/32

Parallel Connectors



17203	22-14	—	—	21/64	9/64
17405	18-10	—	—	21/64	7/32

Three-Way Connectors



17303	16-14	—	—	—	—
17403	12-10	—	—	—	—

Four-Way Connectors



17304	16-14	—	—	1-1/32	—
17404	12-10	—	—	1-5/64	—

QUICK CONNECTORS

Connector Adapters



Stock No.	Description	Length	Width
18001	Snap Conn. to Male Tab	7/8	1/4
18002	Snap Conn. to Female Tab	5/16	19/64
18006*	Screw Term. to Male Tab	19/32	1/4
18010†	Screw Term. to Male Tab	11/64	1/4
18007	Snap Term. to Female Tab	49/64	1/4

* Screw Size 4-6
† Screw Size 8-10

Male Tab



Stock No.	Wire Size	Length	Width
18201	22-18	9/16	3/16
18202	22-18	21/32	3/16
18301	18-14	3/4	1/4
18401	12-10	21/32	5/16

Female Tab



18203	22-18	3/4	9/32
18204	22-18	17/32	3/16
18302	18-14	3/4	1/4
18403	12-10	3/4	9/32
18206	22-20	5/8	1/8

Angle Male Tab



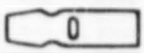
Stock No.	Wire Size	Length	Width
18303	18-14	19/32	1/4

Angle Female Tab



18304	18-14	1/2	1/4
18305	16-14	11/16	7/16
18307	16-14	1-1/8	1/4
18308	18-16	7/8	3/8
18310	14-12	13/16	5/16
18312	16-14	3/4	5/16
18402	12-10	13/16	1/4
18314	18-16	9/16	5/16

Snap Terminals



19301	16-14	5/8	5/32
19303	16-14	43/64	3/16

Snap Connectors



19302	—	3/4	3/16
19304	—	51/64	7/32

20000 SERIES

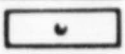
High Temperature, Non-Insulated

Ring Tongue



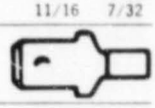
Stock No.	Wire Size	Stud Size	Hole Dia.	Length	Width
21205	22-18	5-6	9/64	19/32	15/64
21208	22-18	8	11/64	43/64	21/64
21210	22-18	10	13/64	43/64	21/64
21305	16-14	5-6	9/64	9/16	1/4
21308	16-14	8	11/64	23/32	21/64
21310	16-14	10	13/64	23/32	21/64
21410	12-10	10	13/64	23/32	25/64

Butt Connectors



27202	22-18	—	—	5/8	9/64
27302	16-14	—	—	5/8	5/32
27402	12-10	—	—	11/16	7/32

Quick Connects Male Tab



28301	18-14	—	—	3/4	1/4

Female Tab



28302	18-14	—	—	3/4	1/4

VACO PRODUCTS COMPANY • 1510 Skokie Blvd. • Northbrook, IL 60062 • Phone: (312) 564-3300

ORIGINAL PAGE IS
OF POOR QUALITY

Soiderless Connectors & Kits

60000 SERIES

Bellmouth Insulated

Ring Tongue



Stock No.	Wire Size	Stud Size	Hole Dia.	Length	Width
61204	22-18	4	7/64	51/64	15/64
61205	22-18	5-6	9/64	51/64	15/64
61206	22-18	5-6	9/64	55/64	19/64
61208	22-18	8	11/64	7/8	21/64
61210	22-18	10	13/64	7/8	21/64
61214	22-18	12-1/4	17/64	1-1/8	15/32
61238	22-18	3/8	25/64	1-17/64	17/32
61304	16-14	4	7/64	51/64	1/4
61305	16-14	5-6	9/64	51/64	1/4
61306	16-14	5-6	9/64	29/32	21/64
61308	16-14	8	11/64	61/64	21/64
61310	16-14	10	13/64	61/64	21/64
61314	16-14	12-1/4	17/64	1-5/32	15/32
61338	16-14	3/8	25/64	1-19/64	35/64
61406	12-10	4-6	9/64	1-1/32	25/64
61408	12-10	8	11/64	1-1/32	25/64
61410	12-10	10	13/64	1-1/32	25/64
61414	12-10	12-1/4	17/64	1-19/64	17/32
61438	12-10	3/8	25/64	1-13/32	39/64

Spade Tongue



63204	22-18	4	7/64	47/64	19/64
63206	22-18	5-6	9/64	53/64	19/64
63208	22-18	8	11/64	59/64	13/32
63210	22-18	10	13/64	59/64	13/32
63306	16-14	4-6	9/64	55/64	19/64
63308	16-14	8	11/64	61/64	13/32
63310	16-14	10	13/64	61/64	13/32
63406	12-10	4-6	9/64	1	23/64
63408	12-10	8	11/64	1	23/64
63410	12-10	10	13/64	1-1/32	13/32

Spade Tongue With Flange



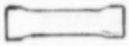
64206	22-18	4-6	9/64	57/64	19/64

Hook Tongue



65206	22-18	4-6	9/64	7/8	23/64
65208	22-18	8	11/64	7/8	23/64
65210	22-18	10	13/64	7/8	23/64
65306	16-14	4-6	9/64	53/64	5/16
65308	16-14	8	11/64	57/64	23/64
65310	16-14	10	13/64	15/16	13/32

Butt Connectors



67202	22-18	—	—	1-1/16	—
67302	16-14	—	—	1-1/16	—
67402	12-10	—	—	1-1/16	—

Pigtail Connectors



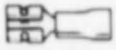
67203	22-14	—	—	3/4	21/64
67405	18-10	—	—	53/64	15/32

Quick Connects Male Tab



68202	22-18	—	—	29/32	5/16
68301	18-14	—	—	63/64	1/4
68401	12-10	—	—	29/32	5/16

Female Tab



68203	22-18	—	—	1-1/4	9/32
68302	18-14	—	—	63/64	1/4
68403	12-10	—	—	1-1/4	9/32

Fully Insulated Quick Connects



68303	18-14	—	—	31/32	1/2
68304	18-14	—	—	59/64	7/16

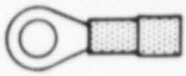
Snap Terminals



69301	16-14	—	—	5/8	5/32
69303	16-14	—	—	43/64	3/16

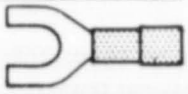
90000 SERIES

Double Grip Insulated Ring Tongue



91204	22-18	4	7/64	51/64	15/64
91205	22-18	5-6	9/64	51/64	15/64
91206	22-18	5-6	9/64	55/64	19/64
91208	22-18	8	11/64	7/8	21/64
91210	22-18	10	13/64	7/8	21/64
91214	22-18	12-1/4	17/64	1-1/8	15/32
91238	22-18	3/8	25/64	1-17/64	17/32
91304	16-14	4	7/64	51/64	1/4
91305	16-14	5-6	9/64	51/64	1/4
91306	16-14	5-6	9/64	29/32	21/64
91308	16-14	8	11/64	61/64	21/64
91310	16-14	10	13/64	61/64	21/64
91314	16-14	12-1/4	17/64	1-5/32	15/32
91338	16-14	3/8	25/64	1-19/64	35/64
91406	12-10	4-6	9/64	1-1/32	25/64
91408	12-10	8	11/64	1-1/32	25/64
91410	12-10	10	11/64	1-1/32	25/64
91414	12-10	12-1/4	17/64	17/32	—
91438	12-10	3/8	25/64	1-13/32	38/64

Spade Tongue



93204	22-18	4	7/64	47/64	19/64
93206	22-18	5-6	9/64	53/64	19/64
93208	22-18	8	11/64	59/64	13/32
93210	22-18	10	13/64	59/64	13/32
93306	16-14	4-6	9/64	55/64	19/64
93308	16-14	8	11/64	61/64	13/32
93310	16-14	10	13/64	61/64	13/32
93406	12-10	4-6	9/64	1	23/64
93408	12-10	8	11/64	1	23/64
93410	12-10	10	13/64	1-1/32	13/32
94206*	22-18	4-6	9/64	57/64	19/64

* With Flange

Hook Tongue



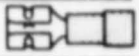
95210	22-18	10	13/64	7/8	23/64
95310	16-14	10	13/64	15/16	13/32

Quick Connects Male Tab



98301	18-14	—	—	63/64	1/4

Female Tab



98302	18-14	—	—	63/64	1/4

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CONTROLLERS, MOTOR

VARIABLE SPEED, AC & DC

(CODE **CR**)

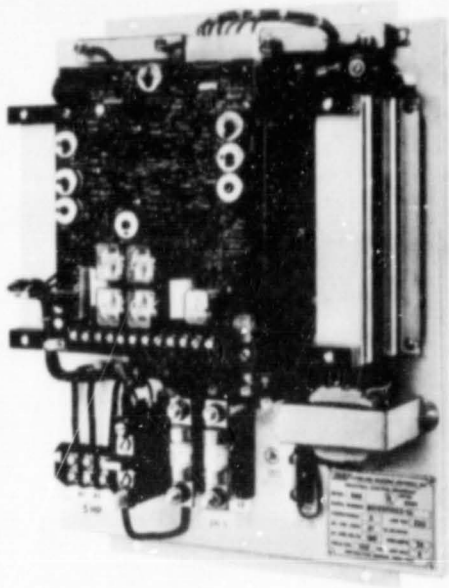
CMC
DC
DRIVE
DIVISION

series 660 controllers

engineering data sheet
and price list DS-660

CLEVELAND MACHINE CONTROLS, INC.
7550 HUB PARKWAY CLEVELAND, OHIO 44125 · (216) 524 8800

UL LISTED



This symbol on the nameplate means the product is Listed by Underwriters Laboratories Inc.
(UL Standard No. 508, Industrial Control Equipment)

Adjustable Speed DC Motor Controllers

SERIES 660 • 1/4-5 HP
115/230V • 50/60 HZ • SINGLE PHASE

Series 660 adjustable speed DC motor controllers have been developed as an extension of the popular, time proven Series 650 with the added feature of being LISTED BY UNDERWRITERS LABORATORIES INC. Standard No. 508 for Industrial Control Equipment.

Series 660 controllers are designed with conservatively rated industrial components. Preconditioned and tested logic semiconductors, high frequency and transient voltage protection, fused speed potentiometer circuit, adjustable current limit with zero overshoot, motor overload protection, and thyristor rated input fuses provide reliability of the system and protection for the driven equipment.

Controllers are available for either 115 or 230 VAC input operation, in a broad range of horsepower ratings. With their many standard features and the selection of factory installed options, they can be applied in a single or multiple motor system to fulfill most non-regenerative applications in industrial machinery and process equipment.

STANDARD FEATURES

- Full wave, constant torque.
- Open chassis design, deadback 14 ga. panel.
- Temperature compensated reference for minimum drift.
- Fast acting fuses for semiconductor protection.
- Motor overload protection.
- Armature contactor.
- Isolated 115 volt control circuit.
- Non-reversing coast to rest.
- SCR dv/dt protection.
- Regulator stability adjustments for speed and current.
- Adjustable acceleration – 2-20 seconds.
- Adjustable current limit 0-150%.
- Adjustable non-linear IR drop compensation.
- Adjustable maximum speed 75-100%.
- Adjustable minimum speed 0-25%.
- Speed reference –8.4 VDC.

AVAILABLE OPTIONS – FACTORY INSTALLED

- NEMA 12 Enclosure.
- Isolated Electronic Anti-Plug (AP).
- Dynamic Braking and AP (DB & AP).
- Reversing DB & AP.
- High Voltage Field Supply.
- Tachometer Feedback:
  Controlled Speed Range of 100:1
  Speed Regulation of ± 0.5%.

PERFORMANCE SPECIFICATIONS

- Controlled Speed Range 30:1.
- Speed Regulation ± 2% of base speed for a 95% load change.
- Motor speed linear to speed control setting.
- Overload capability 150% for one minute.

SERVICE CONDITIONS

- Altitude of 1000 meters (3300 feet).
- Temperature 0° to 40° C (32° to 104° F).
- AC line voltage variation +10% to – 5%.
- Line frequency variation 50 or 60 Hz, ± 2%.

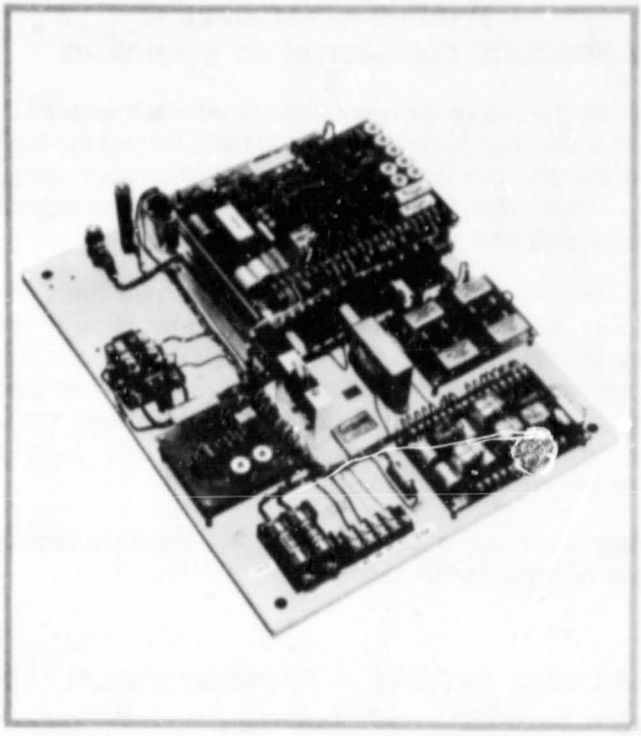
CMC DC DRIVE DIVISION

series 500 controllers

engineering data sheet DS-500

CLEVELAND MACHINE CONTROLS, INC.
7550 HUB PARKWAY CLEVELAND OHIO 44125 - (216) 524 8800

Regenerative DC Drive



SERIES 500 • 1/4 – 7.5 HP
SINGLE PHASE – 50/60 Hz.
FOUR QUADRANT OPERATION

The Series 500 is a controller designed with the same characteristics as an M.G. set, yet is considerably more compact and economical to purchase. The basic characteristics are controllable bi-directional torque, solid state reversing, regenerative braking, and rapid response to speed change signals. The term "regenerative" is derived from the fact that when the Series 500 is used to apply braking torque, the motor acts as a generator. Braking energy is regenerated back into AC power lines rather than being dissipated in braking resistors. During regeneration, maximum decelerating torque is applied throughout the braking operation. Speed reduction from full speed to dead stop is thus more rapidly accomplished. The elimination of mechanical contractors and heat generated by dynamic braking resistors results in a compact and economical design. The Series 500 has been developed for rapid cycling or overhauling load applications, where controlled response to a changing input signal is required.

STANDARD FEATURES

- Four quadrant, constant torque converter
- Open chassis – deadback 12 gauge panel
- Current limit acceleration and deceleration
- Armature voltage feedback
- Temperature compensated reference
- Plus and minus 8.4 volt supply allows contactorless reversing with center tapped pot
- Armature DC loop contactor
- Armature DC Fuse
- Fast acting line fuses for power semi-conductor protection
- Armature converter bank selector
- dv/dt. power semi-conductor protection
- Two mode stopping (coast and regenerative braking)
- Adjustable I. R. drop compensation
- Adjustable current limit 0-150%
- Adjustable maximum speed 80 to 120%
- Adjustable anti-hunt control
- Patented adjustable dead-band offset
- Isolated 115 volt control circuit

AVAILABLE OPTIONS – FACTORY INSTALLED

- Dynamic Braking
- Reversing by reference relay control
- Jog/Inch/Thread at independent speed
- Isolated instrument follower with auto/manual relay, 1-5, 4-20 or 10-50 ma input
- Tachometer or voltage follower
- Tachometer feedback ±0.5% to ±0.1%
- Linear acceleration/deceleration (2-20 sec. independently adjustable
- External torque control
- 24 volt AC relay control circuit
- Extra NO/NC contacts on D.C. loop contactor
- Thermal overload relay
- Field loss relay
- Voltage sensitive relay
- Three mode stopping
- Nema 12 enclosure

ORIGINAL PAGE IS
OF POOR QUALITY

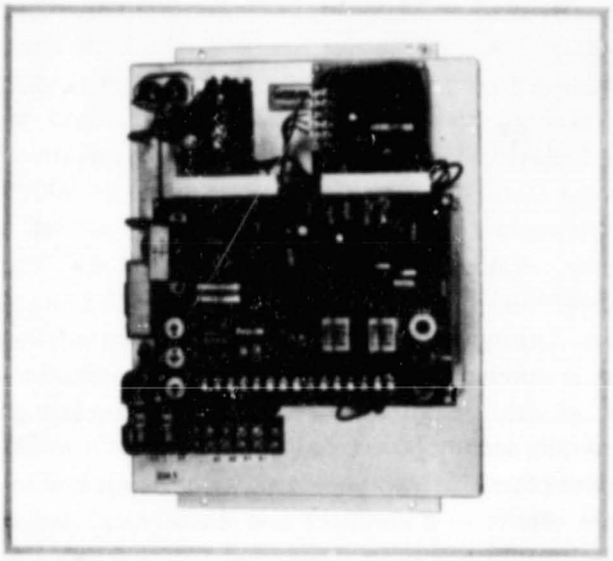
CMC
DC DRIVE DIVISION

series 650 controllers

engineering data sheet DS-650-A

CLEVELAND MACHINE CONTROLS, INC.
7550 HUB PARKWAY CLEVELAND OHIO 44125 · (216) 524-8800

Adjustable Speed DC Drives



SERIES 650 • 1/2-5 HP • SINGLE PHASE
WIDE RANGE OF STANDARD OPTIONS
RELIABLE & FLEXIBLE
ARMATURE CONTACTOR AS STANDARD

The Series 650 is a versatile and reliable adjustable speed DC drive. It is constructed of all discrete parts including plug in printed circuit assemblies and relays. All parts are conservatively rated industrial components. Logic semiconductors are pre-conditioned and tested prior to installation.

Safety features include zero overshoot current limit, fast acting line fuses, fused speed potentiometer circuit, suppressors for high frequency and transient voltage protection. With its many standard functional and performance options it can be applied in a single or multiple motor system to control and safeguard almost any kind of machine or process equipment.

Complete start up, installation and maintenance instructions are furnished with each unit.

STANDARD FEATURES

- Full wave, constant torque
- Open chassis design, deadback
- Fused protection against speed pot grounding/shorting
- Temperature compensated reference for minimum drift
- Fast acting fuses for semiconductor protection
- Armature contactor
- Isolated 115 volt control circuit
- Non-reversing coast to rest
- SCR dv/dt protection
- Adjustable acceleration – 1-10 seconds
- Adjustable current limit 0-150%
- Adjustable non-linear IR drop compensation
- Adjustable maximum speed 75-100%
- Adjustable minimum speed 0-25%
- Speed reference 8.4 VDC

STANDARD PERFORMANCE

- SPEED RANGE 30:1
- REGULATION ±2% of base speed
- Motor Speed Linear to Speed Control Setting
- OVERLOAD CAPABILITY 150% for one minute

AVAILABLE OPTIONS – FACTORY INSTALLED

- Dynamic Braking and Isolated Anti Plug
- Reversing, DB & AP
- High voltage field supply
- Jog/Inch/Thread at independent speed
- Isolated instrument follower with auto/manual relay, 1-5, 4-20 or 10-50 ma input
- Tachometer or Voltage follower
- Tachometer Feedback ±0.5% to ±0.1%, 100 to 1 speed range
- Linear acceleration/deceleration (2 - 20 seconds)
- External torque control
- 24 Volt AC relay control circuit
- Extra NO/NC contacts
- Thermal overload relay
- Field loss relay
- Voltage sensitive electronic relay
- Enclosures Nema 1, 4, 7, 9 or 12

SOME TYPICAL APPLICATIONS

- Indexing Tables
- Induction Heating Machines
- Concrete & Stone Cutting Saws
- Welding Positioners
- Machine Tools
- Tensile Testing Equipment
- Textile Machinery
- Positive Displacement Pumps
- Packaging Equipment
- Book Binding Machines

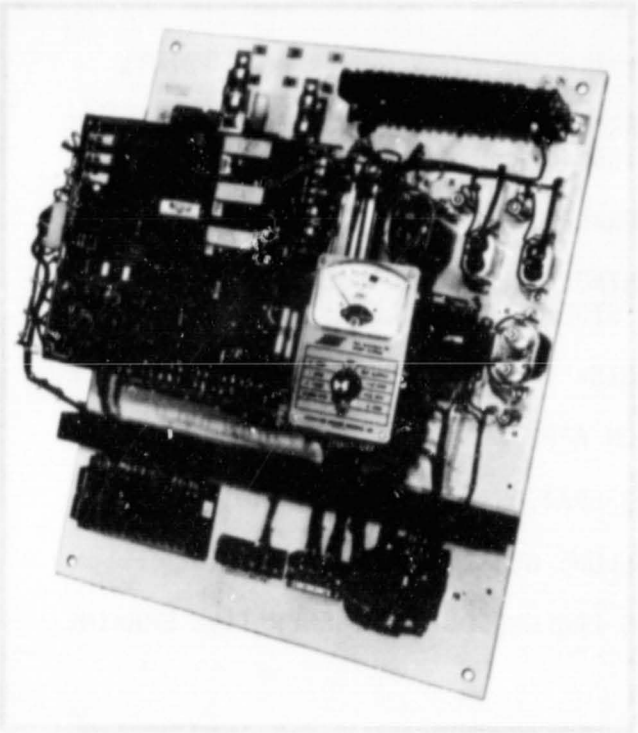
CMC
DC DRIVE DIVISION

series 100 controllers

engineering data sheet DS-100-B

CLEVELAND MACHINE CONTROLS, INC.
7550 HUB PARKWAY, CLEVELAND, OHIO 44125 - (216) 524-8800

Non-Regenerative Adjustable Speed Drive System



SERIES 100 • 5-500 HP • THREE PHASE 50/60 Hz
ADVANCED SOLID STATE DESIGN
MANY STANDARD OPTIONS

The Series 100 Controller with DC Motor and operator's control is a complete non-regenerative adjustable speed drive system for use in the precise control of industrial machinery. It is available in ratings of 5 to 500 HP.

The Series 100 is designed with conservatively rated power components. Pre-conditioned and tested logic semiconductors, high frequency and transient voltage protection, adjustable current limit with zero overshoot, motor overload protection, and fast acting input fuses, are provided to insure maximum reliability for the system and maximum protection for the driven equipment. Modular construction results in a small, space saving package, yet permits easy access to all components for quick servicing. All calibration pots are readily accessible.

STANDARD FEATURES

- Full wave, constant torque converter
- Open Chassis, deadback, 12 gauge panel
- Temperature compensated reference for minimum drift
- Fast acting line fuses for power semiconductor protection
- di/dt and dv/dt power semiconductor protection
- Speed pot protection from grounding and shorting
- Full rated armature contactor
- Test meter, 20 HP and above, to easily check key voltages and currents, optional below 20 HP
- Adjustable current limit 0-150%
- Adjustable non-linear IR drop compensation
- Adjustable linear acceleration (2-20 secs.)
- Adjustable linear deceleration (motoring only) (2-20 secs.)
- Adjustable maximum speed (80 to 120%)
- Adjustable minimum speed (0 to 33%)
- Electronic motor overload 20 HP and above, thermal overload 15 HP and below.
- LED diagnostics

STANDARD PERFORMANCE

- SPEED RANGE 30:1
- REGULATION ±2% of base speed
- Motor Speed Linear to Speed Control Setting
- Overload Capability 150% for one minute

AVAILABLE OPTIONS – FACTORY INSTALLED

- Instrument Follower, 1-5, 4-20, 10-50 ma
- Tachometer or Voltage Follower
- Tachometer Feedback, ±.5% Std., 100 to 1 speed range
- Extended Linear Acceleration and Deceleration 18-180 secs.
- Field Regulator for Constant HP up to 4:1
- External Torque Control
- 24 VAC Control Relays
- Extra NO/NC Contacts
- Field Loss Protection
- Two Mode Stopping
- Load Meter Shunt
- Test Meter, below 20 HP
- Tachometer Loss Relay
- Overspeed Protection
- Blower Motor Starter w/fuses and overloads
- AC Line Circuit Breaker
- Nema I & Nema 12 enclosures
- Contactor Reversing with Anti-Plug Protection
- Dynamic Braking
- Jog/Inch/Thread at Independent Speeds
- Precision Speed Regulator ± .25 or ± .10%

TYPICAL INDUSTRIAL APPLICATIONS

A wide range of standard and optional features are available, plus the unmatched customer-engineered approach of CMC application engineers. The Series 100 is the drive for many industrial applications such as:

- Metalworking Industries
- Process Industries
- Food and Textile Industries
- Printing and Other Machinery

EHV Systems, inc.

1699 A Roosevelt Avenue • Bohemia, New York 11716 • Tel.: (516) 589-2525

MODEL EHV-1 CONTROLLER

RATINGS:

300 AMPS AVERAGE ARMATURE CURRENT (400 AMPS PEAK)

72 to 120 VOLTS INPUT (MAIN BATTERY)

TYPICALLY 10 to 40 HP SHUNT WOUND MOTORS

POWER REQUIREMENTS: 12 VDC at 7 AMPS

TECHNICAL CHARACTERISTICS

- SELECTABLE CURRENT LIMITS AND OVERLOAD TRIPOUT POINTS
- MOTOR TEMPERATURE SENSING LOWERS CURRENT LIMIT AT 115° C SHUTS DOWN MOTOR AT 135° C (or other selected points)
- SMOOTH REGENERATIVE BRAKING (typically down to 7 MPH)
- ACCELERATOR PEDAL CONTROL BUILT IN- ACCELERATOR CABLE CONNECTS TO LEVER ON SIDE OF CONTROLLER
- INSTRUMENTATION OUTPUTS- TEMP GAUGE, AMMETER & VOLTMETER
- PULSE WIDTH MODULATION APPLIED TO MOTOR FIELD
- STABLE, CLOSED LOOP OPERATION
- INTERFERENCE FREE- ALLOWS USE OF NORMAL AM RADIO
- BATTERY CYCLE LIFE IS PROLONGED BY REGENERATIVE BRAKING AND CURRENT LIMIT

PHYSICAL DESCRIPTION:

SIZE - 12.5 X 14.5 X 5.8

WEIGHT - 18 LBS

EXTERNAL CONNECTIONS:

MAIN BATTERY
MOTOR ARMATURE
MOTOR FIELD
MOTOR TEMPERATURE SENSOR
ACCELERATOR CABLE
BRAKE PEDAL SWITCH
IGNITION SWITCH

EHV Systems, inc.

1699 A Roosevelt Avenue • Bohemia, New York 11716 • Tel.: (516) 589-2525

EHV-1 CONTROLLER OPERATION

(1) Depress clutch pedal completely to the floor. (Microswitch must close).

(2) Shift transmission to neutral.

(3) Turn ignition switch on; then hold it in the start position. The motor should come up to full speed in about 1 second. Once motor is up to speed, release switch. Switch should remain in "IGN. ON" position, with motor idling.

(4) Shift into 1st gear. Slowly release the clutch pedal. The motor will have a surprising amount of torque at this point. Be careful to slowly engage the clutch at this point until you get used to the feel of the car.

(5) Use the clutch and accelerator pedals as you would with a conventional vehicle.

(6) Overload Tripout: The normal current limit is set at 250 AMPS. If motor current exceeds 350 AMPS, the Controller will shut down. (Equivalent to "stalling" a conventional vehicle). This typically occurs when the clutch is released too quickly when starting from a standstill, or when the driver shifts to a wrong gear, etc.

(7) Temperature Cutback: The current limit is lowered to 140 AMPS when motor temperature reaches 138°C to force the motor to cool down. The Controller shuts down if motor temperature exceeds 168°C.

(8) Low Voltage Shutdown: The Controller will shut down if the 12V battery voltage drops below 9 volts.

(9) Regenerative Braking: Letting up on the accelerator pedal reduces motor current. If the vehicle has been cruising at some motor speed which is higher than its idle speed, letting up on the accelerator allows the vehicle to slow up while simultaneously charging the main traction battery. This effect feels like "compression" braking in a conventional vehicle. The effect can also be maximized by downshifting at the appropriate points.

(10) Do not attempt to service this Controller. It requires no maintenance under normal conditions. If a problem develops, call the Manufacturer.

EHV Systems, inc.

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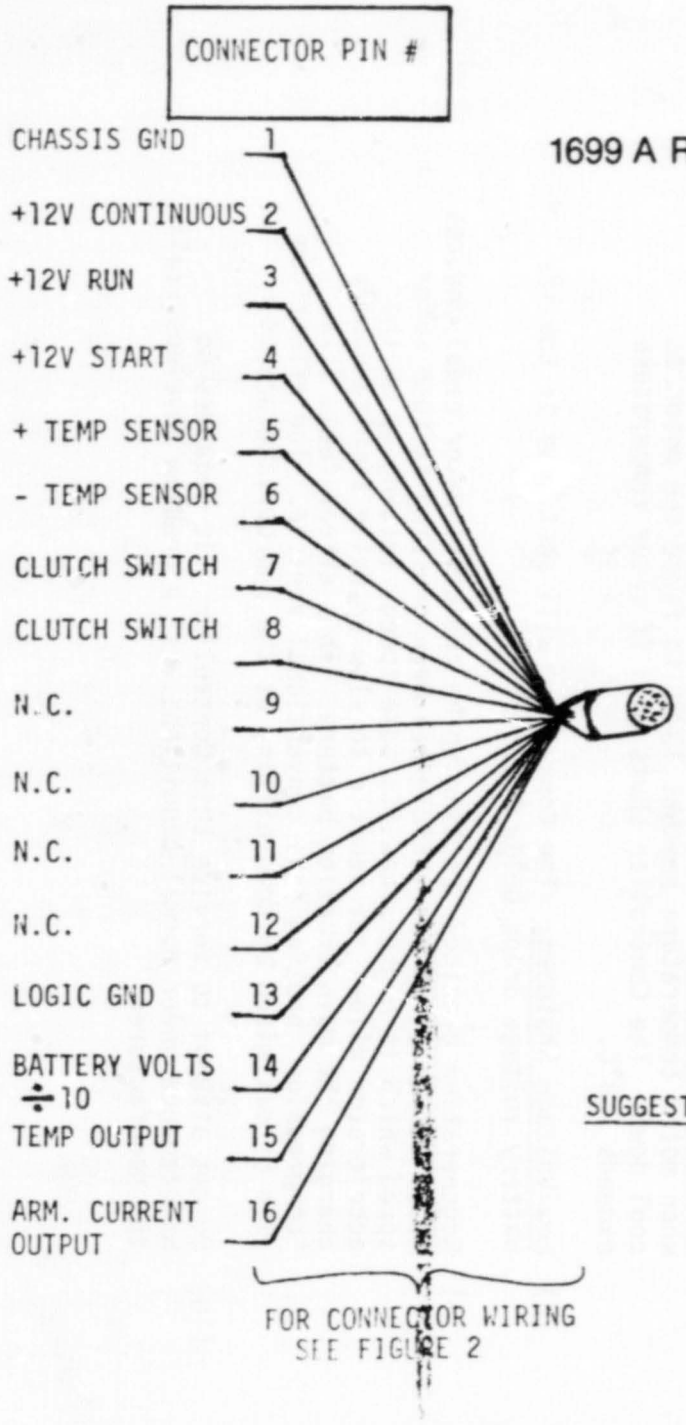


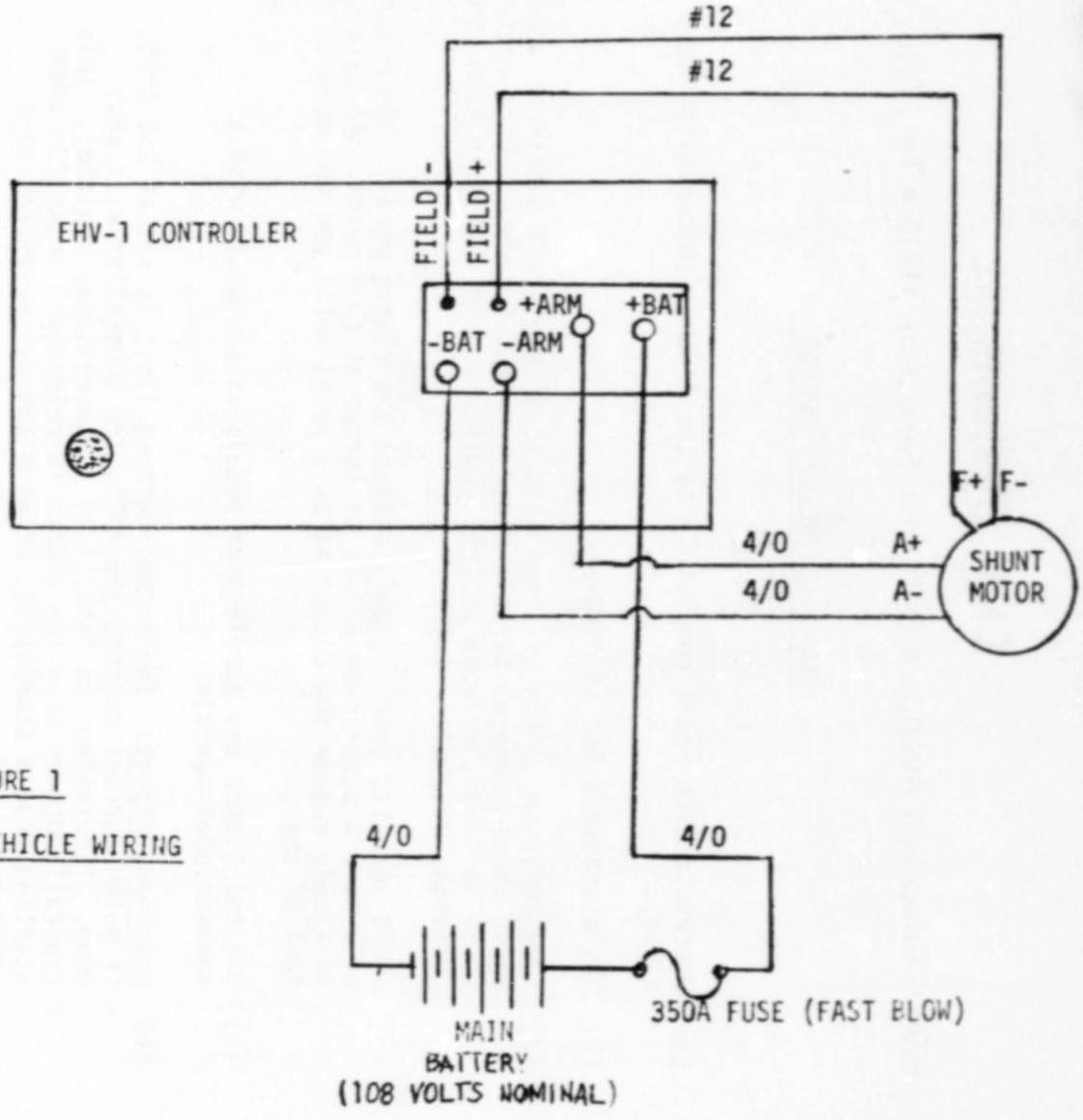
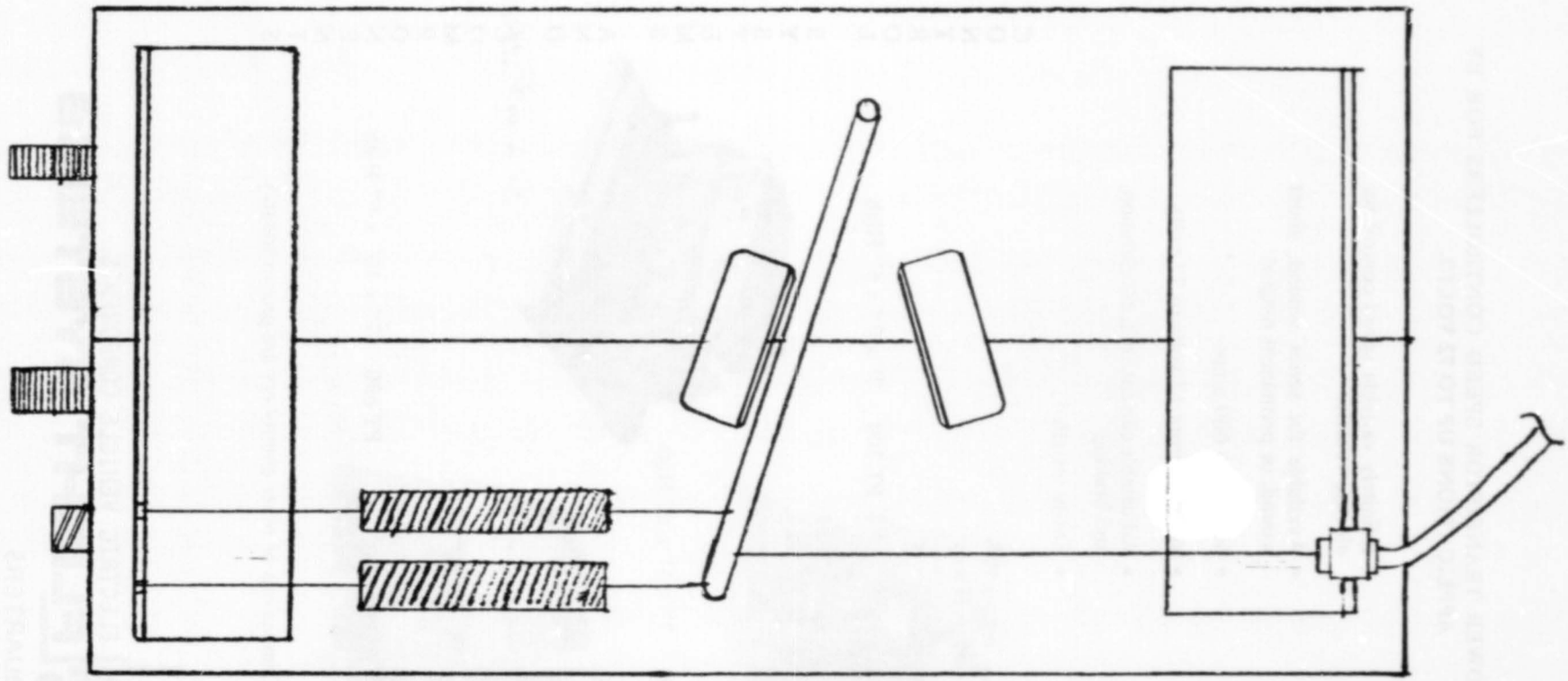


FIGURE 1

SUGGESTED VEHICLE WIRING

MECHANICAL INSTALLATION

EHV-1 CONTROLLER (SIDE VIEW)



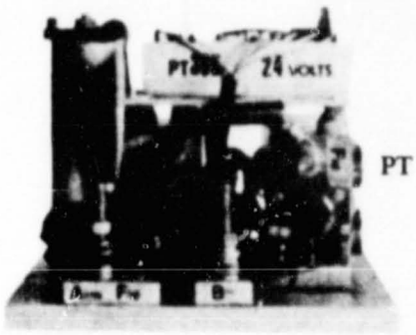
DUAL THROTTLE
RETURN SPRINGS

THROTTLE CABLE
(TO ACCELERATOR PEDAL)

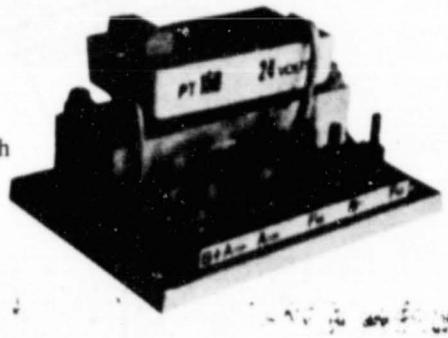
4 TAPPED HOLES (¼ - 20) ARE PROVIDED ON THE BOTTOM OF THE BOX FOR MOUNTING THE CONTROLLER IN THE VEHICLE. CUT OUT NOTCHES IN PLACTIC GUARD FOR POWER WIRES, AS APPROPRIATE.

LOW COST POWER TRANSISTOR SPEED CONTROLLERS FOR EV APPLICATIONS UP TO 72 VOLTS.

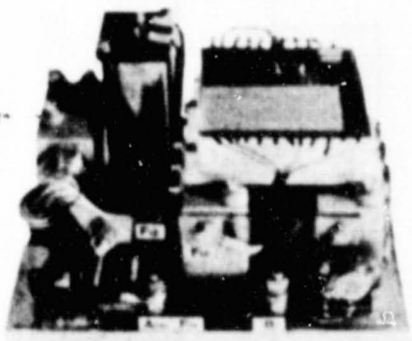
- Infinitely variable speed control for electric vehicles
- Available for series wound, shunt wound, or permanent magnet
- Models to 600 amps
- Voltages from 12 volts to 72 volts
- Adjustable current limit, acceleration, and braking
- Easily installed



PT 300 7" x 7" x 6" High



PT 150 7" x 5" x 6" High



PT 600 7" x 10" x 6" High

(Dimensions of other controllers are proportionate)

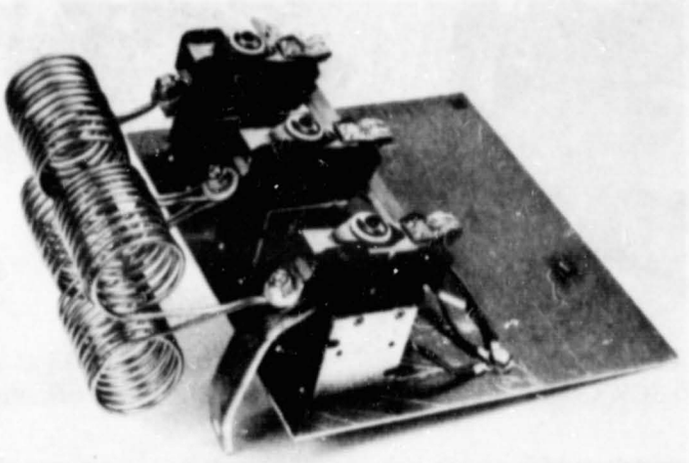
CONTROL SYSTEMS AND COMPONENTS

ELECTRIC VEHICLE COMPONENTS

FLIGHT SYSTEMS

HEADQUARTERS
P.O. BOX 25, MECHANICSBURG, PA 17055
PHONE (717) 697-0333

RESISTOR SPEED CONTROLLER



Here, on one panel, is an entire speed controller complete with resistance coils, contactors, and wiring, and already mounted on a panel. To provide a complete speed control system, attach an accelerator such as our 34-600-800. This economical speed controller has proven its performance in numerous on-the-road EV's. When combined with a four speed transmission, this three step control can provide smooth performance from start to top speed. The contactor coils are 12 volt to allow the controller to be wired across a standard automobile 12 volt ignition system. The resistance coils provide steps of .5 ohms and 1 ohms as switched by the contactors. The resistance coils can be used up to 72 volts and peak current of up to 200 amps. Mounting holes and bolts included for attachment to motor bracket (45-700-800) if desired.

Part No.	Description
35-2001-800	Resistor Speed Controller
	Replacement Parts
36-2002-800	Resistor Coils (set of 4)
37-2003-800	12 Volt Contactors

THIS IS OUR MOST COST EFFECTIVE CONTROLLER

ELECTRIC VEHICLE COMPONENTS
FLIGHT SYSTEMS
HEADQUARTERS
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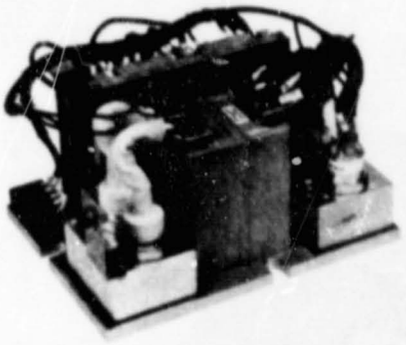
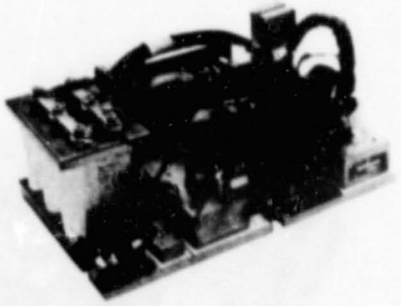
SOLID STATE SPEED CONTROL



For 36V to 48 V – Up to 10 HP
M-210 SCR Control



For 36V to 96V – Up to 25 HP
M-310 (C-290) SCR Control

These SCR controllers offer smooth, jerk-free speed control and most importantly, save up to 30% of battery energy because no power is wasted in speed/current limiting resistors. This allows the EV to go farther between charges. SCR Control is the most efficient method of controlling the voltage to the traction motor. It supplies a series of pulses; a large number of pulses for high speed, a small number of pulses for low speed, with the number of pulses being smoothly adjustable between low speed and high speed. Models M-210 and M-310 (C-290) SCR controls are supplied by FLIGHT SYSTEMS for heavy duty industrial applications and are very rugged and reliable.

Important Note: Accelerator and contactors (not included in price) are required with this SCR controller and specific instructions (included) must be followed or damage to controller that is not covered under warranty will result. Model C-290 or Model M-310 are interchangeable. Either unit is alternately supplied, depending on availability.

Part No.	Description	Max. Motor Amps	Cont. Motor Amps	Size
35-M210-260	SCR Control Panel	600	200	7 x 10 x 6"H
35-M310-260	SCR Control Panel	1000	300	12 x 16 x 8"H
35-28897-260	Instruction Book*			

SPECIFY EXACT BATTERY VOLTAGE WHEN ORDERING.

*Includes information on how SCR control works.

ELECTRIC VEHICLE COMPONENTS
FLIGHT SYSTEMS
HEADQUARTERS
P.O. BOX 25, MECHANICSBURG, PA 17055
PHONE (717) 697-0333

EV-1 Controls

GENERAL ELECTRIC
INDUSTRIAL CONTROL DEPARTMENT
P.O.Box 8106, Charlottesville, VA 22906
TEL: 804-973-1851

Many significant additions and improvements are now available in General Electric's line of EV-1 controls and accessories. All of them give users improved truck performance, higher efficiencies, increased reliability and lower operating costs.

They include two new controls for traction motors—one with regenerative braking and the other for dual-motor vehicles. Also available: a complete new control to power the hydraulic pump motor.

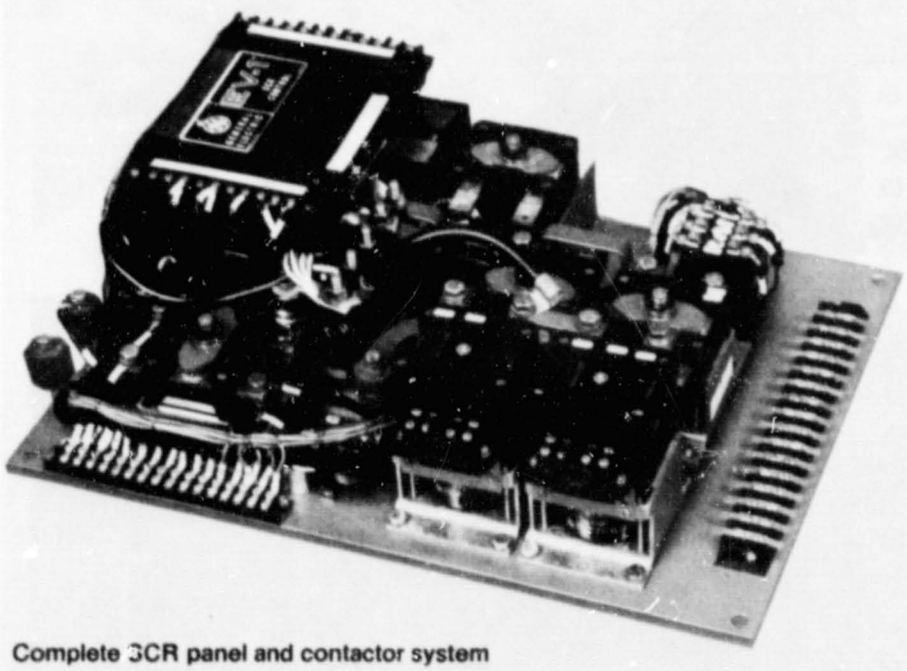
These complete EV-1 SCR and Contactor Systems are engineered, packaged and computer-tested for individual trucks to provide optimum long-term reliability.

The new accessories provide many improvements long sought by electric truck users. They include a battery condition indicator, a 12-volt converter, a solid-state accelerator and a universal driver.

These new products employ the newest solid-state technology, including microprocessors and hybrid circuits. The result is very high levels of performance and reliability.

In addition, General Electric continues to improve its extensive user services, including maintenance training, literature in several languages and worldwide stocking of spare parts.

Users can ask for EV-1 controls and accessories with confidence when purchasing new electric lift trucks from the world's leading manufacturers.



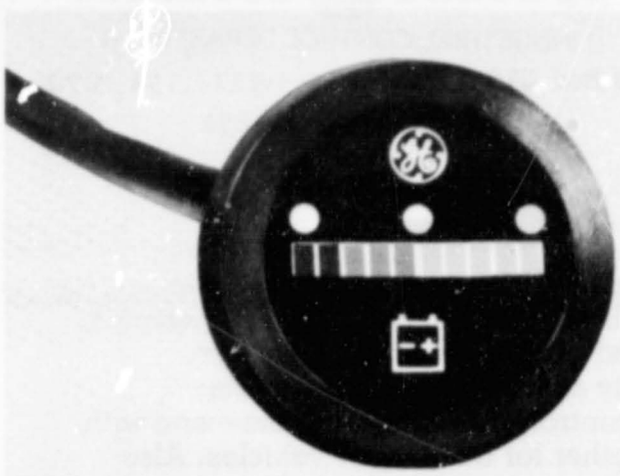
Complete SCR panel and contactor system

Standard traction control

This EV-1 control uses plugging for electrical braking. Result: the fewest possible components.

Key benefits are:

- No wheel slippage because of high-frequency pulsing that delivers smooth braking
- Maximum truck performance because motor current is continuously monitored during braking, acceleration, running, stall and ramp-start
- Bypass contactor provides maximum power with no torque jump
- Excessive motor loads prevented by automatically opening the by-pass contactor
- Serviceable with standard EV-1 Analyzer

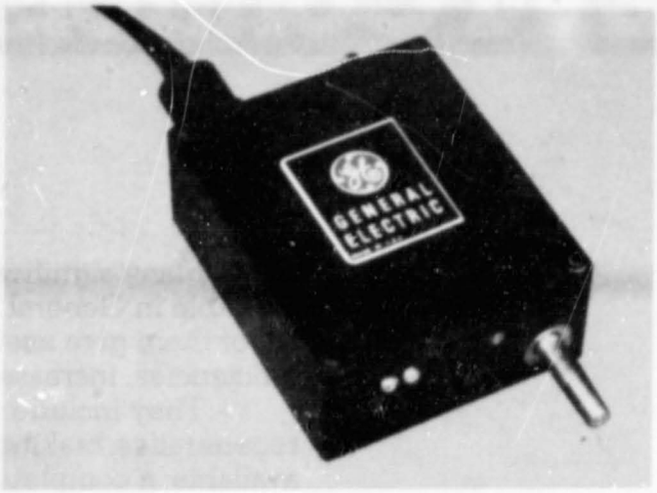


Battery Condition Indicator

The Battery Condition Indicator displays battery condition very clearly and accurately, and maximizes battery life by protecting the battery from the damaging effects of deep discharge.

This microprocessor device actually *measures* energy consumed and displays battery condition on an eight-position LED readout with green, amber, and red zones. If the battery discharges to the red zone condition, the indicator begins flashing and several minutes later, it will render the truck inoperable by disconnecting the hydraulic pump motor (forward contactor disconnect is optional).

The device cannot be fooled by disconnecting the battery or by temporarily connecting a charged battery.



Accelerator Switch

Solid state electronics provide at least 100 times longer life for this new accelerator, and eliminates the potentiometer.

- Only one principal moving part
- Small size
- Rugged, gasketed enclosure
- Short stroke assures positive shaft return
- Reliable solid-state by-pass switch

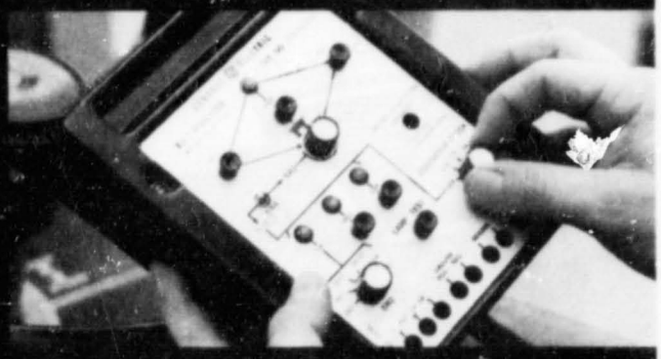
GENERAL ELECTRIC

INDUSTRIAL CONTROL DEPARTMENT

P.O.Box 8106, Charlottesville, VA 22906

TEL: 804-973-1851

You get... outstanding backup and support



System Analyzer for easy troubleshooting

Using the EV-1 Analyzer, one service person can check out the control and all vital truck electrical components in less than 10 minutes. With the flick of a switch, the analyzer can test a key switch, seat switch, brake switch, accelerator switch, directional selector switch, capacitor, SCRs, diodes, thermal protector, motor and wiring.

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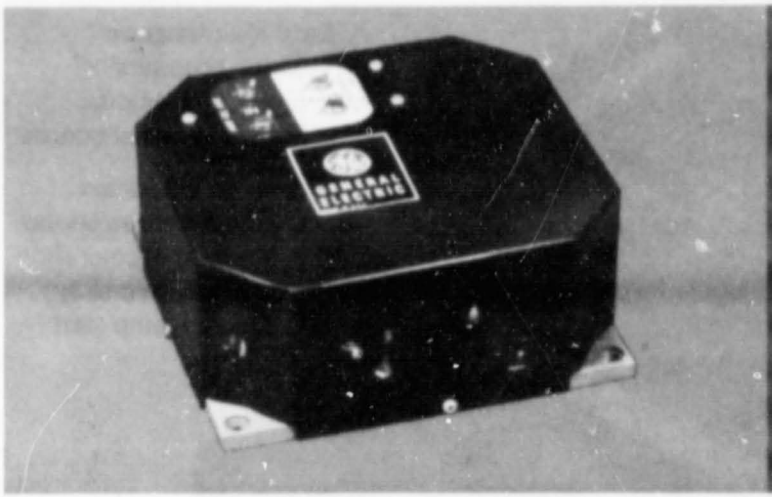
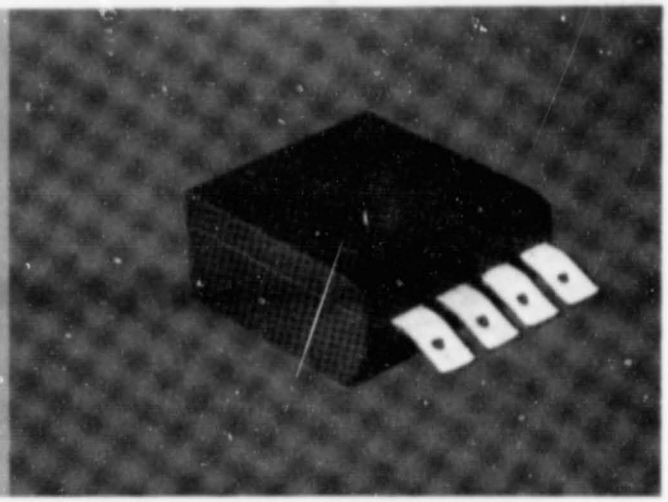


12 Volt Converter

Converts any battery voltage (36-80V) to 12 volts so standard automotive accessories can be used.

- All solid-state
- Short circuit protection
- Thermal protection
- Regulated output (12V)
- Eliminates inrush current which greatly increases life of lamp accessories
- Output isolated from battery voltage



Universal Driver

Converts any battery voltage (24-80V) to 24 volts so one contactor can be used for different battery voltages.

- Spare coil stock significantly reduced
- Less battery drain with lower coil currents
- Longer coil life
- Reduced tip wear from low battery voltage
- Reduced control compartment heating

Other Accessories

- Directional Selector Switch
- Time delay module to increase pump contactor tip life
- Power steer contactor time delay modules to maintain power steer when vehicle is coasting

GENERAL ELECTRIC
INDUSTRIAL CONTROL DEPARTMENT
P.O.Box 8106, Charlottesville, VA 22906
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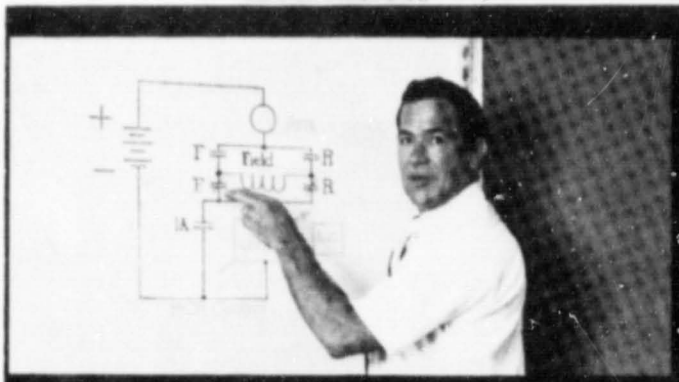


Worldwide maintenance training

Maintenance training for dealers, truck manufacturers and users is conducted at customer facilities and in selected locations throughout the industrial world. To date, over 15,000 maintenance personnel have attended these schools. Maintenance instruction manuals are also provided in several languages.



Insist on genuine General Electric parts

Electric lift trucks are too important to your business to use anything less than the best parts. Genuine General Electric parts assure you of getting the best quality, optimum performance and reliability.

Accept no substitutions. Insist that your company protect its electric vehicles with a policy of purchasing only genuine GE parts. You can't afford to be without them.

the new EV-1 Controls

High Power Performance
- High starting torque
- Fast acceleration
- Full power on ramps
- High thermal capacity

Easy Maintenance
- Quick accessibility
- Easy card removal
- Stab-in terminal boards

Smootn Operation
- Smooth creep speed
- Stepless acceleration
- Smooth reversing
- Positive ramp start



High Reliability
- Thermal protection
- All solid-state
- Overcurrent protection
- Component encapsulation

GENERAL ELECTRIC
INDUSTRIAL CONTROL DEPARTMENT
P.O.Box 8106, Charlottesville, VA 22906
TEL: 804-973-1851

Traction control with regenerative braking

This EV-1 control returns energy to the battery during electrical braking instead of dissipating energy in the motor.

Key benefits are:
- More work per-battery-charge because of energy being returned to the battery during braking
- Longer motor and brush life because of lower currents during braking
- Smoother braking
- Driver control of stopping distance using the accelerator pedal
- Serviceable with standard EV-1 Analyzer

Traction control for dual-motor vehicles

This control for dual-motor trucks (3 or 4 wheel) proportions the power smoothly and automatically to each motor as a function of steering angle. This forms an "electrical differential" where the inside wheel is actually reversed in a very tight turn.

Key benefits are:
- More traction power during turns
- Reduced tire wear because inboard wheel does not skid
- Driver control of stopping distance by position of accelerator pedal
- Maximum power with no by-pass contactor
- Serviceable with standard EV-1 Analyzer

Hydraulic pump motor control system

This control permits stepless control of the lift, tilt and auxiliary hydraulic functions.

Major features and benefits are:
- Reduced noise
- More accurate fork positioning
- Less battery drain
- Less brush arcing and lower motor temperature for reduced maintenance and longer motor life
- Reduced oil heating improves driver comfort and assures longer life of motors and controls
- Virtually eliminates pump contactor tip replacement since contactor acts as a disconnect switch only

Collyer Insulated Wire Division

100 Higginson Ave.
Lincoln, RI 02865
Telephone: 401/723-7800

Control Cables	THERMOSET: Collyer C-150, C-151 — XLP insul. — PVC or Neoprene jacket 600V. Collyer C-148 — XLP XHHW FR-1 conductors, Type T.C. U.L. Listed. Collyer C-191 — EPR/HYPALON conductors — Neoprene or PVC jacket U.L. Listed Type T.C. Collyer C-190 — EPR insul. — Hypalon jacketed extra — flame resistant for nuclear station use. C-140, C-143, C-153, C-150, C-151, C-148, C-190 meet IPCEA — NEMA requirements. C-154, C-148, C-190 meet U.L. Type T.C. requirements.
Machine Tool Wire	**Single conductor** Collyer P-400 U.L. Type THHN/THWN when supplied with 19 wire or more stranding, non compressed, has U.L. Listing as MTW 90°C dry and 60°C in oil. Must be specially ordered.
Motor Lead Cables	**Single conductor — Flexible** IPCEA S-19-81, NEMA WC-3 — RUB. insul., neoprene jacket, 600V 75°C. IPCEA S-68-516, NEMA WC-8 — EPR insul., neoprene or hypalon jkt. 600V, 1000V, 2000V, 90°C. AAR581.3 — Rub. insul., Neop. jkt. diesel locomotive cable — 600V. AAR589 — Hypalon insul., 600V. — Also 1000V non AAR spec.
Traction Cable	**Single conductor** Collyer "Track Star", EPR insulated, Neoprene jacketed, 1000 volt. Also XLP insulated & EPR insulated manufactured to any Transit company's specifications. 600V., 1000V, 2000V.
Tray Cable	**Multi-conductor power and control — U.L. Listed Type TC per NEC article 340** C-148 — XLP, XHHW FR-1 conductors, PVC jacket, 600V. C-154 — THWN/THHN conductors, PVC jacket, 600V. C-191 — EPR/Hypalon FR-1 conductors — Neop., or PVC jacket, 600V.

Eagle Signal Corporation

8004 Cameron Road
Austin, Texas 78753
Telephone: 512/837-8300

Battery Charger	In conjunction with the G+W zinc chloride battery program, Eagle Signal is currently developing a battery charger. Basic specifications are given below. Custom chargers or adaptations of the basic charger will be considered. Basic Specifications: AC Input Voltage — 230 VAC single phase 60Hz DC Rating — 140VDC 85 amperes continuous Control Range — From 10% voltage and current to 100% voltage and current Cooling — Convection Transformer — Class H insulation, Class B temperature rise Circuit Configuration — Single phase full wave thyristor bridge on secondary side of rectifier transformer Off Board Design
Controllers, Motor, Variable Speed	DC traction motor controller now under development. Custom manufacture.
DC-DC Converters (on board)	Under development. Custom manufacture.

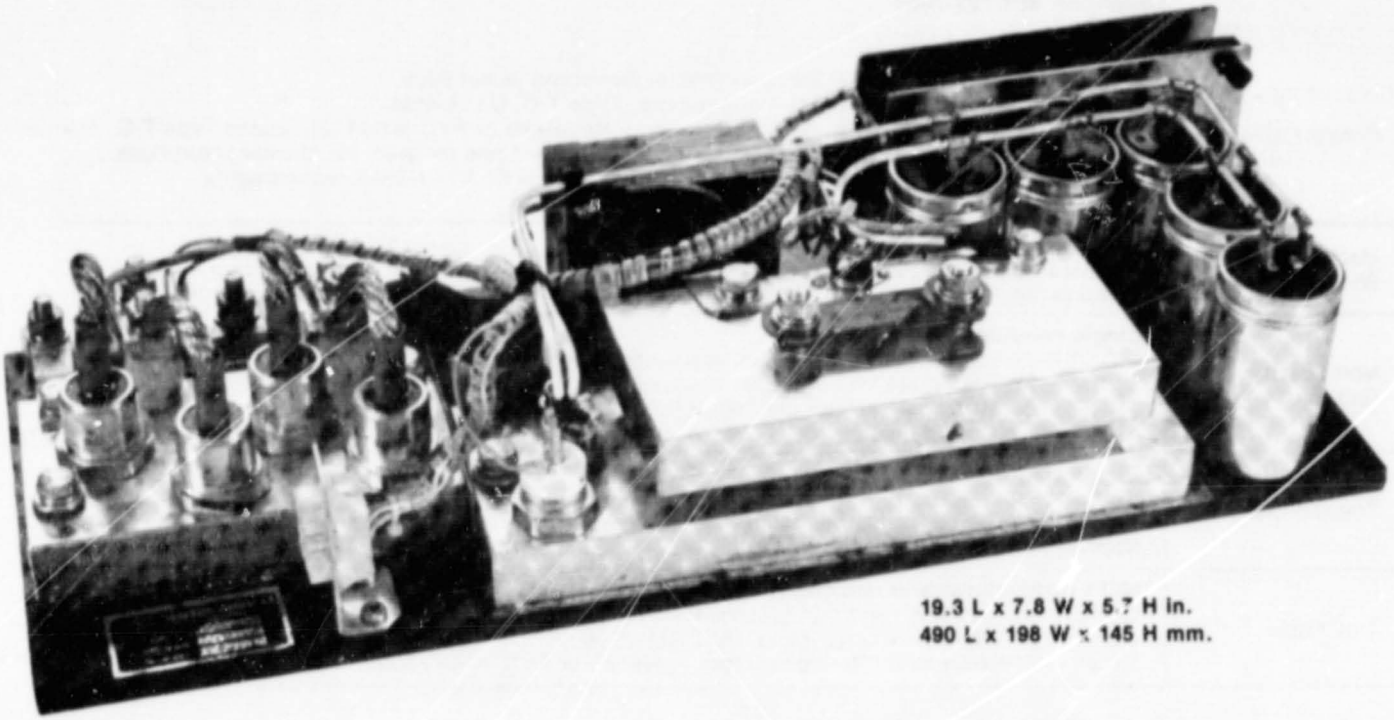
Eagle Signal Industrial Controls Division

736 Federal St.
Davenport, IA 52803
Telephone: 319/326-8111

Control Relays

For very competitive specifications and prices contact EAGLE SIGNAL, 925 Lake Street, Baraboo, Wisconsin 53913, Telephone (608) 356-8321.

DESCRIPTION	CONFIGURATION	POLES	AMPERES
GENERAL PURPOSE			
6/12/24/120/240 VAC	Open Type, solder lug	1, 2, 3	5, 10
6/12/24/48/110 VDC	Open Type, quick disconnect	1, 2, 3	5, 10
	Open Type, printed circuit	1, 2, 3	5, 10
	Enclosed, Plug-in Octal Base	1, 2, 3	5, 10
	Enclosed, Plug-in, Octal base w/light	1, 2, 3	5, 10



19.3 L x 7.8 W x 5.7 H in.
490 L x 198 W x 145 H mm.

HB/Sigma Model A800C SCR Control

OPERATIONAL FEATURES

Variable pulse width and frequency modulated control.

Full time SCR operation available: Provides up to 96% battery voltage to motor reducing the need for by-pass operation.

Complete synchronization of control and contactors:

a) Directional contactors never make or break under load during normal operating conditions.

(b) A smooth and arcless transition in and out of "1A" by-pass operation.

Current limit: Control continuously monitors motor current during all phases of controller operation. The maximum average motor current is limited by an adjustable C/L potentiometer on the control card.

Controlled plugging: Intensity of plug controlled by the accelerator and C/L setting.

Ramp start: As the accelerator setting determines both the normal and plugging controller current, the operator retains full control to hold or accelerate the vehicle up an incline.

CONTROLLER RATINGS

5 minute continuous	800 ampere motor current
1 hour continuous with by-pass	260 ampere motor current
1 hour continuous without by-pass	195 ampere motor current
Operating voltage	24 to 80 VDC

Complete fault detection circuitry:

1. Prevents initial closure of F & R contactors if main SCR is shorted or "1A" is welded.
2. Continuously monitors main SCR commutation and "1A" operation during controller operations. In the event of a failure, the directional contactors will interrupt the circuit and remain open until the system is recycled with the key switch.

HB ELECTRICAL MFG. CO., INC.
P.O. Box 1466 • Mansfield, Ohio 44901
Telephone 419/747-2024

OPERATIONAL FEATURES [Continued]

Thermal protection: If the main SCR exceeds its designed temperature range, the C/L setting will automatically be reduced to maintain a safe operating temperature range. Original C/L setting is restored as panel is allowed to cool.

Single control card: Includes contactor coil drivers and incorporates state of the art digital circuitry.

"1A" By-Pass Operation:

1. Percent on time pick-up - as the main SCR reaches 90% to 96% "on" time the "1A" contactor closes, providing full battery power to the motor allowing the main SCR to cool.
2. "1A" plugging holdoff insures that "1A" will not operate during plug condition.
3. "1A" current limit will not allow "1A" operation if controller is in the C/L mode. While in "1A" mode the controller will automatically return to the SCR operation mode if C/L is exceeded. Complete synchronization during "1A" transition insures longer "1A" contactor tip life.

DESIGN OPTIONS

Field weakening: Supplied with FW pickup and dropout potentiometer adjustments to allow FW operation above the "1A" speed range. FW operation is prevented until "1A" closure occurs.

High voltage operation: Circuitry is available for control operation above 80 VDC.

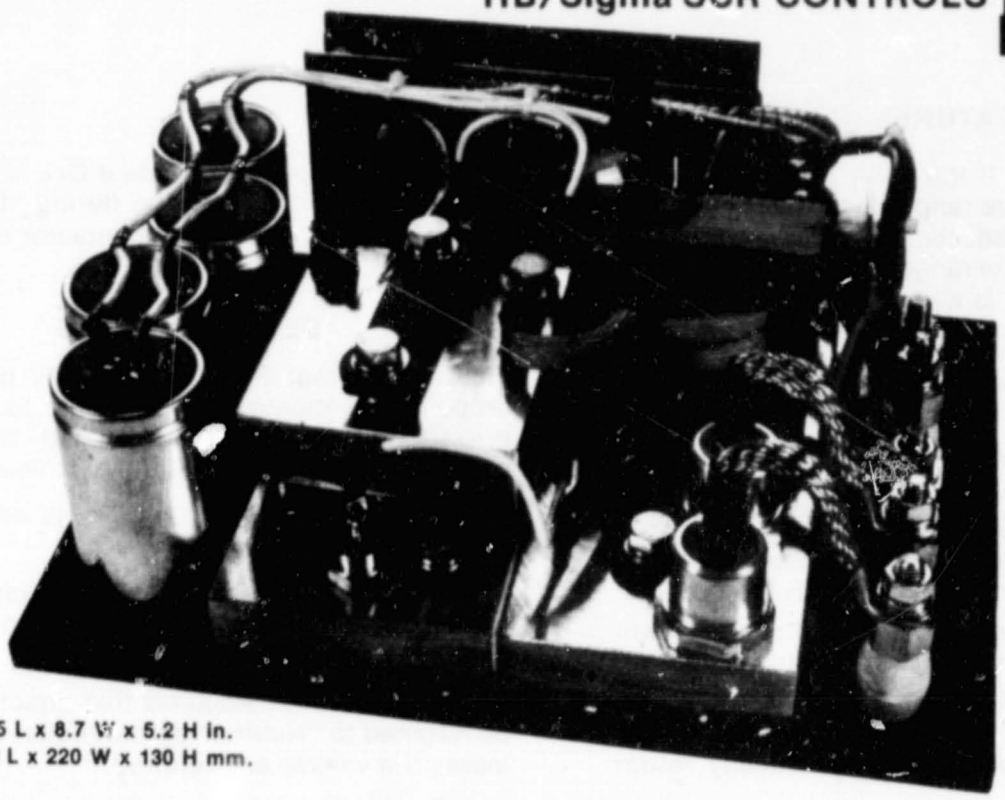
Dual motor control: Additional power circuitry can be added to provide independent operation of paralleled motors.

Static return to off: Requires that directional lever be returned to "Neutral" before restart if operator leaves the vehicle and returns.

Standard HB/Sigma SCR Features

- Complete Control System Design Capability
- Fault Detection Circuitry
- Dual Motor Control, Pump Control, Field Weakening Options
- Nine-Pin Control Connector
- Fifth Generation Control
- Continuous Production Since 1964
- 12 Standard Models
- Variable Frequency and Pulse Width Modulation
- 24 VDC — 80 VDC Operation
- Conductive and Air-Cooled Models
- CMOS Digital Logic Control Card
- Optically Coupled Acceleration Module (Hand or Foot Control)

HB ELECTRICAL MFG. CO., INC.
P.O. Box 1466 • Mansfield, Ohio 44901
Telephone 419/747-2024



11.5 L x 8.7 W x 5.2 H in.
290 L x 220 W x 130 H mm.

HB/Sigma Model A450C SCR Control

OPERATIONAL FEATURES

Variable pulse width and frequency modulated control.

Full time SCR operation available: Provides up to 96% battery voltage to motor reducing the need for by-pass operation.

Complete synchronization of control and contactors:

a) Directional contactors never make or break under load during normal operating conditions.

(b) A smooth and arcless transition in and out of "1A" by-pass operation.

Current limit: Control continuously monitors motor current during all phases of controller operation. The maximum average motor current is limited by an adjustable C/L potentiometer on the control card.

Controlled plugging: Intensity of plug controlled by the accelerator and C/L setting.

Ramp start: As the accelerator setting determines both the normal and plugging controller current, the operator retains full control to hold or accelerate the vehicle up an incline.

Complete fault detection circuitry:

1. Prevents initial closure of F & R contactors if main SCR is shorted or "1A" is welded.
2. Continuously monitors main SCR commutation and "1A" operation during controller operations. In the event of a failure, the directional contactors will interrupt the circuit and remain open until the system is recycled with the key switch.

CONTROLLER RATINGS

5 minute continuous	450 ampere motor current
1 hour continuous with by-pass	170 ampere motor current
1 hour continuous without by-pass	130 ampere motor current
Operating voltage	24 to 80 VDC

HB ELECTRICAL MFG. CO., INC.
P.O. Box 1466 • Mansfield, Ohio 44901
Telephone 419/747-2024

OPERATIONAL FEATURES [Continued]

Thermal protection: If the main SCR exceeds its designed temperature range, the C/L setting will automatically be reduced to maintain a safe operating temperature range. Original C/L setting is restored as panel is allowed to cool.

Single control card: Includes contactor coil drivers and incorporates state of the art digital circuitry.

"1A" By-Pass Operation:

1. Percent on time pick-up - as the main SCR reaches 90% to 96% "on" time the "1A" contactor closes, providing full battery power to the motor allowing the main SCR to cool.
2. "1A" plugging holdoff insures that "1A" will not operate during plug condition.
3. "1A" current limit will not allow "1A" operation if controller is in the C/L mode. While in "1A" mode the controller will automatically return to the SCR operation mode if C/L is exceeded. Complete synchronization during "1A" transition insures longer "1A" contactor tip life.

DESIGN OPTIONS

Field weakening: Supplied with FW pickup and dropout potentiometer adjustments to allow FW operation above the "1A" speed range. FW operation is prevented until "1A" closure occurs.

High voltage operation: Circuitry is available for control operation above 80 VDC.

Dual motor control: Additional power circuitry can be added to provide independent operation of paralleled motors.

Static return to off: Requires that directional lever be returned to "Neutral" before restart if operator leaves the vehicle and returns.

Standard HB/Sigma SCR Features

- Complete Control System Design Capability
- Fault Detection Circuitry
- Dual Motor Control, Pump Control, Field Weakening Options
- Nine-Pin Control Connector
- Fifth Generation Control
- Continuous Production Since 1964
- 12 Standard Models
- Variable Frequency and Pulse Width Modulation
- 24 VDC — 80 VDC Operation
- Conductive and Air-Cooled Models
- CMOS Digital Logic Control Card
- Optically Coupled Acceleration Module (Hand or Foot Control)

HB ELECTRICAL MFG. CO., INC.
P.O. Box 1466 • Mansfield, Ohio 44901
Telephone 419/747-2024

INTERNATIONAL RECTIFIER
SEMICONDUCTOR DIVISION
233 KANSAS STREET, EL SEGUNDO, CALIFORNIA 90245, U.S.A. TELEPHONE: (213) 772-2000

THYRISTOR AC CONTROLLERS

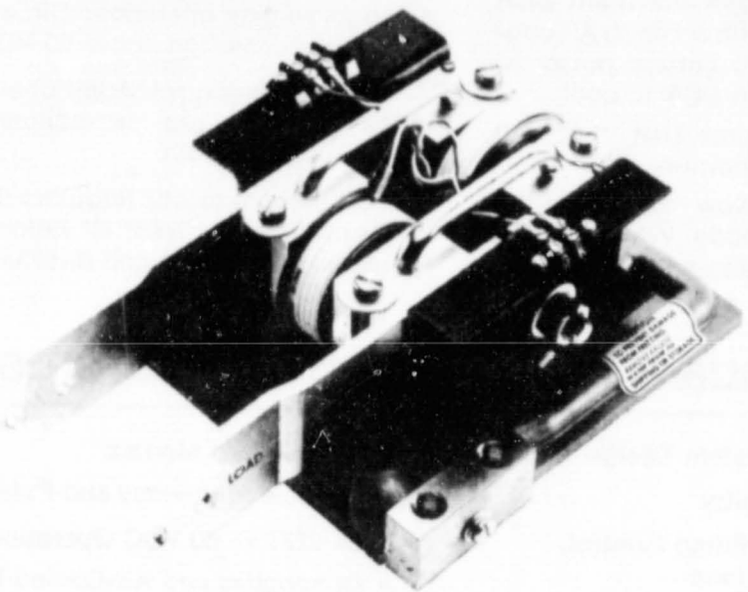
AC CONTROLLERS/AC SWITCHES/ AC CONTACTORS — 3N221 and 3N222

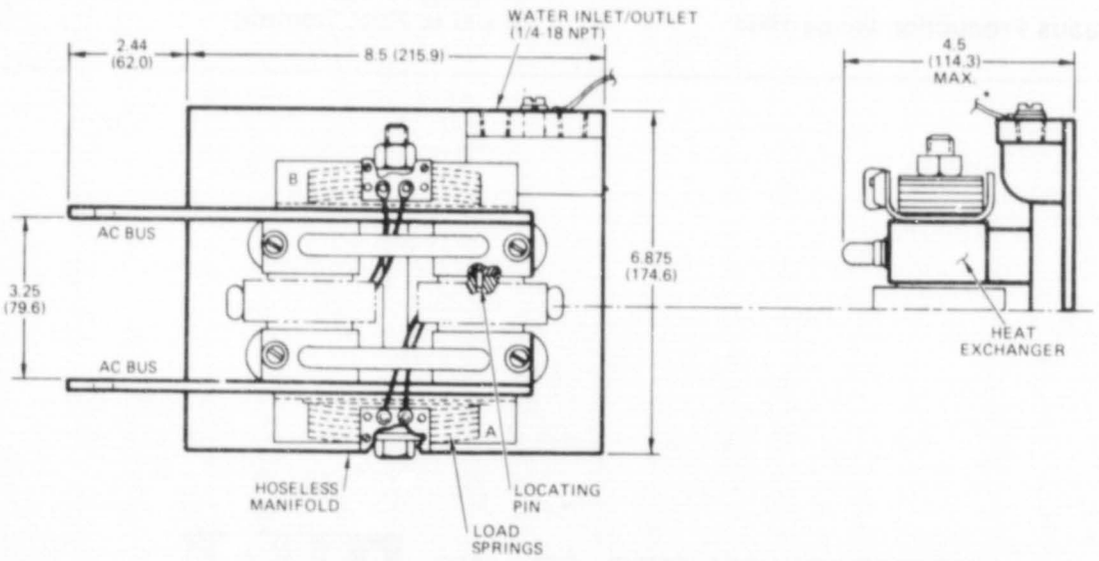
Liquid cooled, single-phase, all-SCR, AC switches feature hoseless water manifold as integral part of assembly. Minimum of 18 inches of water path between opposite polarities exceeds industry standards. Customer connects to brass water inlet and outlet fittings. This eliminates the chances of accidental firing of SCRs by carburized hoses. It also allows quick installation and removal. Design flexibility is another advantage of this system. The 1200A unit replaces a pair of Class D ignitrons in many welding applications.

Max. Continuous AC RMS Current @ 35°C H_2O @ 1.2 Gal./Min. (A)	1 Cycle Surge Rating (A_{pk})	Welding Current Rating (A_{RMS}) (1)		Repetitive PRV Rating (V)	IR Part No.	Case
		5 Cycles	20 Cycles			
1.200	8.000	2.430	2.140	1.700 2.600	3N221 3N222	D-24 —

(1) 10% Duty Factor.

D-24





All Dimensions in Inches and (Millimeters)

Penta Engineering Co.

design - manufacturing - distribution

615 W. Covina Blvd.
San Dimas, CA 91773
(714) 599-6085

DC MOTOR CONTROLLER

The new Penta DC Motor Controllers employ pulse width modulation to control either permanent magnet or series wound DC motors. Speed control is accomplished with a rheostat connected potentiometer giving precise control from creep to full motor speed. The controller includes internal fuse protection against damage due to inadvertent application of 120 V to either of the speed control terminals. Also, protective circuitry is included so that transients will not damage the controller. This allows speed control wires to be in the same cable as inductive switched circuits. Features include a built-in "ramp-up" to protect against excessive start up currents and a low voltage shut down circuit to prevent the controller from operating at full speed when battery supply voltages fall too low. The entire controller is housed in a small (approximately 5" cube) package. The 2 HP Controller (6 electrical HP) is rated at 40A at 120 VDC while the 4 HP Controller (14 electrical HP) is rated at 90A at 120 VDC.

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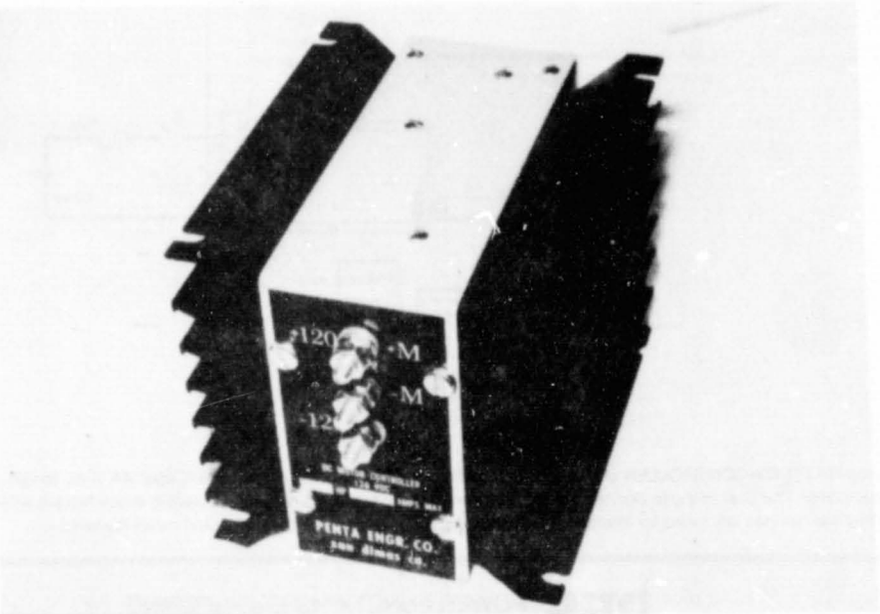
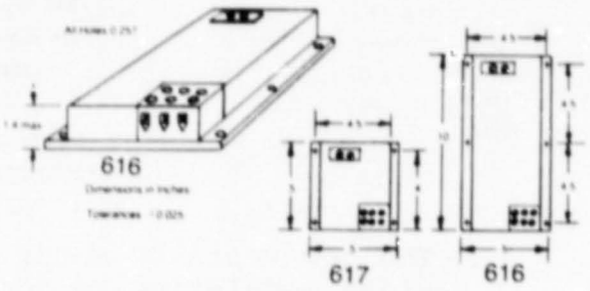


SOLID-STATE CONTROLLERS

TYPES 616, 617

Type	616	617
Rated Peak Current	300A	150A
RMS Current	85A	85A
Peak Voltage	100V	40V
Battery Voltage	10V/48V	10V/24V



- **Protected against short circuited load**
- **Typical switching time: 2 microseconds**
- **Approximate operating frequency: 400 Hz**

These devices are compact, high efficiency, motor speed controllers designed for DC motors in vehicles. They pulse width modulate currents as a function of external resistance.

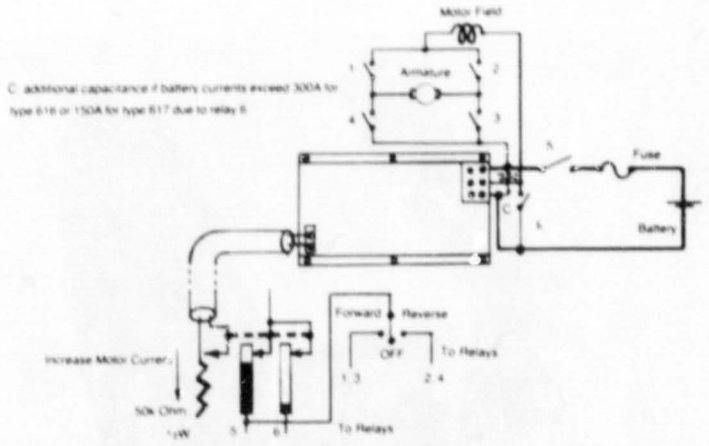
MAXIMUM RATINGS OVER OPERATING CASE TEMPERATURE RANGE

All terminals to case	200V
Positive-to-negative power terminal	RATED VOLTAGE
Continuous current	85A
Storage and operating case temperature range	−30°C to 85°C

ELECTRICAL CHARACTERISTICS AT 25°C CASE TEMPERATURE

Parameter	Test Conditions	Max.	Unit
OFF-State Load Current	Rated Battery Voltage	10	mA
ON-State Forward Voltage	Rated Peak Current	2.0	V

APPLICATION



The cable in loop BATTERY-CONTROLLER should be large in diameter and as short as practical. Cable #4, max. length 12 ft.
Safety Considerations: The user of these devices should be aware that the terminals present an electric shock hazard when energized. It is essential that the devices are fused for internal short circuit to prevent rupture, and uncontrolled motor currents.

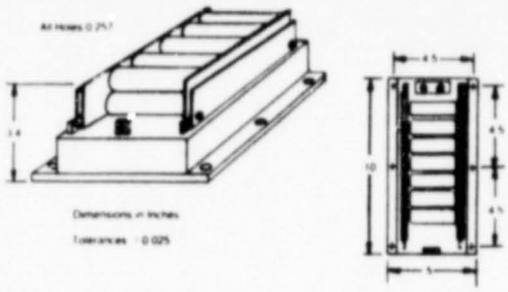
PFE POWER FUNCTIONS ENGINEERING, INC.
3831 CAVALIER DR. • GARLAND, TX 75042
P.O. BOX 2312 • GARLAND, TX 75041
214/278-0996

SOLID-STATE CONTROLLERS

For Variable Speed Motor Drives

TYPES 618, 619, 620

Type	618	619	620
Rated			
Peak Current	400A	400A	400A
RMS Current	200A	200A	200A
Peak Voltage	100V	200V	140V
Battery Voltage	10V/48V	36V/108V	24V/72V



- **Protected against short circuited load**
- **Typical switching time: 2 microseconds**
- **Approximate operating frequency: 400 Hz**

These devices are compact, high efficiency, motor speed controllers designed for DC motors in vehicles. They pulse width modulate currents as a function of external resistance.

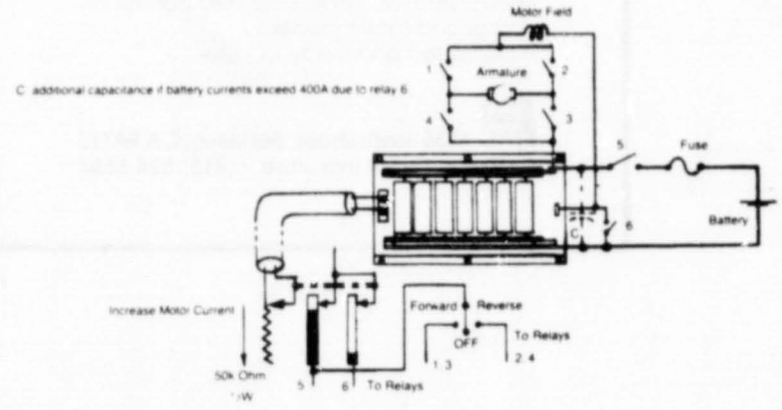
MAXIMUM RATINGS OVER OPERATING CASE TEMPERATURE RANGE

All terminals to case	200V
Positive-to-negative power terminal	RATED VOLTAGE
Continuous current	200A
Storage and operating case temperature range	−30°C to 85°C

ELECTRICAL CHARACTERISTICS AT 25°C CASE TEMPERATURE

Parameter	Test Conditions	Max.	Unit
OFF-State Load Current	Rated Battery Voltage	10	mA
ON-State Forward Voltage	400A	2.5	V

APPLICATION



The cable in loop BATTERY-CONTROLLER should be large in diameter and as short as practical. Cable #1, max. length 12 ft.
Safety Considerations: The user of these devices should be aware that the terminals present an electric shock hazard when energized. It is essential that the devices are fused for internal short circuit to prevent rupture, and uncontrolled motor currents.

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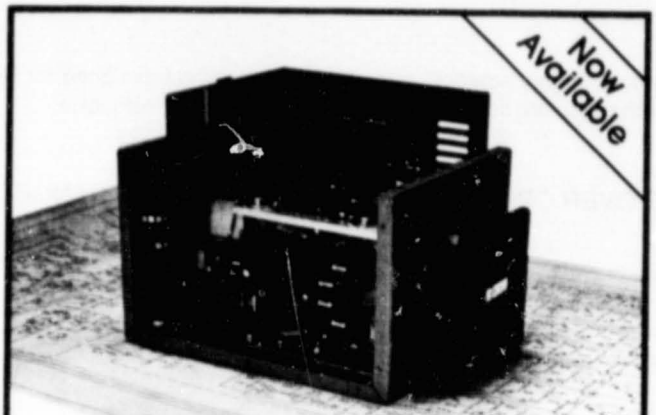


Motor Controller

Fully transistorized high frequency chopper for production & hobby builder.

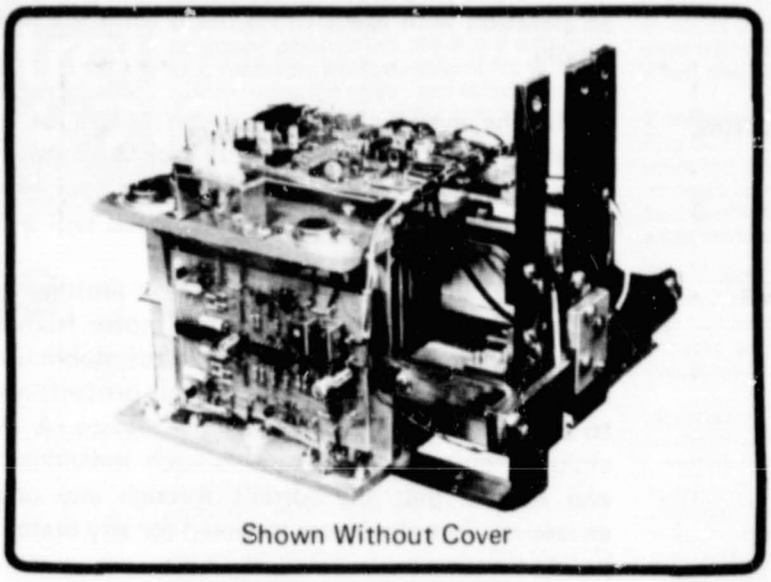
- Models up to 96V and 450 amps available for all types of electric vehicle dc motors.
- High reliability assured with output transistors individually protected by current limiters & thermal protection.
- Integrated armature and field control on compound motor models.
- Fully tested and ready to install.

PMC 1235 Tenth Street, Berkeley, CA 94710
Call or write for literature • (415) 524-8664

EV MOTOR CONTROLLER FOR DC MOTORS

PRODUCT DATA SHEET for DCC-72C DCC-96C DCC-96S

PMC 1235 Tenth Street, Berkeley, CA 94710
Call or write for literature • (415) 524-8664



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MODEL DESIGNATION

CONTROLLER MODEL	DCC-72C	DCC-96C	DCC-96S
MOTOR VOLTAGE	72	96	96
MOTOR TYPE	SHUNT WOUND	SHUNT WOUND	SERIES WOUND
MAXIMUM CURRENT	450	400	300

DESCRIPTION

The PMC controller was specifically designed to meet the need for an efficient, reliable and easy-to-use controller for electric vehicles. The power to the vehicle is smoothly and efficiently controlled by a process called pulse width modulation. In the PMC controller, a high frequency train of pulses (4000 per second) is applied to the motor armature. The power to the motor can be smoothly controlled by varying the pulse duty cycle from zero to 100%. Because of the high frequency operation, the PMC controller is suitable for use on a wide variety of motors (converted aircraft, Baldor, Series, PM, etc.). A fully automatic field control circuit (with regenerative capabilities) is included in the shunt models which provides continuous control of both armature and field voltage.

Motor Controller

DESIGN FEATURES

CURRENT MULTIPLICATION The PMC Controller acts like a dc transformer. It can supply low voltage at high current to the motor for good start-up and acceleration with low current drain from the high voltage battery supply.

THERMAL PROTECTION In the event of a cooling fan failure or other overheating problems, the controller will cut back the output power to a minimum level. This level will allow limited operation. When the overheating has been corrected the cutback will automatically reset.

CURRENT LIMITING There are three separate current limiting functions to fully protect the controller, battery and motor from over-current. The controller's peak current output is adjustable up to its maximum rating. Another current limit circuit protects against failures due to a shorted output or a defective device. A third current limit circuit monitors the current to each individual output transistor and insures that the current through any one device is never excessive. This eliminates the need for any matching or for custom power transistors.

TRANSISTORIZED High-speed transistors instead of SCR's or slow darlington devices are used to give reliable & efficient operation.

SIMPLE INSTALLATION A single 5000 ohm potentiometer, connected to the accelerator pedal, is the only driver input required to control both the field and armature voltage. A low current (½-1½ amps) 24 Volt tap provides all the power to the logic circuitry. The propulsion system is completely isolated from the car frame for safety and reliability. Fans are available as options and may be mounted directly to the controller.

COMPACT The PMC Controller weighs approximately 11 pounds, depending on the model. The containment measures 10½x8½x6¾ inches, excluding the fan and bus bars.

PMC
1235 TENTH STREET
BERKELEY, CA 94710
(415) 524-8664

SOLID STATE CONTROL

the Sevcontrol Mark 7

features

The MK 7 system concept is based on safety and versatility of application.

For safety the MK 7 logic unit incorporates seven separate protection systems which shield the motor and the Sevcontrol from overload, the vehicle from driver abuse and the driver and his fellow workers from potentially dangerous control system failures.

Since the protection systems are built into the Sevcontrol as a fundamental part of the logic circuit they can be used to provide a continuous monitoring of the vehicle operation and actually override the driver's instructions if he attempts an operation which could result in a dangerous condition. For example, if for any reason the solid state control fails to deliver power to the motor and the driver tries to operate the bypass contactor, the logic unit inhibits his instruction, preventing a dangerous lurching start.

Current Limit
The maximum current in the motor is limited by a circuit which senses the armature current and prevents the chopper frequency from increasing when the motor current reaches the desired limit.

By limiting the motor current, rather than the battery current, the Sevcontrol gives a constant torque characteristic which allows maximum voltage to be applied to the motor even at high speed. Other controls, which limit the battery current, reduce the applied voltage to the motor when higher than normal running currents are required. The diagram below compares battery current limit with Sevcon motor current limit.

Controlled Plugging
If the opposite direction of travel is selected while the vehicle is in motion, the Sevcontrol limits the application of power to the motor. This controls the torque to a level which produces smooth braking.

Overtemperature Cutback (optional)
Overheating of the control semiconductors is prevented by a thermal trip which reduces the current limit when the temperature becomes critical. This feature in conjunction with the standard bypass inhibit can be arranged to prevent bypass operation when the control system is cut back.

If a normally closed thermal trip is fitted to the motor it can be connected to provide bypass contactor inhibition when operated.

Bypass Inhibit
The bypass contactor operating circuit is interconnected with the pulsing circuit so that the bypass contactor cannot be energised until the control is operating correctly at a reasonable power level. This feature prevents bypass closure in the event of pulse control failure or, with a logic unit having the 90% inhibit level, when the Sevcontrol is in current limit.

Contactor Arc Suppression
The SCR commutating circuit is used to drive the bypass contactor arc current through zero instantly following the contact opening. This virtually eliminates bypass contactor tip arc erosion.

The pulsing circuit senses the direction contactor coil voltage and anticipates the contacts opening—preventing the pulsing system from passing current at the instant the contact tips separate.

Automatic Emergency Disconnect
In the event of a control system failure which would cause full power to be applied to the motor, power to the main direction contactors is interrupted within thousandths of a second. This can clear a potentially dangerous fault before the driver even becomes aware that a fault exists.

Controlled Acceleration
The rate of increase of voltage to the motor is controlled. The period of time over which the motor voltage is gradually applied can be adjusted over a wide range. This feature prevents wheelspin during rapid acceleration.

Welded Contactor Detector
If a bypass or direction contactor should weld closed the Sevcontrol shuts down and immobilizes the vehicle until the fault is removed.

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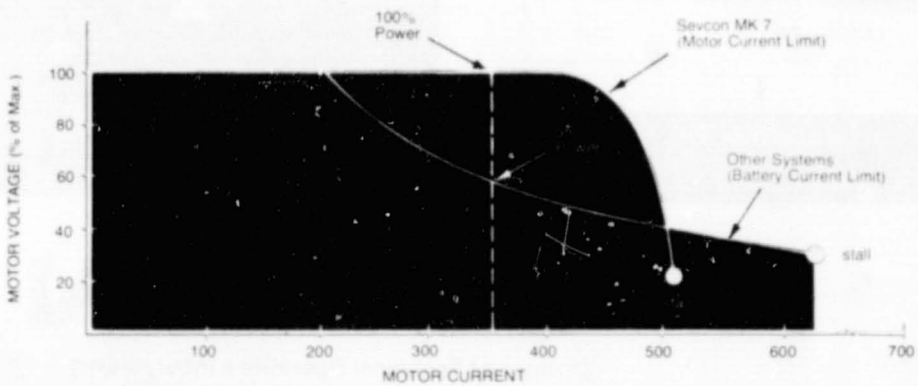
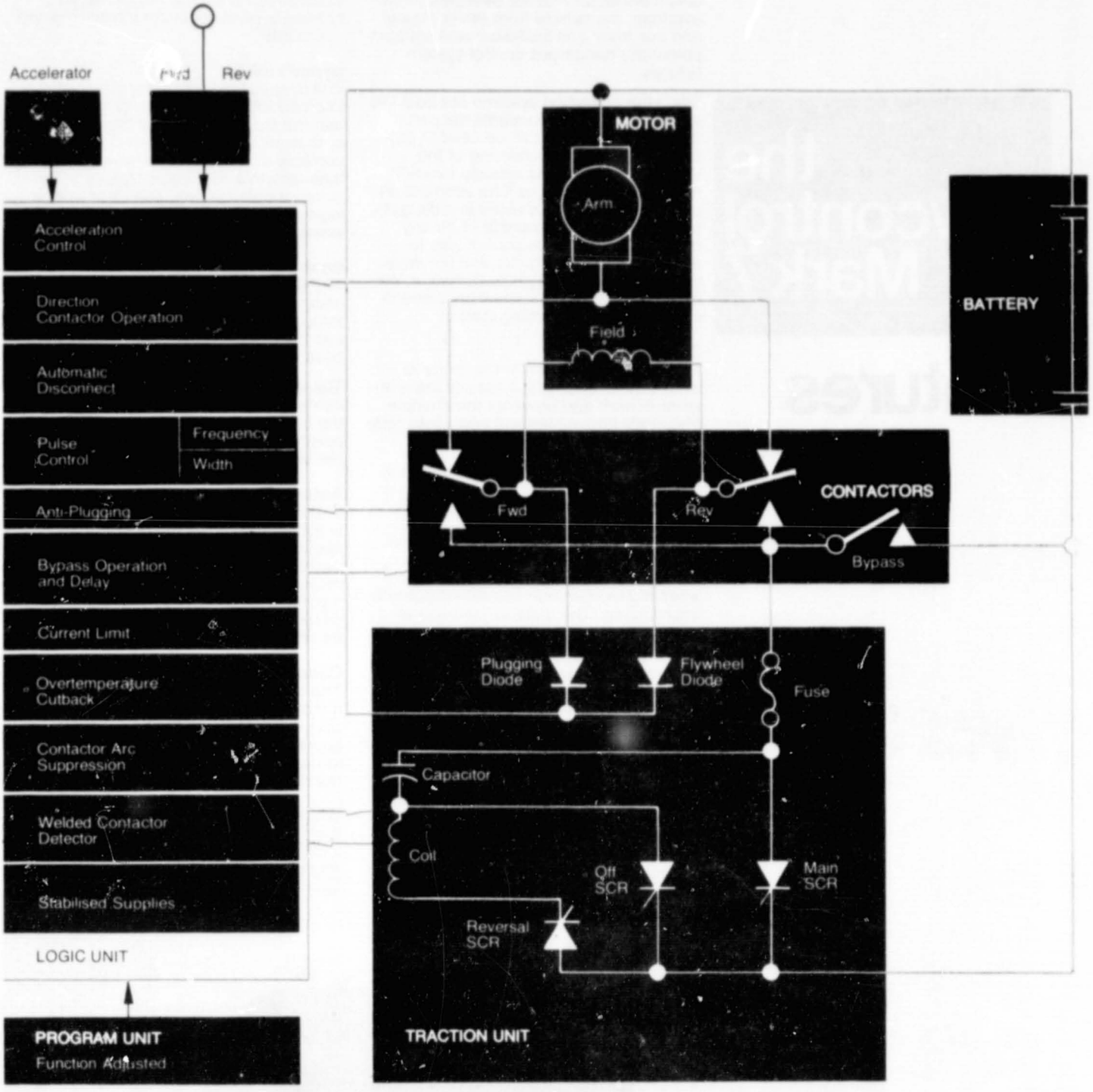


Typical motor current/voltage curves showing how Sevcon's unique motor current limit gives more high speed power for better grade climbing performance.

SEVCON
Division of Technical Operations Incorporated
40 North Avenue, Burlington, Mass. 01803
Telephone (617) 272-2000

the Mark 7 system



SEVCON

Division of Technical Operations Incorporated
40 North Avenue, Burlington, Mass. 01803
Telephone (617) 272-2000

Solid State Speed Control for Electric Vehicles

LOGIC UNITS

The logic unit contains all of the circuits which control the chopper function and monitor its operation. To suit motor and vehicle characteristics, logic units are available with different operating parameters.

Pulse Width

For many applications especially at low voltage a fixed pulse width is satisfactory and gives the simplest system at lowest cost. In applications where a bypass contactor is not used or at higher voltages when cooling is a problem, a variable pulse width is advantageous.

Pulse Frequency

The MK 7 system is basically a variable frequency chopper. The maximum frequency is a function of the pulse width. At maximum frequency with fixed pulse width, the motor voltage is approximately 85% of battery voltage. With variable pulse width the motor voltage is 93% of battery voltage at maximum frequency.

Bypass Inhibit Level

In addition to the bypass delay (the minimum time delay before bypass closure after start up), the bypass is prevented from closing if the pulsing level is below a preset minimum. The 30% level prevents the bypass from closing if the chopper system is not operating.

When it is required to prevent the bypass from closing until the vehicle has reached almost full speed a logic unit having the 90% inhibit level should be used. This would be most often on large vehicles having a very high stall current or high speed vehicles where slow speed bypass operation would cause excessive acceleration.

Plugging

When the opposite travel direction is selected while the vehicle is in motion the Sevcontrol causes the motor to generate a braking torque to slow down the vehicle. Two methods of plug braking are available.

1. Constant current plugging maintains a controlled braking torque down to a standstill and may be used as a means of braking the vehicle electrically.
2. Pulse narrowing is a modification of the constant current system used on motors with unstable characteristics in the plugging mode.

Reversing

The MK 7 system may be connected to provide three different means of changing direction.

Normal Reversing—As the direction switch is changed over the vehicle will free wheel. To apply plug braking the driver must release the accelerator completely to recycle in the opposite direction.

Auto Reversing—Even with the accelerator fully depressed the direction switch can be reversed and the vehicle will be plug-braked to a standstill and re-accelerated in the new direction.

Semi-Auto Reversing—A combination of the above two systems. The reversing is automatic at low speeds but after the bypass contactor is closed the accelerator must be released to recycle the controller in the opposite direction.

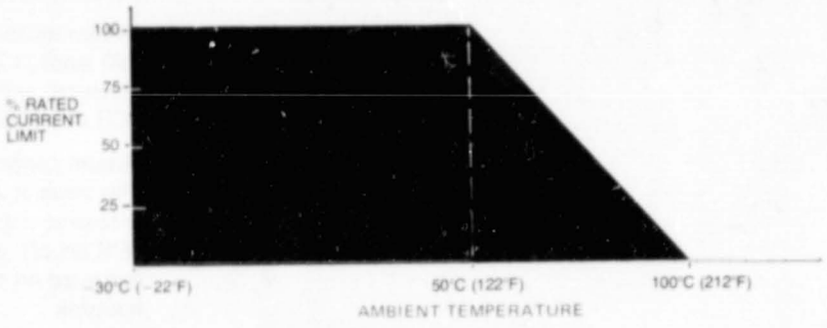
LOGIC UNITS

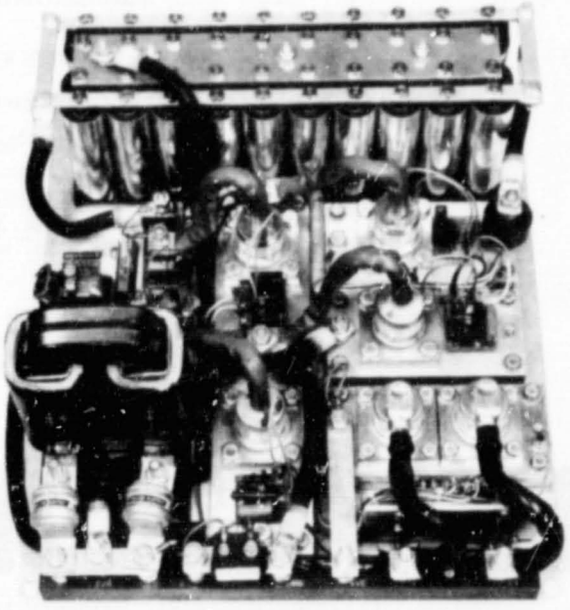
Part No.	Operating Voltage	Pulse Width	Pulse Frequency	Bypass Inhibit Level	Plugging	
705 1-70	24-80	1.2mS	0-800	30%	CC	LV Range
705 1-77	24-80	1.2mS	0-800	90%	CC	
705 1-78	24-80	1.2-2.4mS	0-400	30%	CC	
705 1-79	24-80	1.2-2.4mS	0-400	90%	CC	
705 1-80	24-80	1.2-2.4mS	0-400	30%	PN	
705 1-81	24-80	1.2-2.4mS	0-400	90%	PN	
705 1-82	80-170	1.2mS	0-800	30%	CC	MV Range
705 1-83	80-170	1.2mS	0-800	90%	CC	
705 1-84	80-170	1.2-2.4mS	0-400	30%	CC	
705 1-85	80-170	1.2-2.4mS	0-400	90%	CC	
705 1-86	80-170	1.2-2.4mS	0-400	30%	PN	
705 1-87	80-170	1.2-2.4mS	0-400	90%	PN	

CC– Constant Current
PN– Pulse Narrowing

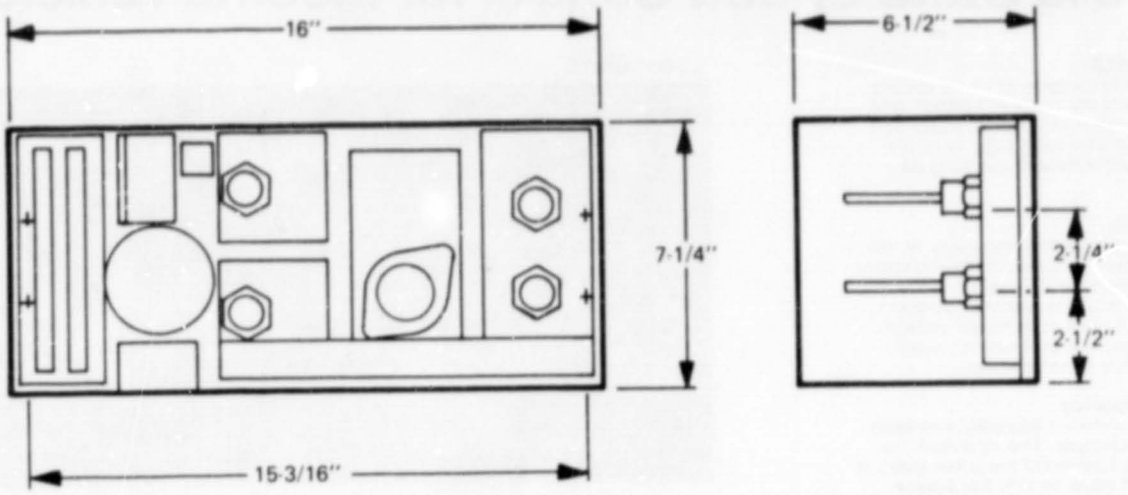
Ambient Temperature Range

The Sevcontrol will operate at rated current from -30°C (-22°F) to +50°C (122°F). Above 50°C the derating curve below should be used.
(for temperatures below -30°C consult Sevcon.)





SEVCON
Division of Technical Operations Incorporated
40 North Avenue, Burlington, Mass. 01803
Telephone (617) 272-2000



Specifications: Model 7218

Voltage Rating:	24-30V, 30-40V, 40-80V
Current Rating:	Maximum motor current (1 min rating): 550 amps at 25°C (77°F) ambient measured with motor stalled, main SCR on:off ratio 1:3
	Maximum continuous motor current: 150 amps at 25°C (77°F) ambient measured with motor running, main SCR on:off ratio 3:1. Controller mounted on finned aluminum heatsink
	Maximum recommended peak motor current in bypass: 650 amps at 80 volts battery
Supply Source:	Lead acid battery.
Dimensions:	16" x 7-1/4" x 6-1/2" high above mounting surface. Commutating coil and capacitor mounted to panel. Logic unit mounts separately on 36" lead. Logic unit size 2-7/8" x 11" x 5-3/4" high above mounting surface.
Mounting Holes:	5/16"-18. 3/8 deep from bottom of base plate.

SEVCON

tech/ops

SEVCON

Division of Technical Operations Incorporated
40 North Avenue, Burlington, Mass. 01803
Telephone (617) 272-2000

COUPLINGS, SHAFT

FLEXIBLE

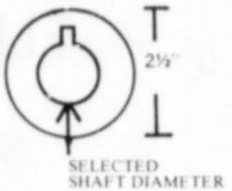
(CODE **CS**)

FLEXIBLE COUPLINGS

These heavy duty 3-piece flexible couplings provide an excellent mechanism for connecting the drive shaft of the electric motor to the EV's transmission. The use of flexible couplings eases motor installation since they will tolerate minor shaft misalignment (up to 1 degree). The spiders are constructed of BUNA-N, a special compound which holds up well under wear and environmental abuse. Two bodies plus one spider are required to make a complete coupling. Choose each body to fit the shaft size of its attached component. All have standard keyway with hollow head screw. Rated up to 10 hp at 3600 RPM. Outside dimensions are approximate.



SPIDER BODY



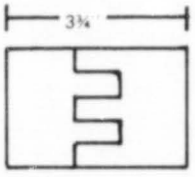
	Description	Shaft Dia.
45-FC075-295	3/4 Coupling Body	3/4"
45-FC087-295	7/8 Coupling Body	7/8"
45-FC100-295	1 Coupling Body	1"
45-FC112-295	1 1/8 Coupling Body	1 1/8"
45-FC125-295	1 1/4 Coupling Body	1 1/4"
45-FC000-295	Buna-N Spider	

VOLKSWAGEN SPECIAL

One body of this 3-piece flexible coupling has been welded to a VW clutch hub. In addition a metal dish has been spot welded to the inside to serve as a stop for the transmission shaft. Sold only as a 3-piece assembly. Specify shaft size desired for motor end.

45-VW100-295 VW 3 Piece Coupling





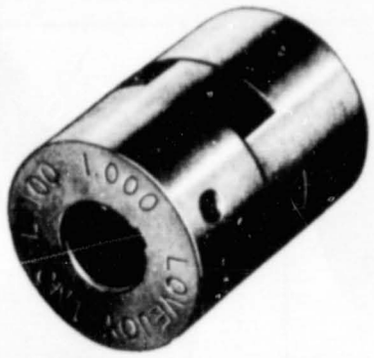
ELECTRIC VEHICLE COMPONENTS
FLIGHT SYSTEMS
HEADQUARTERS
P.O. BOX 25, MECHANICSBURG, PA 17055
PHONE (717) 697-0333

Elastomeric Jaw Type Couplings

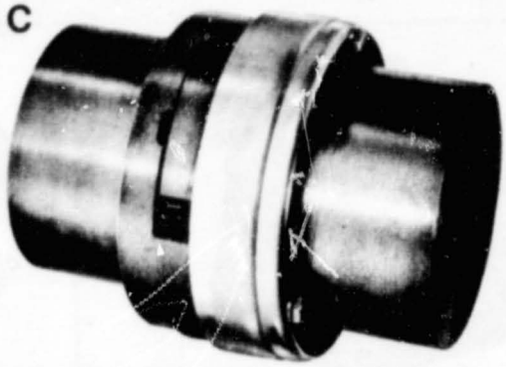
Dimensional Data: Types L, AL, C and H

Mode!	Torque Range (in-lbs)	Misalignment Capability		Standard Materials	
		Maximum Angular Offset	Maximum Parallel Offset		
		Degrees	Inches	Body	Flexible Member
L	Up to 2,080	1°	.015	Sintered Iron & Cast Iron	NBR Rubber
AL	Up to 1,450	1°	.015	Aluminum	NBR Rubber
C	Up to 66,000	1°	.015	Ductile Iron	NBR Rubber
H	Up to 119,700	1°	.015	Ductile Iron	NBR Rubber

Type L



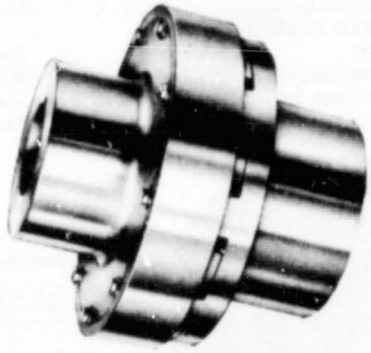
Type C



Type "AL" Aluminum Alloy



Type H



Coupling Number	Rated Torque in-lbs.	HP At 1800 RPM 1.0 S.F.	Maximum Bore	Maximum Diameter	Maximum Overall Length
L-090	126	3.6	7/8	2-7/64	2-1/8
AL-090	126	3.6	7/8	2-1/8	2-11/32
L-095	176	5.0	1-1/8	2-7/64	2-1/2
AL-095	176	5.0	1-1/8	2-1/8	2-1/2
L-099	265	7.6	1-3/16	2-17/32	2-7/8
AL-099	265	7.6	1-3/16	2-17/32	2-13/16
L-100	378	10.8	1-3/8	2-17/32	3-1/2
AL-100	378	10.8	1-3/8	2-17/32	3-1/2
L-110	693	19.8	1-5/8	3-5/16	4-1/4
AL-110	693	19.8	1-5/8	3-5/16	4-1/4
L-150	1,071	30.6	1-7/8	3-3/4	4-1/2
AL-150	1,450	41.4	1-7/8	4-1/4	4-1/2

Coupling Number	Rated Torque in-lbs	HP At 1800 RPM 1.0 S.F.	Maximum Bore	Maximum Diameter	Maximum Overall Length
L-190	1,386	39.6	2-1/8	4-1/2	5-1/4
L-225	2,080	59.4	2-3/8	5	6
C-226	2,898	82.8	2-1/2	5-1/2	7

LOVEJOY, INC., 2655 WISCONSIN AVENUE,

DOWNERS GROVE, ILLINOIS 60515 (312) 852-0500

CENTAflex

Versatile flexible couplings . . .

LOVEJOY, INC., 2655 Wisconsin Ave.
Downers Grove, IL 60515
Tel. 312-852-0500

The Centaflex family of flexible couplings is your "off-the-shelf" solution to power transmission problems. Consisting of a line of standard components that can be assembled into couplings that meet a wide range of applications, Centaflex offers you unmatched versatility. Standard hubs are used with all available flexible elements.

The Centaflex family of couplings consists of seven standard models:
Model 1 — Shaft to customer provided mount
Model 2 — Shaft to shaft/flanged hub
Model 3 — Shaft to flywheel/adaptor plate
Model 4 — Shaft to engine flywheel
Model 5 — Shaft to shaft with taper lock
Model 6 — Floating shaft
Model 7 — Double element



RUBBER ELEMENT
Torsionally soft
Max. angular misalignment 3°
Max. parallel offset .04 in.
Temperature range -40°—105°F



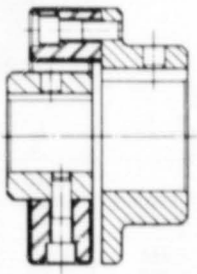
HYTREL ELEMENT
Torsionally stiff
Max. angular misalignment 1°
Max. parallel offset .010 in.
Temperature range -60°—250°F



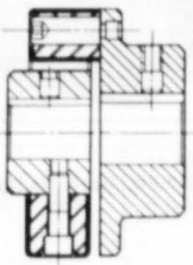
X (ZYTEL) ELEMENT
Torsionally very stiff
Max. angular misalignment 1°
Max. parallel offset .005 in.
Temperature range Up to 300°F



CENTAflex Model 2
Shaft to Shaft / Flanged Hub



Model 2
Standard cylindrical hub, element and mounting screws with standard flanged hub.



Model 2/S
Similar to Model 2, but "S" style axial mounting screws are supplied for blind mounting applications.

TECHNICAL SELECTION DATA: MODELS 1, 2, 3, 1S, 2S, 3S

SIZE	TORQUE, IN.-LBS. ELEMENT			H.P. PER 100 RPM ELEMENT			MAXIMUM RPM ELEMENT			DYNAMIC TORSIONAL STIFFNESS (IN.-LB./RAD)			MAXIMUM BORE (IN.)	
	RUBBER	HYTREL (HY)	ZYTEL (X)	RUBBER	HYTREL	ZYTEL	RUBBER	HYTREL	ZYTEL	RUBBER	HYTREL	ZYTEL	Cylindrical Hub (BC)	Flanged Hub (BF)
1	88	—	—	.14	—	—	10,000	—	—	974	—	—	.63	.88
2	177	—	265	.28	—	.42	8,000	—	10,000	2,036	—	11,000	.88	1.38
4	354	—	530	.56	—	.84	7,000	—	8,000	6,018	—	23,000	1.00	1.75
8	708	900	1,060	1.12	1.43	1.68	6,500	6,500	7,000	10,620	190,100	46,000	1.38	2.00
16	1,415	1,800	2,120	2.25	2.86	3.36	6,000	5,500	6,000	24,780	332,400	92,000	1.63	2.63
25	2,212	—	3,275	3.51	—	5.20	5,000	—	5,000	33,630	—	141,000	2.13	2.75
30	3,540	3,600	4,865	5.62	5.71	7.72	4,000	3,600	4,500	53,100	930,000	200,000	2.44	3.75
50	5,310	7,200	—	8.43	11.42	—	4,000	3,600	—	141,600	2,568,000	—	2.44	3.75
90	7,965	—	11,060	12.64	—	17.55	3,600	—	4,000	132,750	—	478,000	3.13	4.25
140	12,390	14,400	—	19.66	22.85	—	3,600	3,600	—	318,600	5,760,000	—	3.13	4.25
250	22,125	22,500	—	35.11	35.70	—	3,000	3,000	—	575,250	11,520,000	—	4.25	5.00

— Not available at publication date. Consult engineering for your other requirements

CENTAflex

Versatile Flexible Couplings . . .

LOVEJOY, INC., 2655 Wisconsin Ave.
Downers Grove, IL 60515
Tel. 312-852-0500

Model 5 - Taper Lock - Shaft to Shaft

Features:
- Four Way Flexibility
  - Angular
  - Axial
  - Parallel
  - Torsional
- Dampens Vibration
- Requires No Lubrication
- Easy to Install
- Lovejoy Engineering Support Available

CENTAflex Model 5

Taper Lock — Shaft to Shaft

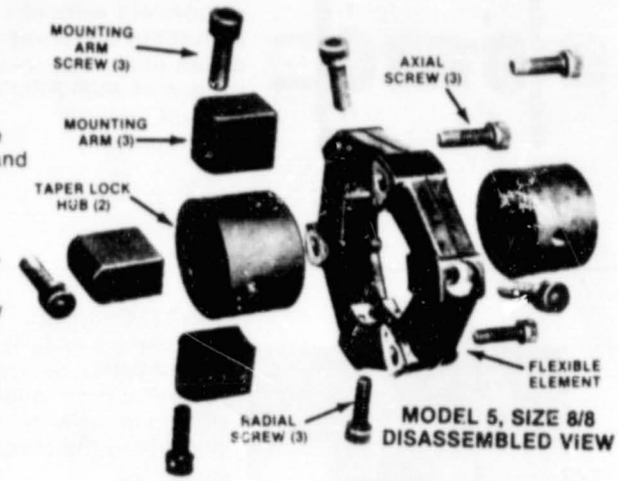
Oversizing your coupling to satisfy a large bore requirement is not economical, nor is a large inventory of separate coupling sizes.

The Centaflex Model 5 provides this economy with its designed versatility. Each standard Centaflex coupling, size 8/8, 16/16, 25/25, etc., can be combined with the hub of the next larger size to make a 8/16, 16/25, etc., to satisfy your larger bore requirements.

The unique feature of the Model 5 is its unmatched versatility in satisfying a broad range of coupling requirements while using only a few sizes of standard components. These are the same components, hubs, elements and mounting hardware featured in our other Centaflex models.

Another economy of the Model 5 is that the standard hubs are bored for taper lock bushings, providing even greater flexibility of bore range. Now there is no need to stock separate finished bore hubs for each of your applications.

All of this is as close as your local Lovejoy distributor.



MODEL 5, SIZE 8/8 DISASSEMBLED VIEW

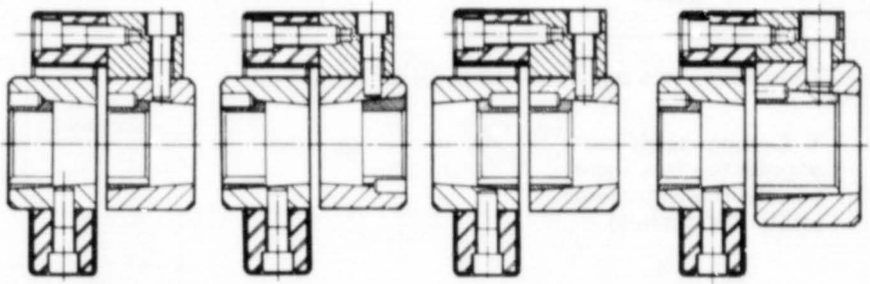
Style AA: Uses two "A" hubs. An "A" hub has the tapped radial mounting holes for the element at the small end of the taper bore. Also available in style AC which is a standard "A" hub and a finished bore to size "C" hub, which is our standard cylindrical hub featured throughout this catalog.

Style AB and Style BA: Uses one standard "A" hub and one standard "B" hub. The "B" hub has the tapped radial mounting holes for the element at the large end of the taper bore. Also available in style BC, which is a standard "B" hub and a finished bore to size "C" hub.

Style A/AA: Uses two standard "A" hubs (explained in style AA above). However the "AA" designation identifies the use of the next larger size hub on the one side of the assembly. The "AA" hub uses a shorter (in height) mounting arm to accommodate the larger diameter hub.

Style AA furnished as standard unless otherwise specified.

STANDARD AVAILABLE TAPER LOCK CONFIGURATIONS

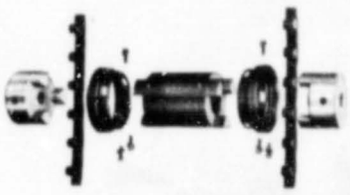

STYLE AA STYLE AB STYLE BA STYLE AC

TECHNICAL SELECTION DATA

SIZE	TORQUE IN.-LBS. ELEMENT		HP PER 100 RPM ELEMENT		MAXIMUM RPM ELEMENT		BORE TAPER LOCK		FINISHED MAX.	TAPER LOCK BUSHING SIZES	
	RUBBER	ZYTEL (X)	RUBBER	ZYTEL (X)	RUBBER	ZYTEL (X)	MIN.	MAX.			
8/8	708	1,060	1.12	1.68	6,500	7,000	.50	1.13	1.38	1108	1108
8/16	708	1,060	1.12	1.68	6,500	7,000	.50	1.25	1.63	1108	1215
16/16	1,416	2,120	2.25	3.36	6,000	6,000	.50	1.25	1.63	1215	1215
16/25	1,416	2,120	2.25	3.36	6,000	6,000	.50	1.63	2.13	1215	1615
25/25	2,212	3,275	3.51	5.20	5,000	5,000	.50	1.63	2.13	1615	1615
25/30	2,212	3,275	3.51	5.20	5,000	5,000	.50	2.00	2.44	1615	2012
30/30	3,540	4,865	5.62	7.72	4,000	4,500	.50	2.00	2.44	2012	2012
30/90	3,540	4,865	5.62	7.72	4,000	4,500	.50	2.50	3.13	2012	1515
90/90	7,965	11,060	12.64	17.55	3,600	4,000	.75	2.50	3.13	2525	2525
50/50	5,310	—	8.43	—	4,000	—	.50	2.00	3.44	2012	2012
50/140	5,310	—	8.43	—	4,000	—	.50	2.50	3.13	2012	2525
140/140	12,390	—	19.66	—	3,600	—	.75	2.50	3.13	2525	2525
140/250	12,390	—	19.66	—	3,600	—	.75	3.00	4.25	2525	3030

Special Application Couplings

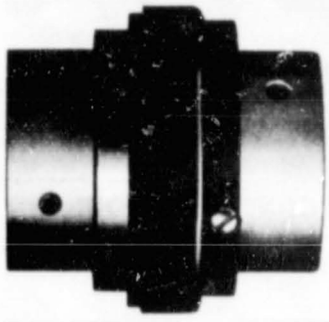
RRS, LC, Uniflex



The RRS was designed for applications requiring quick, easy coupling disconnect without disturbing the driver or driven units. For speeds in excess of 3600 RPM's consult Lovejoy Engineering.

Coupling Number	Torque in-lbs	HP At 1800 1.0 SF	Max. Bore	Max. O.D.	Max. OAL.	* Spacer Length
RRS-095	176	5.0	1-1/8	2-1/2	5-1/2	3-1/2
RRS-100	378	10.8	1-3/8	3-1/8	6-1/4	3-1/2
RRS-110	693	19.8	1-5/8	3-13/16	6-7/8	3-1/2
RRS-150	1071	30.6	1-7/8	4- 7/16	7	3-1/2
RRS-190	1386	39.6	2-1/8	5	7-3/4	3-1/2
RRS-225	2080	59.4	2-3/8	5-5/8	8-1/2	3-1/2

**Spacers are available in other lengths, check Lovejoy Customer Service for availability*

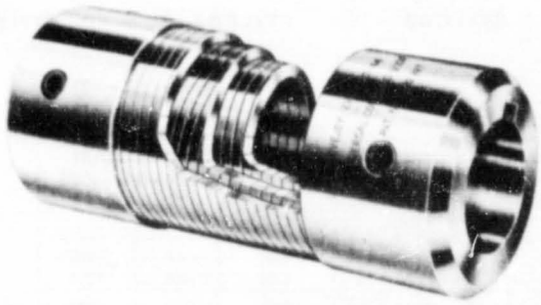


The LC Coupling combines a snapwrap spider with a removeable collar for easy spider replacement without disturbing the coupling hubs.

Coupling Number	Torque in-lbs	HP At 1800 1.0 SF	Max. Bore	Max. O.D.	Max. OAL.
LC-095	176	5.0	1-1/8	2-1/2	2-1/2
LC-099	265	7.6	1-3/16	3-1/8	2-7/8
LC-100	378	10.8	1-3/8	3-1/8	3-1/2
LC-110	693	19.8	1-5/8	3-13/16	4-1/4
LC-150	1071	30.6	1-7/8	4-7/16	4-1/2
LC-190	1386	39.6	2-1/8	5	5-1/2
LC-225	2080	59.4	2-3/8	5-5/8	6

The Uniflex is a one piece all-steel coupling that:

1. Compensates for angular (up to 4°) and parallel misalignment (up to .030 inches)
2. installs quickly and easily
3. Does not require lubrication



Coupling Number	Torque in-lbs	Max. Bore	Max. O.D.	Max. OAL.
U-18	18	.25	.61	1.00
U-25	34	.312	73	1.52
U-37	39	.375	.86	2.06
U-50	82	.500	1.04	2.52
U-62	126	.625	1.41	2.74
U-75	175	.750	1.41	3.29
U-87	346	.875	1.73	3.49
U-100	565	1.000	2.10	4.11
U-125	755	1.250	2.16	4.85
U-137	1260	1.375	2.54	5.23
U-150	1890	1.500	2	5.27

The Uniflex comes in 4 basic mounting configurations:

U = shaft to shaft
UFH = single flange to shaft
UF = double flange
RRU = radially removeable

LOVEJOY, INC., 2655 Wisconsin Ave.
Downers Grove, IL 60515
Tel. 312-852-0500

PENNWALT CORPORATION
EQUIPMENT • CHEMICALS • HEALTH PRODUCTS

S.S.WHITE INDUSTRIAL PRODUCTS
151 OLD NEW BRUNSWICK ROAD, PISCATAWAY, NEW JERSEY 08854 U.S.A.
(201) 752-8300

FLEXIBLE COUPLINGS

FLEXIBLE COUPLINGS ARE NOT COMPLICATED OR EXPENSIVE. SMALL OR LARGE MISALIGNMENT BETWEEN TWO SHAFTS CAN NOW BE ACCOMODATED BY SHORT SEGMENTS OF ROTARY MOTION FLEXIBLE SHAFTS EQUIPPED WITH SUITABLE END FITTINGS. FLEXIBLE COUPLINGS ARE MANUFACTURED IN A LARGE VARIETY OF SIZES, RANGING IN DIAMETER FROM 0.130 in. to 0.750 in. (3.3 to 19 mm); AND ARE AVAILABLE IN LENGTHS FROM 3 in. to 12 in. (7.5 to 30 cm).

THE ADVANTAGE OF FLEXIBLE COUPLINGS, BASED ON ROTARY MOTION FLEXIBLE SHAFTS IS THAT THEY NOT ONLY ALLOW FOR ANGULAR OR LATERAL MISALIGNMENT, BUT THEY ALSO ELIMINATE MUCH OF THE VIBRATION WHICH MAY BE GENERATED BY THE DRIVING COMPONENT. THE RESULT IS THAT THE DRIVEN APPARATUS OPERATES MUCH MORE QUIETLY AND WITH LESS STRAIN. IN ADDITION, THE FLEXIBLE COUPLINGS ABSORB MUCH OF THE SHOCK LOAD OF SUDDEN STARTS OR STOPS, WHICH IS ANOTHER REASON THEY ARE OFTEN INCLUDED IN ADVANCED ENGINEERING DESIGNS.

DEPENDING ON THEIR CONSTRUCTION, FLEXIBLE COUPLINGS FOR FRACTIONAL-HORSEPOWER TRANSMISSION ARE NOW AVAILABLE TO HANDLE TORSIONAL LOADS UP TO 1,000 lb. in. THEY CAN BE ORDERED WITH A VARIETY OF ENDS, OR CUSTOM DESIGNED TO MEET THE NEEDS OF THE CUSTOMER. ALSO, SPECIAL FLEXIBLE SHAFT COUPLINGS ARE USED TO DRIVE COOLING FANS, AND AS PRIMARY STEERING SHAFTS.

continued...

FOR FURTHER INFORMATION OR TECHNICAL ASSISTANCE, PLEASE CALL OR WRITE TO:

S. S. WHITE INDUSTRIAL PRODUCTS
DIVISION OF PENNWALT CORPORATION
151 OLD NEW BRUNSWICK ROAD
PISCATAWAY, NEW JERSEY 08854
PHONE 201-752 8300



S.S.WHITE INDUSTRIAL PRODUCTS
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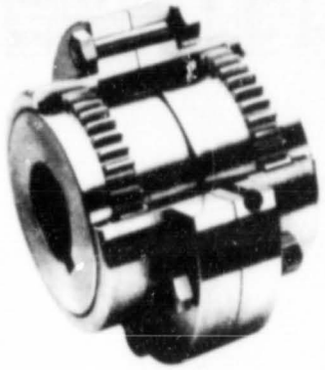
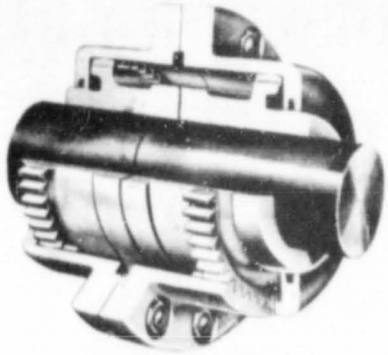
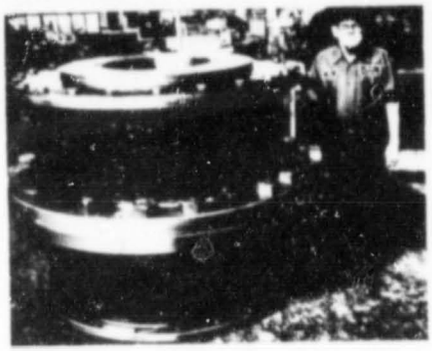
POOLE
FLEXIBLE COUPLINGS



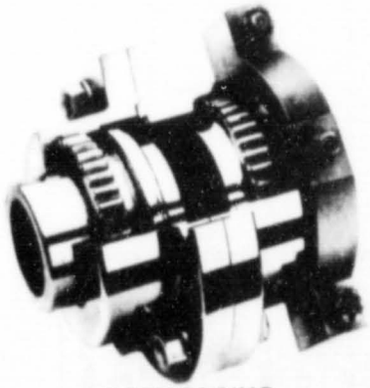
MAXIMUM BORE



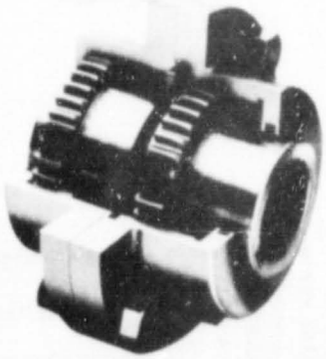
100 SERIES



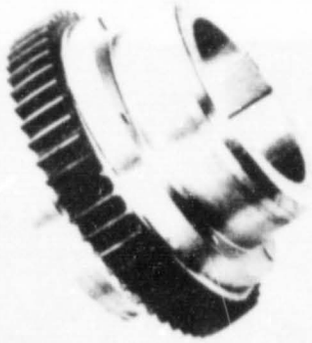
CAST STEEL



DISENGAGING



SLIDE



HIGH MISALIGNMENT

SINCE 1843

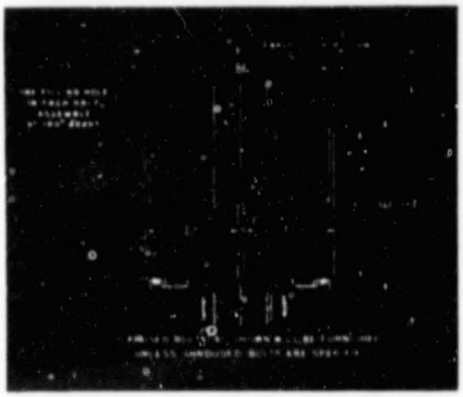
POOLE COMPANY

1700 Union Avenue, Baltimore, Maryland 21211

Phone: 301/235-0800

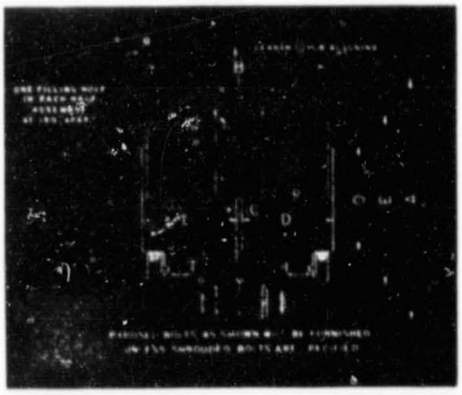
Maximum Bore Type - Double Engagement

Use Service Factors



COUPLING NO.	MAXIMUM BORE SQUARE KEY	MAXIMUM BORE REDUCED KEY	H.P. CAPACITY PER 100 R.P.M.	MAXIMUM SPEED IN R.P.M.	DIMENSIONS IN INCHES							LUBE CAPACITY IN PINTS	NET WEIGHT IN POUNDS	SHIPPING WEIGHT IN POUNDS	COUPLING NO.
					A	B	C	D	E	F	O				
1x1.8	1	1 1/4	13	12500	4 9/16	2 7/8	1/8	1 1/16	3 1/4	3	2	1/4	9	12	1x1.8
1 1/2 x2.4	2 1/4	2 7/16	31	11700	6	3 3/4	1/8	1 15/16	3 15/16	4	3	1/4	20	24	1 1/2 x2.4
2x3	2 15/16	3	62	9300	7	4 5/4	1/8	2 7/16	4 15/16	6	4 1/8	1/4	32	37	2x3
2 1/2 x3.8	3 1/2	3 15/16	101	7820	8 3/8	5 7/8	3/16	3 1/32	5 7/8	7 3/8	4 15/16	1/2	53	61	2 1/2 x3.8

100 Series - Double Engagement



* EXPOSED BOLTS ONLY

EXPOSED BOLTS, AS SHOWN, WILL BE FURNISHED UNLESS SHROUDED BOLTS ARE SPECIFIED

COUPLING NO.	MAXIMUM BORE SQUARE KEY	MAXIMUM BORE REDUCED KEY	H.P. CAPACITY PER 100 R.P.M.	MAXIMUM SPEED IN R.P.M.	DIMENSIONS IN INCHES							LUBE CAPACITY IN PINTS	NET WEIGHT IN POUNDS	SHIPPING WEIGHT IN POUNDS	COUPLING NO
					A	B	C	D	E	F	O				
150	1 1/2	1 15/16	158	11700	6	3 3/4	1/8	1 15/16	3 3/4	4 1/8	2 1/8	1/4	13	17	150
200	2	2 1/16	37.4	9300	7	4 1/4	1/8	2 7/16	4 1/8	6	2 1/4	1/4	23	28	200
250	2 1/2	2 7/16	71	7820	8 1/8	5 7/8	3/16	3 1/32	5 1/8	7 1/8	3 1/8	1/2	42	50	250
300	3	3 1/16	117	6800	9 7/16	7	3/16	3 19/32	6 1/8	8 1/4	4 1/8	1/2	65	77	300

POOLE CO.

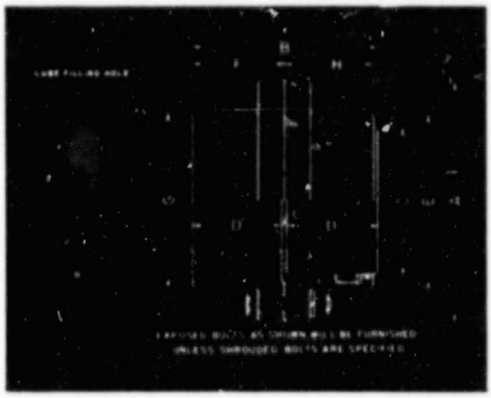
1700 UNION AVENUE

BALTIMORE, MARYLAND 21211

301-235-0800

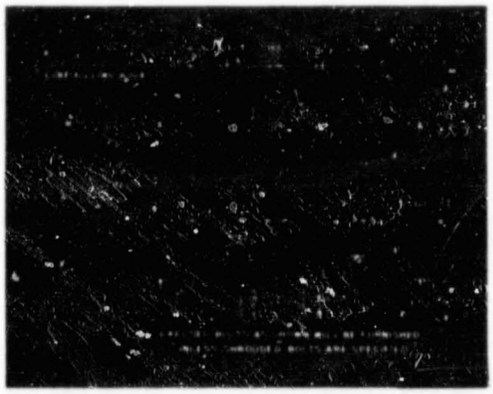
Single Engagement – Maximum Bore Type

Use Service Factors



COUPLING NO.	MAX. BORE FLEX. SQUARE KEY	MAX. BORE FLEX. REDUCED KEY	MAX. BORE RIGID SQUARE KEY	H.P. CAPACITY PER 100 R.P.M.	MAXIMUM SPEED IN R.P.M.	DIMENSIONS IN INCHES										LUBE CAPACITY IN PINTS	NET WEIGHT IN POUNDS	SHIPPING WEIGHT IN POUNDS	COUPLING NO.
						A	B	C	D	D'	E	F	G	H	O				
1x1.8	1	1	2 1/4	13	12500	4	3 5/16		1 1/16	1 13/32	3 1/4	1 7/16	3	1 7/16	2	1/2	10	13	1x1.8
1 1/2x2.4	2	2 1/8	2 1/2	31	11700	6	3		1	1 7/16	3	1	3	1 7/16	3	1	23	27	1 1/2x2.4
2x3	2 1/2	3	3 1/4	62	9300	7	4		2 1/16	2 1/16	4	2	4	2	4	1	40	45	2x3
2 1/2x3.8	3 1/4	3 5/8	4 1/4	101	7820	8	6		3	2 5/8	5	3	5	2 1/2	4	1	66	74	2 1/2x3.8

Single Engagement – 100 Series



* EXPOSED BOLTS ONLY
EXPOSED BOLTS, AS SHOWN, WILL BE FURNISHED UNLESS SHROUDED BOLTS ARE SPECIFIED

COUPLING NO	MAX. BORE FLEX. SQUARE KEY	MAX. BORE FLEX. REDUCED KEY	MAX. BORE RIGID SQUARE KEY	H.P. CAPACITY PER 100 R.P.M.	MAXIMUM SPEED IN R.P.M.	DIMENSIONS IN INCHES										LUBE CAPACITY IN PINTS	NET WEIGHT IN POUNDS	SHIPPING WEIGHT IN POUNDS	COUPLING NO.
						A	B	C	D	D'	E	F	G	H	O				
150	1 1/2	1	2 1/4	15.8	11700	6	3 5/16		1 1/16	1 7/16	3 1/4	1 5/16	3 1/4	1 7/16	2	1/2	16	20	150
200	2	2 1/8	3 1/2	37.4	9300	7	4		2 1/16	2 1/16	4	2	4	2	2	1	26	31	200
250	2 1/2	2 1/4	4 1/4	71	7820	8	6		3	2 5/8	5	3	5	2 1/2	3	1	47	55	250
300	3	3 1/4	4 1/4	117	6800	9	7 1/4		3	3	6	3	6	3 1/2	4	1	71	83	300

POOLE CO.

1700 UNION AVENUE
BALTIMORE, MARYLAND 21211
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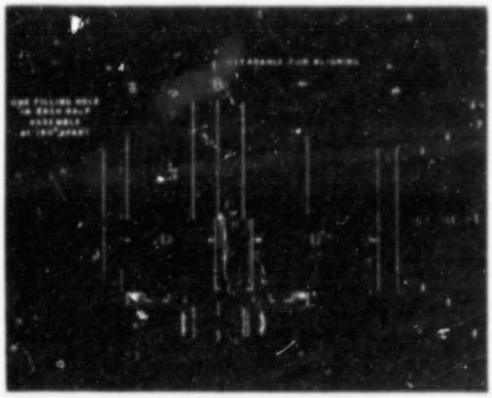
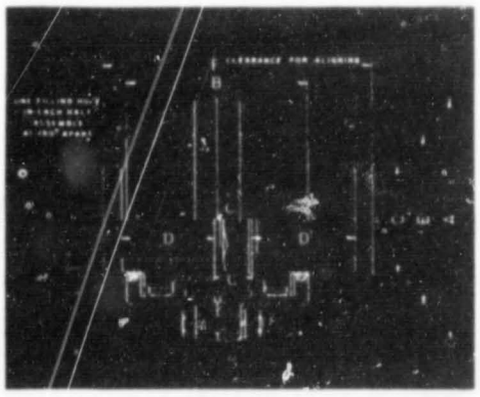
Mill Motor – Maximum Bore Type

Use Service Factors



COUPLING NO	MAXIMUM BORE SQUARE KEY	MAXIMUM BORE REDUCED KEY	H.P. CAPACITY PER 100 R.P.M.	MAXIMUM SPEED IN R.P.M.	DIMENSIONS IN INCHES									LUBE CAPACITY IN PINTS	NET WEIGHT IN POUNDS	SHIPPING WEIGHT IN POUNDS	COUPLING NO
					A	B	C	D	E	O	F	C'	D'				
1½ X 24	2 1/4	2 7/8	31	11700	6	3 3/16	1/8	1 15/16	3 5/16	3 5/16	TO SUIT REQUIREMENTS			1/4	22	26	1½ X 24
2 X 3	2 15/16	3	62	9300	7	4 3/16	1/8	2 7/16	4 5/16	4 1/8				1/4	37	42	2 X 3
2½ X 38	3 1/4	3 5/16	101	7820	8 5/16	5 7/16	1/16	3 1/2	5 7/16	4 5/16				1/4	61	69	2½ X 38

Mill Motor Type – 100 Series



COUPLING NO.	MAXIMUM BORE SQUARE KEY	MAXIMUM BORE REDUCED KEY	H.P. CAPACITY PER 100 R.P.M.	MAXIMUM SPEED IN R.P.M.	DIMENSIONS IN INCHES									LUBE CAPACITY IN PINTS	NET WEIGHT IN POUNDS	SHIPPING WEIGHT IN POUNDS	COUPLING NO.
					A	B	C	D	E	O	F	C'	D'				
150	1 1/4	1 7/16	15.8	11700	6	3 3/16	1/4	1 15/16	3 5/16	2 1/4	TO SUIT REQUIREMENTS			1/4	15	20	150
200	2	2 1/16	37.4	9300	7	4 3/16	1/4	2 7/16	4 5/16	2 1/4				1/4	28	35	200
250	2 1/4	2 5/16	71	7820	8 5/16	5 7/16	1/4	3 1/2	5 7/16	3 1/16				1/4	50	60	250
300	3	3 1/4	117	6800	9 5/16	7	1/4	3 15/16	6 5/16	4 1/4				1/4	75	90	300

POOLE CO.

1700 UNION AVENUE
BALTIMORE, MARYLAND 21211

301-235-0800

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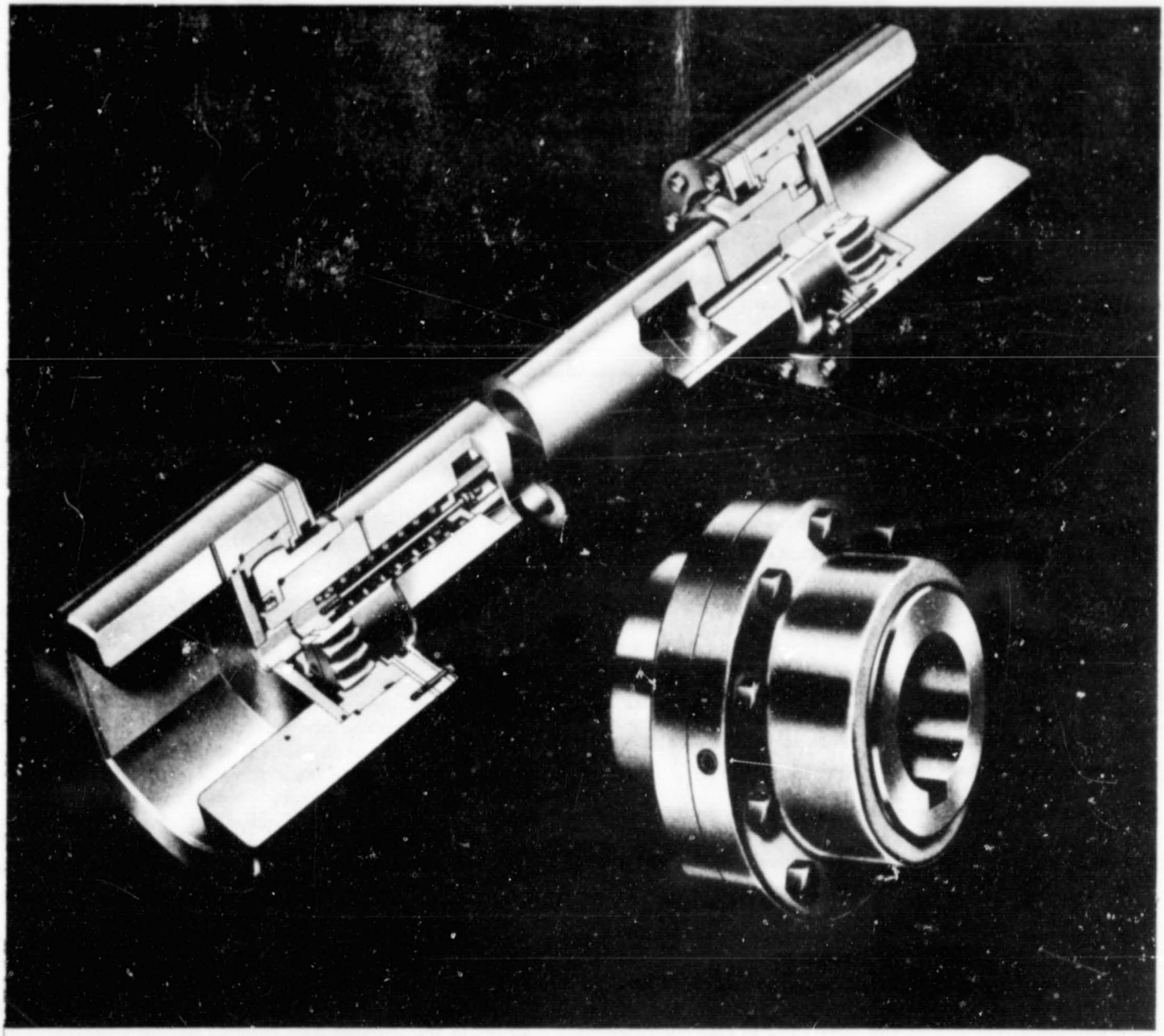
Flexible Couplings

For Power Transmission

RENOLD INC.
P.O. BOX A · WESTFIELD · NEW YORK 14787
Telephone 716-326-3121



RENOLD INC. P.O. BOX A, WESTFIELD, NEW YORK 14787

AJAX

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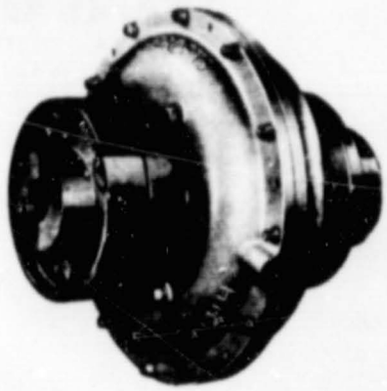
HYDRAULIC COUPLINGS and PULLEY DRIVES

RENOLD INC.
P O BOX A · WESTFIELD · NEW YORK 14787
Telephone 716-326-3121

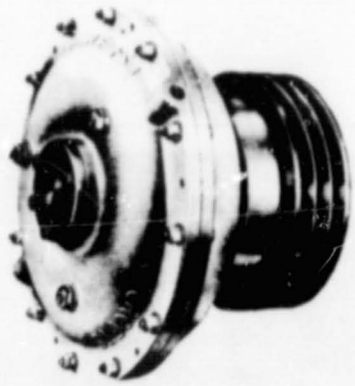
TYPE FSC



HYDRAULIC COUPLINGS

The FSC type is used between the Prime Mover and driven machine for the direct coupling of two shafts in line.

TYPE FSP



HYDRAULIC PULLEY DRIVES

The Pulley type FSP is a variation of the direct coupled FSC type and embodies a sheave keyed to the hub of the coupling.

SPECIFICATIONS

The body of the Freespace Hydraulic Coupling consists of three main parts which are die castings of aluminum alloy, accurately machined and balanced. The outer and inner rotors have radial blades integrally cast and finishing short of the radial inner part of the working circuit to form a FREESPACE.

The inner rotor or runner is securely bolted and dowelled to a steel inner sleeve which is taper bored and keywayed to receive a Flanged Taper Bush.

This Flanged Bush is keywayed and securely located in the sleeve by captive high tensile adjusting screws.

The aluminum alloy outer body casting is bolted and dowelled to the outer rotor or impeller, 'O' rings being fitted to ensure an oiltight joint; a reservoir is thus formed between the outer casing and the back of the inner runner.

The outer body and impeller are mounted on the inner steel sleeve on ball and roller bearings and the complete unit forms a compact, and well balanced assembly.

All bearing housings and end covers are of cast iron. Oil retaining seals are fitted where necessary.

DIMENSIONS

The right is reserved to make modifications as shown to meet manufacturing conditions and developments in design.

OPERATING PRINCIPLE

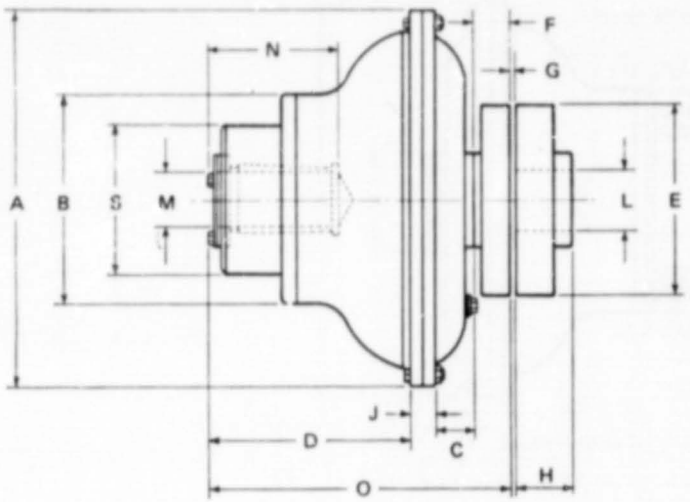
Operation depends upon the transfer of hydrokinetic energy between the radially-vaned impeller and runner, using a calculated quantity of oil. The actual quantity determining the rate of acceleration. See table of oil quantities.

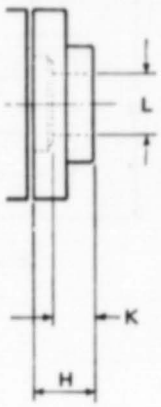
As the prime mover begins to rotate the impeller, oil is carried around by the impeller vanes and moves radially outwards under centrifugal force, crossing the gap between impeller and runner to impinge on the vanes of the runner. Since the coupling is virtually unloaded at starting, the prime mover rapidly increases speed, with torque building up as the square of the speed. When the input torque is sufficient to overcome the starting load of the driven machine, the runner commences to rotate and there is smooth, swift acceleration to full load speed. Full speed for the driven machine is approximately 95% of prime mover full speed. The slip (5% at normal full load speed) is always present and is essential to the operation of the coupling. Since input torque and output torque are always equal, this slight drop in speed represents the efficiency loss in the coupling.

It is due to this condition of slip that the oil circulates outwards in the impeller and inwards between the vanes of the runner, describing a path similar to a coil spring bent in a circle. Energy is thus transferred from the impeller to the runner by means of the annular vortex of oil. In effect the impeller becomes a centrifugal pump and the runner a reaction turbine.

RENOLD INC.

P.O. BOX A · WESTFIELD · NEW YORK 14787
Telephone 716-326-3121





FREESPACE COUPLING TYPE FSC
Fitted with Ajax Pin and Bush Coupling

Sizes 12-14 are fitted with a special centralizing device.

All Dimensions in Inches													*Oil Quantity	Approx. Weight Lbs.	Ajax Pin & Bush Flexible Coupling				
Size	A	B	C	D	E	F	G	J	M	N	O	S			H	L	Diam. Hub	Size	No. Pins
FS1C	8 3/16	4 5/8	3/4	4 11/16	4 5/16	1 1/8	1/16	11/16	7/8	2 3/4	7 1/4	3 1/2	U. S. pints 2 1/2	17	1 1/4	1 1/4	2 1/16	412	4
FS2C	9	5	7/8	5 1/2	5 3/16	1 5/8	3/32	11/16	1 1/8	2 7/8	8 11/16	3 3/4	3	23	1 3/4	1 3/4	2 3/4	417	4
FS3C	10 1/4	5 1/2	1 5/16	6	5 3/16	1 5/8	3/32	7/8	1 3/8	3 5/16	9 7/16	4	4 1/4	26	1 3/4	1 3/4	2 3/4	417	4
FS4C	11 1/4	6	1	6 3/4	6 1/2	1 7/8	1/8	15/16	1 1/2	3 15/16	10 9/16	4 1/8	5 3/4	36	2 1/4	2 1/4	3 1/2	422	4
FS5C	12 5/8	7 1/8	1 1/8	7 3/8	6 1/2	1 7/8	1/8	15/16	1 3/4	4 3/8	11 5/8	4 1/2	6 1/2	53	2 1/4	2 1/4	3 1/2	422	4
FS6C	13 3/8	8	1 1/2	7 3/4	6 1/2	1 7/8	1/8	15/16	1 7/8	5	12 1/16	5 1/8	U. S. gals. 1 1/4	72	2 1/4	2 1/4	3 1/2	422	4
FS7C	14 7/8	8 7/8	1 5/16	8 1/4	7 3/4	2	1/8	1 3/16	2 1/8	5 5/8	13	5 3/4	1 5/8	94	2 3/4	2 3/4	4 1/4	427	4
FS8C	16 5/8	10 5/16	2	8	9 1/8	2 1/2	1/8	1 3/16	2 1/2	5 3/8	13 11/16	7 1/8	2 1/2	110	3 1/8	2 3/4	4 7/8	2 3/8 A	8
FS9C	18 1/2	10 5/16	2 1/16	8 3/8	10 1/2	2 3/4	1/8	1 7/16	2 1/2	5 3/8	14 5/8	7 1/8	3 1/4	147	3 5/8	3 1/8	5 11/16	2 3/4 A	8
FS10C	20 1/8	10 7/8	2 1/4	8 1/2	10 1/2	2 3/4	1/8	1 7/8	3	6	15 3/8	—	4 3/8	173	3 5/8	3 1/8	5 11/16	2 3/4 A	8
FS11C	22 7/8	12 5/8	2 1/4	10 5/8	11 1/4	2 3/4	1/8	1 7/8	3 1/2	7 1/4	17 1/2	—	6 5/8	270	4	3 5/8	6 3/8	3 1/8 A	10
FS12C	26 3/8	14 3/8	2 3/4	12 1/4	13 1/4	3 1/4	1/8	2	4	8 1/8	20 1/4	—	10 1/4	417	4 3/4	4 1/2	8 5/16	4A	10
FS13C	29 5/8	14 3/8	3 5/8	13 1/8	13 1/4	3 1/4	1/8	2	4	8 5/8	22	—	15	469	4 3/4	4 1/2	8 3/16	4A	10
FS14C	33 1/4	15 7/8	4 1/16	16 1/2	16 1/4	3 1/4	1/8	2 11/16	4 1/2	9 7/8	26 1/2	—	24	660	5 5/8	6	11	5A	12

*Oil quantity is approximate (max. filling). Use heavy duty grade SAE-10W.
Weight does not include bored coupling half, or oil.

HORSE POWER TABLE FOR TYPES FSC and FSP
MAXIMUM RATINGS AT NOMINAL 5% SLIP

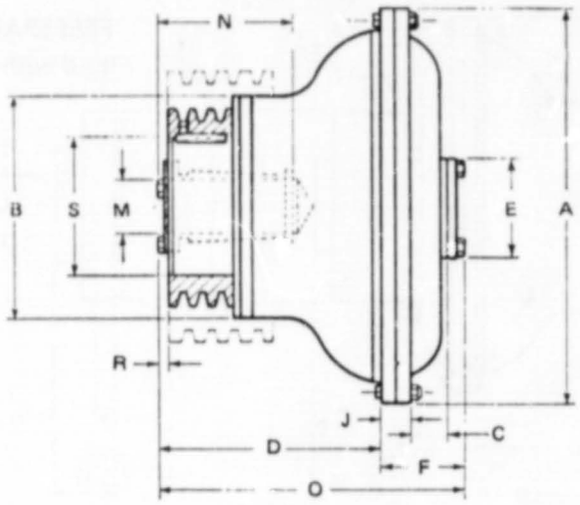
SELECTION TABLES OF HYDRAULIC COUPLINGS	Coupling Size		1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Motor Speeds RPM	475	—	—	—	·23	·4	·63	1·1	2	3·6	5·5	10·3	20·8	37·8	66
		580	·	—	·18	·42	·74	1·2	2	3·8	6·6	11	19	38	69	120
		700	··	·16	·32	·66	1·26	1·9	3·3	6·3	10·5	16	32	63	115	192
		725	·09	·18	·37	·74	1·42	2·3	3·8	7·2	12·5	20	36	73	130	206
		875	·16	·32	·63	1·3	2·5	3·9	6·6	12	21	34	61	120	206	290
		970	·21	·45	·87	1·8	3·4	5·6	9	17·5	30	48	84	166	225	350
		1170	·37	·77	1·51	3·2	6	9·2	16	30	52	80	135	196	330	—
		1450	·73	1·52	2·94	6·3	11·6	18	32	58	89	133	220	420	—	—
		1750	1·26	2·62	5	11	20	32	42	74	125	180	—	—	—	—

check full details of application with Head Office.

RENOLD INC.

P.O. BOX A · WESTFIELD · NEW YORK 14787
Telephone 716-326-3121

FREESPACE
PULLEY TYPE FSP



Size	A	B	C	D	E	F	J	M	N	O	R	S	*Oil Quantity	Approx. Weight
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	U.S. pints	lb.
FS1P	8 1/16	4 5/8	3/4	4 11/16	2	1 7/8	1 1/16	7/8	2 3/4	6 9/16	7/16	3 1/2	2 1/2	15
FS2P	9	5	7/8	5 1/2	2 3/8	2 1/8	1 1/16	1 1/8	2 7/8	7 5/8	7/16	3 3/4	3	21
FS3P	10 1/4	5 1/2	1 5/16	6	2 1/2	2 3/8	7/8	1 3/8	3 5/16	8 3/8	5/8	4	4 1/4	24
FS4P	11 1/4	6	1	6 3/4	3 1/16	2 1/2	1 5/16	1 1/2	3 15/16	9 1/4	11/16	4 1/8	5 3/4	33
FS5P	12 5/8	7 1/8	1 1/8	7 3/8	3 1/8	2 5/8	1 5/16	1 3/4	4 3/8	10	1/2	4 1/2	6 1/2	48
													U.S. gals.	
FS6P	13 5/8	8	1 1/2	7 3/4	3 1/8	3	1 5/16	1 7/8	5	10 3/4	9/16	5 1/8	1 1/4	67
FS7P	14 7/8	8 7/8	1 5/16	8 1/4	3 5/8	3 1/16	1 3/16	2 1/8	5 5/8	11 11/16	7/16	5 3/4	1 5/8	87
FS8P	16 1/8	10 5/16	2	9 7/8	4 1/16	3 7/8	1 3/16	2 1/2	7	13 3/4	9/16	7 1/8	2 1/2	103
FS9P	18 1/2	10 5/16	2 1/16	10 5/16	4 3/4	4 3/8	1 7/16	2 1/2	7	14 11/16	9/16	7 1/8	3 1/4	137

*Oil quantity is approximate (max. filling). Weights exclude sheave and oil.

The FSP Pulley Type is designed for the minimum overhang on the prime mover shaft extension. The Flanged Taper Bush and captive jackscrews permit the unit to be mounted right up to the bearing end cap and readily clamped securely in position by the use of a standard wrench and just as easily removed when required.

A further size FS10P can be supplied if required and details are available on request.

Types FSC and FSP

HP		1/4	1/2	3/4	1	1 1/2	2	3	5	7 1/2	10	12 1/2	15	20	25	30	40	50	60	75	100	150	200	250	300
50 and 60	475	5	6	7	7	8	8	9	10	11	11	12	12	12	13	13	13	14	14	—	—	—	—	—	—
CYCLES	580	4	5	5	6	7	7	8	9	10	10	11	11	11	12	12	12	13	13	14	14	—	—	—	—
MOTOR	700	3	4	5	5	6	6	7	8	9	9	10	10	11	11	11	12	12	12	13	13	14	14	—	—
SPEEDS	725	3	4	4	5	5	6	7	8	8	9	9	10	10	11	11	12	12	12	12	13	14	14	—	—
RPM	875	2	3	4	4	4	5	6	7	8	8	8	9	9	10	10	11	11	11	12	12	13	13	14	—
	970	2	3	3	4	4	5	5	6	7	8	8	8	9	9	9	10	10	11	11	12	12	13	14	14
	1170	1	2	2	3	3	4	4	5	6	7	7	7	8	8	8	9	9	10	10	11	12	12	13	13
	1450	1	1	1	2	2	3	3	4	5	5	6	6	7	7	7	8	8	8	9	10	11	11	—	—
	1750	1	1	1	1	2	2	3	3	4	4	5	5	5	6	6	7	8	8	8	9	—	—	—	—
	2950	1	1	1	1	1	1	1	2	3	3	4	4	4	4	5	5	5	—	—	—	—	—	—	—
	3500	1	1	1	1	1	1	1	2	3	3	3	4	4	4	4	—	—	—	—	—	—	—	—	—

CONTACTORS AC & DC

24-300V, 10-800 AMP

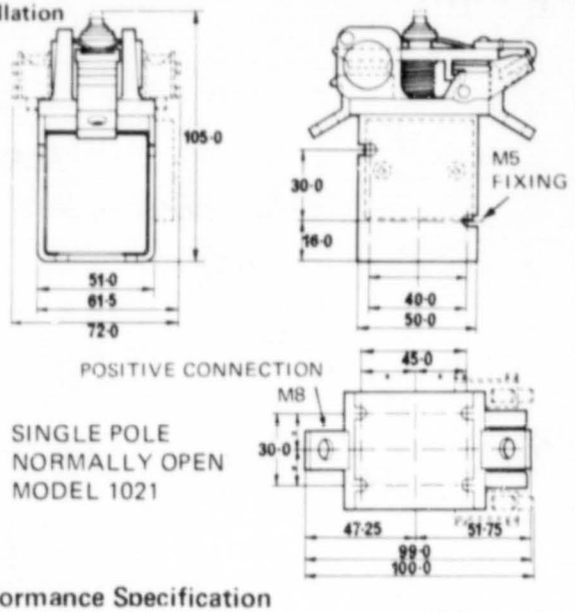
(CODE **CT**)

1000 Series Contactor

The contactor is of the solenoid type and is available as a single pole normally open up to 80 volts and as a double pole change over at 24 volts. Both models conveniently separate for spares into the magnetic and load carrying circuits.

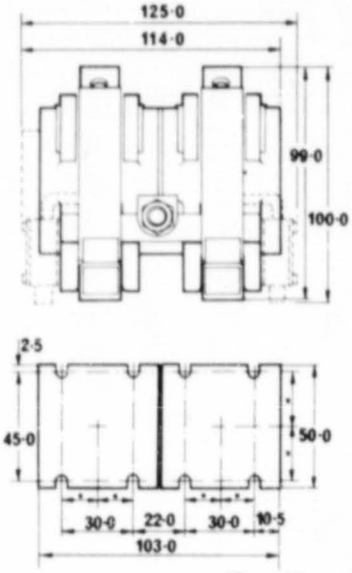
* There are no adjustable parts which means there can be no maladjustment and servicing time is reduced.
* Good utilization of space is possible due to the compact size and the ease of linking contactors together.
* A high quality silver cadmium contact, together with skilful mechanical design give a low erosion rate and long mechanical life.
* The coil is encapsulated to provide protection and is continuously rated.
* Mounting of the 1021 may be on any plane.
  Mounting of the 1023 unit should be on its base with the plunger 90° to the vertical and with the normally open contacts uppermost.
* When fitted with magnetic blowouts the load must be connected in the correct polarity, the positive connection to the fixed contact (marked on the moulding)

Installation



SINGLE POLE
NORMALLY OPEN
MODEL 1021

DIMENSIONS IN
MILLIMETRES



DOUBLE POLE
CHANGE OVER
MODEL 1023

Performance Specification

			Test Conditions
Model	1021–X–2–X	1023–X–2–X	
Voltage range	12 – 80	12 – 24	
Continuous rating	200 amps	200 amps	40°C
Rupturing capability	1000	1000	80V L/R = 15 m secs.
Mechanical Life	1.5 x 10^6	1.5 x 10^6	No load
Temperature	–40° to + 40°	– 40° to + 40°	
Humidity	95 % RH	95 % RH	
Voltage drop across contactor	80m V Max.	80m V max.	Passing 200 amps
Coil dissipation	26 Watts	26 Watts	Rated voltage with cold coil.
Pull in Level	65 % of nominal volts max.		Coil hot.
Drop out Level	5% of nominal volts		20°C.

Order Writing Information

	Please Specify:
Single pole normally open	Model 1021
Double pole change over	Model 1023

Standard Options

AUXILLARY SWITCH (1 amp resistive up to 80 volts)	
Not required	1
Left Hand	2
Right Hand	3
Both	4
MAGNETIC ARC BLOWOUT	
Not required	1
Required	2

Cableform Inc.
ZION CROSS ROADS
TROY, Va 22974
Tel: (804) 589–8224

1200 Series Contactor

The contactor is of the clapper type and is available as a single pole single throw, single pole double throw and double pole double throw. Suitable for systems up to 220 volts as standard.

Features

* Simple sub assembly replacement with the minimum number of adjustments reduces service time.
* Complete contactor systems may be supplied assembled to one insulated panel with inter connecting power and control circuits.
* High quality silver cadmium contacts with a robust long life mechanical design gives the capability for:

  Extreme high make and break currents at high voltage with subsequent low erosion.

  The coil is encapsulated to provide protection and is continuously rated.

Mounting

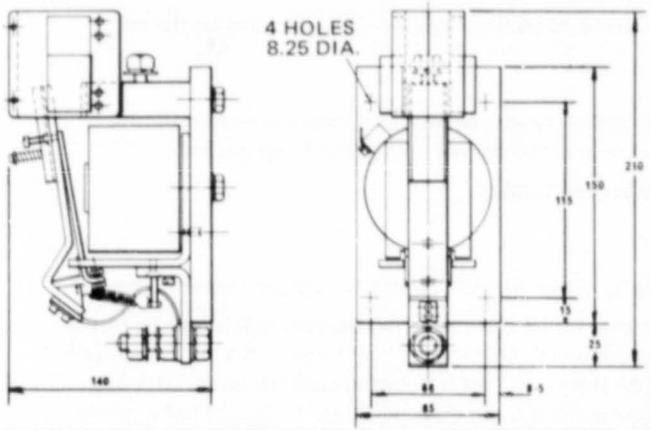
Preferably in the vertical plane for the double throw contactors.

Connection

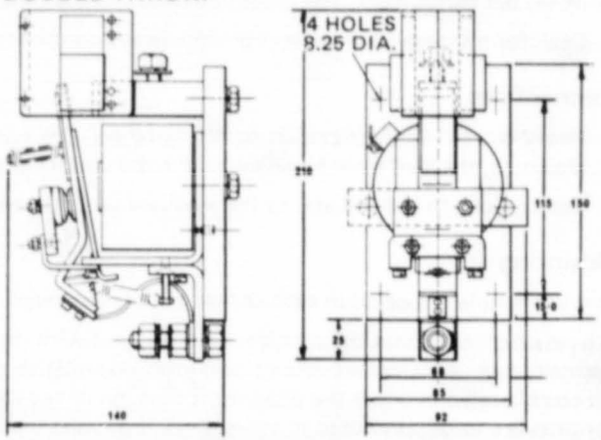
When fitted with magnetic blowout on the normally open contacts the fixed tip will be positive as standard. (Denoted by a black moulding securing the permanent magnet).
If reversed polarity is required, fixed tip negative. This will be denoted by a grey moulding securing the permanent magnet.

Installation

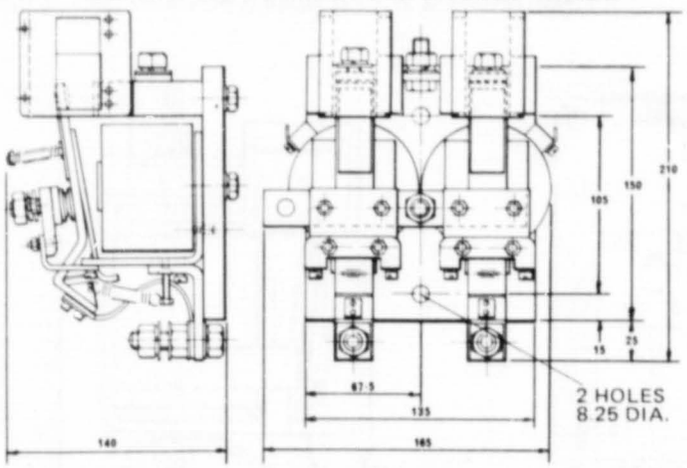
MODEL 1211. SINGLE POLE SINGLE THROW



MODEL 1241 & (1231 dotted) SINGLE POLE DOUBLE THROW.



MODEL 1222 DOUBLE POLE DOUBLE THROW



DIMENSIONS IN MILLIMETRES

Performance Specification

Voltage range	12 to 220 volts
Continuous rating	300 amps
Rupturing capability	2000 amps (242v)
Mechanical life	2 x 10^6 min.
Coil dissipation	45 watts
Pull in level	65% of nominal volts
Drop out level	5% of nominal volts
Humidity	95% RH
Volt drop across the contactor	135 milli volts

Test Conditions

40°C ambient
L/R = 15 m secs.
No load
Coil cold
Coil hot
20°C

Passing 300 amps

Cableform Inc.

ZION CROSS ROADS
TROY, Va 22974
Tel: (804) 589-8224

1300 Series Contactor

Features

- Silver/cadmium oxide tips are highly resistant to wear and provide inherent protection against contact welding.
- Negligible contact bounce and positive wiping action of the contact permit a high current-making capability for a contactor of its size.
- The complete normally-open contactor uses only four fasteners (five on the changeover type) — all of them self-locking — which greatly facilitates assembly and maintenance. The contactor is attached to an insulating base which permits mounting directly onto the vehicle chassis.
- The contactor may be removed from the base panel by slackening a single fastener.
- Absence of adjustable components eliminates any chance maladjustment by the user.
- Blow-out magnets housed in arc-resistant mouldings are supplied as standard and permit high current rupturing capability.
- The coil is sealed to give protection against moisture and shock. The coil may be rotated through 180° to locate the faston connectors in the most convenient position for the user.
- The location of the heavy-current terminals permits exceptionally close packaging to be achieved without restricting access to individual contactors.

Options

- Choice of diode networks for suppression of the coil circuit.
- A microswitch for controlling auxiliary circuits may be fitted to either side of the contactor, and lies within the outline of the contactor itself. The microswitch will handle one amp (resistive).
- Cableform's range of modules for time delays on the make or break operation, may be used with this contactor.

Connections

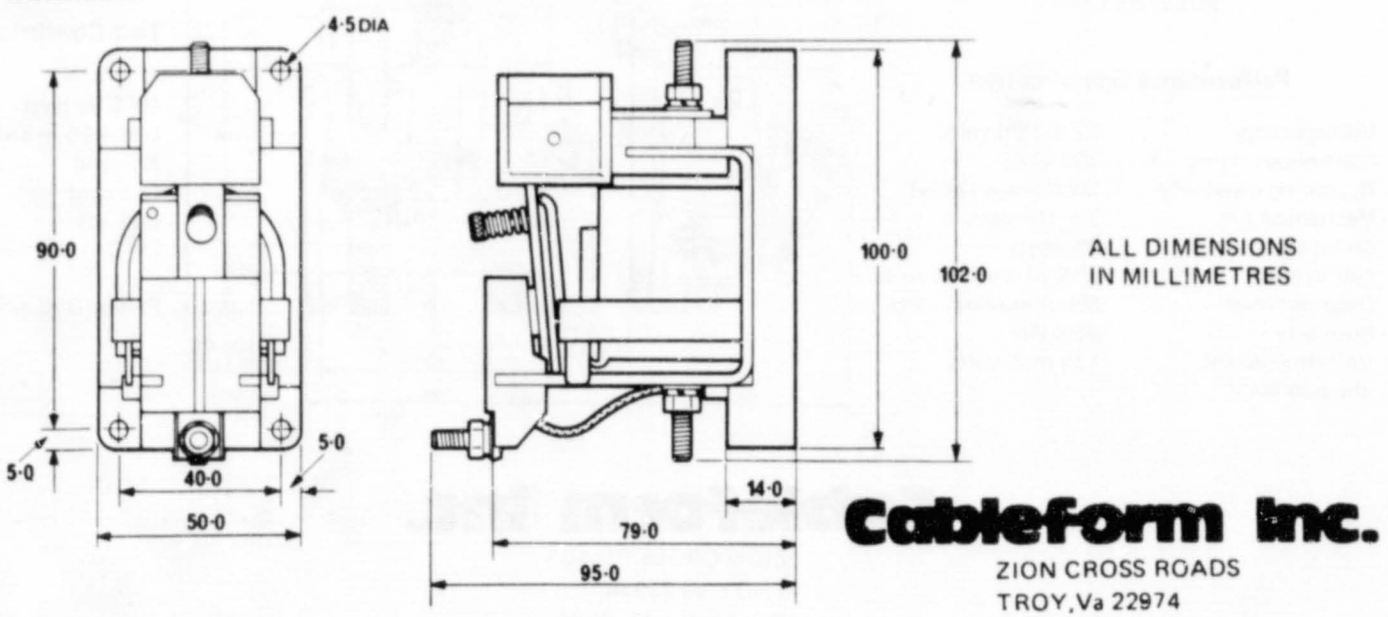
1. Heavy current connections are by M6 fasteners. The normally open contacts being fitted with standard magnetic blowouts, the load must be connected in the correct polarity, the positive connection to the fixed contact.
2. Connections to the coil and to the auxiliary switches are by 6.35 mm fastons.

Mounting

A 4.5 mm hole is located in each corner of the base panel. Fixing by either pair of diagonally-opposite holes is adequate.

It is recommended that the contactor be mounted with its base panel in the vertical plane. Because the terminals of the normally-open contacts are symetrically disposed relative to the base panel, orientation may be with the normally-open contacts located in either the uppermost position or the lowermost position. This is important where several sets of contacts are to be connected in series, since it permits the interconnections to be made with short straight links, while keeping all the fixed contacts on the positive side of the current path. This eliminates the need for either reverse-polarity blowouts or for long interconnections, and it also permits maximum packing density to be achieved.

Installation



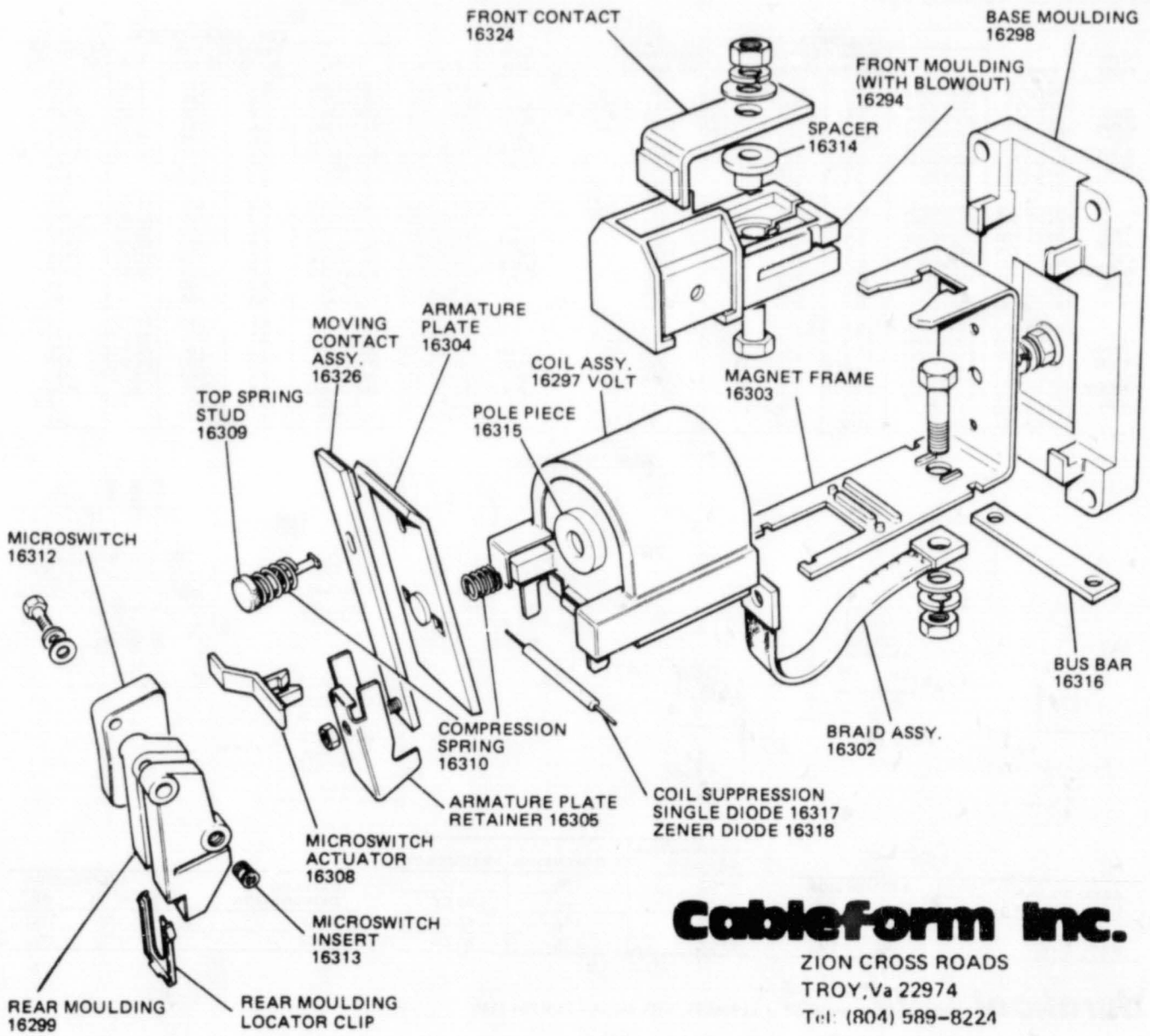
ALL DIMENSIONS
IN MILLIMETRES

Cableform Inc.
ZION CROSS ROADS
TROY, Va 22974
Tel: (804) 589–8224

Performance Specification:

		Test Conditions
Operating D.C. Current:	100 amps 80 amps	At 24V, 0.5mH At 48V, 0.5mH
Rupturing Capability:	700 amps (50 times)	At 48V, 0.5mH
Standard Coil Voltages:	12V, 24V, 36V and 48V D.C.	
Maximum Switching Voltage:	48V	
Contact Life:	300,000 Electrical Cycles Minimum	On Load 100 amps. At 24V, 0.5mH
Minimum Pull in Voltage	50% of Nominal	At 25°C ambient
Minimum drop out Voltage	5% of Nominal	At 25°C ambient
Maximum Coil Dissipation	14 Watts	Coil cold
Maximum Coil Temperature	150° C	At 40° C ambient
Maximum Conductor Temperature	105° C	At 40° C ambient

Model 1321 – Single Pole Normally-open



Cableform Inc.
ZION CROSS ROADS
TROY, Va 22974
Tel: (804) 589-8224

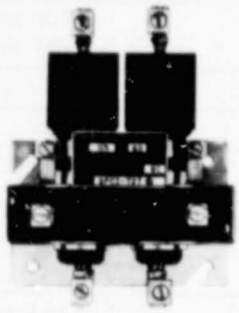
CONTACTORS—60 AMP
UL CSA

BFC Series—Normally Open

BBC Series—Normally Closed



Model BFC700



Model BFC2 700



Model BFC3 700

BFC and BBC 700 series devices are listed under U.L. file #E35126 and C.S.A. file #22416. Catalog numbers other than 700 series are not U.L. or C.S.A. listed. Contact ratings are shown on last page. Leaded versions are also available. Only popular operating coil voltages are shown; consult the factory for part numbers of other AC and DC coils.

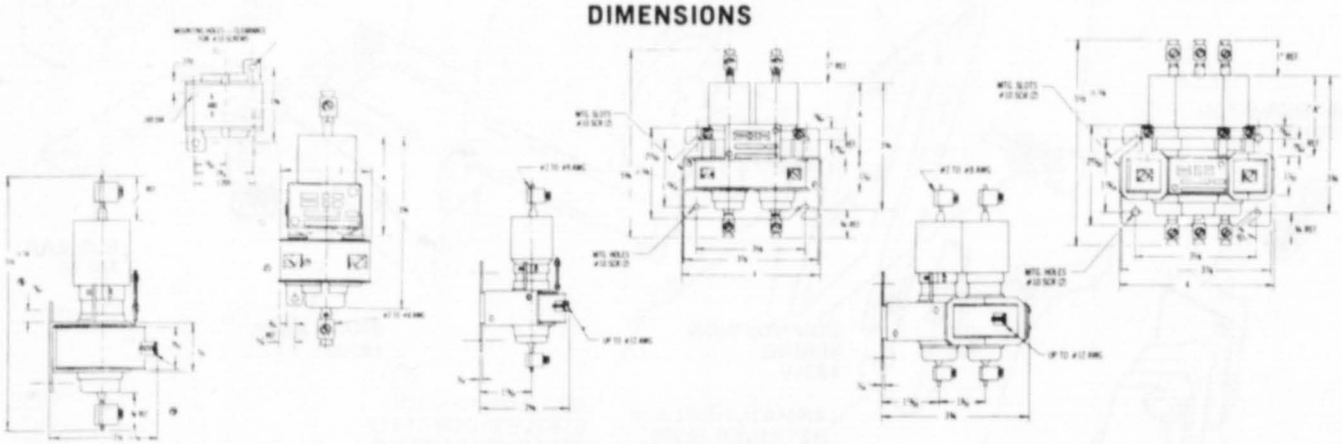
BFC SERIES/Normally Open

Contacts	Part #	COIL DATA—TYPICAL Volts	Power (Watts)	Current (Amps)	V.A.	Resistance (DC Ohms)
One Form "A" S.P.S.T. N.O.	BFC-716	24V60Hz	4.0	.275	6.60	36
	BFC-717	120V60Hz	3.0	.054	6.48	915
	BFC-718	208V60Hz	3.5	.030	6.24	3100
	BFC-719	240V60Hz	3.0	.028	6.72	3700
	BFC-720	277V60Hz	3.2	.022	6.10	5410
	BFC-721	480V60Hz	3.5	.015	7.20	14700
	BFC-730	12VDC	2.7	.210	—	57
	BFC-722	24VDC	2.7	.110	—	230
Two Form "A" D.P.S.T. N.O.	BFC2-726	24V60Hz	6.3	.535	12.8	15
	BFC2-727	120V60Hz	5.8	.110	13.2	350
	BFC2-728	208V60Hz	5.8	.067	13.9	960
	BFC2-729	240V60Hz	5.6	.055	13.2	1400
	BFC2-730	277V60Hz	5.2	.044	12.2	2300
	BFC2-731	480V60Hz	5.8	.028	13.4	5600
	BFC2-741	12VDC	6.0	.500	—	24
	BFC2-733	24VDC	6.1	.255	—	95
Three Form "A" 3P.S.T. N.O.	BFC3-707	24V60Hz	10.7	1.13	27.1	5
	BFC3-708	120V60Hz	10.5	.230	27.6	135
	BFC3-709	208V60Hz	10.0	.128	26.6	480
	BFC3-710	240V60Hz	9.2	.118	28.3	520
	BFC3-711	277V60Hz	10.5	.082	22.7	830
	BFC3-712	480V60Hz	10.5	.059	28.3	2100
	BFC3-720	12VDC	11.3	.938	—	13
	BFC3-721	24VDC	11.0	.470	—	51

BBC SERIES/Normally Closed

Contacts	Part #	COIL DATA—TYPICAL Volts	Power (Watts)	Current (Amps)	V.A.	Resistance (DC Ohms)
One Form "B" S.P.S.T. N.C.	BBC-701	24V60Hz	3.4	.242	5.81	36
	BBC-702	120V60Hz	2.6	.048	5.76	915
	BBC-703	208V60Hz	2.8	.028	5.82	3100
	BBC-704	240V60Hz	2.6	.024	5.76	3700
	BBC-705	277V60Hz	2.6	.020	5.54	5410
	BBC-706	480V60Hz	2.4	.012	5.76	14700
	BBC-719	12VDC	2.5	.210	—	57
	BBC-707	24VDC	2.7	.110	—	230
Two Form "B" D.P.S.T. N.C.	BBC2-309	24V60Hz	5.2	.480	11.52	15
	BBC2-305	120V60Hz	5.3	.105	12.6	350
	BBC2-310	208V60Hz	5.8	.096	19.97	960
	BBC2-306	240V60Hz	5.0	.052	12.48	1400
	BBC2-311	277V60Hz	5.0	.043	11.91	2300
	BBC2-312	480V60Hz	5.0	.026	12.48	5600
	BBC2-313	12VDC	6.0	.500	—	24
	BBC2-308	24VDC	6.1	.255	—	95
Three Form "B" 3P.S.T.	BBC3-308	24V60Hz	8.8	1.040	24.96	5.0
	BBC3-303	120V60Hz	8.5	.200	24.0	135
	BBC3-309	208V60Hz	7.6	.108	22.46	480
	BBC3-306	240V60Hz	7.6	.100	24.0	520
	BBC3-310	277V60Hz	7.4	.080	22.16	830
	BBC3-311	480V60Hz	8.0	.048	23.0	2100
	BBC3-312	12VDC	11.0	1.00	—	12.8
	BBC3-313	24VDC	11.0	.470	—	51

DIMENSIONS



CATALOG DESIGNATION	A DIMENSION 60 Hz	A DIMENSION DC
BFC	1 25/32	1 47/64
BBC	1 25/32	1 47/64

DESIGNATION CATALOG	A DIMENSION	FREQUENCY
BFC2	1 47/64	DC
BFC2	—	25 CY
BFC2	1 51/64	50 CY
BFC2	1 25/32	60 CY

CATALOG DESIGNATION	A DIMENSION 60 Hz	A DIMENSION DC
BFC3	1 25/32	1 47/64
BBC3	1 25/32	1 47/64

durakool®

CONTACTORS—80 AMP

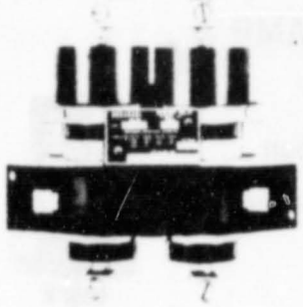
UL

CF Series—Normally Open

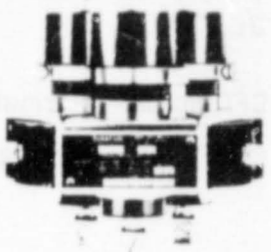
CB Series—Normally Closed



Model CF 700



Model CF2 700



Model CF3 700

CF Series devices are listed under U.L. file #E35126. Catalog numbers other than 700 series are not U.L. or C.S.A. listed. Contact ratings are shown on last page.

Leaded versions are also available. Only popular operating coil voltages are shown; consult the factory for part numbers of other AC and DC coils.

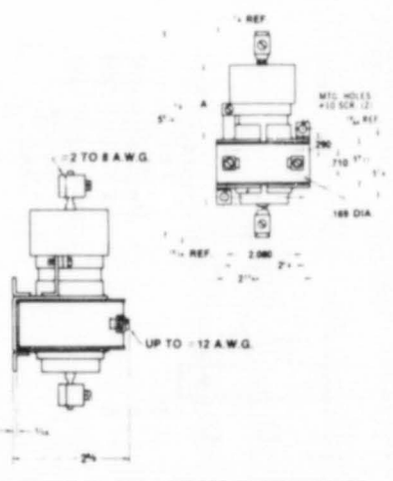
CF SERIES/Normally Open

Con-tacts	Part #	Volts	COIL DATA—TYPICAL Power (Watts)	Current (Amps)	V.A.	Resistance (D.C. Ohms)
One Form "A" S.P.S.T. N.O.	CF-701	24V60Hz	8.2	.750	18.0	7.1
	CF-702	120V60Hz	8.1	.148	17.8	170
	CF-703	208V60Hz	8.2	.085	17.7	600
	CF-704	240V60Hz	8.1	.074	17.8	680
	CF-705	277V60Hz	8.1	.065	18.0	1000
	CF-706	480V60Hz	8.1	.037	17.8	2700
	CF-730	12VDC	5.4	.445	—	27
	CF-707	24VDC	5.5	.230	—	111
Two Form "A" D.P.S.T. N.O.	CF2-301	24V60Hz	18.7	1.8	43.2	2.8
	CF2-302	120V60Hz	17.2	.415	49.8	66
	CF2-303	208V60Hz	19.5	.260	54.08	165
	CF2-304	240V60Hz	16.5	.200	48.0	260
	CF2-305	277V60Hz	18.0	.190	52.63	—
	CF2-306	480V60Hz	18.0	.100	48.0	1100
	CF2-312	12VDC	14.4	1.20	—	10
	CF2-307	24VDC	14.4	.600	—	40
Three Form "A" 3P.S.T. N.O.	CF3-301	24V60Hz	28.6	3.5	84.0	1.04
	CF3-302	120V60Hz	24.0	.690	82.8	27
	CF3-303	208V60Hz	27.5	.405	84.24	100
	CF3-304	240V60Hz	28.0	.350	84.0	110
	CF3-305	277V60Hz	28.0	.300	83.10	150
	CF3-306	480V60Hz	28.0	.180	86.40	440
	CF3-310	12VDC	14.4	1.2	—	10
	CF3-307	24VDC	14.4	.6	—	40

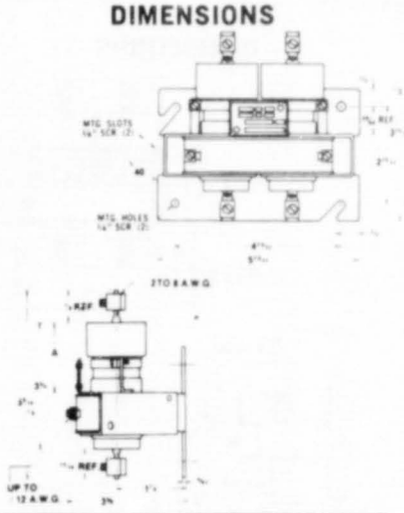
CB SERIES/Normally Closed

Con-tacts	Part #	Volts	COIL DATA—TYPICAL Power (Watts)	Current (Amps)	V.A.	Resistance (D.C. Ohms)
One Form "B" S.P.S.T. N.C.	CB-306	24V60Hz	7.0	.770	18.4	7.1
	CB-301	120V60Hz	7.0	.156	18.72	180
	CB-307	208V60Hz	7.0	.085	17.7	600
	CB-304	240V60Hz	7.0	.075	18.0	680
	CB-308	277V60Hz	7.0	.065	18.0	1000
	CB-309	480V60Hz	7.0	.038	18.2	2700
	CB-310	12VDC	5.4	.455	—	27
	CB-311	24VDC	5.3	.220	—	108
Two Form "B" D.P.S.T. N.C.	CB2-301	24V60Hz	14.8	1.660	39.84	2.8
	CB2-302	120V60Hz	14.2	.365	43.80	66
	CB2-303	208V60Hz	16.6	.244	50.75	165
	CB2-304	240V60Hz	16.0	.188	45.12	260
	CB2-305	277V60Hz	16.0	.170	47.09	430
	CB2-306	480V60Hz	16.0	.094	45.12	1100
	CB2-308	12VDC	14.5	1.20	—	10
	CB2-307	24VDC	14.4	.600	—	40
Three Form "B" 3P.S.T. N.C.	CB3-301	24V60Hz	27.0	3.160	75.84	1.04
	CB3-302	120V60Hz	21.2	.640	76.80	27
	CB3-303	208V60Hz	22.8	.360	74.88	100
	CB3-304	240V60Hz	21.2	.320	76.80	110
	CB3-305	277V60Hz	21.2	.290	80.33	150
	CB3-306	480V60Hz	21.2	.160	76.80	440
	CB3-308	12VDC	14.5	1.20	—	10
	CB3-307	24VDC	14.4	.600	—	40

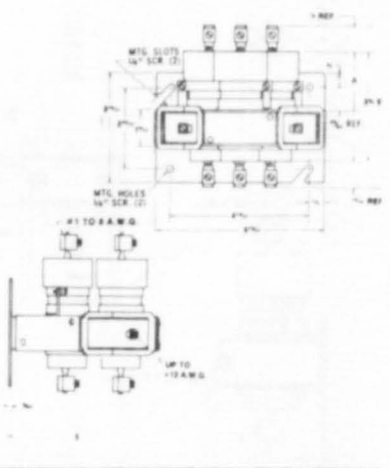
DIMENSIONS



CATALOG DESIGNATION	A 60 Hz	A DC
CF	1 13/64	1 11/16
CB	1 1/32	1 11/32



CATALOG DESIGNATION	A 60 Hz	A DC
CF2	1 13/64	1 11/16
CB2	1 1/32	1 11/32



CATALOG DESIGNATION	A 60 Hz	A DC
CF3	1 13/64	1 11/16
CB3	1 1/32	1 11/32

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durakool®

CONTACTORS—100 AMP
UL CSA

CFC Series—Normally Open

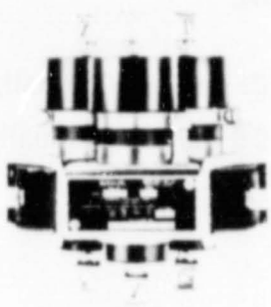
CBC Series—Normally Closed



Model CFC 700



Model CFC2 700



Model CFC3 700

CFC and CBC 700 series devices are listed under U.L. file #E35126 and CSA file #22416. Catalog numbers other than 700 series are not U.L. or C.S.A. listed. Contact ratings are shown on last page. Leaded versions are also available. Only popular operating coil voltages are shown; consult the factory for part numbers of other AC and DC coils.

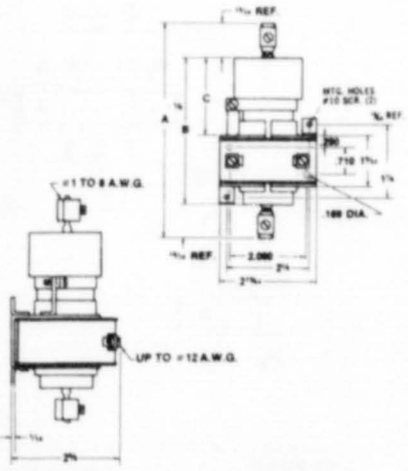
CFC SERIES/Normally Open

Contacts	Part #	Volts	COIL DATA—TYPICAL Power (Watts)	Current (Amps)	V.A.	Resistance (D.C. Ohms)
One Form "A" S.P.S.T. N.O.	CFC-717	24V60Hz	9.0	.820	19.7	7.1
	CFC-718	120V60Hz	8.0	.170	20.4	180
	CFC-719	208V60Hz	8.2	.098	20.4	600
	CFC-720	240V60Hz	8.0	.085	20.4	680
	CFC-721	277V60Hz	8.0	.070	19.4	1000
	CFC-722	480V60Hz	8.0	.045	21.6	2700
	CFC-731	12VDC	5.4	.445	—	27
	CFC-723	24VDC	5.3	.220	—	111
Two Form "A" D.P.S.T. N.O.	CFC2-726	24V60Hz	16.6	1.85	44.4	2.8
	CFC2-727	120V60Hz	15.6	.380	45.6	66
	CFC2-728	208V60Hz	19.6	.246	51.2	165
	CFC2-729	240V60Hz	17.0	.190	45.6	260
	CFC2-730	277V60Hz	17.0	.180	49.9	430
	CFC2-731	480V60Hz	17.0	.095	45.6	1100
	CFC2-741	12VDC	14.4	1.20	—	10
	CFC2-733	24VDC	14.4	.600	—	40
Three Form "A" 3P.S.T. N.O.	CFC3-707	24V60Hz	29.0	3.40	81.6	1.04
	CFC3-708	120V60Hz	28.0	.700	84.0	27
	CFC3-709	208V60Hz	28.8	.380	79.0	100
	CFC3-710	240V60Hz	29.0	.350	84.0	110
	CFC3-711	277V60Hz	29.0	.300	83.1	150
	CFC3-712	480V60Hz	29.0	.180	86.4	440
	CFC3-720	12VDC	14.4	1.20	—	10
	CFC3-721	24VDC	14.4	.600	—	40

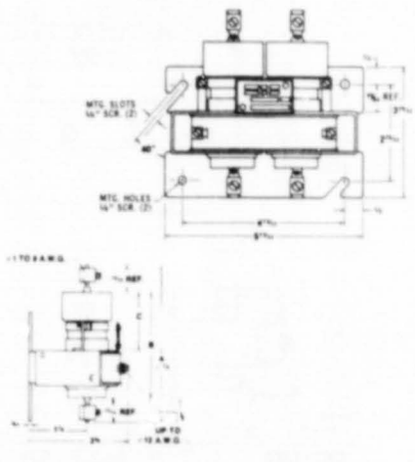
CBC SERIES/Normally Closed

Contacts	Part #	Volts	COIL DATA—TYPICAL Power (Watts)	Current (Amps)	V.A.	Resistance (D.C. Ohms)
One Form "B" S.P.S.T. N.C.	CBC-701	24V60Hz	7.0	.770	18.4	7.1
	CBC-702	120V60Hz	6.6	.150	18.0	180
	CBC-703	208V60Hz	7.0	.085	17.7	600
	CBC-704	240V60Hz	7.0	.075	18.0	680
	CBC-705	277V60Hz	7.0	.065	18.0	1000
	CBC-706	480V60Hz	7.0	.038	18.2	2700
	CBC-719	12VDC	5.4	.455	—	27
	CBC-707	24VDC	5.3	.220	—	111
Two Form "B" D.P.S.T. N.C.	CBC2-315	24V60Hz	14.8	1.660	39.84	2.8
	CBC2-309	120V60Hz	14.2	.365	43.80	66
	CBC2-316	208V60Hz	16.6	.244	50.75	165
	CBC2-306	240V60Hz	17.0	.188	45.12	260
	CBC2-317	277V60Hz	17.0	.170	47.09	430
	CBC2-313	480V60Hz	17.0	.094	45.12	1100
	CBC2-318	12VDC	14.5	1.20	—	10
	CBC2-319	24VDC	14.4	.600	—	40
Three Form "B" D.P.S.T. N.C.	CBC3-307	24V60Hz	27.0	3.16	75.84	1.04
	CBC3-304	120V60Hz	21.2	.64	76.80	27
	CBC3-308	208V60Hz	22.8	.36	74.88	100
	CBC3-306	240V60Hz	21.2	.32	76.80	110
	CBC3-309	277V60Hz	21.2	.29	80.33	150
	CBC3-305	480V60Hz	21.2	.16	76.80	440
	CBC3-310	12VDC	14.5	1.20	—	10
	CBC3-311	24VDC	14.4	.600	—	40

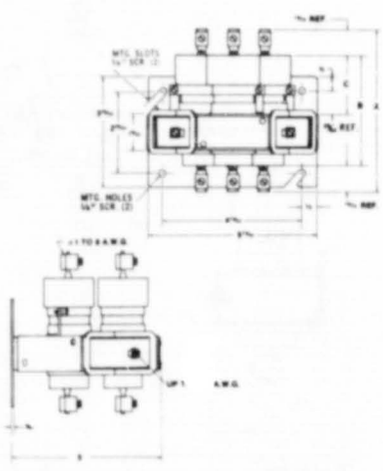
DIMENSIONS



CATALOG DESIGNATION	A	B	C 60 Hz	C DC
CFC	5 5/16	3 3/4	1 1/64	1 11/16
CBC	5 13/16	4 1/64	1 7/32	1 11/32



CATALOG DESIGNATION	A	B	C 60 Hz	C DC
CFC2	5 5/16	3 3/4	1 1/64	1 11/16
CBC2	5 13/16	4 1/64	1 7/32	1 11/32



CATALOG DESIGNATION	A	B	C 60 Hz	C DC
CFC3	5 5/16	3 3/4	1 1/64	1 11/16
CBC3	5 13/16	4 1/64	1 7/32	1 11/32

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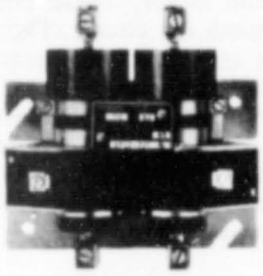
CONTACTORS — 150 AMP

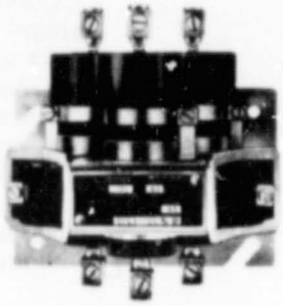
DFC — Normally Open



Model DFC-300



Model DFC2-300

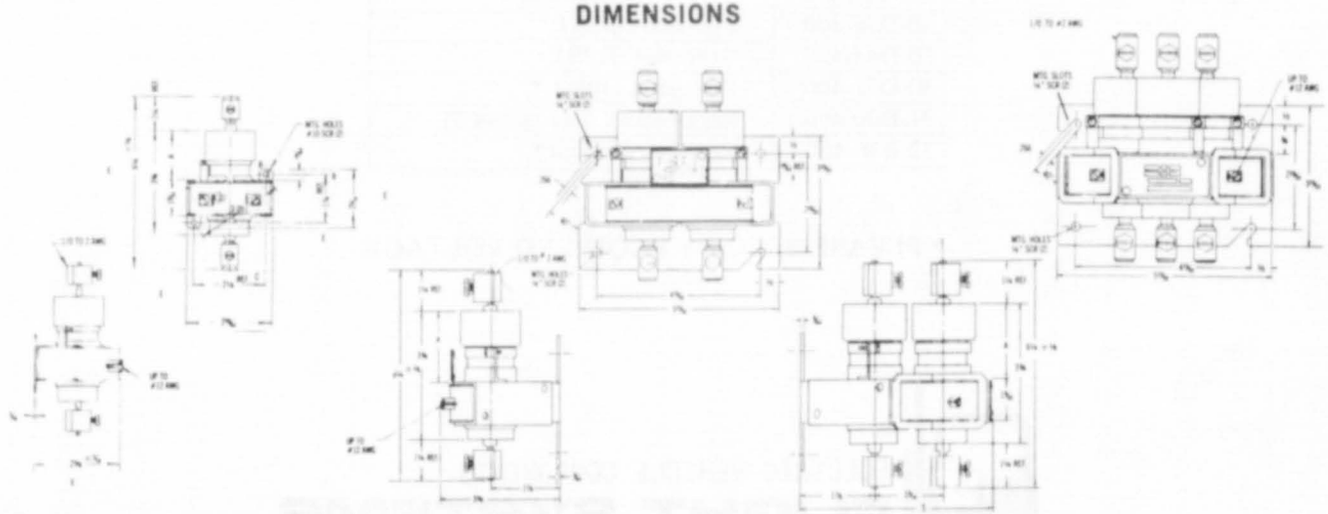


Model DFC3-300

DFC 300 Series contactors per pole contact ratings are shown on last page. Leaded versions are also available. Only popular operating coil voltages are shown in the selection chart. Consult the factory for part numbers of other AC and DC coils.

Contacts	Part Number	Coil Data — Typical				
		Volts	Power (Watts)	Current (Amps)	V.A.	Resistance (Ω)
One Form "A" S.P.S.T. N.O.	DFC-307	24V 60 Hz	9.0	.820	19.7	7.1
	DFC-301	120V 60 Hz	8.0	.170	20.4	180.
	DFC-304	208V 60 Hz	8.2	.098	20.4	600.
	DFC-303	240V 60 Hz	8.0	.085	20.4	680.
	DFC-305	277V 60 Hz	8.0	.070	19.4	1000.
	DFC-306	480V 60 Hz	8.0	.045	21.6	2700.
	DFC-313	12V DC	5.4	.445	—	27.
	DFC-310	24V DC	5.3	.220	—	111.
Two Form "A" D.P.S.T. N.O.	DFC2-307	24V 60 Hz	16.6	1.85	44.4	2.8
	DFC2-301	120V 60 Hz	15.6	.380	45.6	66.
	DFC2-304	208V 60 Hz	19.6	.246	51.2	165.
	DFC2-303	240V 60 Hz	17.0	.190	45.6	260.
	DFC2-305	277V 60 Hz	17.0	.180	49.9	430.
	DFC2-306	480V 60 Hz	17.0	.095	45.6	1100.
	DFC2-313	12V DC	14.4	1.20	—	10.
	DFC2-310	24V DC	14.4	.60	—	40.
Three Form "A" 3P.S.T. N.O.	DFC3-307	24V 60 Hz	32.0	3.6	86.	.68
	DFC3-301	120V 60 Hz	32.0	.72	86.	18.
	DFC3-304	208V 60 Hz	32.0	.41	86.	55.4
	DFC3-303	240V 60 Hz	32.0	.36	86.	69.
	DFC3-305	277V 60 Hz	32.0	.31	86.	100.
	DFC3-306	480V 60 Hz	32.0	.18	86.	275.
	DFC3-313	12V DC	14.4	1.2	—	10.
	DFC3-310	24V DC	14.4	.6	—	40.

DIMENSIONS



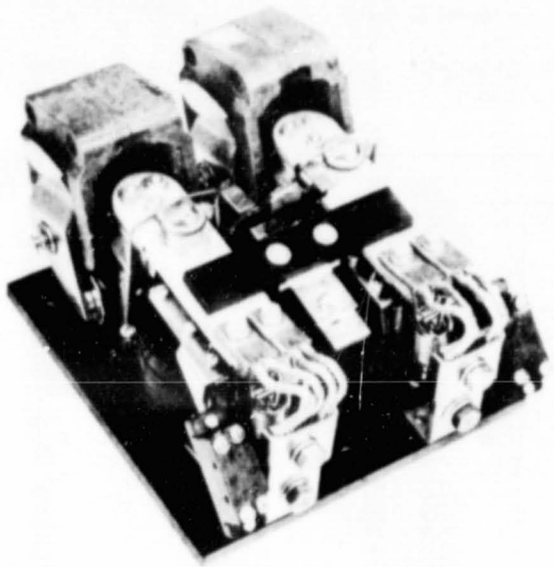
A Dimension	Coil Frequency
1 11/16	DC
1 53/64	25 Hz
1 25/32	50 Hz
1 41/64	60 Hz

A Dimension	Coil Frequency
1 11/16	DC
1 53/64	25 Hz
1 25/32	50 Hz
1 41/64	60 Hz

A Dimension	Coil Frequency
1 11/16	DC
1 15/32	25 Hz
1 17/32	50 Hz
1 15/32	60 Hz

300 AMP CONTACTORS
SPST and DPST

Contactors are heavy duty relays used to switch high current DC from the battery to the motor. These contactors have silver tips that actually make and break the circuit. The coil is an electromagnet that closes or switches the contactor when energized. A contactor can be viewed as a "knife switch" that is actuated via remote control. A 200 amp contactor will perform quite satisfactorily in most EV applications. Certain combinations of motors and batteries, however, require higher current versions. These 300 amp contactors are well suited to fill the requirements for the 400 amp power relays as used in David Arthur's plans. All 300 amp contactors are supplied with arc suppression.



Part No.	Description
30-D36-400	Contactor, SPST *
30-D48-400	Contactor, DPST *
30-D72-400	Contactor, DPDT *
31-D00-400	Replacement Tips (set of 2)
32-E36-400	Replacement Coil *

* PLEASE SPECIFY REQUIRED VOLTAGE

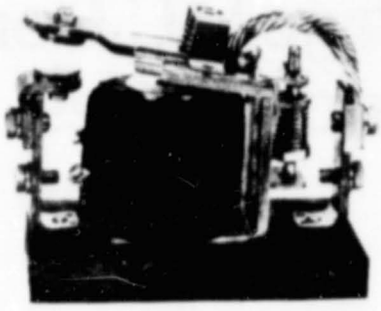
ELECTRIC VEHICLE COMPONENTS
FLIGHT SYSTEMS
HEADQUARTERS
P.O. BOX 25, MECHANICSBURG, PA 17055
PHONE (717) 697-0333

200 AMP CONTACTORS SPST AND DPDT

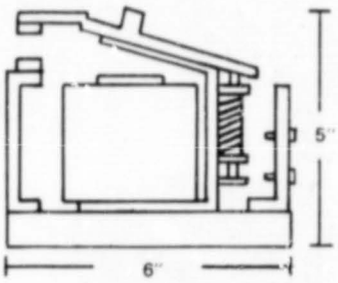
These heavy duty (200 Amp) contactors will pgovide excellent service in a variety of applications including:

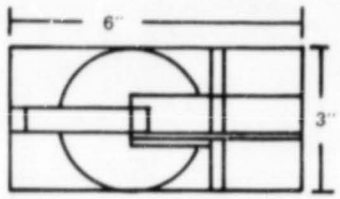
- Directional control
- Bypass switching
- Resistor switching
- Battery tapping

The amp rating of contactors used in a speed control system should at least equal the full speed rating of the motor. The contactors are designed to handle accelerating and ramp currents intermittently in excess of the nominal rating. See Table at right. Available in the most popular voltages for operation off the EV's main power system. We supply top name contactors such as GE or SQUARE-D, depending on availability.



Amps	Duty Cycle	Max on Time
75	100%	Continuous
100	50%	20 Minutes
400	5%	1 Minute
600	2%	½ Minute





Shown above: single pole single throw, normally open (SPST,N O.)

Part No.	Description
30-B36-400	Contactor, SPST, N.O. *
30-B48-400	Contactor, DPST *
30-B72-400	Contactor, DPDT *
31-B00-400	Replacement Tips (set of 2)
32-C36-400	Replacement Coil *

* Please Specify Required Voltage

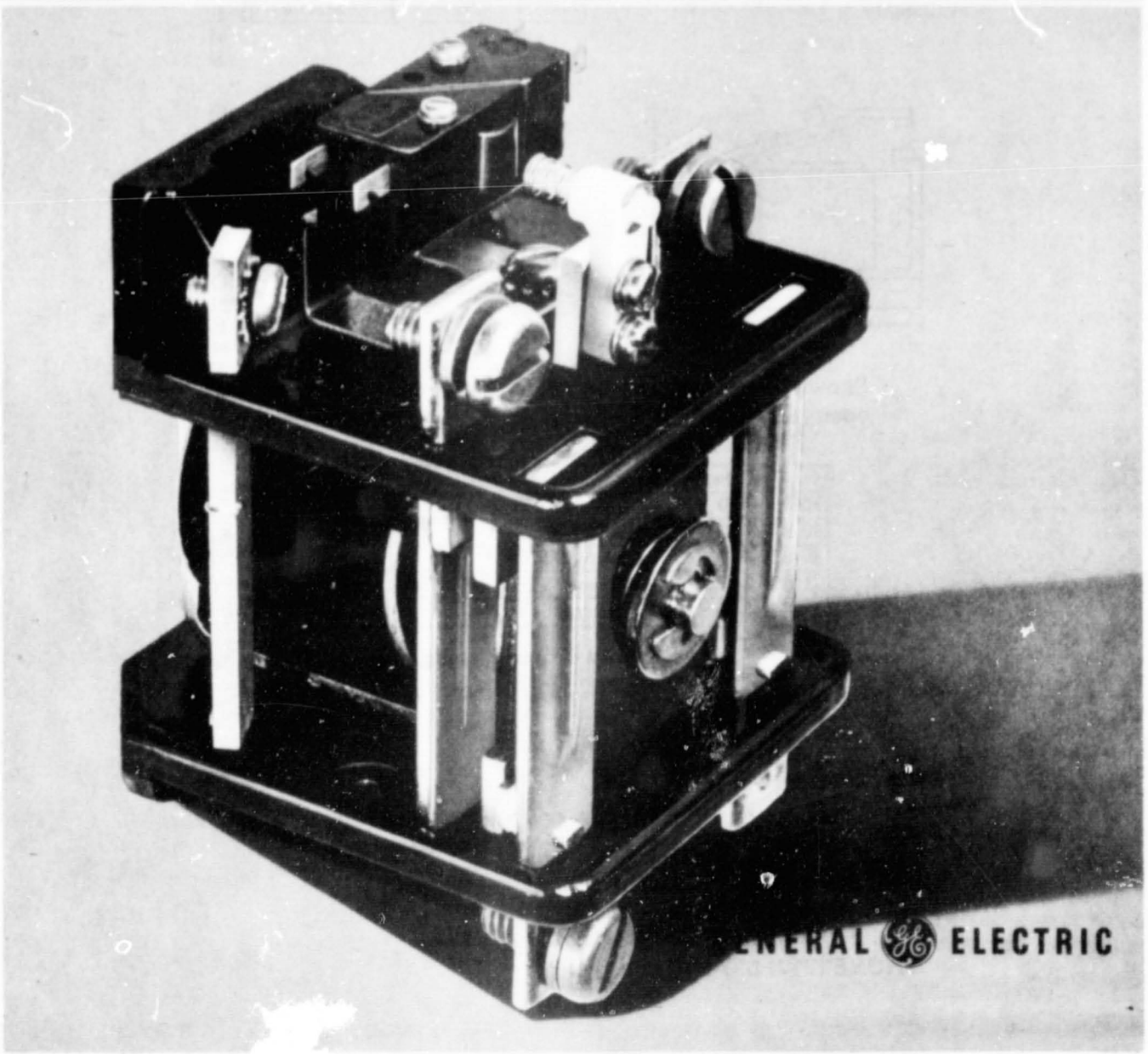
ELECTRIC VEHICLE COMPONENTS
FLIGHT SYSTEMS
HEADQUARTERS
P.O. BOX 25, MECHANICSBURG, PA 17055
PHONE (717) 697-0333

General Electric

Low Voltage D-C Contactors for Electric Vehicles

GENERAL ELECTRIC
INDUSTRIAL CONTROL DEPARTMENT
P.O.Box 8106, Charlottesville, VA 22906
TEL: 804-973-1851

75 AMP



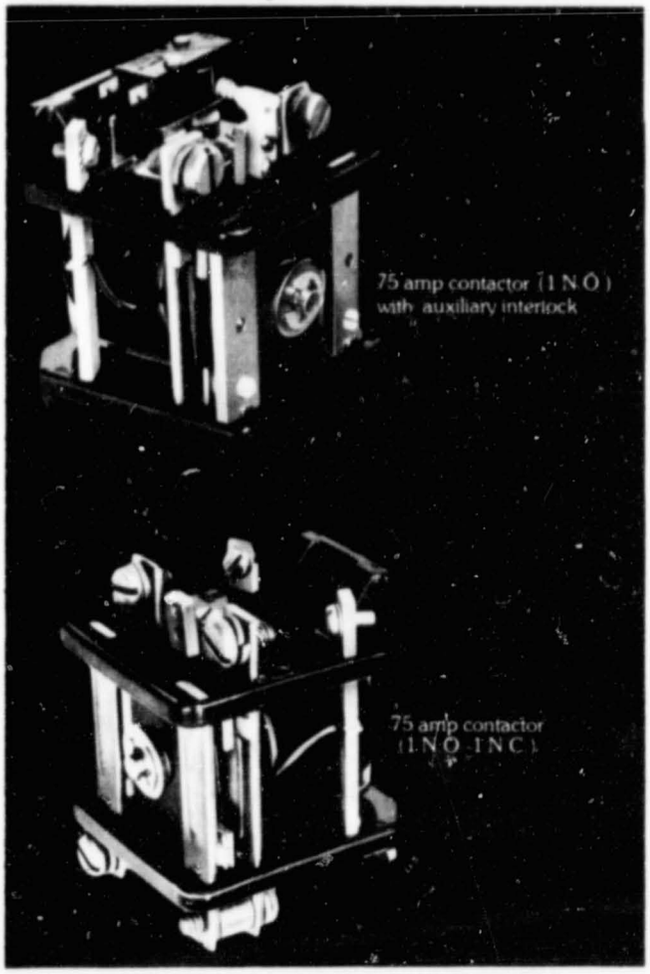
General Electric 75-amp Contactor

Less maintenance, more dependability

General Electric's 75-amp contactor meets the exacting needs of today's electric vehicles. Our 75-amp contactor features a more compact design to control d-c motors used to power lift trucks, utility vehicles, floor sweepers, walkie trucks and other electric vehicle applications.

Its small size makes it ideally suited for interchangeable packaged power drives used in various truck models. The 75-amp contactor is rated for use with all battery truck motors up to 75 amps, 1 hour rating, 12-36 volts d-c.

Here are excellent reasons why General Electric's contactors can help make your battery-powered vehicle more dependable and require less maintenance:



- Contactor is more reliable because tips are made of silver alloy. Wiping action scrubs tips, provides good contact at all times.
- Heavy duty industrial design. Contactors mount and wire easily, resist shock, vibration, and adverse atmospheric conditions.
- Installation and wiring are speeded because only a screwdriver is needed.
- Contact bars and coils are replaceable.
- Contactor is UL recognized for industrial trucks.
- A single-pole, double-throw, snap-action interlock is optional for added versatility.
- Carries full General Electric one-year warranty against defects in material and workmanship.

PERFORMANCE DATA

Mechanical Life

The 75-amp contactor has a mechanical life of three million operations without detrimental wear of moving parts, springs, or interlocks.

Electrical Life

General Electric contactors have been thoroughly tested before delivery. They are continually re-evaluated, using actual vehicle components, under conditions based on typical vehicle operation. Testing includes reversing operations. The normal electrical life of contacts that may be expected is two million operations. This figure may vary depending on the particular vehicle design and mode of operation. Contactors will pick up at 50 percent of intermittent coil voltage rating at 25 C.

GENERAL ELECTRIC
INDUSTRIAL CONTROL DEPARTMENT
P.O.Box 8106, Charlottesville, VA 22906
TEL: 804-973-1851

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OF POOR QUALITY

75-amp Performance Specifications

Current Ratings

Current	Duty Cycle % On-time	Max. Time On
50 Amps	100	Continuous
75 Amps	**50**	**5 Minutes**
250 Amps	5	30 Seconds
500 Amps	2	5 Seconds
See Coil Ratings		

Interlock Ratings-Amps (Inductive)

Volts		Make & Break	Carry
Normally open or normally closed	12	3.3	5
	18	2.0	5
	24	1.5	5
	36	1.0	5

Coil Burden Ratings At 25 C

Coil No.	Volts	Amp
012	12	2.0
015	18	1.2
013	24	1.0
014	36	0.7

Make and Break Ratings*

Make	800 Amps	36 Volts
Interrupt	600 Amps	12 Volts
	300 Amps	24 & 36 Volts

*These ratings were established in accordance with Arc Rupturing Tests as described in Part 5 of Underwriters Laboratories Inc. Bulletin No. 583. The make rating is based on resistive loading and the interrupting rating is based on inductive loading.

Coil Ratings

Coils are suitable for a duty cycle of 50% time on with a maximum time on of 5 minutes when operating at a nominal coil voltage rating. Contactors will pick up at 50% of rated voltage at 25 C. Continuous coil ratings are available with a holding resistor that can be controlled using the auxiliary interlock.

GENERAL ELECTRIC

INDUSTRIAL CONTROL DEPARTMENT

P.O.Box 8106, Charlottesville, VA 22906

TEL: 804-973-1851

Ordering Directions

To order: select form, add coil number and interlock letter. Example: IC2800M601H012A

Step 1. Select Form

Contact Arrangement	Form IC2800M	Dimensions
1 N.C.	601 H	See Fig. 1
1 N.O.	610 P	See Fig. 1
1 N.O.-1 N.C.	611 AA	See Fig. 1

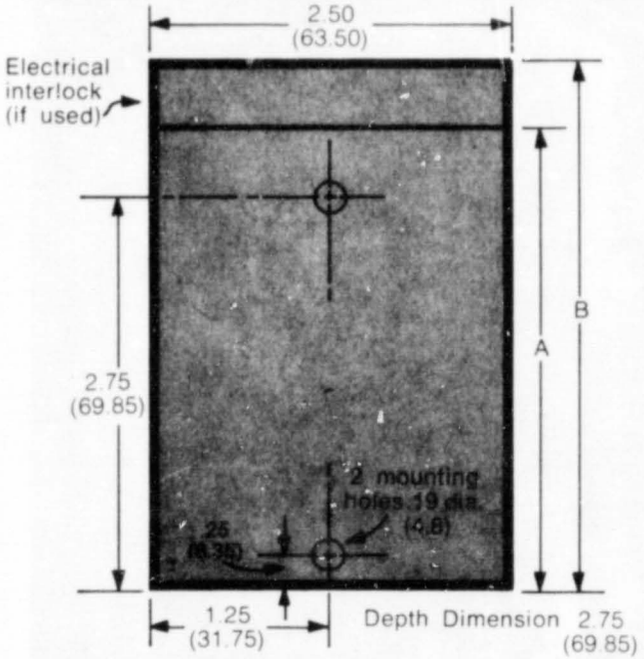
Step 2. Add Coil Number

Volts	Coil Number
12	012
18	015
24	013
36	014

Step 3. Add Interlock Letter

Number of Contacts	Interlock Letter
None	A
1 N.O.-1 N.C.	B

Top view Dimensions Inches and (Millimeters)



Outline Dimensions Inches and (Millimeters)

Contactor	Dimension A	Dimension B	Outline Drawing No.
M601H (1 N.C.)	3.19 (81.00)	3.69 (93.73)	167A8815
M610P (1 N.O.)	3.13 (79.50)	3.56 (90.42)	167A8810
M611AA (1 N.O.-1 N.C.)	3.25 (82.55)	3.69 (93.73)	167A8818

GENERAL ELECTRIC
INDUSTRIAL CONTROL DEPARTMENT
P.O.Box 8106, Charlottesville, VA 22906
TEL: 804-973-1851

Many significant additions and improvements are now available in General Electric's line of EV-1 controls and accessories. All of them give users improved truck performance, higher efficiencies, increased reliability and lower operating costs.

They include two new controls for traction motors—one with regenerative braking and the other for dual-motor vehicles. Also available: a complete new control to power the hydraulic pump motor.

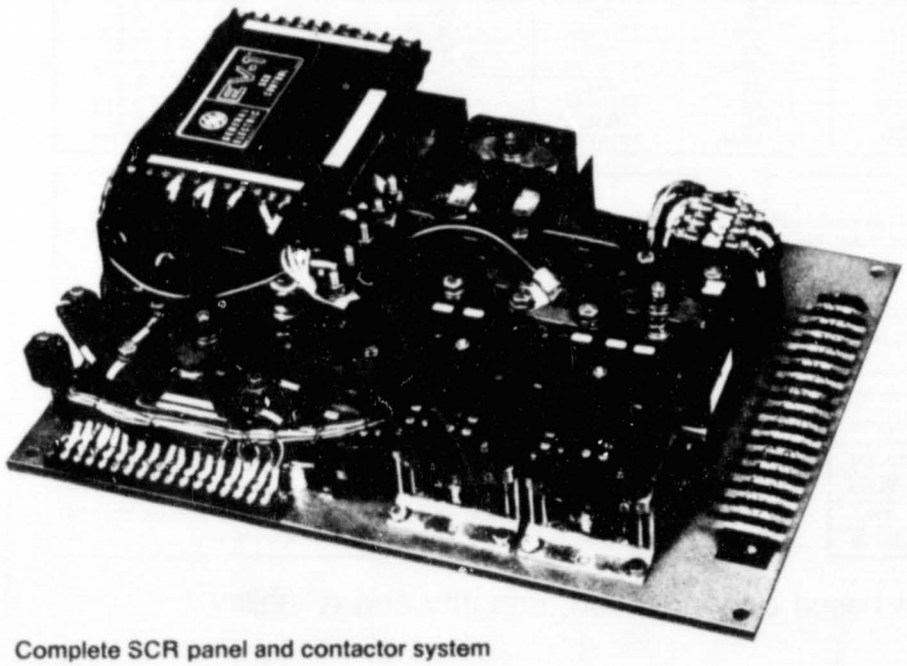
These complete EV-1 SCR and Contactor Systems are engineered, packaged and computer-tested for individual trucks to provide optimum long-term reliability.

The new accessories provide many improvements long sought by electric truck users. They include a battery condition indicator, a 12-volt converter, a solid-state accelerator and a universal driver.

These new products employ the newest solid-state technology, including microprocessors and hybrid circuits. The result is very high levels of performance and reliability.

In addition, General Electric continues to improve its extensive user services, including maintenance training, literature in several languages and worldwide stocking of spare parts.

Users can ask for EV-1 controls and accessories with confidence when purchasing new electric lift trucks from the world's leading manufacturers.



Complete SCR panel and contactor system

Standard traction control

This EV-1 control uses plugging for electrical braking. Result: the fewest possible components.

Key benefits are:

- No wheel slippage because of high-frequency pulsing that delivers smooth braking
- Maximum truck performance because motor current is continuously monitored during braking, acceleration, running, stall and ramp-start
- Bypass contactor provides maximum power with no torque jump
- Excessive motor loads prevented by automatically opening the by-pass contactor
- Serviceable with standard EV-1 Analyzer

A-C Non-Combination Magnetic Contactors

Non-Reversing — Without Overload Protection
Type TM Full Voltage — Single and Poly Phase

Section 11
Contactors
Bulletin 7707-TM

SYLVANIA
GTE
Electrical Equipment Group
GTE Sylvania Incorporated
One Stamford Forum
Stamford CT 06904
203 357 2000

CATALOG NUMBERS

MAXIMUM MOTOR HOSREPOWER RATING			CONTINUOUS AMP. RATING ②	Tungsten Lamp Load-250 V or Less	SIZE	NEMA TYPE 1 Enclosure (General Purpose)			NEMA TYPE 4 ③ Enclosure (Watertight—Dusttight)	NEMA TYPE 12 Enclosure (Industrial—Dusttight)	TYPE U Open Contactors
						For Separate Push Button	Hand-Off-Auto Selector Switch in Cover	Start-Stop Push Button in Cover	For Separate Push Button	For Separate Push Button	For Separate Push Button
115 Volts	230 Volts		**2 POLE SINGLE PHASE**								
7½	15		90	60	3	**448.** T77AO23	**480.** T77AB23	**480.** T77AC23	**856.** T77WO23	**552.** T77TO23	**368.** T77UO23
—	—		135	120	4	**1056.** T77AO24	**1088.** T77AB24	**1088.** T77AC24	**1752.** T77WO24	**1400.** T77TO24	**888.** T77UO24
—	—		270	240	5	**2232.** T77AO25	**2264.** T77AB25	**2264.** T77AC25	**3112.** T77WO25	**3112.** T77TO25	**1924.** T77UO25
200 Volts	230 Volts		**3 POLE POLY PHASE**								
7½	7½		27	15	1	**144.** T77AO31	**176.** T77AB31	**176.** T77AC31	**288.** T77WO31	**192.** T77TO31	**136.** T77UO31
10	15		45	30	2	**288.** T77AO32	**320.** T77AB32	**320.** T77AC32	**576.** T77WO32	**376.** T77TO32	**248.** T77UO32
25	30		90	60	3	**480.** T77AO33	**512.** T77AB33	**512.** T77AC33	**888.** T77WO33	**584.** T77TO33	**400.** T77UO33
40	50		135	120	4	**1128.** T77AO34	**1160.** T77AB34	**1160.** T77AC34	**1824.** T77WO34	**1472.** T77TO34	**960.** T77UO34
75	100		270	240	5	**2400.** T77AO35	**2432.** T77AB35	**2432.** T77AC35	**3280.** T77WO35	**3280.** T77TO35	**2092.** T77UO35
150	200		540	480	6†	**7068.** T77AO36	**7156.** T77AB36	**7156.** T77AC36	**9188.** T77WO36	**8148.** T77TO36	**5712.** T77UO36
—	300		810	720	7 ④	**8888.** 77A37	—	—	—	—	**7620.** 77U37
200 Volts	230 Volts		**4 POLE POLY PHASE**								
7½	7½		27	15	1	**176.** T77AO41	**208.** T77AB41	**208.** T77AC41	**320.** T77WO41	**224.** T77TO41	**168.** T77UO41
10	15		45	30	2	**360.** T77AO42	**392.** T77AB42	**392.** T77AC42	**760.** T77WO42	**448.** T77TO42	**320.** T77UO42
25	30		90	60	3	**592.** T77AO43	**624.** T77AB43	**624.** T77AC43	**1112.** T77WO43	**696.** T77TO43	**512.** T77UO43
40	50		135	120	4	**1504.** T77AO44	**1536.** T77AB44	**1536.** T77AC44	**2488.** T77WO44	**1968.** T77TO44	**1336.** T77UO44

NOTES:

① Price includes contactor complete with one normally open control circuit contact. To complete the catalog number, add suffix from Suffix Table For Coil Volts And Herts.

② NEMA Type 4 enclosures are stainless steel.

③ 8-Hour open ratings are in accordance with NEMA Standards ICS 2-211.23.

④ Size 7 are Type DRA. While designed and built to satisfy UL requirements, they are not listed.

SUFFIX TABLE FOR COIL VOLTS AND HERTZ

Select catalog number of contactor and add suffix from following table:

Volts/Herts	Suffix
110-120/60 or 110/50	—76
220-240/60 or 220/50	—26
200-208/60	—86
110/25	—12
220/25	—22
Other (See Note A)	—00

NOTE A:
For other volts and herts not listed, add suffix "—00" and specify volts and herts of coil.

ADDITIONAL DATA	Page No.
Factory Modifications	201-202
Field Modifications	209-213
Renewal Parts	214
General Engineering Data	220-225

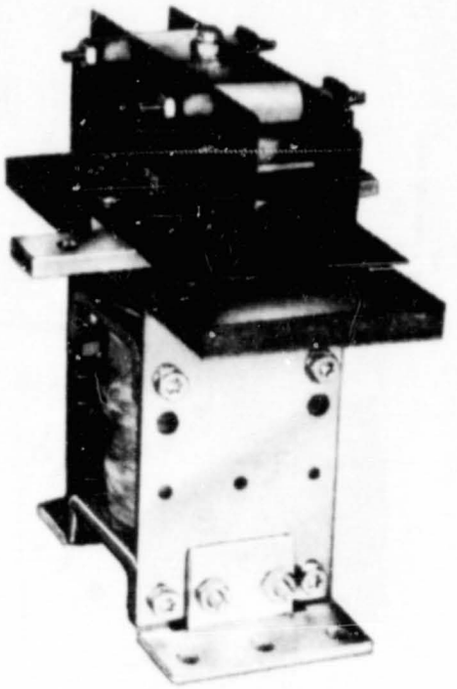
ORDER AS FOLLOWS: (Quantity)—Catalog No. ( ) Bulletin 7707-TM ( ) ampere, ( ) pole, ( ) volts a-c, ( ) herts contactors.

†UL and CSA Listing pending.

Sylvania quality is based on innovation, integrity and reliability.

HB PRODUCT DATA SHEET

400 AMPERE, 250 VOLT DC CONTACTOR



4.66 L x 6.09 W x 6.38 H in
118.4 L x 154.8 W x 162.2 H mm

MODEL HB631 DC CONTACTOR

Model HB631 is a contactor designed for rugged 400 ampere (continuous) applications. A new contact design incorporates features which aid in switching DC voltages to 250 VDC. Arcing horns and magnetic blowouts stretch the arc on opening to achieve arcing times of less than 5 milliseconds. The actuator design is recommended for high shock and vibration applications in mining equipment or similar devices and may be mounted in any position.

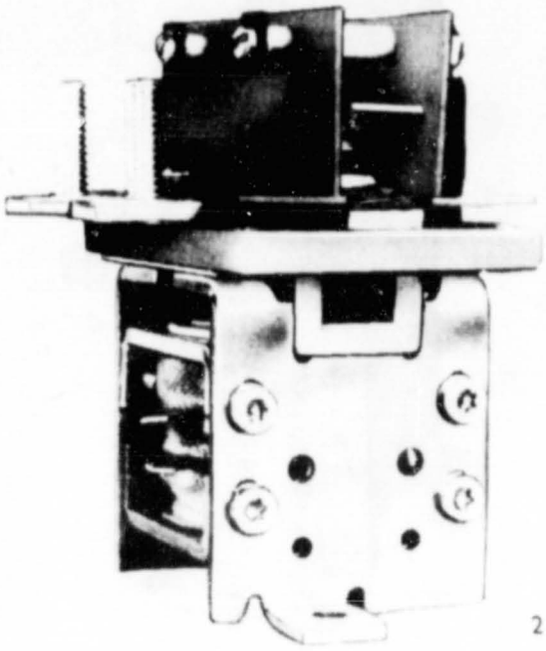
Contact Arrangement: Single Pole, Single Throw

Contact Design: Double break with permanent magnet blow-out and arcing horns
Current Rating: Make into 4000 amperes
: Carry 400 amperes continuously
: Open 400 amperes at 250 VDC
: Rupture: 4000 amperes
Voltage Rating: 250 VDC
Mechanical Life: 10,000,000 cycles
Electrical Life: 100,000 cycles
Contact Bounce: Less than 6 milliseconds
Coil Design: Wrapped or encapsulated
Coil Terminals: Quick disconnect or screw
Coil Voltage: 12, 24, 36, 48, 60, 72, 150 or 250 VDC

HB ELECTRICAL MFG. CO., INC.
P.O. Box 1466 • Mansfield, Ohio 44901
Telephone 419/747-2024

HB PRODUCT DATA SHEET

100 AMPERE, 250 VOLT DC CONTACTOR



2 7/8 L x 3 5/8 W x 3 7/8 H in
73 L x 92 W x 98 H mm

MODEL HB 601 DC CONTACTOR

HB 601 is a compact DC Contactor rated for 250 volt DC applications. The actuator construction is identical to several hundred thousand contactors now in service in a wide variety of applications. A new contact design incorporates features to aid in switching DC voltages to 250 VDC. Arcing horns and magnetic blowouts stretch the arc on opening to achieve arcing times of less than 5 milliseconds. This model may be mounted in any position without degrading performance.

Contact arrangement: Single Pole, Single Throw

Contact design: Double break with permanent magnet blow-out and arcing horns

Current Rating: Make into 1000 Amperes
: Carry 150 Amperes continuously
: Open 100 Amperes at 250 VDC

Voltage Rating: 250 Volts DC

Mechanical Life: 10,000,000 cycles

Electrical Life: 100,000 cycles

Contact Bounce: Less than 6 milliseconds

Coil Design: Wrapped or encapsulated

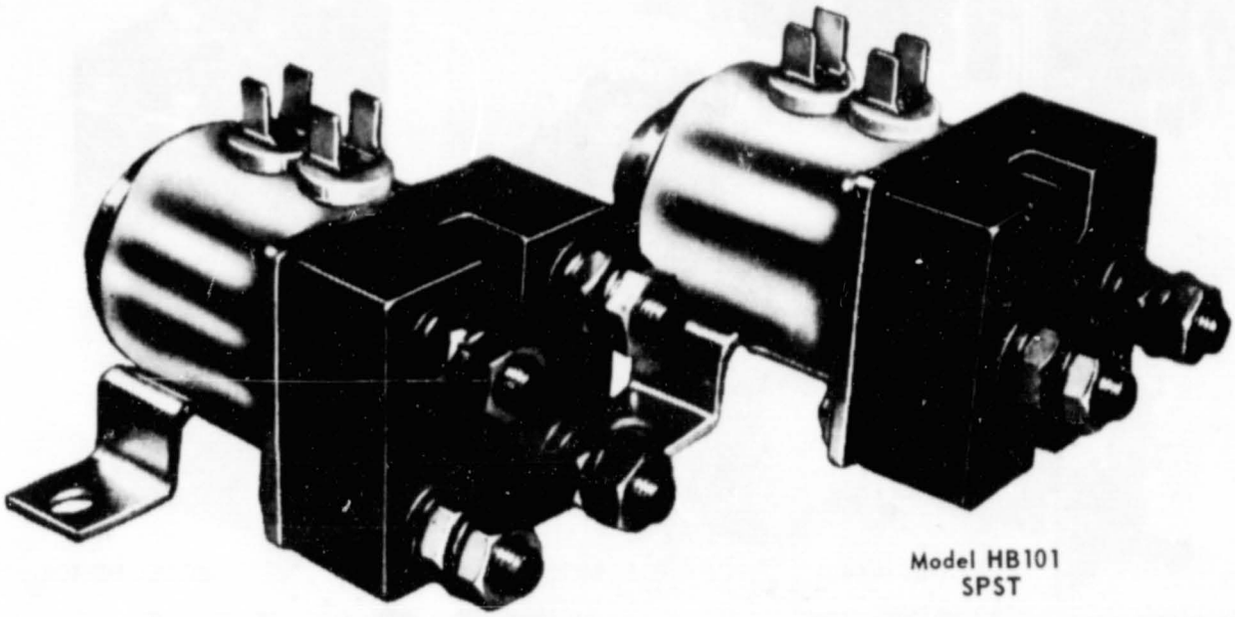
Coil Terminals: Quick connect or screw

Coil Voltage: 12, 24, 36, 48, 60, 72, 120 or 250 VDC

HB ELECTRICAL MFG. CO., INC.
P.O. Box 1466 • Mansfield, Ohio 44901
Telephone 419/747-2024

HB PRODUCT DATA SHEET

75 AMPERE, 48 VOLT ENCLOSED CONTACTORS



Model HB101
SPST

Model HB 107
DPST

4.11 L, 3.47 W, 2.69 H in.

MODEL HB101 AND HB107 ENCLOSED CONTACTORS

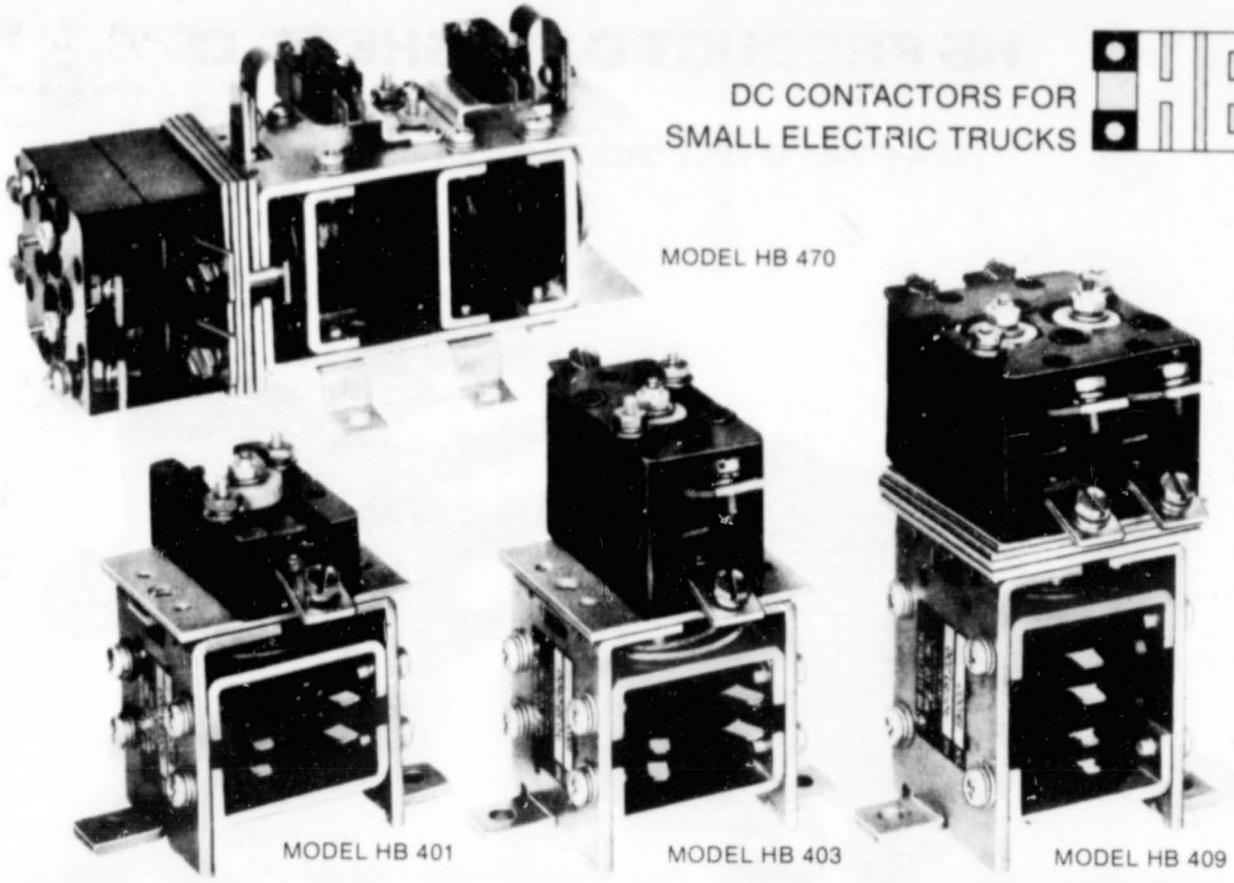
The HB100 series contactors are designed to fill the gap between the automotive solenoid and HB heavy duty industrial contactors. The use of our standard 75 ampere contact bridge provides a double break contact configuration for long electrical life. A molded cover for the contact sections provides protection against dust, oil, etc.

This series is offered in SPST, DPST, Reversing and series-parallel versions. The offset mounting allows interlacing for minimum space requirements. As with all HB contactors these may be mounted in any position and are highly resistant to shock and vibration.

Contact Design:	Double break
Current Rating:	Make 750 amperes Carry 75 amperes continuous Rupture 750 amperes
Voltage Rating:	48 VDC
Mechanical Life:	10,000,000 cycles
Electrical Life:	1,000,000 cycles
Contact Bounce:	Less than 6 milliseconds
Coil Design:	Enclosed
Coil Terminals:	Quick disconnect
Coil Voltages:	6, 12, 24, 36 and 48 VDC

HB ELECTRICAL MFG. CO., INC.
P.O. Box 1466 • Mansfield, Ohio 44901
Telephone 419/747-2024

DC CONTACTORS FOR
SMALL ELECTRIC TRUCKS



MODEL HB 470

MODEL HB 401

MODEL HB 403

MODEL HB 409

HB 50/75 Ampere DC Contactors

HB 50/75 ampere DC Contactors are designed for small electric truck applications including hand-controlled "walkie" trucks. They are available in 20 different models with a choice of many optional features to meet the requirements for standard truck and special purpose service.

These low-cost contactors combine a special molded contact section with HB's standard heavy-duty actuator design.

The special contact design is capable of over 1 million electrical cycles and 10 million mechanical operations. It utilizes the double-break approach which has proved to be extremely durable in our higher capacity models.

The actuator design is identical to that of our 150 ampere models. It employs the same standardized parts and is built with the same controlled precision. The result is a high-performance 50/75 ampere contactor at low cost.

OTHER SPECIAL FEATURES

- The standard double-break design is capable of up to 48 VDC operation. Multiple bridge designs are available for higher current and voltage applications.
- Coils are available with quick-disconnect or screw-type terminals.
- Interlocks are available for control circuit switching.
- All contactor models are capable of being mounted in any attitude. Horizontal mounting is recommended only for Model HB 470, shown above, which combines two contactors in a single unit.
- Special design U-shaped coil terminations permit suppression and/or timing functions to be added at the discretion of the user.
- Various models have been tested under simulated pump motor starting conditions, making into 750 amperes and breaking 250 amperes, far in excess of 1.8 million electrical cycles.
- All models have been recognized by UL for use in forklift truck motor control circuits.

ORIGINAL PAGE IS
OF POOR QUALITY

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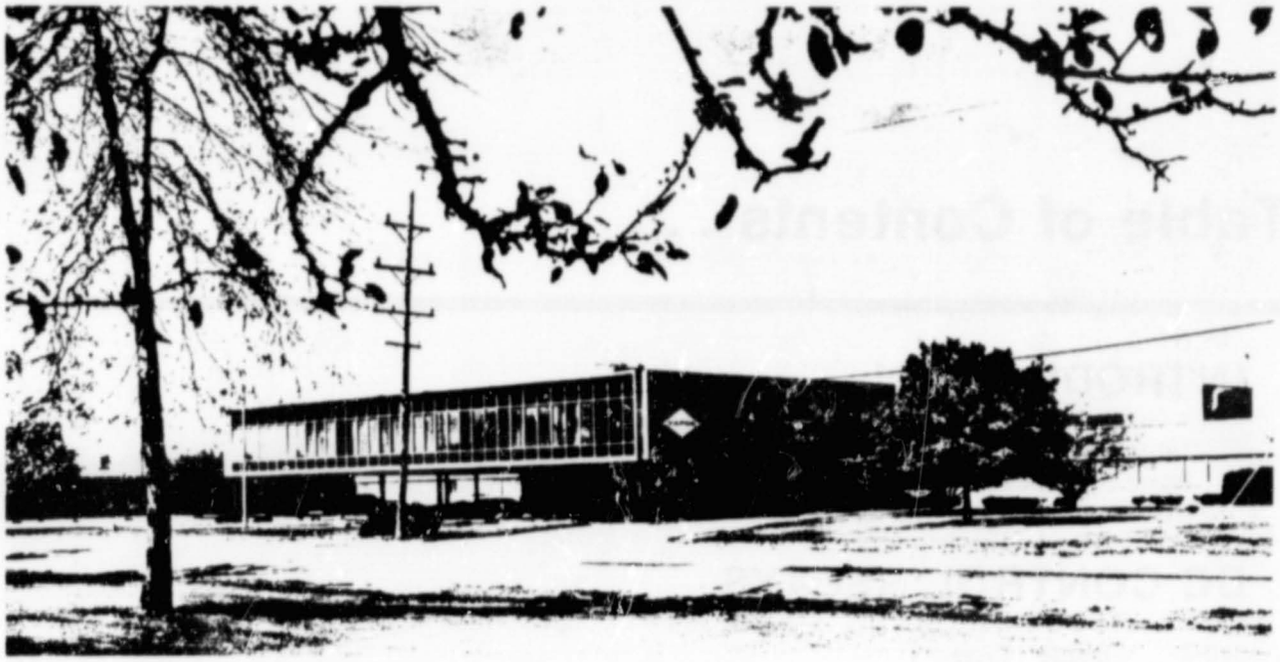

Introduction . . .

Vapor Corporation manufactures a wide range of relays and contactors to meet specific applications with maximum reliability and minimum maintenance requirements. Items shown in this catalog are meeting with high approval in the transportation, heavy construction, off road equipment, industrial, and commercial fields.

Vapor began designing relays and contactors out of necessity in the 1920's. As a pioneer in railroad passenger car heating, Vapor required tough, long life relays for temperature control circuits that could withstand the rigors of rail application. When no satisfactory existing product could be found, Vapor engineers were forced to design relays to the exacting specifications required. Ever since, the Vapor relay and contactor line has been continuously expanded and improved as the need for rugged, dependable relays grew.

In the 1940's Vapor developed a line of heavy duty relays and contactors for locomotive control. In the 1960's the product line was again expanded to include industrial relays and contactors. This constant expansion and improvement program has led to a full line of relays and contactors designed to meet severe operating conditions where long mechanical life and high reliability are paramount. Vapor relays and contactors provide a 1 to 2 million cycle load life and 20 million mechanical cycles with control relays; 5 million mechanical cycles with contactors.

For better service and reliability a relay or a contactor should always be designed to fit a particular application. This is why we invite discussion of your particular application. The use of our Customer Relay and Contactor Specification Sheet makes it easier to select or design a specific device for your engineering problem; use it in your inquiry.

Closely associated with its relay and contactor line, Vapor also designs and manufactures many solid state devices to customer's particular specifications. Close-differential relays, temperature compensated and time delay relays, and transistorized switching circuits are just a few of the many items manufacured in our modern, well-equipped facilities.

Whatever your needs are in the transportation, industrial, or commercial fields, contact our Vapor Sales Engineer in your territory. Our many years of experience in these fields will save you time and money.

VAPOR CORPORATION

TRANSPORTATION SYSTEMS DIVISION
6420 West Howard Street, Chicago, Illinois 60648
Telephone No. 312/631-9200

Table of Contents . . .

INTRODUCTION

A Guide to Using the General Catalog
Table of Contents
Basic Specifications
Customer Relay and Contactor Specification Sheet

DC CONTROL RELAYS

572-2 Two & Three Form "C" Type — Quick Disconnect Terminals
572-3 "Bottle" Type
572-4 Six-Pole Type — Quick Disconnect Terminals
572-5 Eight Pole Type — Quick Disconnect Terminals
572-6 Twelve Pole Type — Quick Disconnect Terminals
572-7 Fourteen Pole Type — Quick Disconnect Terminals
572-8 Two Form "C" Type — Solder Type Terminals
572-9 Three Form "C" Type — P.C. Type Terminals
572-10 Four Form "C" Type — Quick Disconnect Terminals
572-11 Two Form "C" Type — Printed Circuit Type Terminals
572-12 Two Form "C" Type — Plug-In Type Terminals
572-13 One Form "C" Type — Quick Disconnect Terminals

CONTROL RELAYS (CRITICAL CIRCUITS)

572-20 One Form "C" Type — Quick Disconnect Type Terminals
572-21 Two Form "C" Type — Quick Disconnect Type Terminals
572-22 Three Form "C" Type — Quick Disconnect Type Terminals
572-23 Four Form "C" Type — Quick Disconnect Type Terminals
572-24 Six Pole Type — Quick Disconnect Type Terminals
572-25 Eight Pole Type — Quick Disconnect Type Terminals
572-26 Twelve Pole Type — Quick Disconnect Type Terminals
572-27 Fourteen Pole Type — Quick Disconnect Type Terminals

MEDIUM DUTY DC CONTACTORS

572-100 Two, Three and Four Pole Type Screw Type Terminals
572-101 Three Pole Type (w or w/o aux. contacts) for 3 phase AC Loads
572-102 Four Pole Type — Quick Disconnect Terminals
572-103 Two, Three, Four and Six Pole Type — Lug Type Terminals
572-104 Three Pole Type (with arc barriers) — Lug Type Terminals
572-105 Six Pole Type — Quick Disconnect Terminals

VAPOR Transportation Systems
A BRUNSWICK COMPANY

6420 West Howard Street, Chicago, Illinois 60648
Telephone No. 312/631-9200

Table of Contents (cont.)

HEAVY DUTY DC CONTACTORS

572-200 One to Six Pole Type — Pierced Lug Type Terminals
572-201 Two Pole Type — Hex Head Screw Type Terminals
572-202 One Pole Type — Hex Head Screw Type Terminals
572-203 Two Pole Type — Top Mounted Main Contact Terminals, Quick Disconnect Auxiliary Contact and Coil Terminals
572-204 Two Pole Type — Top Mounted Contact Terminals, Quick Disconnect Coil Terminals
572-205 Two Pole Type with Optional Auxiliary Contacts — Top Mounted Main Contact Terminals, Quick Disconnect Auxiliary Contact and Coil Terminals
572-206 One Pole Type — Top Mounted Contact Terminals, Quick Disconnect Coil Terminals
572-207 One Pole Type with Auxiliary Contacts — Top Mounted Main Contact Terminals, Quick Disconnect Auxiliary Contact and Coil Terminals
572-208 Two Pole Type for AC or DC — Top Mounted Main Contact Terminals, Screw Type Coil Terminals
572-210 Four Pole DC Reversing Type — Hex Head Screw Type Terminals
572-300 Two Pole DC Starting Type — Stud Type Terminals

DC CURRENT ACTUATED RELAYS

572-400 "Bottle" Type — Binder Head Screw Type Terminals
572-401 Two Pole Type — Hex Head Screw Type Terminals
572-402 Six Pole Type — Hex Head Screw Type Terminals

DC CLOSE DIFFERENTIAL RELAY

572-500 One Form "C" Type — Quick Disconnect Terminals
572-502 Four Form "A" Type — Solder Type Terminals
572-503 Two Form "A", Two Form "B" Type — Solder Type Terminals

DC LATCHING RELAYS

572-700 Two Form "C" Mechanical Type — Quick Disconnect Type Terminals
572-702 Two Form "C" Electrical Type — Quick Disconnect Type Terminals

AC/DC RELAYS AND CONTACTORS

572-801 Three Form "C" Type Relay — Quick Disconnect Type Terminals
572-802 One Form "C" Type Relay — Quick Disconnect Type Terminals
572-826 One Pole Type Contactor — DC Contact Action, AC Coil Operation

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Telephone No. 312/631-9200

Basic Specifications . . .

Relay Type	Current Load Rating @ 28 VDC	Current Load Rating @ 140 VDC	Number of Poles	Type of Terminations	Bulletin Number
General Control	4 Amps	1 Amp	3 Form "C"	.03" dia. Pins	572-9
Heavy Duty Control	20 Amps	5 Amps	1 Form "C"	Fast-ons	572-13
Heavy Duty Control	20 Amps	5 Amps	2 Form "C"	Fast-ons	572-2
Heavy Duty Control	15 Amps	3 Amps	2 Form "C"	Solder	572-8
Heavy Duty Control	15 Amps	3 Amps	2 Form "C"	.045" Square Printed Circuit	572-11
Heavy Duty Control	15 Amps	3 Amps	2 Form "C"	Plug-in	572-12
Heavy Duty Control	20 Amps	5 Amps	3 Form "C"	Fast-ons	572-2
Heavy Duty Control	20 Amps	5 Amps	4 Form "C"	Fast-ons	572-10
Heavy Duty Control	20 Amps	5 Amps	6 Pole	Fast-ons	572-4
Heavy Duty Control	20 Amps	5 Amps	8 Pole	Fast-ons	572-5
Heavy Duty Control	20 Amps	5 Amps	12 Pole	Fast-ons	572-6
Heavy Duty Control	20 Amps	5 Amps	14 Pole	Fast-ons	572-7
"Bottle" Type Control	15 Amps	5 Amps	2 & 4 Pole	Fast-ons, Screw Type	572-3
Critical Circuit Control	15 Amps	3 Amps	1 Form "C"	Fast-ons	572-20
Critical Circuit Control	15 Amps	3 Amps	2 Form "C"	Fast-ons	572-21
Critical Circuit Control	15 Amps	3 Amps	3 Form "C"	Fast-ons	572-22
Critical Circuit Control	15 Amps	3 Amps	4 Form "C"	Fast-ons	572-23
Critical Circuit Control	10 Amps	2 Amps	6 Pole	Fast-ons	572-24
Critical Circuit Control	10 Amps	2 Amps	8 Pole	Fast-ons	572-25
Critical Circuit Control	10 Amps	2 Amps	12 Pole	Fast-ons	572-26
Critical Circuit Control	10 Amps	2 Amps	14 Pole	Fast-ons	572-27
Medium Duty Contactor	25 Amps	5 Amps	2 & 4 Pole	Self Locking Screw	572-100
Medium Duty Contactor - for 3 phase loads	15 Amps	5 Amps	3 Pole	Self Locking Screw	572-101
Medium Duty Contactor	25 Amps	5 Amps	4 Pole	Fast-ons	572-102
Medium Duty Contactor	50 Amps	15 Amps	1 thru 6 Pole	Lug Type	572-103
Medium Duty Contactor - with arc barriers	15 Amps	5 Amps	3 Pole	Self Locking Screw	572-104
Medium Duty Contactor	20 Amps	5 Amps	6 Pole	Fast-ons	572-105
Current Actuated	20 Amps	4 Amps	2,4 and 6 Pole	Binder-head Screw	572-400
Current Acutated	25 Amps	5 Amps	2 Pole	Self Locking Screw	572-401
Current Acutated	25 Amps	5 Amps	6 Pole	Self Locking Screw	572-402
Mechanical Latching	20 Amps	5 Amps	2 Form "C"	Fast-ons	572-700
Mechanical Latching - indicating light	20 Amps	5 Amps	2 Form "C"	Fast-ons	572-700
Electrical Latching	20 Amps	5 Amps	2 Form "C"	Fast-ons	572-702
AC/DC Control	20 Amps	5 Amps	3 Form "C"	Fast-ons	572-801
AC/DC Control	20 Amps	5 Amps	1 Form "C"	Fast-ons	572-802
Close Differential	10 Amps		1 Form "C"	Fast-ons	572-500

Contactor Type	Current Load Rating	Number of Poles	Type of Terminations	Bulletin Number
Heavy Duty DC	15A @ 140 VDC/60A @ 36 VDC	1 to 4 Pole	Pierced Lug	572-200
Heavy Duty DC	15A @ 750 VDC/30A @ 300 VDC	2 Pole	Self Locking Screw	572-201
Heavy Duty DC	15A @ 750 VDC/30A @ 300 VDC	1 Pole	Self Locking Screw	572-202
Heavy Duty DC	15A @ 1500 VDC/40A @ 750 VDC	2 Pole	Stud Type	572-203
Heavy Duty DC	15A @ 1500 VDC/40A @ 750 VDC	2 Pole	Stud Type	572-204
Heavy Duty DC	25A @ 140 VDC/50A @ 74 VDC	2 Pole	Stud Type	572-205
Heavy Duty DC	50A @ 600 VDC/200A @ 140 VDC	1 Pole	Stud Type	572-206
Heavy Duty DC	50A @ 600 VDC/200A @ 140 VDC	1 Pole	Stud Type	572-207
Heavy Duty DC	30A @ 140 VDC/160A @ 40 VDC	2 Pole	Stud Type	572-208
DC Reversing	5A @ 600 VDC/30A @ 150 VDC	4 Pole	Self Locking Screw	572-210
DC Starting	1800A @ 74 VDC/2000A @ 28 VDC	2 Pole	Stud Type	572-300
AC/DC	30A @ 750 VDC	1 Pole	Self Locking Screw	572-826

NOTE: AC resistive rating @ 110 VAC equals current load rating @ 28VDC

VAPOR Transportation Systems
A BRUNSWICK COMPANY

6420 West Howard Street, Chicago, Illinois 60648
Telephone No. 312/631-9200

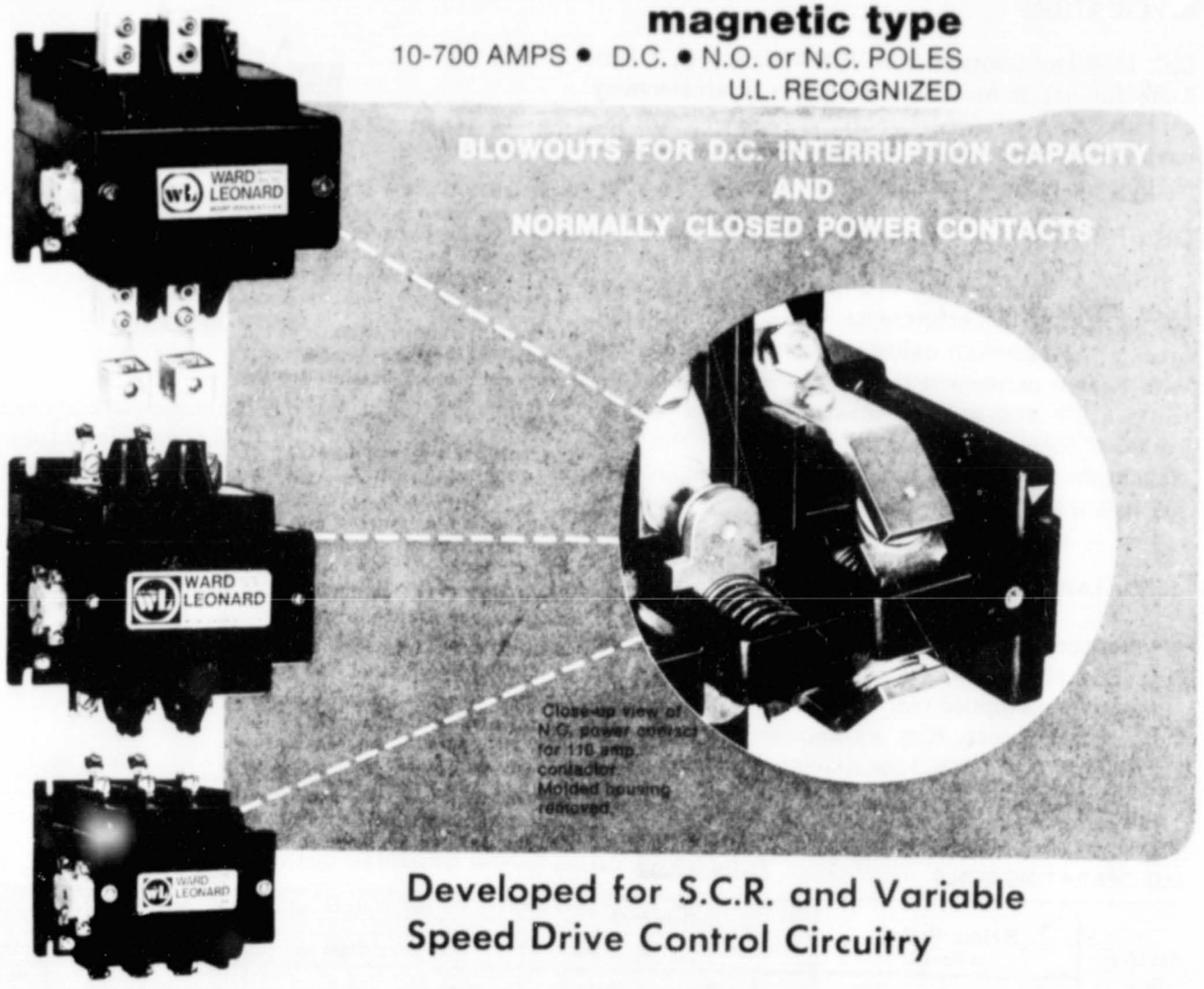
DEFINITE PURPOSE CONTACTORS

Ward Leonard

31 South St.
Mt. Vernon NY 10550
Phone (914) 664-1000
Subsidiary of
The Unimax Group Inc

magnetic type

10-700 AMPS • D.C. • N.O. or N.C. POLES
U.L. RECOGNIZED



Developed for S.C.R. and Variable Speed Drive Control Circuitry

FEATURES

- Normally open and/or normally closed power contacts in same contactor
- Available in 10/40 and 40; 30, 56; 75; 110, 180, 260; 360, 535 and 700 amp. ratings
- Contacts D.C. rated
- Small – requires little panel area for mounting
- Simple inspection and installation
- Excellent mechanical and electrical life
- Modern design
- Low cost

5000 DP Definite Purpose Contactors are designed for d.c. adjustable speed drive circuits using silicon controlled rectifier switching and other controls where a combination of normally open and normally closed power contacts is required. In all applications, reduced panel area for contactor mounting is made possible through an exceptionally compact design and the exclusive built-in N.C. dynamic brake power contact feature.

In silicon controlled rectifier switching circuits, the SCR is normally phased back prior to contactor opening. Therefore, the N.O. contacts are not required to interrupt any appreciable current. Under abnormal conditions such as failure of the SCR or the control circuit, the contactor may interrupt up to 200% current. The N.O. contacts must be equipped with permanent magnet blowouts to meet this requirement.

The dynamic brake N.C. contact is required to insert the dynamic brake resistor and therefore must make up to 200% of rated current each time the contactor is deenergized.

Jogging is accomplished at low voltage and current. Therefore, the dynamic brake contact is rated at ⅓ of rated voltage and dynamic brake current. The permanent magnet blowouts provide this interrupting ability.

D.C. MAGNETIC CONTACTORS

Ward Leonard
31 South St.
Mt. Vernon NY 10550
Phone (914) 664-1000
Subsidiary of
The Unimax Group Inc.

solenoid type

NEMA SIZES 1-4 • 25-150 AMPS. • 250 VOLTS MAX.

APPLICATION

D.C. Magnetic Contactors in NEMA Sizes 1, 2, 3, and 4 are for use as main line, reversing or accelerating contactors in d.c. magnetic motor starters and controllers. Other applications include switching resistive heating and battery loads.



100 amp. Contactor with auxiliary contact.

DESCRIPTION

All D.C. Contactors are solenoid operated for fast, constant, long-life performance. Generous size double break silver cadmium oxide contacts in combination with built-in permanent magnet blowouts assure long contact life and positive load circuit interruption. Terminal location makes the contactors ideal for straight-through wiring and for wire channel layouts. Accessible up-front pressure-type terminals are furnished as standard.

AUXILIARY CONTACTS

All contactors can be furnished with N.O., N.C. or N.O. and N.C. auxiliary contact blocks. Each contactor can be supplied with a maximum of four auxiliary contact blocks. Kits are also available for field installation. See Table 3 for auxiliary contact ratings.

OPERATING COILS

Standard coils for d.c. operation are molded and equipped with pressure type terminals. On order a.c. coils can be furnished for those applications requiring a.c. control circuits.

COIL SUFFIX NOS. Table 1

D.C. Volts (see note 1)	Suffix Nos.	A.C. Volts Nominal (50/60 Hz.)	Suffix Nos.
24	82	110	11
50	32	208/220	21
120	12	440	41
240	22	550	51

Note 1 — Contactor with d.c. coils includes economizing resistor and normally closed late break auxiliary for inserting resistor.

1 and 2-POLE CONTACTORS - 250 Volts D.C. Max. on Contacts

D.C. OPERATING COILS

ORDER BY Catalog Number followed by Coil Suffix Number. Table 2

NEMA Size	8-Hour Rating in Amps		1-Pole N.O. † Open Type ▲		2-Pole N.O. † Open Type ▲		2-Pole N.O. & 1-Pole N.C. † Open Type ▲	
	Open	Encl.	Cat. No.	Price **	Cat. No.	Price **	Cat. No.	Price **
1	25	22.5	7401-4010-*		7401-1020-*		7401-3050-*	
2	50	45	7402-4010-*		7402-1020-*		7402-3050-*	
3	100	90	–		7403-1020-*		7403-3050-*	
4	150	135	–		7404-1020-*		7404-3050-*	

A.C. OPERATING COILS

NEMA Size	8-Hour Rating in Amps		1-Pole N.O. † Open Type ▲		2-Pole N.O. † Open Type ▲		2-Pole N.O. & 1-Pole N.C. † Open Type ▲	
	Open	Encl.	Cat. No.	Price **	Cat. No.	Price **	Cat. No.	Price **
1	25	22.5	7441-4010-*		7441-1020-*		7441-3050-*	
2	50	45	7442-4010-*		7442-1020-*		7442-3050-*	
3	100	90	–		7443-1020-*		7443-3050-*	
4	150	135	–		7444-1020-*		7444-3050-*	

† On Sizes 3 and 4 only for single pole applications use two poles in series and for two pole applications use one pole in each line.

▲ NEMA 1 General Purpose Enclosures can be supplied. To order contactor with enclosure change 6th digit in Cat. No. from, "0" to "1" and. Consult factory for price.

** Contactor furnished without auxiliary contact. See Accessories and Modifications.

* For complete catalog number add coil suffix number from Table 1.

D.C. CONTACTORS

magnetic type

FOR BATTERY OPERATED VEHICLE USE

Ward Leonard

31 South St.
Mt. Vernon NY 10550
Phone (914) 664-1000
Subsidiary of
The Unimax Group Inc.

CONTACTOR CATALOG NUMBERS

For prices contact Home Office. Table 1

Model	CONTACTOR AMPS. 72 V.D.C.	NO. OF POLES N.O.	N.C.	Cat. No. Without Auxiliary	Cat. No. With One D.T. Auxiliary	Cat. No. With Two D.T. Auxiliaries
M	75	1	-	7700-1000-*	7700-1001-*	7700-1005-*
		2 ▲	-	7700-2000-*	7700-2001-*	7700-2005-*
		1	1	7700-1100-*	7700-1101-*	7700-1105-*
M	100	1	-	7703-1000-*	7703-1001-*	7703-1005-*
		2 ▲	-	7703-2000-*	7703-2001-*	7703-2005-*
		1	1	7703-1100-*	7702-1101-*	7703-1105-*
S	100	1	-	7701-1000-*	7701-1001-*	7701-1005-*
		2	-	7701-2000-*	7701-2001-*	7701-2005-*
		1	1	7701-1100-*	7701-1101-*	7701-1105-*
		2	2	7701-2200-*	7701-2201-*	7701-2205-*
S	200	1	-	7702-1000-*	7702-1001-*	7702-1005-*
		2	-	7702-2000-*	7702-2001-*	7702-2005-*
		1	1	7702-1100-*	7702-1101-*	7702-1105-*

* For Complete Catalog Number add Coil Suffix Nos. from Table 2.
▲ These 2 - pole N.O. contactors are for intermittent duty only.

COIL SUFFIX NOS.

Table 2

D.C. Volts*	Suffix Nos.	A.C. Volts	Suffix Nos.
6	13	115	11
12	23		
24	43		
36	53		
48	63		
72	73		

Table 3

AUXILIARY CONTACTS

Type Auxiliary	Kit No.
D. T.	7M600

ORDER BY Catalog No. followed by Coil Suffix No.

D.C. COIL DATA

Table 4

Model	Contactor Size Amps	Coil Volts* D.C.	Amps.	Nos.	Nos.
S	100 & 200	6	34	349L8	7ML10
		12	34	349L3	7ML11
		24	34	349L4	7ML12
		36	34	349L2	7ML13
		48	34	349L5	7ML20
		72	34	349L6	7ML14
M	75 ▲ & 100 ▲	6	15	351L1	7ML15
		12	15	351L2	7ML16
		24	15	351L3	7ML17
		36	15	351L4	7ML18
		48	15	351L5	7ML21
		72	15	351L6	7ML19

▲ These 2 - pole N.O. contactors are for intermittent duty only.

A. C. COIL DATA

Table 5

Model	Contactor Amps.	Coil Volts 60 Hz.	V. A.	Coil Nos.	Kit Nos.*
S	100 & 200	115	34	349L7	7M105
M	75 & 100	115	15	351L7	7M106

*Kit includes coil, rectifier and mounting hardware.

CONTACT KITS - for 1-pole

Table 6

Model	Contactor Size Amps	N.O. Contacts Kit Nos.	Price	Double Throw (1 N.O. & 1 N.C.) Kit Nos.
S	100	7M50		7M51
S	200	7M52		7M53
M	75&100	7M48		7M49

DIMENSIONS - Approximate

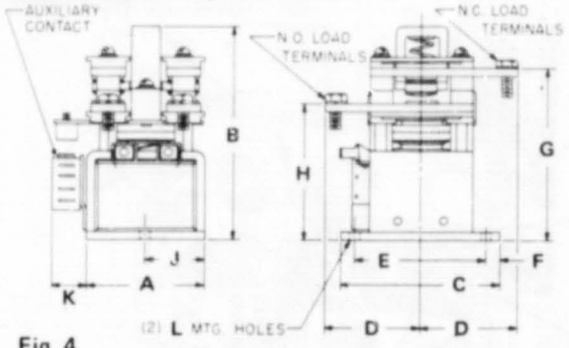


Fig. 4

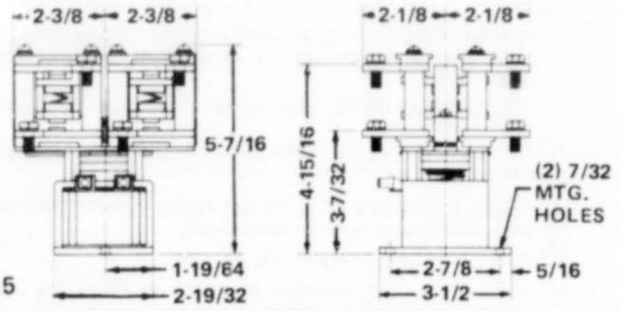


Fig. 5

CONTACTOR Model	Amps.	Fig. 4 DIMENSION — In Inches A	B	C	D	E	F	G	H	J	K	L
S*	100* & 200	2-9/16	4-11/16†	3-1/2	2-1/8	2-7/8	5/16	3-3/4	3	1-9/32	5/8	7/32
M††	75 & 100	2	3-9/16	3-1/4	1-5/8	2-3/4	1/4	3-1/8	2-1/2	1	5/8	7/32

* See Fig. 5 for 100 amp. 2N.O. and 2 N.C. dimensions.
†† For dimensions of Model S 2 - pole N.O. contactors consult factory
† Dimension B for 2 - pole N.O. contactors is 5".

D.C. CONTACTORS

magnetic type

FOR BATTERY OPERATED VEHICLES

Ward Leonard
31 South St.
Mt. Vernon NY 10550
Phone (914) 664-1000
Subsidiary of
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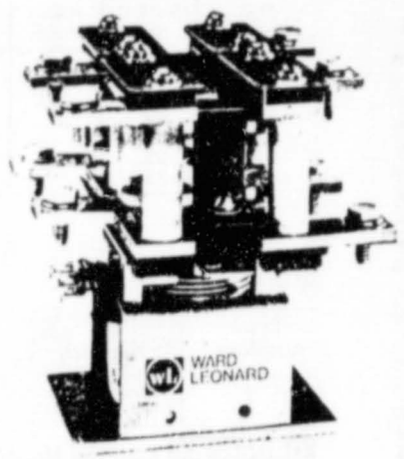


Fig. 1, Model S 100 amp. Contactor with 2 N.O. and 2 N.C. power poles.

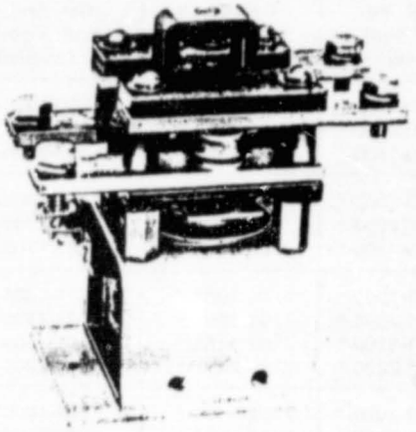


Fig. 2, Model S 200 amp. Contactor with 1 N.O. and 1 N.C. power pole

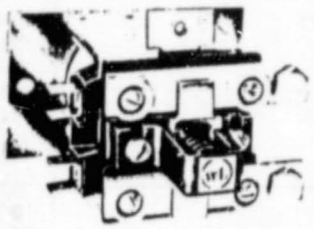


Fig. 3, Model M 100 amp. Contactor with 1 N.O. power pole

FEATURES

- Space-saving design
- Fast, solenoid operation
- Long-life, heavy duty construction
- 100 and 200 amp. ratings
- Low in cost
- Quick, easy installation and inspection

CONSTRUCTION DETAILS

1. DOUBLE BREAK POWER CONTACTS - made of silver cadmium oxide furnish anti-weld protection under overload conditions. Generous size contacts are permanently brazed to bus bar. Contacts are long-wearing, maintenance free.
2. ACCESSIBLE LOAD TERMINALS - Up-front location permits straight-thru wiring. Terminal screws mount directly in stationary contact bus bar.
3. STAINLESS STEEL CONTACT SPRING - maintains contact pressure and assures fast contact break (N.O.) and make (N.C.)
4. STURDY BUS BARS - constructed of heavy gauge copper;
5. CONICAL STEEL RETURN SPRING - assures fast contact break.
6. QUICK-CONNECT COIL TERMINALS - mate with standard .250" quick connect receptacles.
7. HEAVY STEEL MOUNTING PLATE
8. POWERFUL D.C. POWER PLANT - designed for fast, consistent operation. Magnet frame and movable plunger suitably protected against corrosion.
9. OPERATING COILS - Standard coils in voltages from 6 - 72V D.C. Constructed to resist moisture, thermal and mechanical stress. Higher voltage coils also available.
10. OPTIONAL FEATURES - Auxiliary Contacts (interlocks)

APPLICATION

Model M "mini" contactors are 75 and 100 amp. rated and can be furnished with 1 N.O., 2 N.O. and 1 N.O. and 1 N.C. power poles. Model S standard contactors, with ratings of 100 and 200 amps. are available with 1 N.O., 2 N.O., or 1 N.O. and 1 N.C. power poles. Model S contactors in the 100 amp. size are also available with 2 N.O. and 2 N.C. power poles.

Model S 100 amp. contactors have higher interrupting ratings than Model M 100 amp. units and are more suitable for severe duty applications. All contactors can be supplied with or without double throw auxiliary contacts.

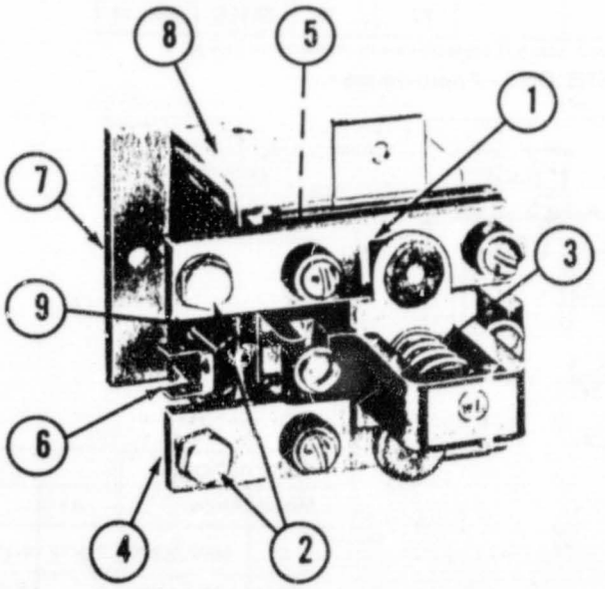
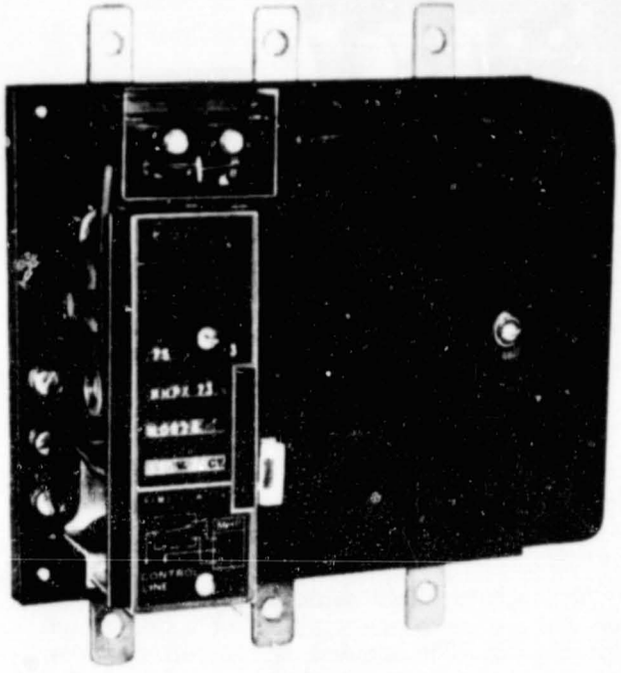


Fig. 4, Model S 100 amp. Contactor with 1 N.O. power pole.

ZENITH BUS MOUNTING CONTACTORS

electrically operated — mechanically held



MODEL MHP-73.
RATED FOR INDUCTIVE, TUNGSTEN AND MIXED LOADS

APPLICATIONS: The Zenith MHP series remote control switches, with their compact frame and extended bus bar mounting, are specifically designed for panelboard and switchboard use. They are power or lighting circuit control contactors that are actuated electrically and then maintained in position mechanically only.

These switches are correctly called electrically operated — mechanically held contactors. However, the term "remote control switch" has been applied to these contactors throughout the electrical industry.

The MHP switch acts as a feeder disconnect switch. Once closed, it is unaffected by line voltage drops. It can be controlled by banks of push buttons, time switches, relays and other pilot control devices. The switch can also be operated through use of its manual handle. The unique mechanically held design insures quiet operation and completely eliminates coil hum.

OPERATION: When the pilot control switch is turned ON, the closing coil operates and the main contacts close. The closing coil is then electrically disconnected by the cutout switch. When the pilot switch is turned OFF, the opening coil operates and the main contacts open. The opening coil is then electrically disconnected by the cutout switch. In either the open or closed position, contactor is held mechanically only.

When there are more than one remote stations controlling a mechanically held contactor, the control switches must be of the momentary contact type, otherwise voltage might be applied to both the opening and closing coils at the same time causing the coils to burn out.

Specifications
MHP

Amperage	30, 75 and 100.
Voltage Ratings	600 V. AC (30 & 75 amp) 480 V. AC (100 amp) General Use—all loads including inductive above .6 PF. 277/480 V. AC Tungsten.
Poles	2 or 3 pole.
Models	Model MHP-open type for direct bus mounting. Model MHPX-open type on sub panel. Model MHPC-enclosed type in NEMA-1 cabinet.
Inrush Current Capacity	20 times rated current.
Interrupting Capacity	150% of rated current.
Approvals	Underwriters' Laboratories

ZENITH CONTROLS, INC. 830 WEST 40th STREET • CHICAGO, ILLINOIS 60609

Phone: 312-247-6400

SECTION B CATALOG 20

SERIES

MHP

ZENITH CONTROLS, INC., 830 40th St., Chicago, IL 60609
Phone: 312-247-6400

ZENITH BUS MOUNTING CONTACTORS

Design Features

BASE: Constructed of fiberglass melamine compound, non-tracking arc quenching. Compression molded with inserts for phase barriers.

ARC CHUTE: Constructed of fiberglass melamine compound, non-tracking and arc quenching. Compression molded with phase barriers and arc chambers. Nested seating to base inserts insures against arcing between poles. Firmly held to base with threaded anchor pin.

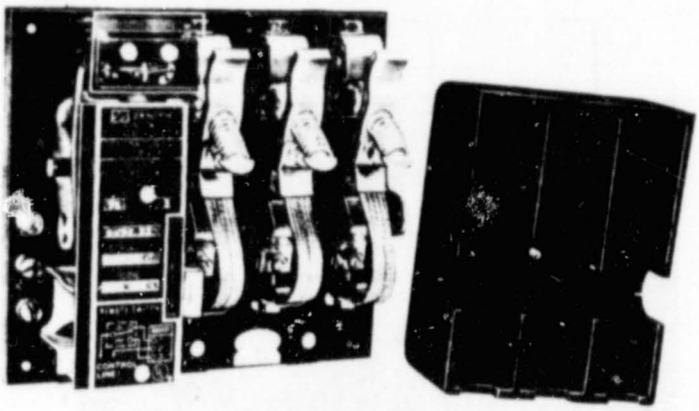
BUS BARS: All bus material is highest grade oxygen free copper, securely riveted to base panel. Upper bus bars supplied with brazed current carrying shoulder stud to permit full surface mating to stationary contact support. Integral formed lower bus bars fit through base panel to load carrier termination.

CONTACTS: The 30 and 75 ampere contacts are cadmium plated copper and 100 ampere contacts feature silver cadmium oxide inlays. All contacts meet with a rolling and wiping, self cleaning action, thus eliminating the need for arcing tips. Heavy compression springs assure positive contact pressure.

LOAD CARRIERS: Constructed of oversized braided copper for maximum flexibility and current carrying capacity. Pressure welded within copper terminal fittings.

OPERATING LINKAGE: Main operating shaft is mounted in self-lubricated oilite bearings. Toggle linkage and pivot points made of corrosion free material. All pins securely locked with tension rings.

OPERATING LEVER: An insulated manual operating handle is provided. Also provided is a special keyed lever for screwdriver setting and position indication.



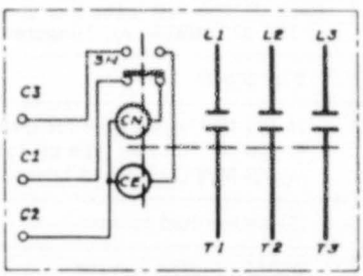
COIL CUTOUT SWITCH: A heavy duty, double break, visible, silver contact snap action switch is supplied. It is securely and positively mounted in position on a die-formed bracket.

OPERATING COILS: Two windings inside of one molded coil are used, one winding for opening and one for closing. The molded epoxy coil provides greater resistance to moisture and insulation deterioration. It is easily replaceable from front of panel without removal or disassembly of arc chute. Coil cover is hinged for easy access and removed by taking out one screw.

BASE INSULATION: The underside of base is insulated with a snap-in bakelite cover.

ACCESSORIES: A full line of accessory equipment is available for the MHP series contactors as described on page B-11.

Typical Wiring



(Omit middle pole for 2 pole units). When the remote switch is turned on, voltage is applied to terminals C1, C2 of the contactor. CN operates and the main contacts close. SN opens, disconnecting the CN coil. The unit is locked closed mechanically only. When the remote switch is turned OFF, voltage is applied to C2, C3 of the contactor. CE operates and the main contacts open. SE opens, disconnecting the CE coil. The unit is locked open mechanically only. SN closes so that the contactor is ready for the next ON operation.

MODEL VARIATIONS

THE MHP SERIES features extended bus bars to provide both mechanical and electrical connections to the bus line in switchboard installations. Mounting and panel dimensions of the 30, 75 and 100 ampere units are identical.

THE MHPX SERIES features the contactor mounted on a sub-panel for separate installation where a dead back is required.

THE MHPC SERIES features the enclosed unit. This is the MHPX unit with the sub-panel and solderless lugs mounted within an enclosure. Standard enclosures are NEMA-1, although other types of enclosures are available upon request.

DC-DC CONVERTERS

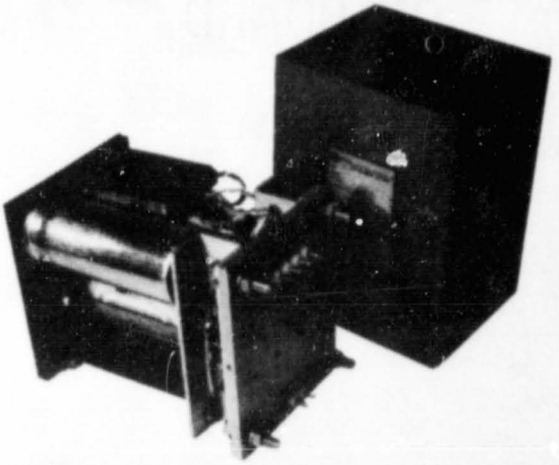
ON-BOARD

(CODE **CV**)

1 Aerovista Park, San Luis Obispo, CA 93401/Phone 805-544-5454/TWX 910-351-6705

CEA
a Division of Berkleonics, Inc.

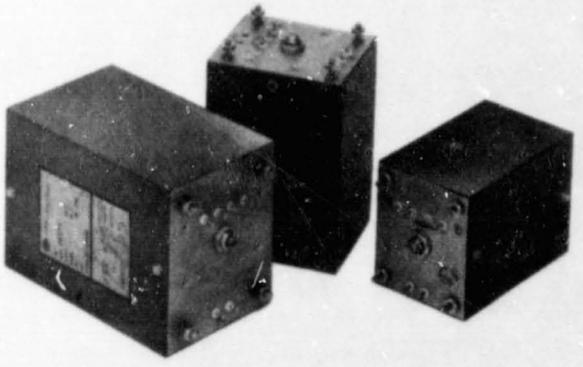
CEA POWER SUPPLIES



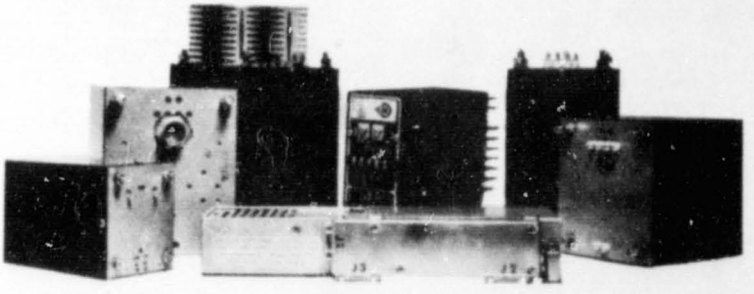
HIGH PRECISION LINEARS



AC/DC SWITCHERS



DC/DC SWITCHERS



INDUSTRIAL AND MILITARY CUSTOMS

CEA'S DC TO DC SWITCHERS

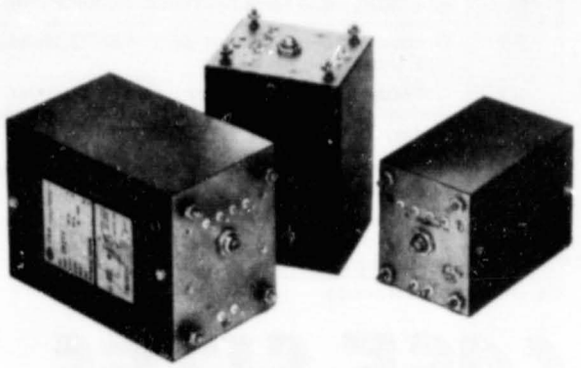
1 Aerovista Park, San Luis Obispo, CA 93401/Phone 805-544-5454/TWX 910-351-6705

CEA
a Division of Berkleonics, Inc.

SINGLE OR TRIPLE OUTPUT POWER SUPPLIES

FEATURES INCLUDE

- OUTPUT from 5 to 28VDC, 1 to 40 AMPS, to 560 WATTS.
- INPUTS from 10.5 to 60VDC in three voltage ranges. See the CEA3 series for an input voltage range of 120-190VDC.
- REGULATION 0.5% for line or load.
- 80°C BASE TEMPERATURE without derating.
  Floating outputs, + or − output may be ±500VDC from case.
  Remote sensing on regulated models, eliminating load lead errors.
  Output voltage adjustable ±10% or fixed.
  OVP, current limit and overtemperature cut-out standard on regulated models.
  Output short circuit protection.
  Modular case sizes with removable covers for servicing.
  Critical components pretested, aged, and graded.
- BURN-IN (stabilization), 16 hrs. min. at rated load and high base temperature.
- 100% TESTING after burn-in, test data with shipment.
- 3 YEAR WARRANTY for parts and labor against defects in workmanship and materials.



CEA2 SERIES

SPECIFICATIONS

Class of Regulation	Line Regulation for Full DC Input Change	Load Regulation from 10% to Full Load	P-P* Ripple Plus Noise	Temperature Coefficient Per Degree C	Efficiency Up to	Option Required
A	None[1]	10% +.5V	3.0%	1.0%	90%	A2
C	0.5%	0.5%	1.0%	0.02%	80%	None

* Measured at 300 kHz bandwidth, 10% minimum load required.
[1] Measured at nominal line and 50% load.

Input Voltage: 10.5 to 15.0VDC standard (12.25VDC nominal), other input ranges are optional. (See options "I")

Output Voltage and Current: 5 to 28VDC (with ±10% adjust or see "A" options), 1 to 48 Amps. See correlation in table below.

Recovery Time: Typically less than 1ms for a 50% to 100% load change.

Insulation Resistance: 100 Megohms DC for input, output and case.

Temperature, Base: −20°C to +80°C operating, −40°C to +85°C storage.

OVP: Set typically from 110 to 130% of rated output. Current limit: occurs typically at 130% of rated output. Overtemperature cut-out: above 85°C.

Size-Weight-Terminations: Details associated mechanical data (GA thru RA), tabulated below, are shown on page 5.

MODELS

This table is for "C" regulated units. Replace "C" with "A" for unregulated units.

VDC OUT	AMPS OUT	SIZE	PART NUMBER
SINGLE OUTPUT			
5V	1.0A	GA	2C50X102
5V	2.5A	GA	2C50X252
5V	5.0A	HA	2C50X502
5V	10.0A	KA	2C50X103
5V	20.0A	NA	2C50X203*
5V	40.0A	QA	2C50X403*
10V	1.0A	GA	2C100Y102
10V	2.5A	GA	2C100Y252
10V	5.0A	JA	2C100Y502
10V	10.0A	MA	2C100Y103*
10V	20.0A	PA	2C100Y203*
10V	40.0A	RA	2C100Y403*
12V	1.0A	GA	2C120Y102
12V	2.5A	GA	2C120Y252
12V	5.0A	JA	2C120Y502
12V	10.0A	MA	2C120Y103*
12V	20.0A	PA	2C120Y203*
12V	40.0A	RA	2C120Y403*
15V	1.0A	GA	2C150Y102
15V	2.5A	JA	2C150Y252
15V	5.0A	MA	2C150Y502*
15V	10.0A	PA	2C150Y103*
15V	20.0A	RA	2C150Y203*
24V	1.0A	GA	2C240Y102
24V	2.5A	JA	26240Y252
24V	5.0A	MA	2C240Y502*
24V	10.0A	PA	2C240Y103*
24V	20.0A	RA	2C240Y203*
28V	1.0A	GA	2C280Y102
28V	2.5A	JA	2C280Y252
28V	5.0A	MA	2C280Y502*
28V	10.0A	PA	2C280Y103*
28V	20.0A	RA	2C280Y203*

TRIPLE OUTPUT				
VDC OUT	AMPS OUT +5V	AMPS OUT ±15V	SIZE	PART NUMBER
+5V, ±15V	1.0A	0.25A	JA	DCT50J15
+5V, ±15V	2.5A	0.5A	MA	DCT50M15
+5V, ±15V	5.0A	1.0A	NA	DCT50N15
+5V, ±15V	10.0A	2.5A	QA	DCT50Q15*

* Requires "I1" or "I2" option.

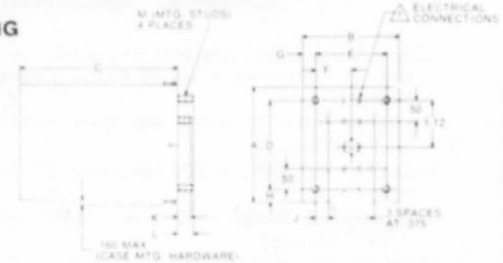
OPTIONS

OPTION	DESCRIPTION	√ AVAILABLE ON THESE MODELS						
		CEA3A	CEA2C	CEA2A	CEA6	CEAD6	CEAT	DCT
A1	Remote adjust, external adjust ±5% (pot not provided)				√	STD		
	Remote adjust, external adjust ±10% (pot not provided)	√	√				(+5V)	(+5V)
A2	Fixed output ±5% STD on 2A's. Set at nominal line and 50% load	√	√	STD	√	√	STD	STD
	Fixed output ±0.1% (CEA6C and CEAD6C only)				√	√		
	Fixed output ±0.01% (CEA6D and CEAD6D only)				√	√		
H	Extended operating temp. −40°C to +95°C	√	√	√	√	√	√	√
I1	21-32VDC input voltage (28VDC nominal line)		√	√				√
I2	42-60VDC input voltage (51VDC nominal line)		√	√				√
P2	Overtemperature cut-out over +85°C standard or over 100°C base with H option	STD	STD	STD	√	√	√	STD
P3	Crowbar style over voltage, protects power supply and system circuit if power supply voltage exceeds approximately 110 to 130% of rated.	STD	STD		√	√	√ (+5V)	√ (+5V)
T1	100 db transformer shielding reduces capacitance between line and circuit by 100,000X				√	√	√	
W	Solid potted encapsulation with polyurethane resin. Use this option in MIL-STD-810B applications. Increases weight approximately 30%	√	√	√	√	√	√	√

See price list for unit pricing.

CASE SIZES

OUTLINE AND MOUNTING



△ **ELECTRICAL CONNECTIONS:**

CASE SIZE:

GA — Solder Terminals

HA thru RA — No. 6-32 Threaded Terminals

EXCEPTIONS:

Units with over 20 amps output current have ¼-20 threaded output terminals

CEA2 Series with over 20 amps input current have ¼-20 threaded input terminals

"TI" option — shielded input leads 6" long min. (Shields should be connected to power ground.)

NOTE:

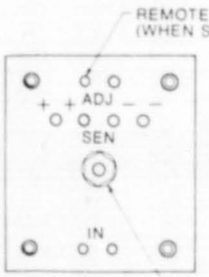
Terminal spacing modified with ¼-20 threaded terminals. (Consult factory for modification.)

Electrical connections subject to change without notice.

CASE SIZE	A Max.	B Max.	C Max.	D ±.015	E ±.015	F ±.030	G ±.030	H ±.030	J ±.030	K Max.	L ±.030	M	Wt. Lbs. (Approx.) Linears	Wt. Lbs. (Approx.) Switchers	Volume Cu. In.
GA	2.75	2.38	3.82	2.12	1.75	.88	.31	.31	.31	.38	.38	6-32	1.75	1	25
HA	3.06	2.62	4.26	2.30	1.86	.93	.38	.38	.38	.38	.38	6-32	2.50	1.50	34
JA	3.56	3.06	4.89	2.62	2.12	1.06	.47	.47	.50	.38	.38	8-32	3.50	1.88	53
KA	3.94	3.38	5.26	3.00	2.44	1.22	.47	.47	.66	.50	.50	10-32	4.25	2.75	70
LA	4.31	3.68	5.57	3.31	2.68	1.34	.50	.50	.78	.50	.50	10-32	5.50	3.33	88
MA	4.68	4.00	6.00	3.68	3.00	1.50	.50	.50	.94	.62	.62	¼-20	7.00	4.25	112
NA	5.10	4.35	6.84	4.06	3.31	1.66	.50	.50	1.09	.62	.62	¼-20	9.00	5.38	149
PA	5.98	4.73	6.81	5.06	3.81	1.91	.50	.50	1.34	.62	.62	¼-20	12.00	7.25	198
QA	6.98	5.48	7.06	6.06	4.56	2.28	.50	.50	1.72	.65	.65	5/16-18	17.00	10.00	277
RA	8.03	6.64	7.06	7.06	5.68	2.84	.50	.50	2.28	.65	.65	5/16-18	30.00	18.00	381

Note: Chassis cutouts should be designed for maximum base plate contact area with mounting surface for thermal conduction.

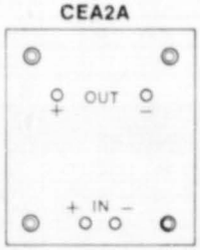
ELECTRICAL TERMINATION DATA:



CEA2C

VOLTAGE ADJUST (NOT INCLUDED WITH REMOTE ADJUST OR FIXED OUTPUT)

CEA2A



CEA
a Division of Berkleonics, Inc.

1 Aerovista Park, San Luis Obispo, CA 93401/Phone 805-544-5454/TWX 910-351-6705

C-RAN Corporation

High Performance Custom Solid-State D.C. Power Supplies

Designed specifically for critical airborne or ground applications, C-RAN offers a complete line of ruggedized and compact custom power supplies which feature high performance and reliability at competitive prices. Typical of our custom designs is the supply which is the key element in the Omega Navigation System, providing a stable source of D.C. power under extreme environmental conditions.

GENERAL

HIGH RELIABILITY: TYPICALLY 50,000 HOURS TO 100,000 HOURS PER MIL-HDBK-217

EFFICIENCY: 50% - 65%

SIZE: 35.8 CU.IN. TO 346.5 CU.IN.

WEIGHT: 3 LBS. TO 10 LBS.

CONFORMS TO: MIL-E-5400 CLASS 1 CONSTRUCTION

AVAILABLE DESIGN CONFIGURATIONS:
SWITCHING TYPE
SERIES TYPE

OPERATING FEATURES

INPUT/OUTPUT CHARACTERISTICS:
AC TO DC (60~ & 400~)
DC TO DC (28V)

OUTPUT: 5V TO 18V
200 MA TO 20 AMPS
50W TO 200W

POWER FACTOR: .6 TO .7

RIPPLE: 50 MV

OPERATING TEMPERATURE RANGE:
-54°C TO +80°C

SAFETY FEATURES

OVER-VOLTAGE PROTECTION

CURRENT LIMITING

OUTPUTS, MULTIPLE INDEPENDENT FLOATING

P.O. Box 65, 699 4th Street N.W., Largo, Florida 33540, U.S.A.

Phone (813) 585-3850



Corporation

- SMALL BUSINESS, WOMAN OWNED
- DAR SECTION 7
- P.L. 95-507
- MIL-Q-9858A
- PRODUCTION CAPABILITY
- RELIABILITY TESTING
- PROTOTYPE MANUFACTURING
- RESEARCH & DEVELOPMENT

We are a small business concern as defined under the Small Business Act and Section 7 of the Defense Acquisition Regulation as passed by Congress and signed by the President under Public Law 95-507.

We are a fully qualified Corporation under the Quality Requirements of MIL-Q-9858A & MIL-I-45208. The compliance to these documents is continually maintained by C-RAN and audited by Defense Contract Administration Service (DCAS) Quality Representatives.

Our facilities have a production capability with Mil-Standard Reliability testing and Quality Assurance. Additional capabilities include Research and Development, Prototype Manufacturing and Technical Software preparation.

LOW COST - QUICK DELIVERY - FAST TURN AROUND

for build-to-print work and short-run production such as:

CIRCUIT BOARD ASSEMBLIES, in small or moderate runs, with drawings and/or sample and parts supplied.

CABLES AND CABLE HARNESSES, with drawings and/or sample and material supplied.

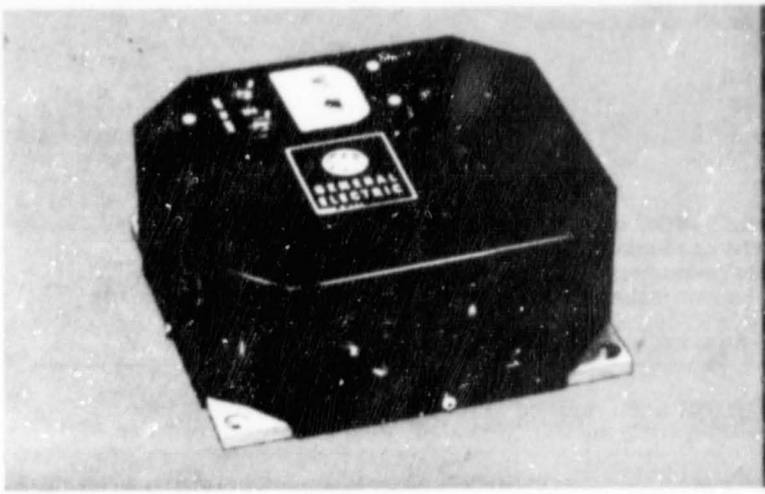
SMALL ELECTRICAL / ELECTROMECHANICAL DEVICES SUBASSEMBLIES with sample and/or drawings and parts supplied.

POTTING OF SMALL ASSEMBLIES, which do not require specialized equipment or use toxic chemicals (unless special equipment is provided.)

TESTING OF CIRCUITS AND ASSEMBLIES, using standard test equipment such as oscilloscopes, multimeters, frequency generators, frequency counters and wave analyzers, etc. Other testing can be performed if special test equipment is provided.

P.O. Box 65, 699 4th Street N.W., Largo, Florida 33540, U.S.A.

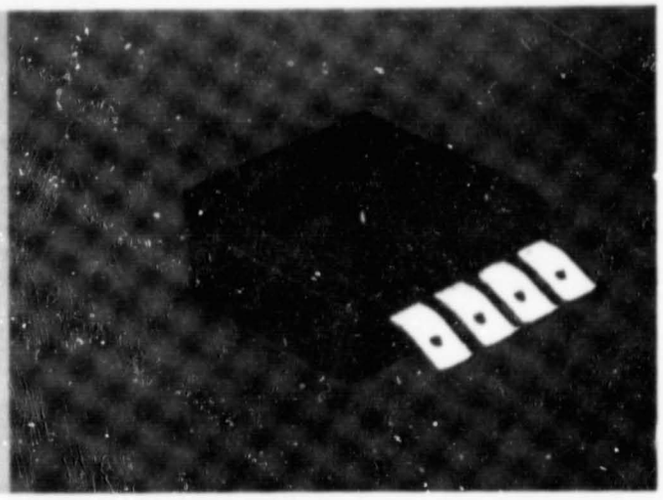
Phone (813) 585-3850



12 Volt Converter

Converts any battery voltage (36-80V) to 12 volts so standard automotive accessories can be used.

- All solid-state
- Short circuit protection
- Thermal protection
- Regulated output (12V)
- Eliminates inrush current which greatly increases life of lamp accessories
- Output isolated from battery voltage



Universal Driver

Converts any battery voltage (24-80V) to 24 volts so one contactor can be used for different battery voltages.

- Spare coil stock significantly reduced
- Less battery drain with lower coil currents
- Longer coil life
- Reduced tip wear from low battery voltage
- Reduced control compartment heating

Other Accessories

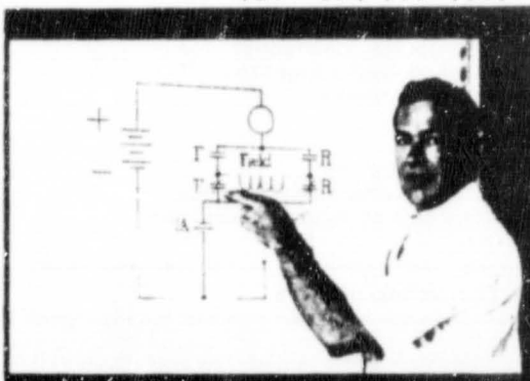
- Directional Selector Switch
- Time delay module to increase pump contactor tip life
- Power steer contactor time delay modules to maintain power steer when vehicle is coasting

GENERAL ELECTRIC

INDUSTRIAL CONTROL DEPARTMENT

P.O.Box 8106, Charlottesville, VA 22906

TEL: 804-973-7851



Worldwide maintenance training

Maintenance training for dealers, truck manufacturers and users is conducted at customer facilities and in selected locations throughout the industrial world. To date, over 15,000 maintenance personnel have attended these schools. Maintenance instruction manuals are also provided in several languages.



Insist on genuine General Electric parts.

Electric lift trucks are too important to your business to use anything less than the best parts. Genuine General Electric parts assure you of getting the best quality, optimum performance and reliability.

Accept no substitutions. Insist that your company protect its electric vehicles with a policy of purchasing only genuine GE parts. You can't afford to be without them.

G+W Gulf+Western Manufacturing Company

Collyer Insulated Wire Division

100 Higginson Ave.
Lincoln, RI 02865
Telephone: 401/723-7800

Control Cables	THERMOSET: Collyer C-150, C-151 — XLP insul. — PVC or Neoprene jacket 600V. Collyer C-148 — XLP XHHW FR-1 conductors, Type T.C. U.L. Listed. Collyer C-191 — EPR/HYPALON conductors — Neoprene or PVC jacket U.L. Listed Type T.C. Collyer C-190 — EPR insul. — Hypalon jacketed extra — flame resistant for nuclear station use. C-140, C-143, C-153, C-150, C-151, C-148, C-190 meet IPCEA — NEMA requirements. C-154, C-148, C-190 meet U.L. Type T.C. requirements.
Machine Tool Wire	**Single conductor** Collyer P-400 U.L. Type THHN/THWN when supplied with 19 wire or more stranding, non compressed, has U.L. Listing as MTW 90°C dry and 60°C in oil. Must be specially ordered.
Motor Lead Cables	**Single conductor — Flexible** IPCEA S-19-81, NEMA WC-3 — RUB. insul., neoprene jacket, 600V 75°C. IPCEA S-68-516, NEMA WC-8 — EPR insul., neoprene or hypalon jkt. 600V, 1000V, 2000V, 90°C. AAR581.3 — Rub. insul., Neop. jkt. diesel locomotive cable — 600V. AAR589 — Hypalon insul., 600V. — Also 1000V non AAR spec.
Traction Cable	**Single conductor** Collyer "Track Star", EPR insulated, Neoprene jacketed, 1000 volt. Also XLP insulated & EPR Insulated manufactured to any Transit company's specifications. 600V., 1000V, 2000V.
Tray Cable	**Multi-conductor power and control — U.L. Listed Type TC per NEC article 340** C-148 — XLP, XHHW FR-1 conductors, PVC jacket, 600V. C-154 — THWN/THHN conductors, PVC jacket, 600V. C-191 — EPR/Hypalon FR-1 conductors — Neop., or PVC jacket, 600V.

Eagle Signal Corporation

8004 Cameron Road
Austin, Texas 78753
Telephone: 512/837-8300

Battery Charger	In conjunction with the G+W zinc chloride battery program, Eagle Signal is currently developing a battery charger. Basic specifications are given below. Custom chargers or adaptations of the basic charger will be considered. Basic Specifications: AC Input Voltage — 230 VAC single phase 60Hz DC Rating — 140VDC 85 amperes continuous Control Range — From 10% voltage and current to 100% voltage and current Cooling — Convection Transformer — Class H insulation, Class B temperature rise Circuit Configuration — Single phase full wave thyristor bridge on secondary side of rectifier transformer Off Board Design
Controllers, Motor, Variable Speed	DC traction motor controller now under development. Custom manufacture.
DC-DC Converters (on board)	Under development. Custom manufacture.

Eagle Signal Industrial Controls Division

736 Federal St.
Davenport, IA 52803
Telephone: 319/326-8111

Control Relays

For very competitive specifications and prices contact EAGLE SIGNAL, 925 Lake Street, Baraboo, Wisconsin 53913, Telephone (608) 356-8321.

DESCRIPTION	CONFIGURATION	POLES	AMPERES
GENERAL PURPOSE			
6/12/24/120/240 VAC	Open Type, solder lug	1, 2, 3	5, 10
6/12/24/48/110 VDC	Open Type, quick disconnect	1, 2, 3	5, 10
	Open Type, printed circuit	1, 2, 3	5, 10
	Enclosed, Plug-in Octal Base	1, 2, 3	5, 10
	Enclosed, Plug-in, Octal base w/light	1, 2, 3	5, 10

HEWLETT hp PACKARD

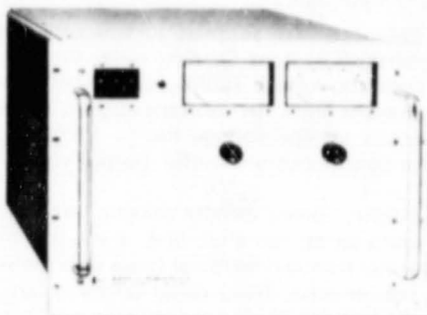
INDUSTRIAL PERFORMANCE DC POWER SUPPLIES 300 - 11,000 WATTS

MODELS **6427B-6483C**

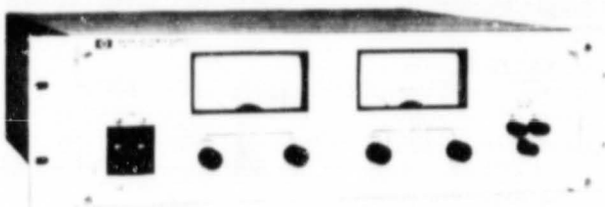
Technical Data, October 1976



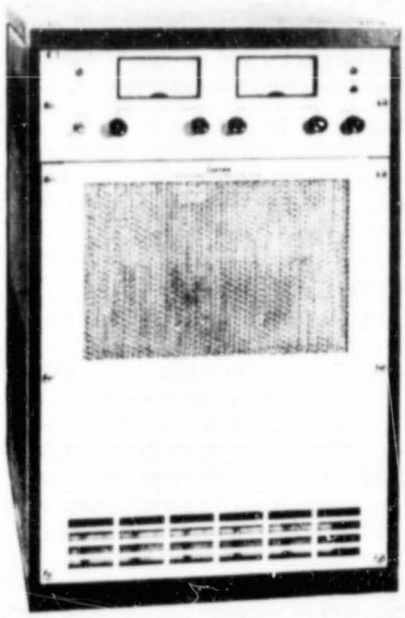
6427B, 6433B, 6438B, 6443B
0-20 to 0-120V; up to 300W



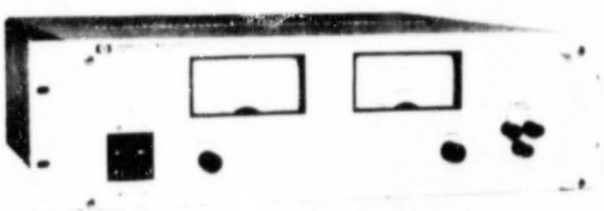
6453A, 6456B, 6459A
0-15 to 0-64V; up to 3,600W



6428B, 6434B, 6439B
0-20 to 0-60V; up to 1,000W



6464C, 6466C, 6469C, 6472C
6475C, 6477C, 6479C, 6483C
0-8 to 0-600V; up to 11,000W



6448B
1-600V @ 1.5A

Features

- Outstanding Value — Low Cost/Watt
- Up to 75% Efficiency at Full Output
- Constant-Voltage/Constant-Current Operation
- Remote Resistance and Voltage Programming
- Remote Sensing
- Auto-Series, -Parallel, -Tracking Operation
- Five 3-Phase Input Options (208/230/380/400/460Vac) for Models 6453A-6483C

For more information, call your local HP Sales Office or [illegible]t (301) 948-6370 • Midwest (312) 677-0400 • South (404) 434-4000 • West (213) 877-1281. Or write: Hewlett-Packard, 1501 Page Mill Road, Palo Alto, CA 94304. In Canada: 275 Hymus Blvd., Point Claire, Quebec. In Europe: Hewlett-Packard, P. O. Box 85, CH-1217 Meyrin 2, Geneva, Switzerland. In Japan: Yokogawa-Hewlett-Packard, 1-59-1, Yoyogi, Shibuya-ku, Tokyo, 151.

Description

This series of SCR-regulated supplies is designed for high-power applications requiring a fixed or variable dc source with moderate regulation and ripple. Among the benefits of SCR-regulated supplies (as compared to series-regulated supplies of equal output) are lower cost, higher efficiency, smaller size, and greater reliability. Typical applications include battery charging and discharging, precision welding and weld testing, life testing and aging large quantities of components, dc motor control, and other applications where the closer regulation, faster response time, and lower ripple of series-regulated supplies is not needed. (For laboratory performance and lower-power supplies, see the HP Power Supply Catalog.)

Operating Features. All supplies in this series are of the Constant-Voltage/Constant-Current type. When a supply is used as a constant-voltage source, the current controls establish the current limit. In constant-current operation, the voltage controls set the voltage limit. Large easy-to-read panel meters continuously monitor output voltage and current.

Input and output power, remote sensing, remote programming, and auto-series, -parallel, and -tracking connections are made to bus bars and terminal blocks on the rear panel. For added convenience, front panel terminals are provided on Models 6427B-6448B for monitoring purposes and for load connections up to 3 amperes.

Voltage and Current Controls. The Models 6453A, 6456B, and 6459A use single-turn voltage and current controls. The 6427B-6443B and 6464C-6472C have separate coarse and fine voltage and current controls (10-turn coarse voltage in the 6443B). The 6448B and the 6475C-6483C have 10-turn voltage controls and single-turn current controls.

Protective Features. In addition to the overload protection inherent in Constant-Voltage/Constant-Current operation, there are many other built-in protective features included in these supplies. The features vary within the three model classifications, as follows:

Models 6427B-6448B: (1) Reverse voltage protection. (2) Fused AC input line.

Models 6453A, 6456B, 6459A: (1) AC line loss protection circuit monitors 3-phase input and cuts off SCR's and opens output bus if a phase drops out. Operation resumes when AC input returns to normal. (2) 3-phase input circuit breaker. (3) Optional internal crowbar (Option 006) protects load from overvoltage condition.

Models 6464C-6483C: (1) High-temperature protection thermostat opens input to power transformer and lights front panel indicator if supply overheats. (2) Prolonged overload protection circuit is activated and lights front panel indicator if output current exceeds approximately 115% of maximum rating. (3) Optional internal crowbar (Option 006) protects load from overvoltage condition (not available in Model 6464C). (4) Turn-on circuit limits peak line current during start-up into low impedance loads. (5) Phase-balance circuit permits operation with line-to-line input voltage imbalance up to 8%. (6) Overcurrent and overvoltage circuits of master and slave supplies used in auto-series, -parallel, or -tracking operation can be interlocked.

Auto-Series, -Parallel, -Tracking Operation. Supplies may be connected in auto-series (to obtain higher output voltage), auto-parallel (for higher output current), or auto-tracking (for coordinated opposite-polarity voltage outputs). (Exceptions are Models 6448B and 6483C which can not be connected in auto-series).

For the lower-power models (6427B-6448B), up to three supplies may be connected in any of the above configurations. Connection of the higher-power models (6453A-6483C) in auto-series, -parallel, or -tracking should ordinarily include no more than two supplies. If a specific application calls for the combining of more than the recommended number of supplies, consult your local HP Field Engineer for additional information.

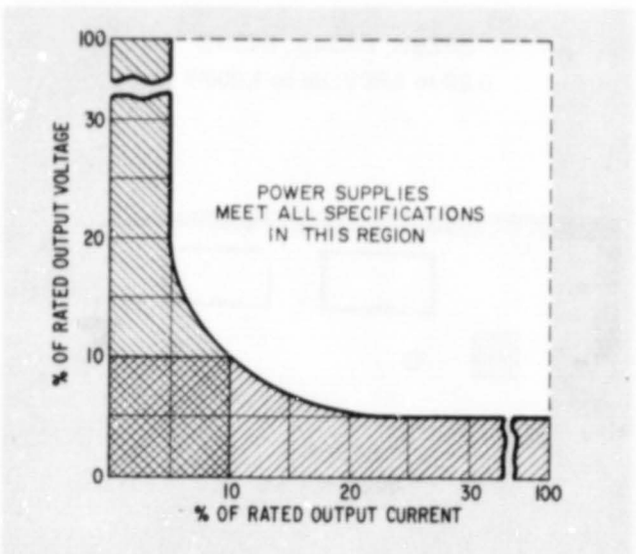
Remote Sensing. Remote sensing permits regulation with respect to the point of load connection, rather than at the output terminals of the power supply. In all cases, there are limits to the permissible load-lead voltage drops, and the amount varies within the model groups, as follows:

Models 6427B-6448B: 2 volts in negative output lead.
Models 6453A, 6456B, 6459A: 1 volt in negative output lead.
Models 6464C-6483C: 3 volts in negative output lead.

Remote Programming. The voltage and current outputs of the supplies can be programmed by a remotely located variable resistance or, for most models, a voltage source. Programming speeds and coefficients are detailed in the specifications table.

AC Power Requirements. The AC power requirements vary with the three model classifications, as itemized below. When powered from a 50Hz source (possible with Option 005), the rms ripple and transient response specifications of the supply increase by 50%. The p-p ripple specification is unchanged by line frequency.

Models 6427B-6448B:
Standard – 115Vac, ±10%, single phase, 57-63Hz.
Option 027 – 208Vac, ±10%, single phase, 57-63Hz.
Option 028 – 230Vac, ±10%, single phase, 57-63Hz.
Option 005 – Realignment for 50Hz operation at any of the above line voltages.



Power Supply Output Restrictions as a Function of Loading
(Refer to note § on specification pages)

Unspecified region for CC operation. Meets specifications in CV operation.

Unspecified region for CV operation. Meets specifications in CC operation.

Unspecified region for both CC and CV modes of operation.

For more information, call your local HP Sales Office or East (301) 948-6370 • Midwest (312) 677-0400 • South (404) 434-4000 • West (213) 877-1281. Or write: Hewlett-Packard, 1501 Page Mill Road, Palo Alto, CA 94304. In Canada: 275 Hymus Blvd., Point Claire, Quebec. In Europe: Hewlett-Packard, P. O. Box 85, CH-1217 Meyrin 2, Geneva, Switzerland. In Japan: Yokogawa-Hewlett-Packard, 1-59-1, Yoyogi, Shibuya-ku, Tokyo, 151.

Models 6453A, 6456B, 6459A: These models require a 3-phase ac input with one of the line-to-line voltages listed. (One of the following line voltage options must be specified on the order.) AC input connections are by means of a 4-conductor connector at rear of unit. A matching Hubbell No. 7413G plug (HP Part No. 1251-1570) is furnished.

Option 001 – 208Vac ±10%, 3-phase, 15.5A per phase 57-63Hz.

Option 002 – 230Vac ±10%, 3-phase, 14A per phase, 57-63Hz.

Option 031 – 380Vac ±10%, 3-phase, 8.5A per phase, 57-63Hz.

Option 032 – 400Vac ±10%, 3-phase, 8.0A per phase, 57-63Hz.

Option 003 – 460Vac ±10%, 3-phase, 7A per phase, 57-63Hz.

Option 005 – Realignment for 50Hz operation at any of the above line voltages.

Models 6464C-6483C: These models require a 3-phase ac input with one of the line-to-line voltages listed. (One of the following line voltage options must be specified on the order.) AC input connections are by means of an enclosed 4-wire terminal block.

Option 001 – 208Vac ±10%, 3-phase, 55A per phase, 57-63Hz.

Option 002 – 230Vac ±10%, 3-phase, 50A per phase, 57-63Hz.

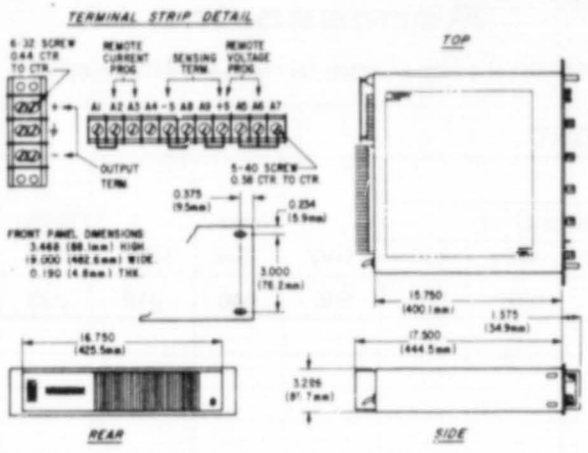
Option 031 – 380Vac ±10%, 3-phase, 30A per phase, 57-63Hz.

Option 032 – 400Vac ±10%, 3-phase, 28.5A per phase, 57-63Hz.

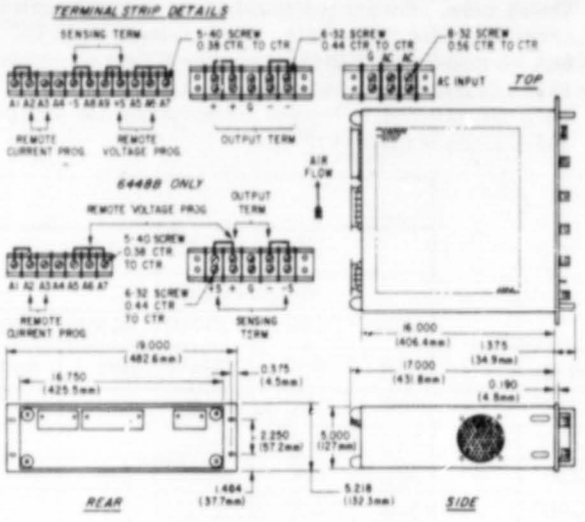
Option 003 – 460Vac ±10%, 3-phase, 25A per phase, 57-63Hz.

Option 005 – Realignment for 50Hz operation at any of the above line voltages.

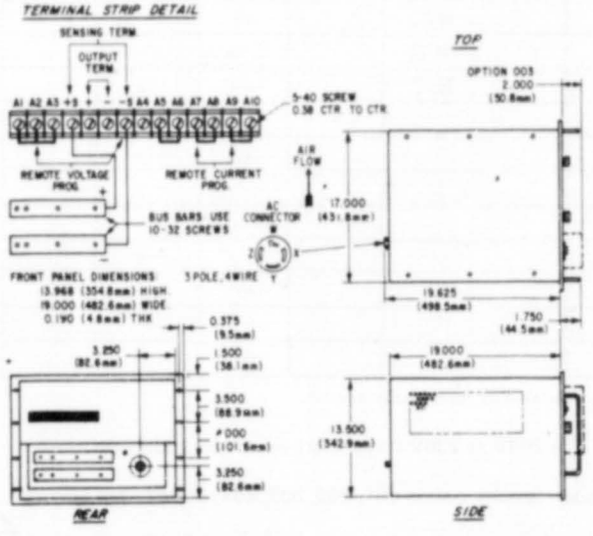
Dimensions



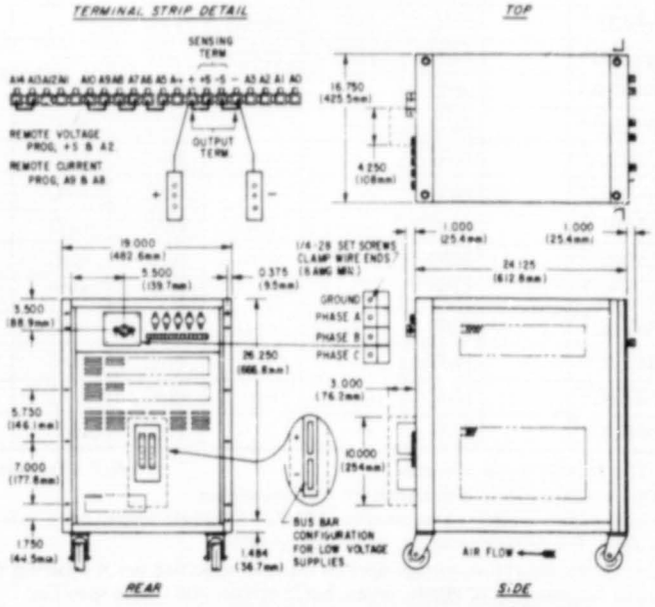
6427B, 6433B, 6438B, 6443B



6428B, 6434B, 6439B, 6448B



6453A, 6456B, 6459A



6464C, 6466C, 6469C, 6472C
6475C, 6477C, 6479C, 6483C

Options

Options are customer-requested, factory-performed, mechanical and/or electrical modifications to standard instruments. A list of all options available on Models 6427A-6483A dc power supplies is given below. To determine which options are available for a particular supply, refer to the option table below.

No.	Description
001	208Vac ± 10% 3-phase input, 57-63Hz.
002	230Vac ± 10%, 3-phase input, 57-63Hz.
003	460Vac ± 10%, 3-phase input, 57-63Hz.
005	50Hz ac input. Standard instrument is wired for nominal 60Hz ac input. Option 005 includes realignment, and in some cases, internal rewiring.
C06	Internal overvoltage protection crowbar. Protects delicate loads against power supply failure or operator error. Monitors the output voltage and places a virtual short circuit (conducting SCR) across load after preset trip voltage is exceeded. For complete specifications, refer to specifications table.
010	Chassis slides. Enables convenient access to rack-mounted power supply for maintenance. Chassis slides (one pair 1¾" high on models 6427B-6448B; two pair, 3" high on models 6453A-6459A) are attached to supply at factory
023	Rack kit (attached at factory) for mounting one 6464C-6483C supply in standard 19" rack.
027	208Vac ± 10% single phase input. Factory modification consists of reconnecting the multi-tap input power transformer (and other components where necessary) for 208V operation.
028	230Vac ± 10% single phase input. Factory modification consists of reconnecting the multi-tap input power transformer (and other components where necessary) for 230V operation.
031	380Vac ± 10% 3-phase input, 57-63Hz.
032	400Vac ± 10% 3-phase input, 57-63Hz.
040	Interfacing for Multiprogrammer Operation. Prepares standard HP power supplies for resistance programming by the 6940B Multiprogrammer or 6941B Multiprogrammer Extender. Operation with either of these instruments requires that the power supply be subjected to a special calibration and a protection checkout. The special calibration insures that the power supply can be accurately set to zero and to its maximum rated output voltage or current when programmed by the Multiprogrammer. The protection checkout insures that the power supply will not be damaged by the rapid repetitive programming possible with the Multiprogrammer.

Accessories

14545A. Set of 4 snap-on casters for one 6464C-6483C supply.

	OPTIONS[3]											
	AC Input											
		Single-Phase		3-Phase (Line-to-Line)								
	50Hz	208V	230V	208V	230V	380V	400V	460V	OVP	Inter-face	Slides	Rack Kit
Model No.	005	027	028	001	002	031	032	003	006	040	010	023
6427B[1]	N/C	N/C	N/C	--	--	--	--	--	--	--		*
6428B[1]	N/C	N/C	N/C	--	--	--	--	--	--	--		*
6433B[1]	N/C	N/C	N/C	--	--	--	--	--	--	--		*
6434B[1]	N/C	N/C	N/C	--	--	--	--	--	--	--		*
6438B[1]	N/C	N/C	N/C	--	--	--	--	--	--	--		*
6439B[1]	N/C	N/C	N/C	--	--	--	--	--	--	--		*
6443B[1]	N/C	N/C	N/C	--	--	--	--	--	--	--		*
6448B[1]	N/C	N/C	N/C	--	--	--	--	--	--	--		*
6453A[2]	N/C	--	--	N/C	N/C			N/C		--		*
6456B[2]	N/C	--	--	N/C	N/C			N/C		--		*
6459A[2]	N/C	--	--	N/C	N/C			N/C		--		*
6464C[2]	N/C	--	--	N/C	N/C				--		--	
6466C[2]	N/C	--	--	N/C	N/C						--	
6469C[2]	N/C	--	--	N/C	N/C						--	
6472C[2]	N/C	--	--	N/C	N/C						--	
6475C[2]	N/C	--	--	N/C	N/C					--	--	
6477C[2]	N/C	--	--	N/C	N/C					--	--	
6479C[2]	N/C	--	--	N/C	N/C					--	--	
6483C[2]	N/C	--	--	N/C	N/C					--	--	

-- This feature is not available. N/C - This feature is available at no additional cost.

* - The standard model is designed for rack mounting.

1 - The standard model is equipped for 115Vac/57-63 Hz single-phase operation. For 208V or 230V single-phase operation, order option 027 or 028. For 50Hz operation, order option 005.

2 - One of the input line voltage options must be specified when ordering this model. Specify option 001, 002, 003, 031, or 032. The ac input frequency is 57-63Hz unless 50Hz option 005 is also specified.

3 - Order option 910 for extra operating and service manual.

[ ] Indicates that option is available.

For more information, call your local HP Sales Office or East (301) 948-6370 • Midwest (312) 677-0400 • South (404) 434-4000 • West (213) 877-1281. Or write: Hewlett-Packard, 1501 Page Mill Road, Palo Alto, CA 94304. In Canada: 275 Hymus Blvd., Point Claire, Quebec. In Europe: Hewlett-Packard, P. O. Box 85, CH-1217 Meyrin 2, Geneva, Switzerland. In Japan: Yokogawa-Hewlett-Packard, 1-59-1, Yoyogi, Shibuya-ku, Tokyo, 151.

C-5

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Raster scan video graphics generators.
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*MARCONI — Delaware only

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electronic instrumentation & data systems

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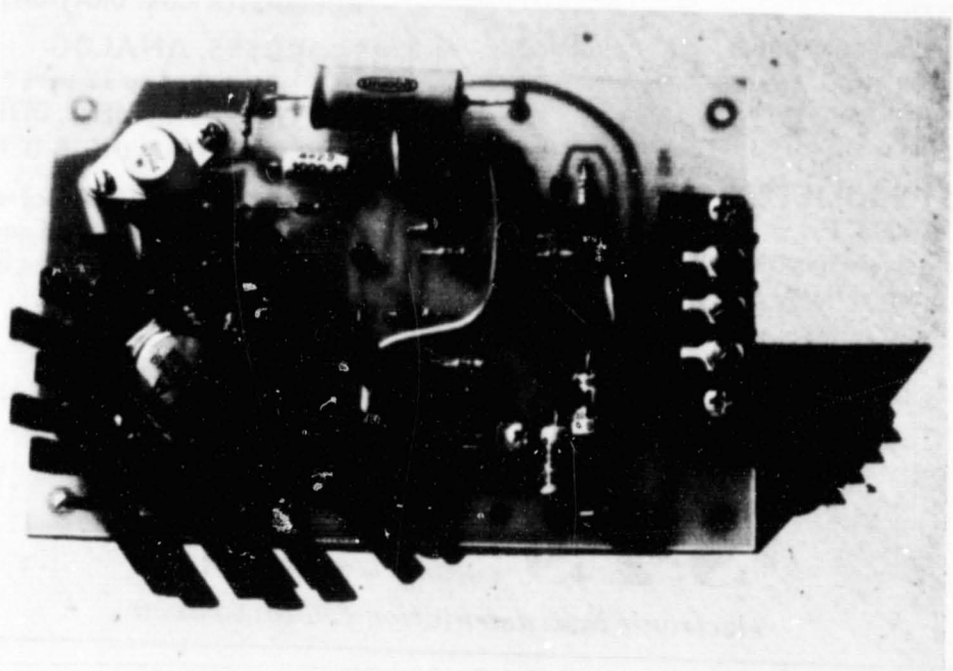
Penta Engineering Co.

design - manufacturing - distribution

615 W. Covina Blvd.
San Dimas, CA 91773
(714) 599-6085

DC VOLTAGE CONVERTER CARD

The new Penta Converter Card is used to reduce high DC voltages to lower DC voltages. For instance, the use of solenoid operated hydraulic valves on a 120 VDC powered machine is preferably done with 12 VDC Solenoids. This greatly simplifies switch selection and wiring because the extremely high inductive transient voltages associated with 120 VDC solenoid switching are not present with 12 VDC solenoids. The Converter Card is designed to supply up to 10 A of DC (intermittent duty) current to inductive loads, such as solenoid valves and relays. The Converter Card can also operate resistive loads, such as lights, with the addition of an optional external inductor. The Converter Card is supplied as a printed circuit card, complete with mounting holes and terminal block connections. Short Circuit protection is provided.



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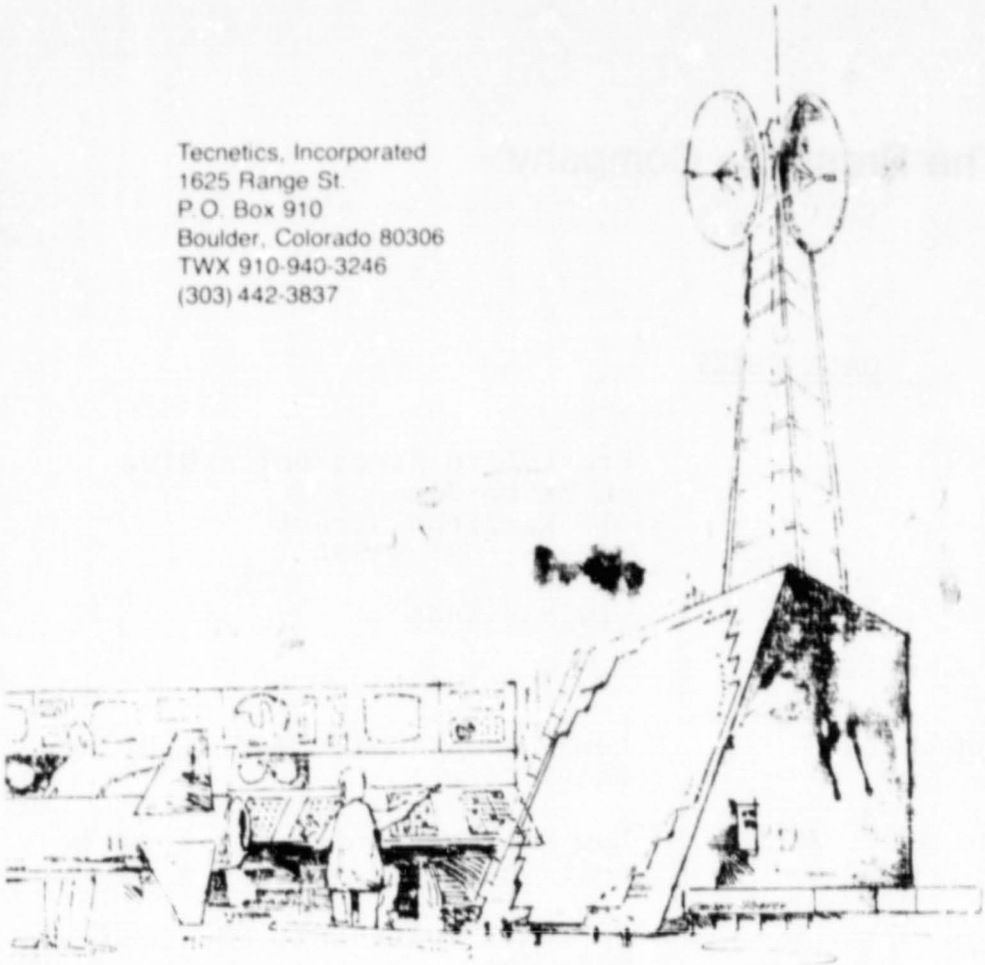
The Prestolite Company

DATA SHEET

Company Name -	Prestolite Electronics Div. an Eltra Company 511 Hamilton Street Toledo, OH 43694
Company Phone Number -	419/255-4068
Name of Items -	
DC - DC Converters (on board)	Low Power (Instrument lighting only)
Relays, AC & DC (up to 300V, AC & DC)	Low Voltage, only i.e. 6 to 24 volt (horn relays, etc.)
Solenoids	Up to 72 Volt; SAZ, SBC, SAW, SAS, etc.
Switches (6-3000V, 1-20 Amp, AD&DC)	High Current low voltage push type switches
Transducers, Control Current	Brush Wear Indicators
Voltage Regulators	Generator & Alternator Voltage Regulators for 6 to 36 volt applications Solid state and Electro Mechanical types, i.e. VSH, VBC, VCA, etc.
Production Status of Above Items -	All are currently in production

Tecnetics, Incorporated
1625 Range St.
P.O. Box 910
Boulder, Colorado 80306
TWX 910-940-3246
(303) 442-3837



Index

Introduction
Selector Guide (DC-DC)
DC-DC High Efficiency Regulated Converters
150 watt
100 watt
50 watt
25 watt
Mil Type DC-DC Regulated Converters
25 watt
10 watt
6 watt
3 watt
1 watt
Industrial/Commercial DC-DC Regulated Converters
25 watt
10 watt
6 watt
3 watt
1 watt
Miniature Hybrid DC-DC Converters
HCN, HCH, HCE Series
Selector Guide (AC-DC)
400 HZ AC-DC High Efficiency Power Supplies
3 and 6 watt
10, 15 and 20 watt
25, 50, 100 watt-single and triple phase
200 watt-3 phase
47-440 HZ AC-DC Regulated Power Supply
200 watt

Selector Guide — DC to DC Power Supplies

For Tecnetics AC to DC power supplies, see pages 20 through 27.

OUTPUT						INPUT			DIMENSIONS			
POWER WATTS	SINGLE(S) DOUBLE(D) TRIPLE(T)	VOLTAGE VDC	EFFICIENCY	PROTECTION		VOLTAGE VDC	FILTER	REV PROT	L IN.	W IN.	H IN.	SERIES
				OVER LOAD	OVER VOLTAGE							
150	S	5-48	High	•	•	48	•	•	6	4	2.60	3150-48
100	S	5-48	High	•	•	48	•	•	6	4	2.25	3100-48
100	S	5-48	High	•	•	28	•	•	6	4	2.25	3100-28
50	S	5-48	High	•	•	48	•	•	4	4	2	3050-48
50	S	5-48	High	•	•	28	•	•	4	4	2	3050-28
25	S	5-48	High	•	•	48	•	•	4	4	2	3025-48
25	S	5-48	High	•	•	28	•	•	4	4	2	3025-28
25	S.D.T	5-24	Std.	•		48	•	•	4	4	1.5	9525-48
25	S.D.T	5-24	Std.	•		28	•	•	4	4	1.5	9525-28
10	S.D	5V-5KV	Std.			28	•	•	4	2	0.8	9584
10	S.D	5V-5KV	Std.	•		28	•	•	4	2	0.8	9586
6	S.D	5V-5KV	Std.			28	•	•	3.5	1.75	0.7	9589
6	S.D	5V-5KV	Std.	•		28	•	•	3.5	1.75	0.7	9591
3	S.D	5V-5KV	Std.			28	•	•	3.0	1.50	0.6	9567
1	S.D	3V-3KV	Std.			28	•	•	2.5	1.25	0.5	9583
25	S.D.T	5-28	High	•		12.24.28.48	•	•	5.0	4.1	1.25	1200
10	S.D.T	5-24	Std.	•		5.6.12.24.28.48	•	•	3.5	2.5	0.96	1000
6	S.D.T	5-24	Std.	•		5.6.12.24.28.48	•	•	3.5	2.5	0.96	1600
3	S.D.T	5-24	Std.	•		5.6.12.24.28.48	•	•	2.35	2.125	0.84	1300
1	S.D	5-24	Std.	•		5.6.12.24.28.48	•	•	1.75	1.50	0.65	1100
max 3	S.D	5-300	High			5.6.12.15.20.24.28			1.05	0.94	0.32	HCH N E

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Documentation

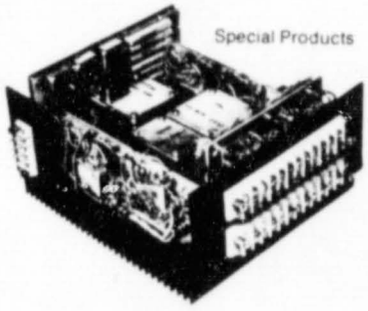


In Process Testing

Documentation. Tecnetics is perhaps unique among power conversion specialists in its formal procedure for making changes on engineering drawings. No changes are made on the line without corresponding changes in the drawings, signed and approved by all concerned.

Complete documentation is kept under tight control to insure that the power supply we build for you today is the same power supply we build for you tomorrow. In this way, long-lasting consistency and quality are guaranteed without depending upon memory or undocumented drawing notations.





Special Products

Special Products

Within the specialized area of power conversion from direct and 400 Hz alternating current to direct current, Tecnetics produces one of the broadest lines available, maintaining a large inventory so as to meet needs on an immediate basis. But there will always be special needs.

Tecnetics can provide power supplies with outputs up to 20,000 volts. And we can supply products for lower voltages up to 500 watts output.

By customizing around circuitry with proven reliability, it may be possible to meet your application needs at a far lesser cost than could be done with extensive in-house research and development. So if you have production coming on stream requiring a special power supply, it will pay to investigate the Tecnetics alternative first.

This is the kind of expertise that has made Tecnetics one of the most reliable names in power conversion, with multi-market involvement and international representation.

Perhaps you do not require such a high level of expertise. But wouldn't it be reassuring to know that the same people who are putting reliability and quality into the power conversion units of the U.S. Space Shuttle Program are going to work for you?

We invite you to meet our people, tour our new facilities, and realize for yourself the power of positive tecnology. Tecnetics.



Spectrum Analysis (EMI Testing)



Soldering to NASA Requirements

Standards for excellence

MIL-Q-9858A. Tecnetics is certified to perform to the highest level of quality control demanded by the military, and to MIL-I-45208A which is standard operating procedure at Tecnetics. The point is this; when your supplier is certified to the highest standards you can be sure that you are buying a quality product.

MIL-STD-202 and 810. Environmental testing is a big part of quality control, and it is under these tough military standards that Tecnetics performs such tests as:

Temperature cycling and thermal shock tests to insure meeting customer specifications and reliability requirements;

Altitude/temperature testing up to 175,000 feet on units with outputs of up to 20,000 volts;

Temperature cycling and underload burn-in (up to 168 hours) to eliminate the possibility of early failures when required by customer contractual requirements;

And 100 percent final testing — test documents provided with shipment.

MIL-HDBK-217. This is the handbook utilized by Tecnetics to calculate the Mean Time Between Failure (MTBF). This is a carefully calculated prediction of product life based upon statistical history of each component. Tecnetics is one of the very few power conversion suppliers that provides this calculation.

MIL-STD-461 and 462. Electromagnetic Interference (EMI) is a problem that everybody in the power supply and systems design business must contend with at one time or another. And it is under these military standards that Tecnetics has become one of the few manufacturers providing power conversion units with known EMI levels.

Through the highly sophisticated process of spectrum analysis (up to 50 megahertz) Tecnetics can measure the amount of EMI conducted out of its products, and the amount of EMI tolerated before the function is affected.

At Tecnetics, we know what our products do.

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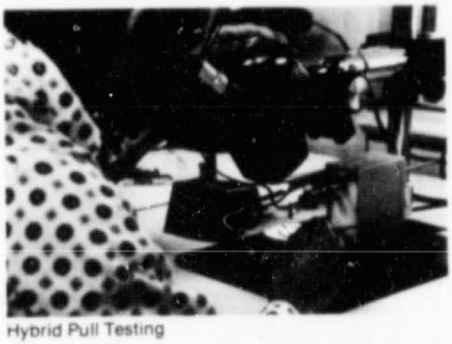
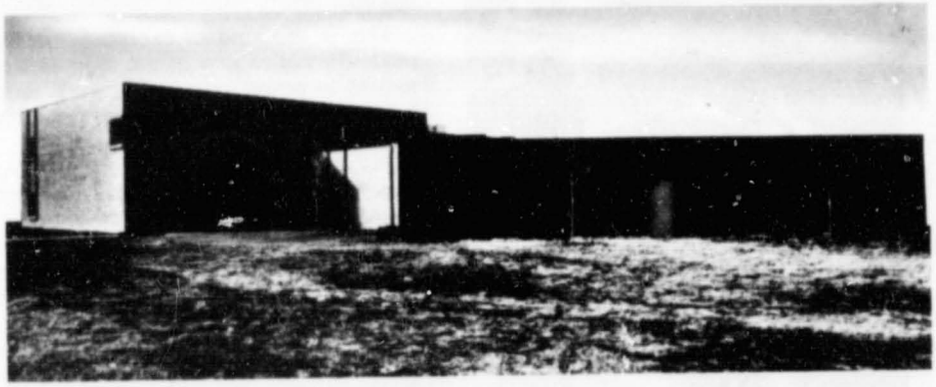


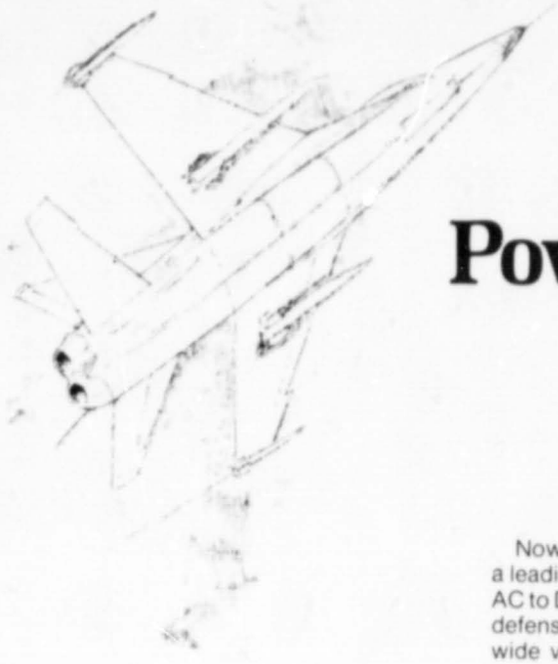
Hybrid Pull Testing



Burn-In Under Load







Tecnetics In The Forefront Of Power Supply Technology

Now in its twenty-first year, Tecnetics is a leading supplier of DC to DC and 400 Hz AC to DC power converters for the nation's defense and space programs, as well as a wide variety of high-technology markets such as telecommunications, data processing and transportation.

Unlike other power supply manufacturers, Tecnetics does not claim to offer a converter for every application, nor does it rush to introduce a multitude of new products every year.

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Hybrid "Cold Welding"

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Hybrid Wire Bonding



Altitude/Temperature Testing



Wave Soldering

The firm's success stems from its philosophy of concentrating its engineering expertise within a specific segment of the total power supply market. This philosophy enables Tecnetics to bring the highest state of the art to every product within this catalog in terms of efficiency, size-to-power relationships, mean-time-before-failure and electrical characteristics.

Located in the scientific community of Boulder, Colorado, Tecnetics has continued to expand its engineering base and production facilities. Plant size was increased to 22,500 square feet in 1979 with plans to add yet another 14,000 square feet in 1981. The acquisition of new equipment, such as our wave soldering unit, has greatly increased production capabilities.

Yet, despite our new "bigness," we have not forgotten the importance of quality at the individual level. Our people are still capable of soldering to stringent NASA requirements. We still maintain a refreshingly large ratio of quality control personnel to production personnel. And we are still capable of performing to the highest standards of quality.

Nor have we forgotten that it is our technological pioneering which brought us to our present position. Tecnetics is still in the forefront of high efficiency technology, finding new and better ways to meet your needs. And we aim to keep it that way.

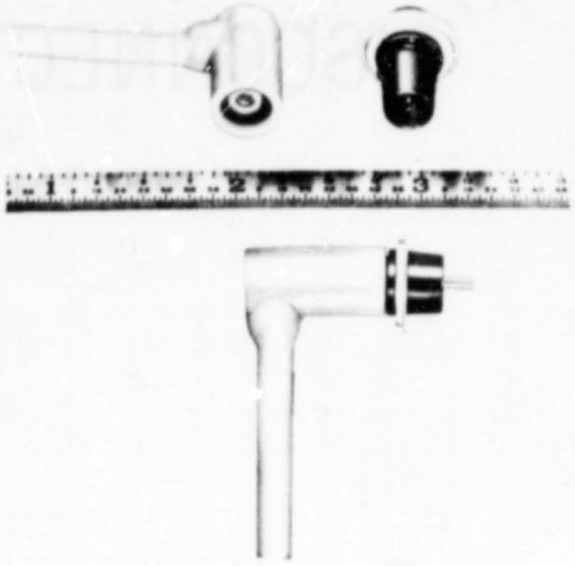
At Tecnetics, we believe our growth can be squarely attributed to leadership—leadership in technology—leadership in quality.

DISCONNECTS, EMERGENCY

ELECTRICAL and MECHANICAL

(CODE **DE**)

SID SERIES SUBMINIATURE INLINE DISCONNECT HIGH VOLTAGE CONNECTOR



FEATURES:

- 15 KV DC Operation
- Quick Disconnect/Push-Pull Mating
- Temperature Range -55°C to 150°C
- Subminiature Size
- Corona Free thru 70,000 ft.
- Tapered Environmentally Sealed Interface
- Mating/Unmating Force 3-5 lbs.
- Shock & Vibration Resistant

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SPECIALISTS IN CORONA-FREE HIGH VOLTAGE INTERCONNECTIONS

TECHNICAL DATA

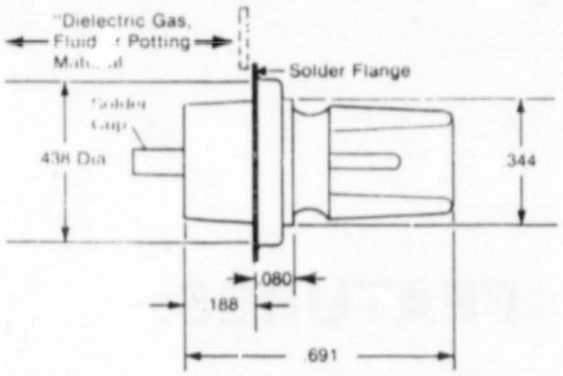
APPLICATIONS:

- **Electronic Counter Measure Systems**
- **Traveling Wave Tube Connection**
- **Lasers**
- **Power Supplies**
- **CRT Displays**
- **Radar**

CONNECTOR MATERIAL SPECIFICATIONS

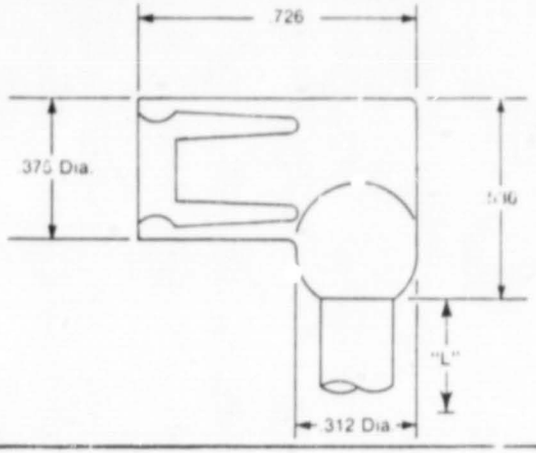
- **Contacts: Pin; Brass per QQ-B-626, Gold Plated per Mil-G-45204**
  Socket; Beryllium Copper, Per QQ-C-532, Gold Plated per Mil-G-45204
- **Plug Molded: Silicone per ZZ-R-765**
- **Receptacle Molded: Glass per Mil-M-24325**
- **Mounting Ring: Brass per QQ-B-611, Tin Plated Mil-T-10727A**
- **Cable: Rowe P/N R790-3020 #20 AWG Silicone Insulated**

Connector, Receptacle Rowe P/N 26RC1031



Twice Actual Size

Connector, Cable Plug Rowe P/N 11RC1030



ORDERING INFORMATION:
Connector, Receptacle order Rowe P/N 26RC1031, Connector Cable Plug order as single or double ended type with specified cable length. (Length does not include connector.)

EXAMPLE:
Single Ended 2 feet 6 inches long - P/N 11RL1030-2L6

Double Ended 10 feet 6 inches long P/N 29R1030-10L6

The Rowe High Voltage Subminiature High Voltage Connector is designed for maximum voltage capability within the smallest space. Ideally suited for ECM, Radar System. These connectors are small, lightweight molded type, and exhibit Rowe's exclusive air excluding, interfacial seal. They are corona free thru altitude and temperature extremes and require minimal mating/unmating force.

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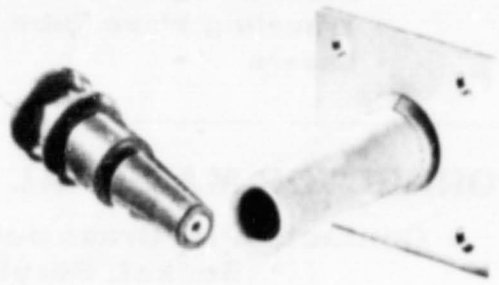
HIGH VOLTAGE IN-LINE DISCONNECTS



FEATURES:

- Thru 60 KVDC Operating Capability
- Thru 70,000 ft. Operation
- Temperature Range - 55° C to 200° C
- Corona Suppressing Interfacial Seal
- Vibration & Shock Resistant
- Field or Factory Assembled
- Small Size/High Reliability
- All Materials Conform to Military Specifications

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SPECIALISTS IN CORONA-FREE HIGH VOLTAGE INTERCONNECTIONS

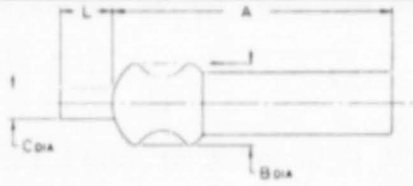
ROWE TECHNICAL DATA

The In-Line Disconnects have been designed to withstand extreme operational temperature, high G forces, vibration, humidity, and other severe environments without altering the operational characteristics.

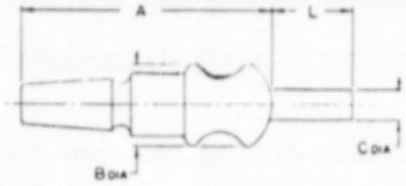
The In-Line Disconnects utilize the resilient properties of a molded silicone rubber design. The connector may be molded to a specified length of silicone insulated wire or assembled in the field with suitable RTV silicone adhesive.

Of outstanding importance to the performance of these connectors are the tapered, mating interfaces with the air excluding, corona improving, interlocking, and weatherproofing engagement. Their capability has been recognized and approved under several Ordnance part numbers. All configurations are stocked unassembled and/or preassembled to standard cable lengths.

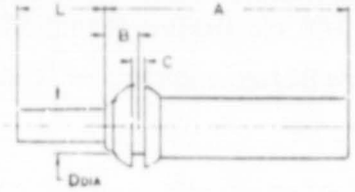
The Panel Mounting Connectors are available with aluminum mounting flanges as an option.



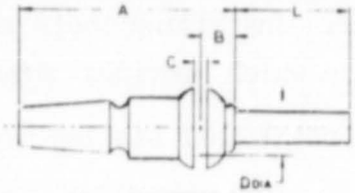
Rowe P/N & Min. Voltage Rating	Dimensions A	B	C	Mating P/N's
2R1030 30KVDC (18 AWG)	2.09	.625	.149	R1031 2R1031
2R1032 45KVDC (16 AWG)	2.56	.781	.294	R1033 2R1033
4R1032 60KVDC (16 AWG)	3.00	.812	.300	5R1033 6R1033



Rowe P/N & Min. Voltage Rating	Dimensions A	B	C	Mating P/N's
2R1031 30KVDC (18 AWG)	1.85	.625	.149	R1030 2R1030
2R1033 45KVDC (16 AWG)	2.31	.781	.294	R1032 2R1032
5R1033 60KVDC (16 AWG)	2.75	.812	.300	4R1032 5R1032



Rowe P/N & Voltage Rating	Dimensions A	B	C	D	Mating P/N's
R1030 30KVDC (18 AWG)	1.81	.281	.125	.438	R1031 2R1031
R1032 45KVDC (16 AWG)	2.25	.312	.125	.531	R1033 2R1033
5R1032 60KVDC (16 AWG)	3.00	1.22	.125	.625	5R1033 6R1033

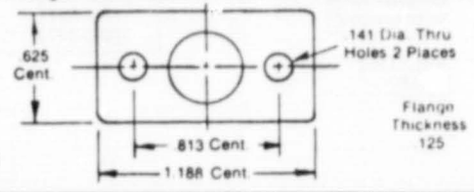


Rowe P/N & Voltage Rating	Dimensions A	B	C	D	Mating P/N's
R1031 30KVDC (18 AWG)	1.56	.281	.125	.438	R1030 2R1030
R1033 45KVDC (16 AWG)	2.00	.312	.125	.531	R1032 2R1032
6R1033 60KVDC (16 AWG)	2.75	1.16	.125	.625	4R1032 5R1032

Ordering Information: Single ended connector specify P/N and length (i.e. 2R1030 with 1 foot 6 inch lead order 2R1030-1L6). Double ended lead specify P/N's for both ends and lead length. For flange mount specify flange P/N with connector Part No.

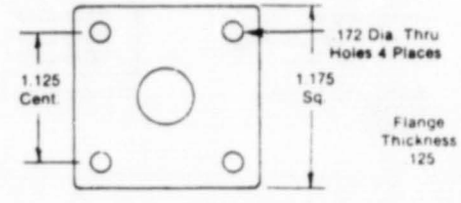
Recommended Wire: 30KV Unit use Rowe P/N R790-2518, 45KV Unit use Rowe P/N R790-4516, 60KV Unit use Rowe P/N R790-6014.

Mounting Flange For R1032, R1033, 5R1032, and 6R1033



P/N 5R1030-1

Mounting Flange For R1030 on R1031



P/N 3R1032-1

ROWE INDUSTRIES
6225 Benore Road, Toledo, Ohio 43612,
(419) 729-9761.

T&B/Thomas & Betts, Division of Thomas & Betts Corporation
920 Route 202 Raritan, New Jersey 08869 (201) 685-1600

Disconnects, Electrical

STA-KON® disconnect terminals provide a quick, reliable method of connection to terminal blocks and boards. They are available in a variety of styles to meet virtually all quick disconnect requirements.

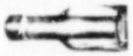
Both female disconnects and male tabs are available with Nylon or Vinyl insulation, or non-insulated. The insulated disconnects are color-coded to indicate their wire range. They will accommodate a range of wire sizes from 22 AWG to 10 AWG, and tab sizes .250 x .032, .205 x .032, .187 x .032, .205 x .020, and .187 x .020.

Precise compression installing tools produce a positive contact between wire and terminal. Installing tools are available with the T&B exclusive SHURE STAKE® mechanism which provides correct compression by preventing opening of the tool handles until full staking action is completed.

Disconnect Cat. Series: 18RA, 14RB, 10RC, RA18, RB14, RC10, RAD18, RBD14, 18RAD, 14RBD

Availabe at authorized T&B Heavy Duty Automotive Products distributors.

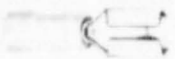
FEMALE DISCONNECT
nylon fully-insulated



INSTALLING TOOL—
WT2000
WT145C

Cat. No.	Tab Size	Wire Range	Max. Ins.	Unit Quan.	Std. Pkg.
18RA-2577 14RB-2577 10RC-2577	.250 x .032	22-16 16-14 12-10	.120 .145 .200	100 100 5	500 500 500

vinyl self-insulated



INSTALLING TOOL—
WT2000
WT145C

18RA-250F* 14RB-250F* 10RC-250F*	.250 x .032	22-18 16-14 12-10	.150 .170 .210	50 100 50	500 500 500

*U.L. Listed and CSA Certified

nylon self-insulated



INSTALLING TOOLS—
WT145C
WT2000

RA18-250F* RB14-250F* RC10-250F*	.250 x .032	22-18 16-14 12-10	.136 .162 .215	100 100 50	500 500 500

*U.L. Listed and CSA Certified

nylon fully insulated
90° flag



INSTALLING TOOLS—
WT145C
WT2000

RA18-250A RB14-250A RC10-250A	.250 x .032	22-18 16-14 12-10	.150 .170 .215	50 100 50	500 500 500

T&B/Thomas & Betts, Division of Thomas & Betts Corporation
920 Route 202 Raritan, New Jersey 08869 (201) 685-1600

STA-KON® Disconnects

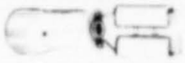
nylon self-insulated



INSTALLING TOOLS—
WT145C
WT2000

RAD18-203	.205 x .032 or .187 x .032	22-18	.136	100	500
RAD18-202	.205 x .020 or .187 x .020	22-18	.136	100	500
RBD14-203	.205 x .032 or .187 x .032	16-14	.163	100	500
RBD14-202	.205 x .020 or .187 x .020	16-14	.163	100	500

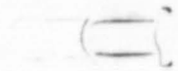
vinyl self-insulated



INSTALLING TOOLS—
WT145C
WT2000

18RAD-203	.205 x .032 or .187 x .032	22-18	.150	100	500
18RAD-202	.205 x .020 or .187 x .020	22-18	.150	100	500
14RBD-203	.205 x .032 or .187 x .032	16-14	.170	100	500
14RBD-202	.205 x .020 or .187 x .020	16-14	.170	100	500

nylon fully insulated



INSTALLING TOOLS—
WT145C
WT2000

18RAD-20377	.205 x .032 or .187 x .032	22-18	.150	100	500
18RAD-20277	.205 x .020 or .187 x .020	22-18	.150	100	500
14RBD-20377	.205 x .032 or .187 x .032	16-14	.170	100	500
14RBD-20277	.205 x .020 or .187 x .020	16-14	.170	100	500

MALE TABS
vinyl self-insulated



INSTALLING TOOL—
WT2000
WT145C

Cat. No.	Tab Size	Wire Range	Max. Ins.	Unit Quan.	Std. Pkg.
14RB-250T	.250 x .032	16-14	.162	100	500
10RC-250T	.250 x .032	12-10	.250	50	500

nylon fully insulated



INSTALLING TOOL—
WT2000
WT145C

18RA-251T	.250 x .032	22-18	.150	50	500
14RB-251T		16-14	.170	50	500
10RC-251T		12-10	.210	50	500

adapter
2 Males and 1 Female—



No Tools Required

F250-TA	.250 x .032			50	500

Note: Minimum factory shipment unit quantity or multiples thereof.

insulated coupler



No Tool Required

RB14-250	.250 x .032	—	—	50	500

DIFFERENTIALS

(CODE **DF**)

American Motors Corporation
Engine and Component Sales Department
27777 Franklin Road
Southfield, Michigan 48034
(313) 827-3817

American Motors' products which have potential applications for electric and hybrid vehicles include components used in the manufacture of AMC/Jeep vehicles, such as:

- Alternators
- Axle Assemblies
- Brake Assemblies
- Differentials
- Manual Transmissions
- Automatic Transmissions

For additional information please contact:

American Motors Corporation
Engine and Component Sales Department
27777 Franklin Road
Southfield, Michigan 48034
(313) 827-3817

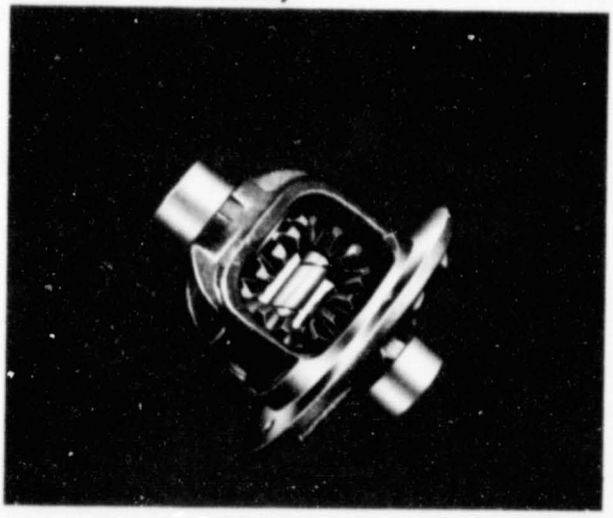
DANA CORPORATION
SPICER CLUTCH DIVISION
5TH & BRANDON STREETS
AUBURN, INDIANA 46706

(219) 925-3800

PRODUCT:	DIFFERENTIALS
PRODUCTION STATUS:	PRODUCTION
AVAILABILITY:	90 DAYS
PRINCIPLES OF OPERATION:	AUTOMOTIVE TYPE DIFFERENTIAL CASE . USING STRAIGHT BEVEL PINION MATES AND SIDE GEARS
MODEL NUMBER:	MODEL 12
BROCHURES:	#10001-1, PAGE 11
WEIGHT:	10.84#
RATING:	1068 LB.FT. TORQUE CAPACITY

Recently made available for marketing is our Model 12 Differential Case Assembly which has a rugged malleable iron housing and durable cut steel gears. This compact 5 lb. design accommodates up to 1000 lb. ft. of torque and is also adaptable to chain driven applications.

Differential Case Assembly

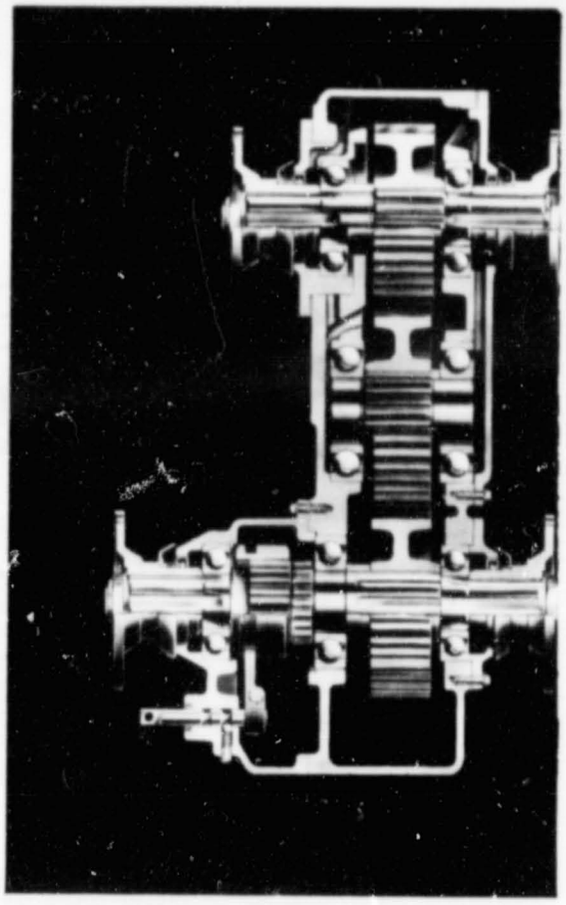


DRIVES, SPEED INCREASING/DECREASING

BELT, CHAIN, GEAR

(CODE **DS**)

DANA CORPORATION
411 Will Carlton Road
Hillsdale, Michigan 49242
Telephone: (517) 437-4493

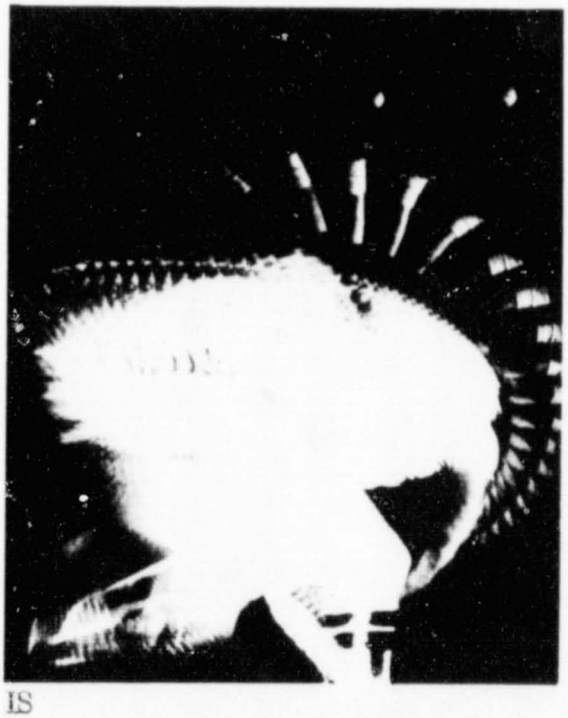


Spicer®

TRANSFER CASES

DANA INDUSTRIAL

Spicer DANA



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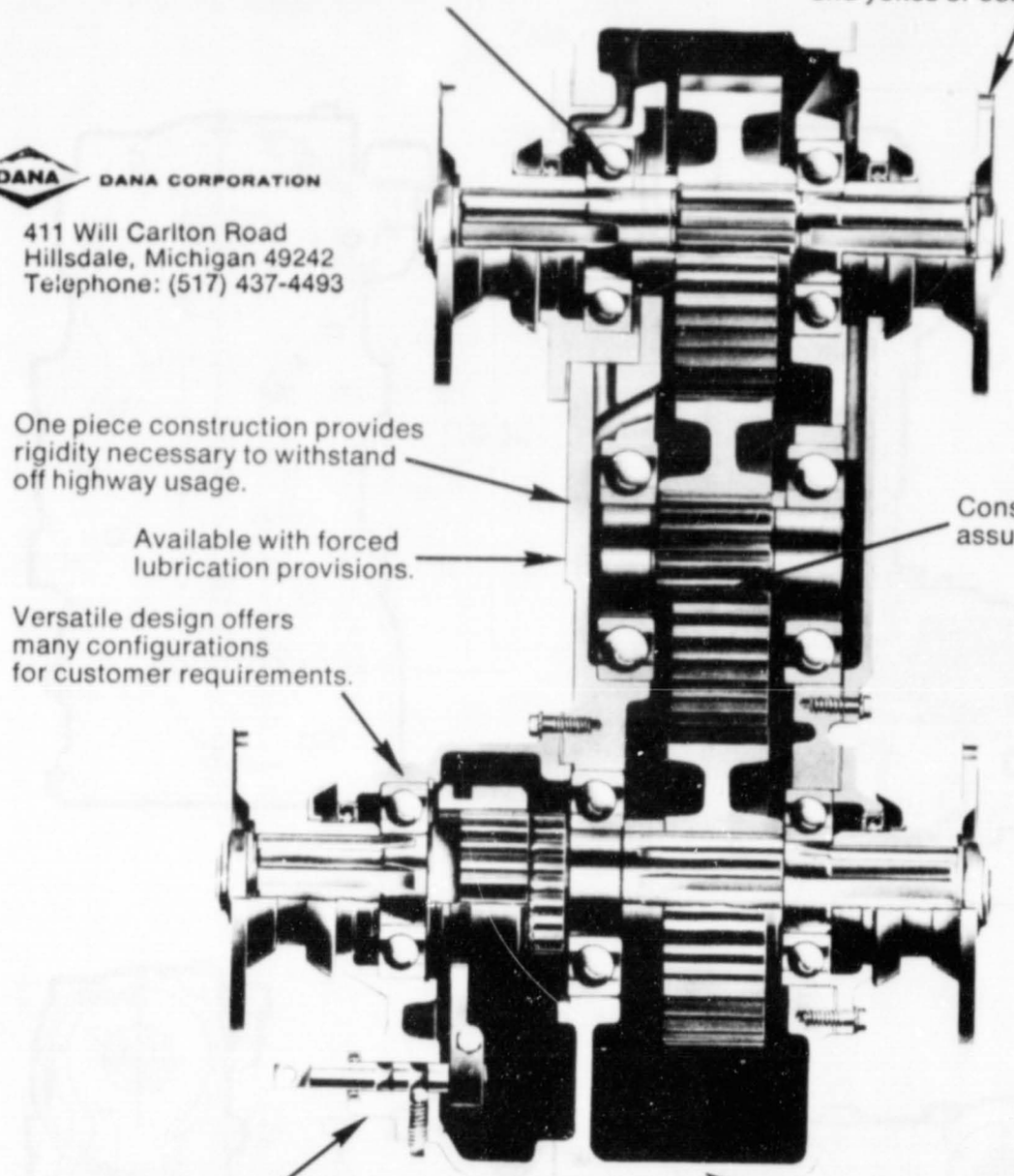
FEATURES AND BENEFITS

DANA CORPORATION
411 Will Carlton Road
Hillsdale, Michigan 49242
Telephone: (517) 437-4493



TRANSFER CASE TORQUE RATINGS

Continuous Duty Torque Rating — 3725 lb-ft.

Manual Transmission Low Gear Net Torque Rating (Based on 85% Efficiency) — 8500 lb-ft.

Automatic Transmission Stall Torque Rating — 11,000 lb-ft. (Stall Torque Value to be taken from Engine-Transmission Performance Curve).

Maximum Operating Speed — 5000 RPM

The maximum torque at the transfer case can be limited by either the engine capacity or the vehicle wheel skid. All applications must be approved by our Engineering Department.

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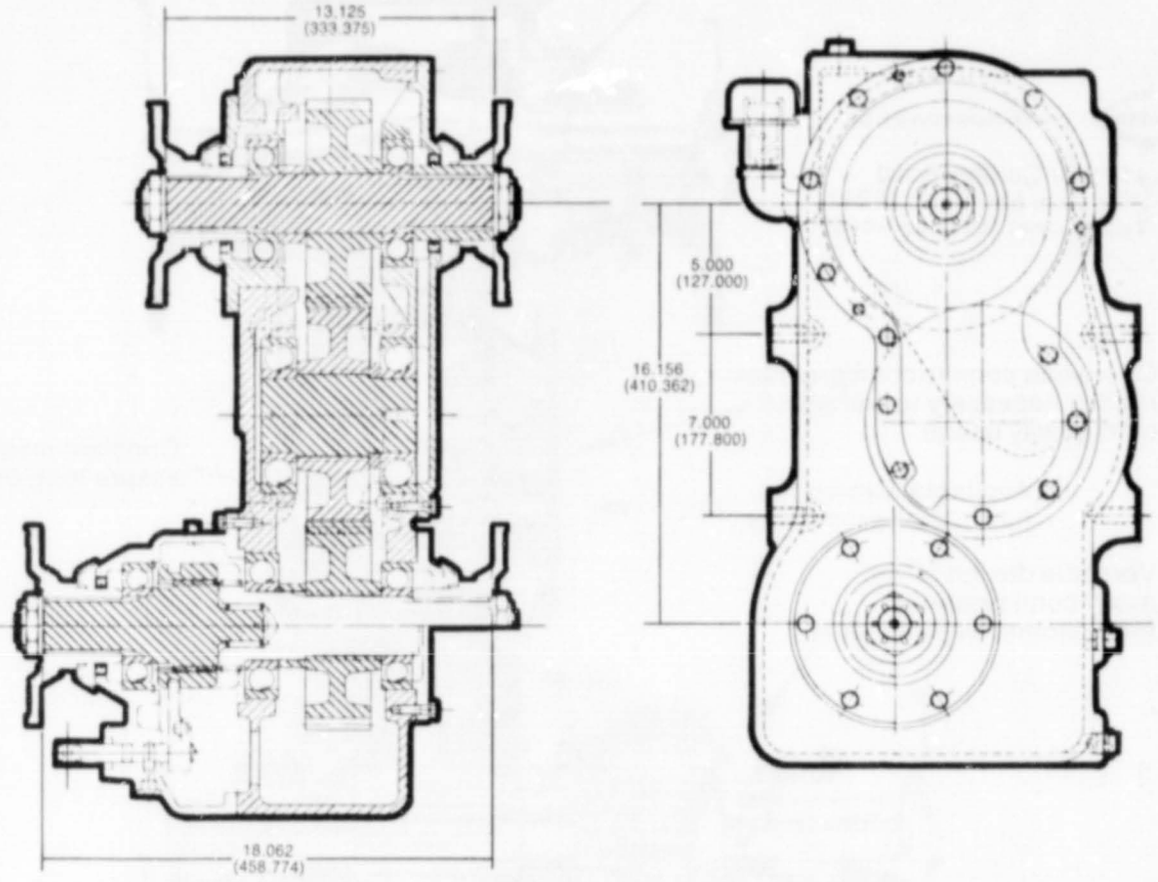
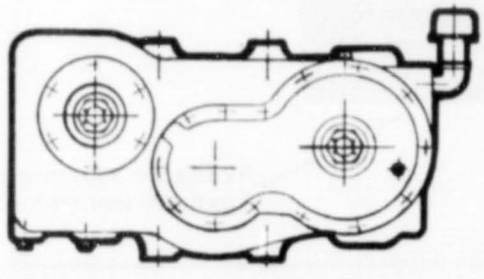
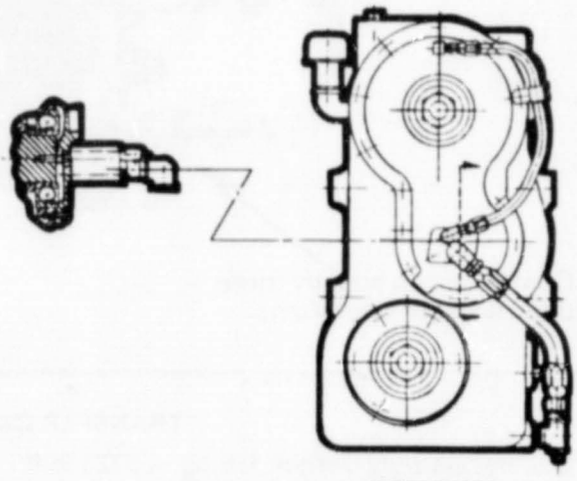
DANA CORPORATION
411 Will Carlton Road
Hillsdale, Michigan 49242
Telephone: (517) 437-4493

738-A





ARRANGEMENT FOR HORIZONTALLY MOUNTED TRANSFER CASE



OPTIONAL PRESSURE LUBE

RECOMMENDED LUBRICANTS

Temperature	SAE Specification	Type
Above 0°F	SAE 50	Heavy Duty Engine Oil API Service Classification MS, DG, DM or DS
Below 0°F	SAE 30	Same as above

738 MODEL NUMBER CONSTRUCTION — REMOTE MOUNT

DANA CORPORATION
411 Will Carlton Road
Hillsdale, Michigan 49242
Telephone: (517) 437-4493

738 A 1 2 3 A 4 - F

Basic Model — 738

A — Remote Mount less Speedo

Forced Lube — F, CW
Forced Lube — G, CCW
Splash Lube — S

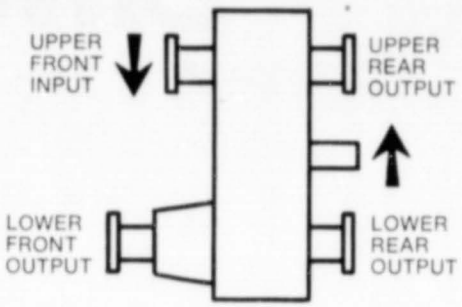
Upper front Input flange
*See flange listing below
0 thru 9, N, P
N — No input

Shifter type
M — Manual disconnect
A — Air disconnect
E — Air disconnect w/switch
L — Less shifter

Lower Front Output
*See flange listing below
0 thru 9, N, P

Lower Rear Output
*See flange listing below
0 thru 9, N, P

Upper Rear Output
*See flange listing below
0 thru 9, N, P

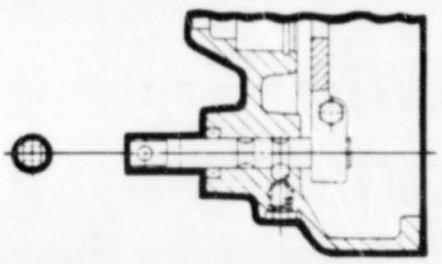


↓ Direction of Rotation must be determined for proper pump selection.

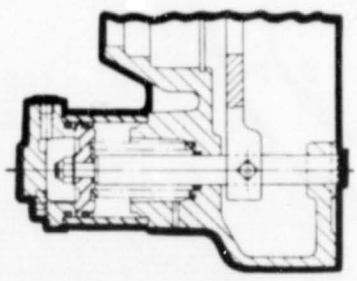
NOTE: CW Input Pump — 378889-1 (F)
CCW Input Pump — 378853-1 (G)

*FLANGE LISTING

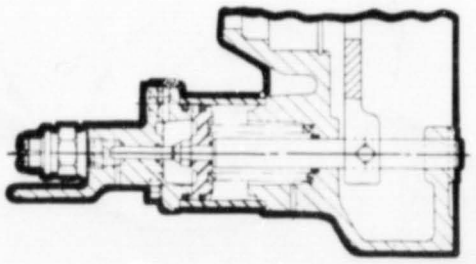
N — No output
P — No flange, output
0 — 1600 Series flange
1 — 1600 Series flange with slinger
2 — 1700 Series flange
3 — 1700 Series flange with slinger
4 — 1800 Series flange
5 — 1800 Series flange with slinger
6 — 1700 End Yoke
7 — 1700 End Yoke with slinger
8 — 1800 End Yoke
9 — 1800 End Yoke with slinger



OPTIONAL MANUAL SHIFT

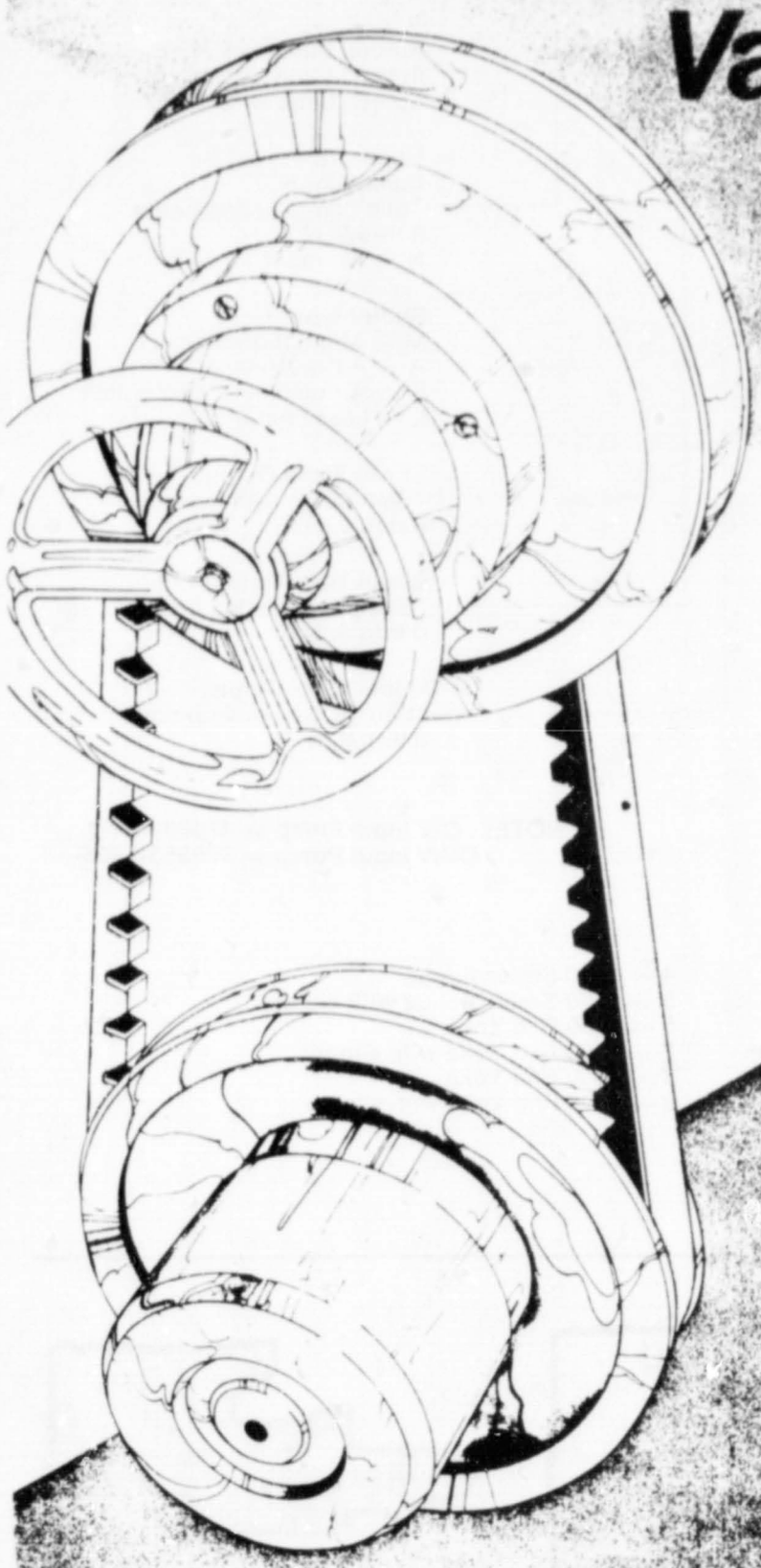


OPTIONAL AIR SHIFT



OPTIONAL AIR SHIFT WITH INDICATOR SWITCH

Hi-Lo Variable Speed Pulley Drives

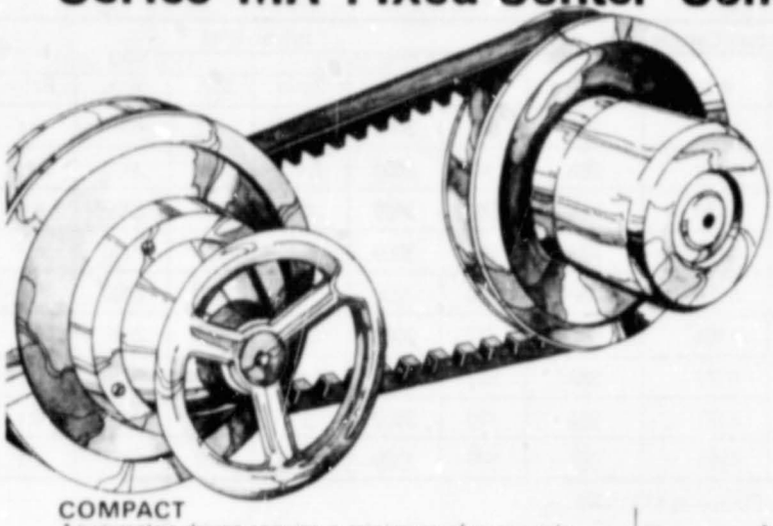


hi-lo

Hi-Lo Manufacturing Company
1700-G Freeway Blvd.
Minneapolis, MN 55430
Phone: 612-566-2510

... with automatic belt tensioning.

Series MA Fixed-Center Compound Drives, 5-100 HP



An Asymmetric fixed-center drive consists of one type A automatic variable pitch pulley, one type MA manually adjustable pulley and an asymmetric transmission belt. Speed changes are accomplished by turning the handwheel of the type MA pulley. A counterclockwise turn moves the sliding pulley face towards the fixed face and forces the belt to a larger diameter. A clockwise turn has an opposite effect. Any belt diameter change in the type MA pulley will cause a compensating belt diameter change in the type A automatic pulley. Manufactured under U.S. patent numbers 3783705, 3811331, 3628389 and 3365967.

COMPACT
Asymmetric drives require a minimum of space relative to their horsepower and speed change capacity.

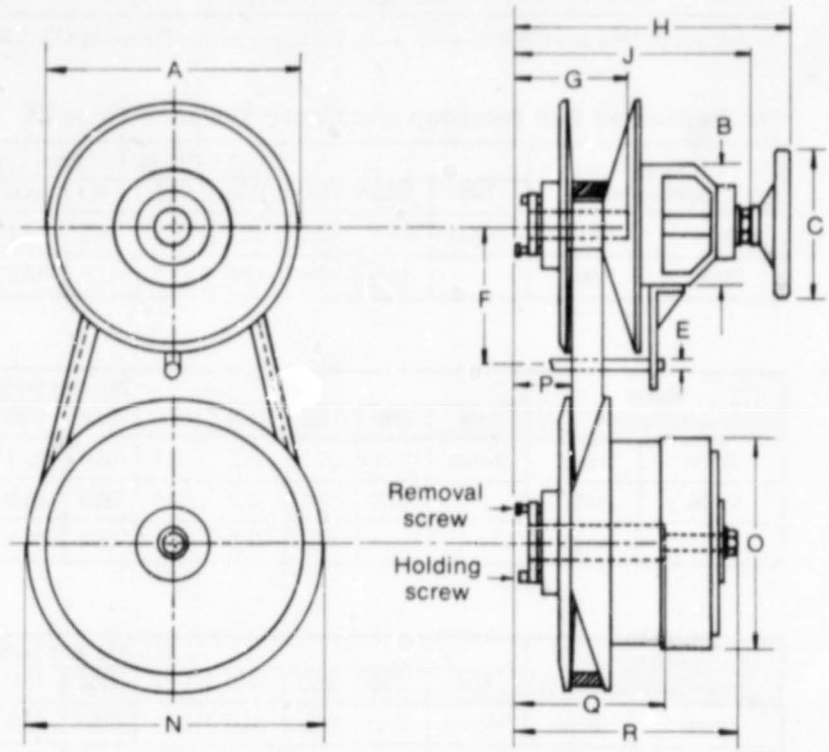
REDUCED OVERHUNG LOAD
The nearly perpendicular angle of the fixed pulley face places the point of bending moment close to the shaft bearing and still allows belt alignment to be maintained throughout the pulley's speed range.

SUPERIOR BELT CAPACITY
The asymmetrically designed belt does not distort under load, has superior lateral stability and uniformly tensioned tensile members. The result is greater horsepower capacity per belt width than symmetric belts.

TORQUE SENSITIVE
A torque dependent belt pressure device automatically adjusts the belt tension and compression to the requirement of the driven load. An energy saving feature.

LIFETIME LUBRICATION
The sliding pulley faces have a steel backed teflon impregnated bushing and are not keyed to the pulley shaft. The pulley shafts are stainless steel. Fretting corrosion has been eliminated.

Q-D HUBS
Provide a positive grip on the shaft and prevent side wobble due to bad fits.



Dimensions Table I

Pulley Combination		Pitch Diameters					Driver									[1] QD	Driven					[1] Hub or Collet
		Driver		1-1	Driven																	
Driver	Driven	Min.	Max.	Ratio	Min.	Max.	A	B	C	E	F	G	H	J	P	Hub	N	O	P	Q	R	Size
MA82	A96	2.64	7.88	6.15	4.32	9.24	8.27	3.94	4.0	.38	4.9	3.2	8.2	6.9	2.00	JA	9.63	6.94	1.14	4.0	6.44	512
MA96	A112	3.45	9.24	7.32	5.32	10.7	9.63	5.12	5.0	.47	5.3	5.4	12.9	11.1	2.16	SH	11.20	6.94	1.49	4.0	7.25	512
MA112	A130	3.55	10.7	8.35	5.82	12.4	11.2	5.12	5.0	.47	6.1	5.6	13.2	11.4	2.53	SH	13.00	6.94	1.49	4.88	7.25	7713
MA112-33	A130-33	4.20	10.7	8.54	6.25	12.4	11.2	6.30	5.0	.63	7.5	5.8	13.7	11.9	2.53	SD	13.00	6.94	1.49	4.88	7.25	7713
MA136	A164	4.30	13.0	10.5	6.43	15.7	13.6	6.30	7.9	.63	7.5	4.3	14.0	12.2	2.53	[2]	16.40	7.29	3.18	6.75	12.2	SK
MA164	A164	6.43	15.7	11.4	6.43	15.7	16.4	7.49	7.9	.67	8.7	6.6	15.5	13.8	3.18	SK	16.40	7.29	3.18	6.75	12.2	SK
MA164	A177	6.43	15.7	12.1	6.94	17.0	16.4	7.49	7.9	.67	8.7	6.6	15.5	13.8	3.18	SK	17.70	8.98	4.20	6.94	15.8	SF
MA177	A177	6.94	17.0	12.3	6.94	17.0	17.7	9.46	9.8	.79	9.5	6.6	18.4	15.8	4.20	SF	17.70	8.98	4.20	6.94	15.8	SF
MA177	A221	7.31	17.0	15.0	12.5	21.5	17.7	9.46	9.8	.79	9.5	6.6	18.4	15.8	4.20	SF	22.10	10.0	4.20	8.12	17.2	SF

Hi-Lo Manufacturing Company
1700-G Freeway Blvd.
Minneapolis, MN 55430
Phone: 612-566-2510

Drive Ratings and Driven Speeds Table II

HP With 1750 RPM Motor			Torque at 1-1 Ratio & Min. RPM	Pulley-Belt Combination			Driven RPM					
							1750 RPM Motor			1150 RPM Motor		
at 1-1 Ratio	at Max. RPM	at Min. RPM		Driver	Driven	Belt Section	Min.	Max.	Ratio	Min.	Max.	Ratio
5.00	5.00	1.50	180 in. lbs.	MA82	A96	23A	500	3000	6:1	333	2000	6:1
10.00	10.00	3.20	360 in. lbs.	MA96	A112	26A	560	3000	5.4:1	373	2000	5.4:1
15.00	15.00	4.30	540 in. lbs.	MA112	A130	26A	500	3000	6:1	333	2000	6:1
30.00	30.00	9.80	1080 in. lbs.	MA112-33	A130-33	33A	600	3000	5:1	400	2000	5:1
40.00	40.00	11.4	1440 in. lbs.	MA136	A164	36A	600	3000	5:1	400	2000	5:1
50.00	50.00	21.0	1800 in. lbs.	MA164	A164	36A	717	3580	5:1	478	2848	6:1
60.00	60.00	23.0	2160 in. lbs.	MA164	A177	36A	662	3178	4.8:1	441	2118	4.8:1
75.00	75.00	31.0	2700 in. lbs.	MA177	A177	36A	720	3600	5:1	480	2880	6:1
100.00	100.00	34.0	3600 in. lbs.	MA177	A221	36A	595	2380	4:1	397	1587	4:1

HP Ratings at 1150 and 875 RPM are 2/3 and 1/2 respectively of those at 1750 RPM

Pre-Engineered Belt Selection and Center Distance Table III

Pulley Combination		23A Belt Section Pitch Lengths										
		MM	1060	1100	1180	1250	1400	1500	1600	1700	1800	2000
Driver	Driven	Inches	41.7	43.3	46.5	49.3	55.2	59.2	63.0	66.9	70.9	78.7
MA82	A96		11.2	12.8	13.6	15.0	17.9	19.9	21.8	23.8	25.8	29.7

Pulley Combination		26A Belt Section Pitch Lengths													
		MM	1250	1300	1400	1500	1600	1750	1800	1900	2000	2120	2400	2500	2650
Driver	Driven	Inches	49.3	51.2	55.2	59.2	63.0	68.9	70.9	74.8	78.7	83.5	94.5	98.4	104.3
MA96	A112		13.2	14.1	16.1	18.1	20.0	23.0	24.0	25.9	27.8	30.3	35.8	37.7	40.6
MA112	A130			12.5	14.5	16.5	18.4	21.3	22.3	24.3	26.2	28.6	34.1	36.1	39.0

Pulley Combination		33A Belt Section Pitch Lengths													
		MM	1500	1600	1700	1750	1800	1900	2000	2120	2300	2400	2500	2650	2800
Driver	Driven	Inches	59.2	63.0	66.9	68.9	70.9	74.8	78.7	83.5	90.6	94.5	98.4	104.3	110.2
MA112-33	A130-33		16.2	18.1	20.0	21.0	22.0	24.0	25.9	28.3	31.9	33.8	35.8	38.7	41.7

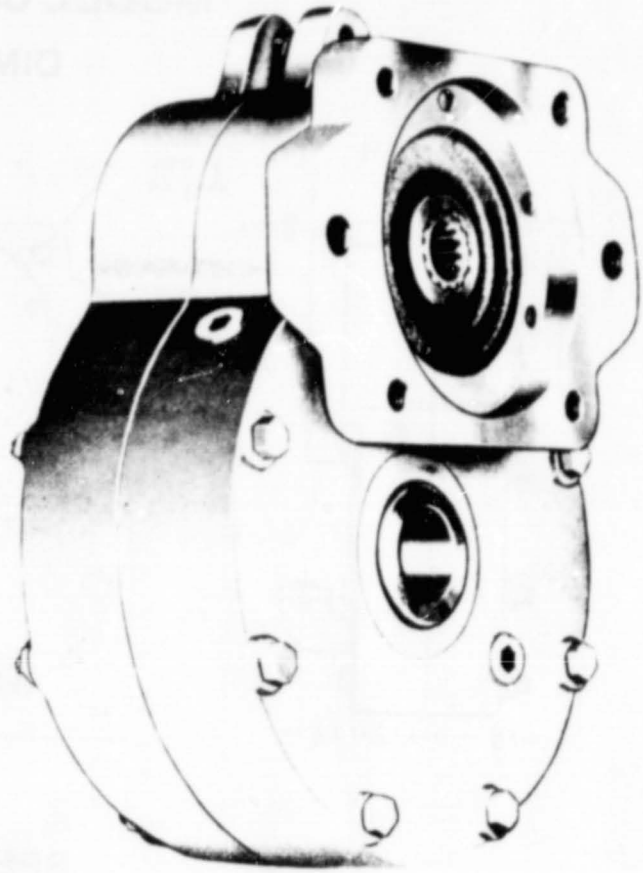
Pulley Combination		36A Belt Section Pitch Lengths											
		MM	1800	1900	2000	2120	2250	2400	2500	2600	2700	2800	3000
Driver	Driven	Inches	70.9	74.8	78.7	83.5	88.6	94.5	98.4	102.4	106.3	110.2	118.1
MA136	A164		19.0	20.9	22.9	25.3	27.8	30.8	32.7	34.7	36.7	38.6	42.6
MA164	A164		17.6	19.5	21.5	23.9	26.4	29.4	31.3	33.3	35.3	37.2	41.2
MA164	A177			18.4	20.4	22.8	25.3	28.3	31.2	32.2	34.2	36.1	40.1
MA177	A177			18.1	20.0	22.4	24.9	27.9	30.8	31.8	33.8	35.7	39.7
MA177	A221							23.7	25.7	27.7	29.7	31.6	35.6

Hi-Lo Manuafacturing Company
1700-G Freeway Blvd.
Minneapolis, MN 55430
Phone: 612-566-2510

HUB CITY DIVISION
SAFEGUARD POWER TRANSMISSION CO.
Phone (605) 225-0360 — P.O. BOX 1089 — ABERDEEN, S. DAKOTA 57401

MODEL 330 PUMP DRIVE

- Two standard ratios available
- Increases 540 or 1000 RPM tractor P.T.O. speed to 1825 RPM to facilitate use of a smaller, less expensive hydraulic pump.
- Fits most standard SAE hydraulic pumps having SAE A, B OR C mounting flange.
- Easy installation and removal on most standard tractor P.T.O. shafts.
- Torque arm bracket furnished as standard equipment.
- Rugged cast aluminum housing.
- All steel alloy gears.
- High strength alloy shafts.
- Off-the-shelf delivery.
- Rated for pumps requiring up to 45 HP at 540 RPM and 65 HP at 1000 RPM.



Shown is a Char-Lynn Model PFTR-003B-011A Pump mounted on the Hub City Series 330 pump drive.

WEIGHT 35 LBS.

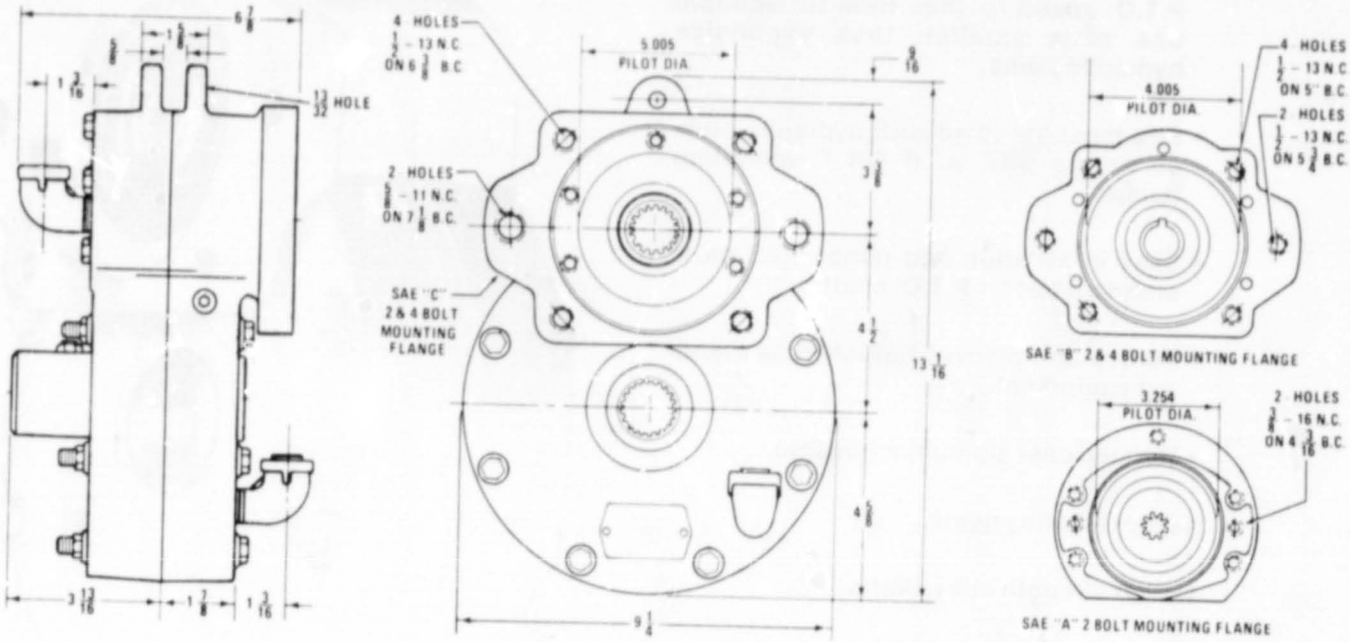


With the new HUB CITY Series 330 Pump Drive, it is now possible to increase either 540 RPM or 1000 RPM tractor P.T.O. speed to 1825 RPM to permit use of a smaller, less expensive hydraulic pump for your implements. Three flange sizes are available, SAE 'A, B & C' for use with standard SAE pumps. Also, both spline and round shafts are available in several sizes to suit your pump adaption requirements.

HUB CITY DIVISION
SAFEGUARD POWER TRANSMISSION CO.
Phone (605) 225-0360 — P.O. BOX 1089 — ABERDEEN, S. DAKOTA 57401

MODEL 330 PUMP DRIVE

DIMENSIONS



SPECIFICATIONS

PART NUMBER	SAE ADAPTER	PUMP SLEEVE			OPERATING SPEED	
		NO. SPLINES	SPLINE/KEYWAY SPECIFICATIONS	SPLINE OR BORE I.D.	TRACTOR*	PUMP
02-20-06107-330	A	9	16/32 DP 30° PA	.625	540 RPM	1825 RPM
02-20-06101-330	A	9	16/32 DP 30° PA	.625	1000 RPM	1825 RPM
02-20-06108-330	A	Keyway	5/32" x 5/64" KW	.625	540 RPM	1825 RPM
02-20-06102-330	A	Keyway	5/32" x 5/64" KW	.625	1000 RPM	1825 RPM
02-20-06118-330	A	Keyway	3/16" x 3/32" KW	.750	540 RPM	1825 RPM
02-20-06114-330	A	Keyway	3/16" x 3/32" KW 1/4" x 1/8" KW	875	540 RPM	1825 RPM
02-20-06110-330	B	Keyway	3/16" x 3/32" KW 1/4" x 1/8" KW	875	540 RPM	1825 RPM
02-20-06104-330	B	Keyway	1/4" x 1/8" KW	875	1000 RPM	1825 RPM
02-20-06109-330	B	13	16/32 DP 30° PA	875	540 RPM	1825 RPM
02-20-06103-330	B	13	16/32 DP 30° PA	875	1000 RPM	1825 RPM
02-20-06117-330	B	14	12/24 DP 30° PA	1.250	540 RPM	1825 RPM
02-20-06113-330	B	Keyway	1/4" x 1/8" KW	1.000	1000 RPM	1825 RPM
02-20-06115-330	B	Keyway	1/4" x 1/8" KW	1.000	540 RPM	988 RPM
02-20-06112-330	C	Keyway	5/16" x 5/32" KW	1.25	540 RPM	1825 RPM
02-20-06106-330	C	Keyway	5/16" x 5/32" KW	1.25	1000 RPM	1825 RPM
02-20-06111-330	C	14	12/24 DP 30° PA	1.25	540 RPM	1825 RPM
02-20-06105-330	C	14	12/24 DP 30° PA	1.25	1000 RPM	1825 RPM

. forsepower. Rated for pumps requiring up to 45 HP @ 540 RPM and 65 HP @ 1000 RPM.
Weight: 35 lbs.

*Input designed for 1⅜" P.T.O. shaft only.
540 RPM Tractor 1⅜-6 Spline.
1000 RPM Tractor 1⅜-21 Spline.

Fixed Center Compound Drives

Speed Command and Econoline Compound Drives

Speed Command Selection

1. Determine the required input HP of your application.
2. Find the pulley series that meets your HP requirements.
3. Determine if your application is a Z or C mounting configuration.
4. Select the manual pulley and spring loaded pulley that meets the above requirements.
5. Specify the bores for both the manual and spring loaded pulley.
6. Indicate whether the input rpm is 1750 rpm *or* 1150 rpm.
7. Select the torque arm bracket.

1750 RPM Input To Driver — Speed Command

Input HP Rating	Output RPM Ratio	Driven Pulley RPM Max.	Driven Pulley RPM Min.	Spring Loaded Pulley Z Model Number	Spring Loaded Pulley C Model Number	Spring Loaded Pulley Bores Max.	Spring Loaded Pulley Bores Min.†	Manual Pulley** Model Number	Manual Pulley** Bores Max.	Manual Pulley** Bores Min.†	Lovejoy Belt Series	Size
*1/2, 3/4	8.5:1	4950	580	260	260	3/4	1/2	M-260	3/4	1/2	087	7/8"
*1-1/2	8:1	4650	580	301-D	301-C	1-1/8	5/8	M-1	1-1/8	5/8	12	1-3/16"
*2-3	8:1	4650	580	3030-D	3030-C	1-1/8	7/8	M-3	1-1/8	7/8	14	1-7/16"
1/2, 3/4	7.8:1	4900	625	1-007	HC-007	15/16	1/2	HM-1	15/16	1/2	087	7/8"
1	7.8:1	4900	625	1-010	HC-010	15/16	1/2	HM-1	15/16	1/2	087	7/8"
1-1/2	8:1	4650	580	1-015	HC-015	1-1/8	5/8	HM-3	1-1/8	5/8	12	1-3/16"
2-3	8:1	4650	580	1-020	HC-020	1-1/8	7/8	HM-3	1-1/8	7/8	12	1-3/16"
5—7-1/2	7:1	4060	580	1-050	HC-050	1-3/8	1-1/8	HM-7	1-3/8	1	18	1-13/16"
10	6:1	3300	580	14407	34407	2-1/8	1-5/8	HM-30	2-1/8	1-3/8	27	2-3/4"
20-30	6:1	3300	580	14420	34420	2-1/8	1-5/8	HM-30	2-1/8	1-5/8	27	2-3/4"

**Designates pulleys are "WB" series, lubricated pulleys. All other pulleys are standard non-lubricated Hex series pulleys.*
†Refer smaller bores to Lovejoy Pulley Engineering.

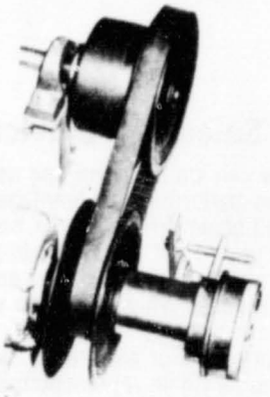
1750 RPM Input To Driver — Econoline Compound Drives

Input HP Rating	Output RPM Ratio	Driven Pulley RPM Max.	Driven Pulley RPM Min.	Spring Loaded Pulley Z Model Number	Spring Loaded Pulley C Model Number	Spring Loaded Pulley Bores Max.	Spring Loaded Pulley Bores Min.†	Manual Pulley** Model Number	Manual Pulley** Bores Max.	Manual Pulley** Bores Min.†	Lovejoy Belt Series	Size
1/2	3.5:1	3150	900	450	450-R	3/4	1/2	M-450	3/4	1/2	A	1/2"
3/4	5:1	3750	750	550	550-R	3/4	1/2	M-550	3/4	1/2	A	1/2"
1	6:1	4100	675	650	650-R	7/8	1/2	M-650	7/8	1/2	B	5/8"

For 1150 RPM applications, refer to the Lovejoy General Catalog, LJ1006 or contact Lovejoy Pulley Engineering.
***Manual pulleys must always be mounted on the driver (motor shaft).*

Torque Arm Bracket

For the following Speed Command Drives	Model Number
Fract. thru 3 HP	501
5 thru 30 HP	501
Econoline	501



Lovejoy
America's word for couplings
LOVEJOY, INC., 2655 WISCONSIN AVENUE,
DOWNERS GROVE, ILLINOIS 60515 (312) 852-0500

MORSE HY-VO® HIGH-SPEED CHAIN DRIVE

MORSE® BORG WARNER®



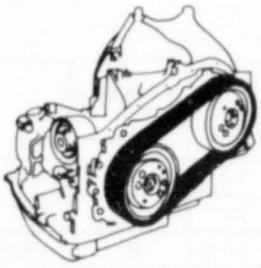


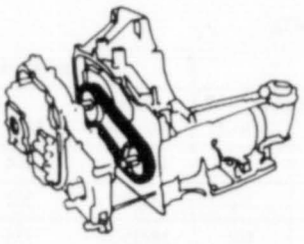
Front-Wheel-Drive Vehicles:

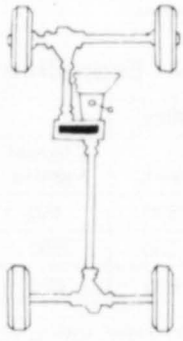
Front-wheel drive requires clever packaging of major mechanical components — transverse or longitudinal engines, perhaps even vertical engines, all with the help of HY-VO drives. Flexibility of positioning, a HY-VO drive feature, permits the designer to "fold" the power path around other components, while still maintaining high efficiency and low noise levels in operation. In the original application of HY-VO to front-wheel drive, the Oldsmobile Toronado, and in various front-drive applications — most recently General Motors' X cars — HY-VO chain handles a wide range of power and speeds.

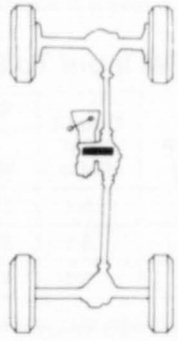
Four-Wheel-Drive Vehicles:

Four-wheel-drive vehicles require the use of more components than two-wheel drives. As a result, the simplicity, compactness and flexibility of positioning of the HY-VO drive help the designer use available space most effectively, while enhancing vehicle performance. Two types of transfer cases, both using HY-VO chain, are shown. Chain driven four-wheel-drive transfer cases, first introduced in 1972, used HY-VO chain. Two years later, more than 60% of the four-wheel-drive vehicles made in the U.S. used HY-VO. Presently, chain-drive transfer cases are used by most American four-wheel-drive manufacturers.









ORIGINAL PAGE IS
OF POOR QUALITY

Morse Sales and Service:

Now, how can we help you use the special combination of design and performance advantages of the Morse HY-VO high-speed chain drive to *your* best advantage?

Even if you're not sure it could play a part in your design thinking, our trained application engineers will suggest some basic approaches which can help you solve the problem facing you.

For information or assistance, worldwide, just contact your nearest Morse Chain representative.

AUTOMOTIVE OFFICES

United States

Morse Chain, Div. of
Borg-Warner
620 South Aurora Street
Ithaca, New York 14850
Phone: 607-272-7220

HY-VO Design Performance Characteristics:

The HY-VO high-speed chain drive is suitable for use with any type of engine or power source, large or small, for almost any type of application including:

- 2-wheel-drive vehicles
- 4-wheel-drive vehicles
- Transverse-engine vehicles
- Motorcycles
- Power takeoff drives and equipment
- Off-highway vehicles and equipment
- Fixed-base power sources
- Industrial tools and equipment
- Marine applications
- Agricultural applications

Quiet Operation

The HY-VO chain runs quietly at all speeds. In fact, often it is the only practical means of transferring power when speeds become high enough to create noise or life problems using gears. While the use of helical gears in some cases will reduce noise to acceptable levels, this creates new problems of greater thrust loads and higher costs. The use of HY-VO chain not only reduces the noise problem, but eliminates thrust loading as well. And because HY-VO is a standard production product, it is far less costly than specially engineered gears.

AUTOMOTIVE OFFICES

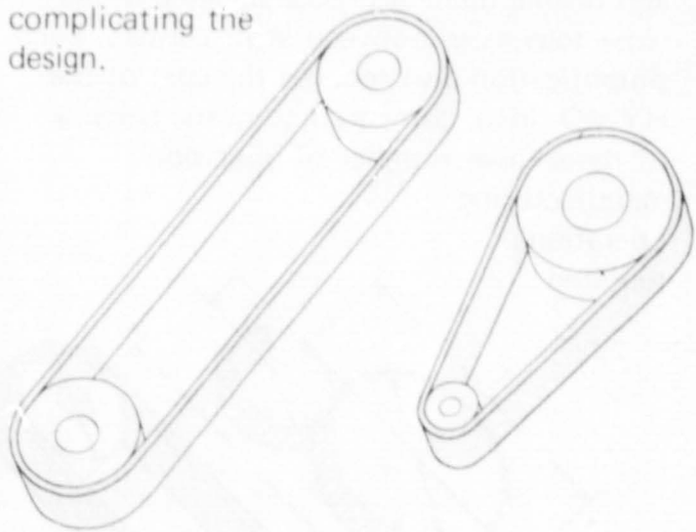
United States
Morse Chain, Div. of
Borg-Warner
620 South Aurora Street
Ithaca, New York 14850
Phone: 607-272-7220

Positioning Flexibility

Two factors contribute here.

1) Because the HY-VO drive consists simply of a sprocket on the driving shaft and a second sprocket on the driven shaft connected by the HY-VO chain, the drive can be used with great effectiveness in limited-space applications.

2) In addition, length of the HY-VO chain can be varied over a wide range of center distances without affecting performance. Consequently, components which are comparatively widely separated can be connected simply and directly without losing efficiency or complicating the design.



With the HY-VO drive, almost any center distance and drive ratio can be accommodated without affecting efficiency and quietness of operation.

High Efficiency

The HY-VO chain drive achieves power efficiencies as high as 99.5%, as measured on drives in actual use.

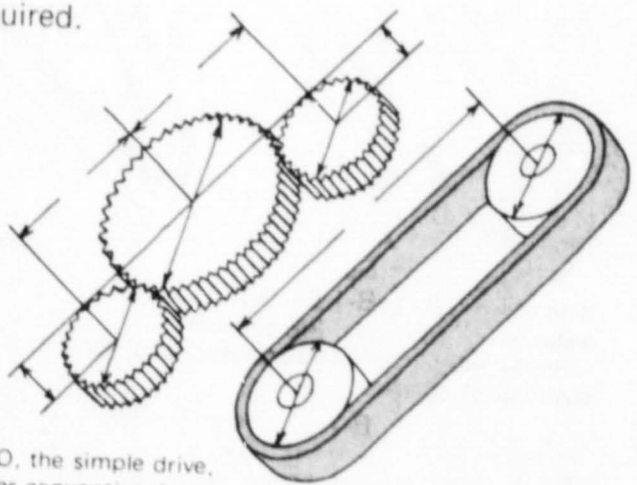
MORSE HY-VO® ENGINEERING GUIDE

Broad Speed Spectrum

Except for very low-speed applications, standard HY-VO chain drives are suitable for almost any power transfer application at drive speeds up to 10,000 rpm. For speeds above 10,000 rpm, specially designed HY-VO drives can be provided.

Drive Simplification

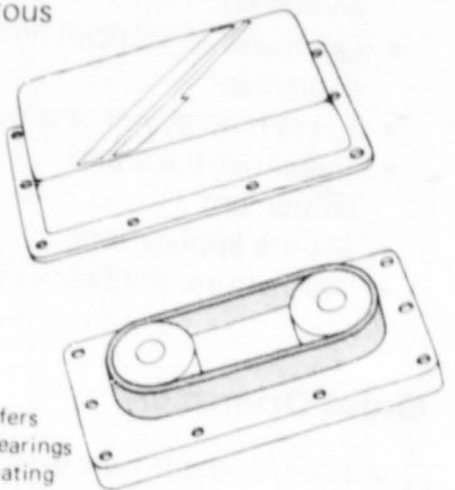
Because of the simplified sprocket/chain/sprocket construction of the HY-VO drive, it eliminates the need for idler gears, thrust bearings and heavy-walled, highly stressed drive cases. In addition, it reduces the problem of maintaining precise alignment and close tolerances between shaft centers. Such simplification also reduces the cost of the HY-VO drive, compared to gears, because of the smaller number of precision manufacturing operations required.



HY-VO, the simple drive, replaces conventional gears, shafts and bearings with two sprockets and a HY-VO high-speed chain, and greatly reduces the problem of compound tolerances with gear sets. It also reduces weight, noise and the cost of parts and assembly.

Cost and Weight Savings

The transfer of power between chain and sprocket is essentially through tension, with only compressive loads, but no thrust loads, to be absorbed. This permits the use of light-duty bearings rather than tapered roller bearings with their heavier support systems. As a result, casings or housings can be made of non-ferrous alloys or thin-section materials, which further reduces both the weight and cost of components in the system.



The HY-VO drive transfers power without heavy bearings and thrust loads, eliminating the requirement for large bearings and their heavy support systems. This permits the use of lightweight, non-ferrous alloys or stamped materials in casing construction.

AUTOMOTIVE OFFICES

United States

Morse Chain, Div. of
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620 South Aurora Street
Ithaca, New York 14850
Phone: 607-272-7220

MORSE CHAIN DIVISION
BORG-WARNER
CORPORATION

MORSE HY-VO® HIGH-SPEED CHAIN DRIVE

AUTOMOTIVE OFFICES

United States
Morse Chain, Div. of
Borg-Warner
620 South Aurora Street
Ithaca, New York 14850
Phone: 607-272-7220

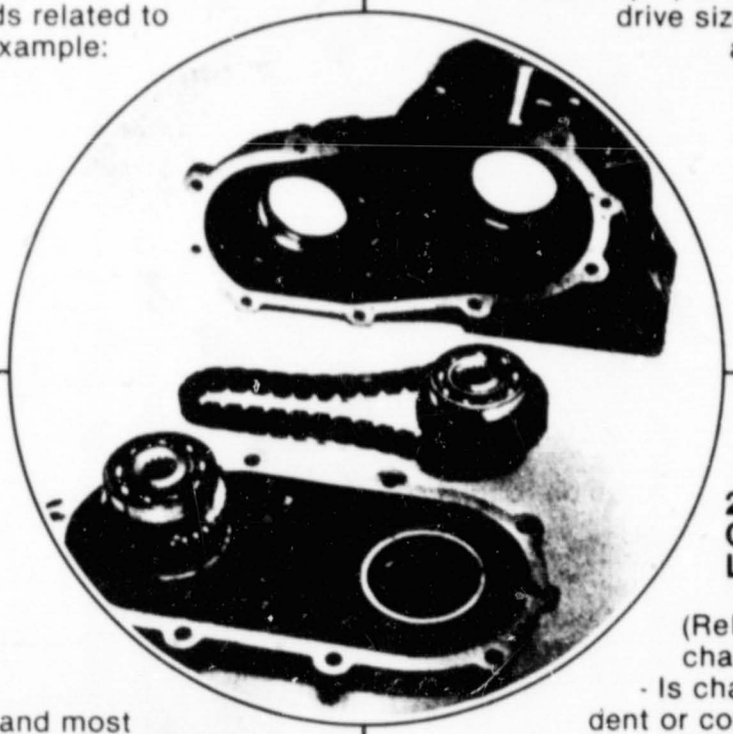
BASIC CRITERIA AFFECTING DRIVE DESIGN

2-1-1 DRIVE LINE CHARACTERISTICS

- Drive line layout
- Position of chain within drive line
  . Immediately after prime mover (Primary Drive)
  . After transmission or any speed reduction (Secondary drive)
- Type of prime mover
- Range of loads and speeds to be transmitted by chain drive
- Any limitation to loads related to the driven element (example: Wheel slip)

2-1-2 CHAIN DRIVE LAYOUT

- Basic dimensions and physical limitations.
  . Center distance and ratio
  . Inclination of drive
  . Eventual inertia limitation (for primary drives)
  . Case mounting
- Can the chain drive be operated near its optimum chain linear speed (generally 6000 to 8000 fpm) or is this speed limited by drive size limitations or by non-availability of adequate lubrication - (see 2-1-4 below)



2-1-3 REQUIRED LIFE AND DUTY CYCLE

For vehicle applications in particular, the real objective is to select the smallest and most economical drive **for a certain duty cycle and drive life.**

The existence of composite duty can make final selection a nebulous area.

"Rating charts" have been developed to be used as a guide for chain drive selection.

In the final analysis, dynamometer and vehicle testing are determining factors in the final selection.

2-1-4 CHAIN DRIVE LUBRICATION

(Related particularly to chain linear speed).

- Is chain lubrication independent or common with other drive line components.
- May pump lubrication be considered economically.
- For drives with continuous chain linear speeds not exceeding 2500 fpm. an oil bath is generally satisfactory.
- For continuous chain linear speeds above 2500 fpm., pressure lubrication is advisable; but with specific development of chain casing design, an oil bath can be made effective in many applications, using the chain itself as a pumping element.

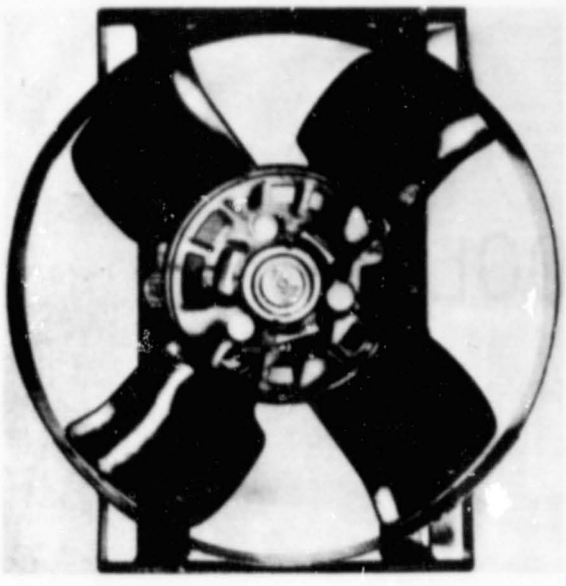
FANS, COOLING

(CODE **FC**)

Automotive Cooling Accessories

830 N. Lake St., Burbank, Ca. 91502

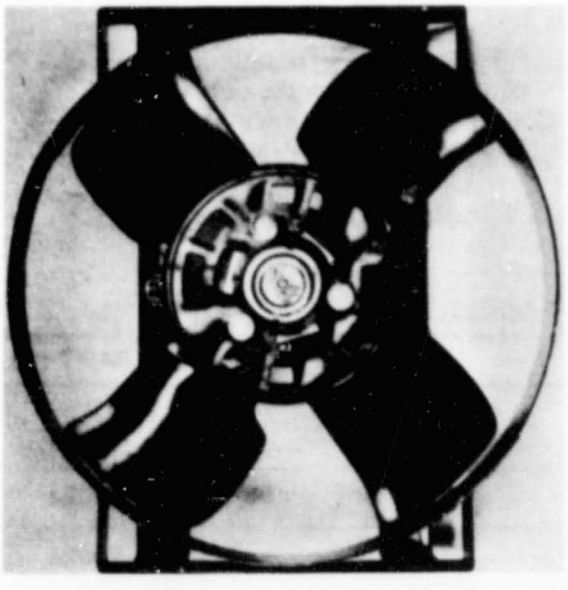
(213) 843-1383 (213) 849-3008

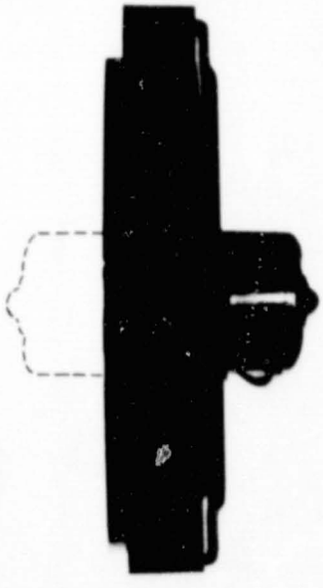




Part No. 1050
Auxiliary Electricool™ fan (10″ dia.)
(Universal application)

12 volt self contained fan assembly. Only 2¼″ thick, it mounts anywhere with its own fan shroud. A must for add on air conditioning or trailer towing vehicles. Saves fuel and increases horesepower. Can be used for push or pull applications without reversing motor. Pancake motor design fits almost any vehicle.
Complete kit includes fan assembly, wiring harness, and control switch.





Part No. 1055
Auxiliary Electricool™ fan (10″ Dia.)

Energy saver economy model
Use where space is not a limiting factor.
4⅜″ thick, 12 volt 80 watt permanent magnet motor.
Reversible motor for push or pull applications.
Improves engine performance and helps solve cooling problems. Can be used on all automobiles, buses and coaches, agricultural equipment, and boats with inboard engines.
Complete kit includes fan assembly, wiring harness, control switch and instructions.

Flex-a-lite Corporation

5915 Lake Grove Ave., SW • Tacoma, Wash. 98499 • 206–584-1336

430 WEATHERLY INDEX

The Flex-a-lite® fan

"To be successful in the automotive aftermarket, one must make available to the consumer a product better suited to his *needs* than originally placed on his vehicle."



To take a new idea, work on it, and see it grow and blossom into international recognition in the largest of all industries, is truly a satisfying experience. The remarkable growth of leadership in the fan aftermarket in a matter of little over a decade is strong evidence of the genuine need for this improved product. It also is evidence of our innovative research and development program that continually brings to the market new and even better Flex-a-lite fans. The thrust of this on-going program is always directed toward creating fans that do an improved job of engine cooling in specific vehicle classifications and service situations. As a result, we can say with assurance that whatever the engine cooling job may be, Flex-a-lite either has developed or will design a fan to do a better job.

Today, Flex-a-lite is unique in being the only known source for a full line of fiberglass and stainless steel fans for the automotive (and truck/industrial) markets. In this catalog you'll find a fan for just about every type of service and for every type of auto, race car, recreational vehicle or light truck. Every effort has been made to make the catalog a useful, easily understandable guide to selecting, ordering and applying fans for every engine cooling job. This is in line with our policy of providing strong distributor support and reliable recommendations for fan specification and purchase. It is our way of showing that Flex-a-lite, who originated the fan aftermarket business, intends to maintain its market leadership and its reputation for quality, service, and uncompromising integrity. It's the best way we can think of to let all of our good customers know that we truly appreciate their business and the loyalty that has built our growth, and that we are dedicated to maintaining their continuing patronage.

Eddy H. Hawk

President/Founder
Flex-a-lite Corporation

DESIGN LEADERSHIP

Flex fans are designed to reduce air flow as engine RPM's increase. Engine RPM's are normally in proportion to road speed and at the higher road speeds power robbing fan air is not needed.

Flex-a-lite fans are especially designed to flex at these high RPM's to reduce air flow and give better vehicle performance.

When Flex-a-lite developed this flex concept for engine cooling fans several years ago, our basic 18 inch diameter, 100 series fan took care of virtually all autos at that time in history. Subsequently, both larger and smaller autos became popular, including recreational vehicles and the mini-cars—each have their own purpose and each their inherent variables in cooling needs.

In keeping pace, Flex-a-lite developed various characteristics in fan flexing, making the broad range available in both the reliable lightweight fiberglass and unequalled stainless steel materials.

Full flex, semi-flex and no flex based on user requirements, in either fiberglass or stainless steel in diameters from 12 thru 22 inches, take care of all known cooling problems. All these fans give maximum cooling at low RPM range when most needed. The full flex starts flexing almost immediately. The semi-flex begins to flex at a higher RPM while the no flex maintains high air flow even at high engine RPM's.

ORIGINAL PAGE IS
OF POOR QUALITY

Flex-a-lite is a member of and supports these national organizations:

S.A.E. ASIA awda MEMA NARSA APAS SEMA

Flex-a-lite Corporation

5915 Lake Grove Ave., SW • Tacoma, Wash. 98499 • 206–584-1336

430
WEATHERLY INDEX

The Flex-a-lite fan

Flex-a-lite has a fan for the job



200
SERIES

Projected Width 1¾",
In 8 Diameters:
12 thru 19 inches

Designed to replace factory equipped fans on most popular automobiles. A must with air conditioning and where added cooling is desired.



400
SERIES

NEW

Projected Width 2",
In 4 Diameters:
15 thru 18 inches

Designed for efficiency. This new lightweight, one-piece injection molded fan is designed for today's fuel economies and driving conditions. Improved airflow, lower noise and more horsepower are a result of this series.



700
SERIES

Projected Width 1¼",
in 7 diameters:
12 thru 18 inches

Designed for competition applications where added power is needed. Bench tested to 10,000 RPM.



1100
SERIES

Projected Width 1⅞",
In 6 diameters:
17 thru 22 inches

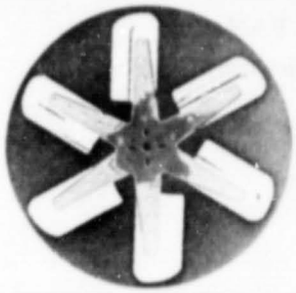
Designed to replace factory equipped fans on small and medium size trucks, including models with air conditioning.—Popular winner in off-hiway racing.

Flex-a-lite Corporation

5915 Lake Grove Ave., SW • Tacoma, Wash. 98499 • 206–584-1336

The Flex-a-lite fan 430 WEATHERLY INDEX

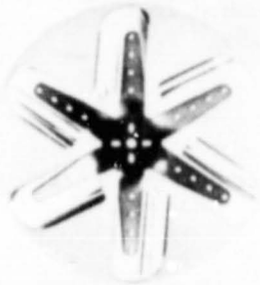
in fiberglass and stainless steel.



1300 SERIES

Projected Width 2¼",
In 8 diameters:
12 thru 19 inches***
for 20" diameters see below.

Designed to replace factory equipped fans on recreational vehicles and small to medium size trucks. Recommended for use where overheating problems have been experienced.



1400 SERIES

Projected Width 2-3/5",
in 7 diameters:
13 thru 19 inches***
for 20" diameters see below.

Designed to replace factory fans and fan clutch drives. Recommended for use where overheating problems have been experienced.

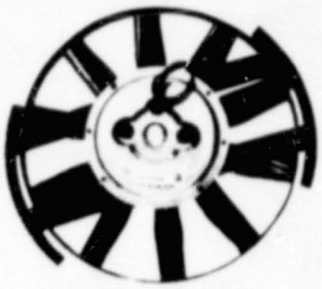
Fan Specification List

	Automobile		Recreation Vehicle		Light Truck		Competition	Fan Clutch Replacement
Fan Type	Added Cooling Air Conditioning	Extra Heavy Duty	Trailer Tow & Heavy Service	Extra Heavy Duty	Ordinary Service	Extra Heavy Duty	High Performance	Full Flex
Series No.	200	1300	1100	1300	1100	1300	700	1400
RPM Rating	6,000	10,000	6000	10,000	6,000	10,000	10,000	9,000
FAN DIAMETER 12"	212	1312	—	1312	—	1312	720	
FAN DIAMETER 13"	213	1313	—	1313	—	1313	730	1413
FAN DIAMETER 14"	214	1314	—	1314	—	1314	740	1414
FAN DIAMETER 15"	215	1315	—	1315	—	1315	750	1415
FAN DIAMETER 16"	216	1316	—	1316	—	1316	760	1416
FAN DIAMETER 17"	217	1317	1117	1317	1117	1317	770	1417
FAN DIAMETER 18"	218	1318	1118	1318	1118	1318	780	1418
FAN DIAMETER 19"	219	1319***	1119	1319***	1119	1319***	—	1419...
FAN DIAMETER 20"	—	...	1120	...	1120	...	—	...
FAN DIAMETER 21"	—	—	1121	—	1121	—	—	—
FAN DIAMETER 22"	—	—	1122	—	1122	—	—	—

***1319 and 1419 (19½ diameter) recommended to replace factory equipped 20" diameter fans.

THERMOSTATICALLY CONTROLLED ELECTRIC FAN

Set the desired temperature and built-in heat sensor turns fan on when the device being monitored exceeds the set temperature and turns it off when the temperature is normal--automatically. Package comes complete with high-volume fan, patented printed circuit motor, brackets, under dash control, all necessary hardware, and step-by-step installation instructions.



Specifications:

Diameter: 12"
Voltage: 12 volts DC
Mounting Surface Required: 13-3/4" vertically or horizontally
Fan RPM: 2,000 rpm
Depth: 3-1/2"
Air Flow: 1,050 cfm
Current Draw: 11.2 amps
Rating: 10,000 hours continuous

700-10-850	Electric Fan

AIR CIRCULATING FAN

Rubber bladed fan requires no guard. Remote dash-mounted, two-speed switch and extra long power cord.

Specifications:

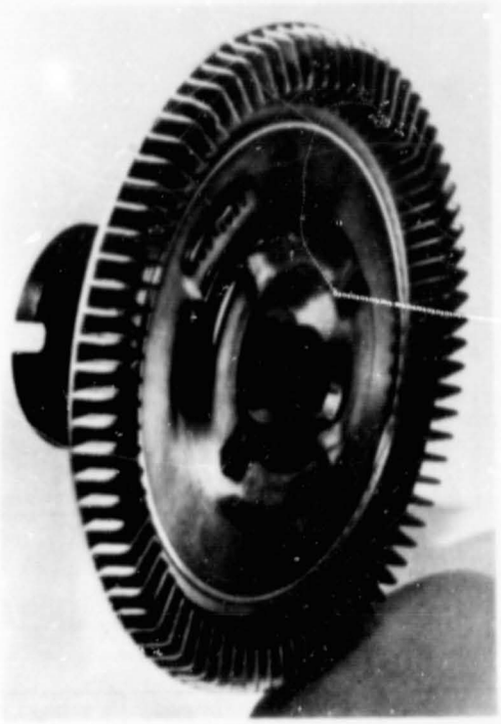
Blade Diameter: 5-1/2"
Voltage: 12 volts DC
Depth: 4-7/8"
Air Flow: 140 cfm
Current Draw: 1.2 amps

700-4C585-860	Circulating Fan



ELECTRIC VEHICLE COMPONENTS
FLIGHT SYSTEMS
HEADQUARTERS
P.O. BOX 25, MECHANICSBURG, PA 17055
PHONE (717) 697-0333

FAN CLUTCHES



Principle of operation:

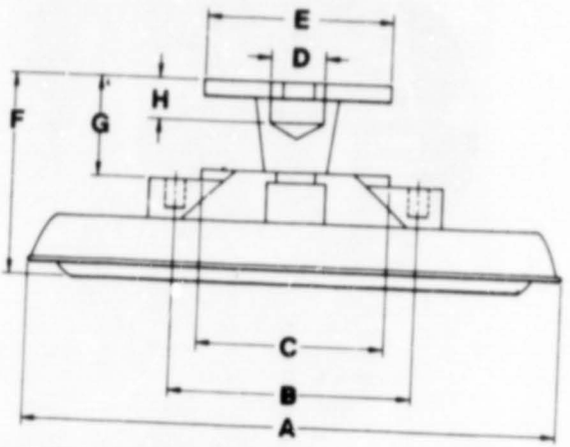
The fan clutch is a visco hydrodynamic device wherein a disc like impeller is attached via a shaft to the water pump. As the water pump rotates, it rotates the impeller. The impeller is surrounded by a housing which rotates on the impeller's shaft by means of a ball bearing; thus the impeller is free to rotate within the housing, to a point. The relative speed of rotation is actually controlled by a viscous fluid inside the housing in which the impeller is partially submerged. By this arrangement the impellar is spun by the water pump and it drags the viscous fluid with it; the fluid then drags the housing along and, since the fan is bolted to the housing, it is thus rotated to move cooling air across the radiator.

In a non-thermal fan clutch the fan rotates somewhat more slowly than the water pump, but rotates at all times. In a thermal fan clutch a temperature-sensitive valve and reservoir system removes the viscous fluid from the housing when the engine is cold, thus elimimating the load of spinning the fan from the engine when the temperature is low enough not to need it.

HAYDEN INC.
1531 Pomona Road, Corona, California 91720
(714) 735-4900 Outside CA (800) 854-4757

FAN CLUTCHES

DIMENSIONS:



No.	"A" Body	"D" Pilot	"E" Fig	"G" Shaft
1601-2601	6"	*	S	1 3/4
1602-2602	6"	*	S	2 1/4
1603-2603	6"	*	L	1-7/8
1605-2605	6"	3/4	S	1-5/8
1607-2607	6"	*	L	1-3/8
1608-2608	6"	3/4	L	2 1/4
1609-2609	6"	*	S	2 1/4
1701-2701	7 1/4"	*	S	1-7/8
1702-2702	7 1/4"	*	S	1 1/2
1704-2704	7 1/4"	3/4	S	1 3/4
1705-2705	7 1/4"	*	L	1 1/2
1707-2707	7 1/4"	*	L	2
1708-2708	7 1/4"	3/4	L	1-3/8

*Pilot holes (D) are 5/8" unless specified.
"E" Mounting flanges are listed:
(S) for small 2-5/16"
(L) for large 2-9/16"

HAYDEN INC.
1531 Pomona Road, Corona, California 91720
(714) 735-4900 Outside CA (800) 854-4757

FAN CLUTCHES

WEIGHT

Fan clutches utilize aluminum impellers and housings to keep the weight in the 2-4 pound range.

RATING

A fan clutch is rated according to the amount of torque available for turning the fan and by the reduction in engine power required when thermally disengaged.

PERFORMANCE DATA

An adequate fan clutch should be capable of rotating a fan at 80% of the water pump RPM (torque requirement is then a function of fan design). A thermal fan clutch should reduce the engine load by 85% or more when the fan is disengaged.

OPERATING INSTRUCTIONS

A fan clutch operates automatically and requires no external operation.

FANS, COOLING

Principle of operation:

Flex fans are engine cooling fans, attached to the water pump and rotated thereby, which draw air across the radiator. The amount of air drawn is the same as a rigid fan at idle, but less at increased engine RPM. The purpose is to reduce engine load by taking advantage of the fact that at increased speed, the ram air will provide sufficient cooling air and the fan is not needed.

This is achieved by virtue of flexibility built into the fan blades so that as the fan turns faster, more air pressure is exerted aginst the blade causing it to flatten out.

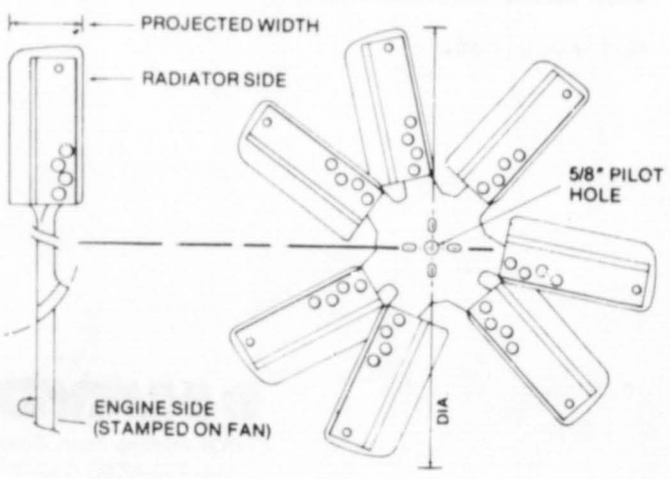
DIMENSIONS:

ALL FANS ARE BALANCED AT FACTORY.

PROJECTED WIDTH SPECIFICATIONS			
Fan Diam.	5-Blade 3500 Series	7-Blade 3700 Series	7-Blade SHD 4700 Series
13"	2"	2"	---
15"	2"	2"	---
17"	2.2"	2.2"	2.68"
18¼"	2.2"	2.2"	2.68"
19½"	2.2"	2.2"	2.68"

Specifications subject to change without notice

7 BLADE AUTOMOTIVE FANS



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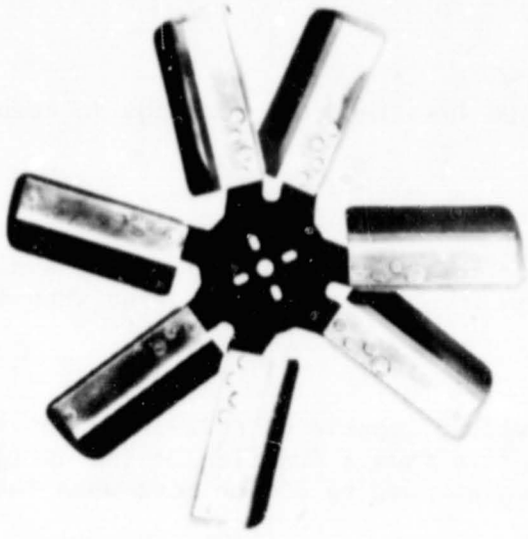
FANS, COOLING



WEIGHT

Flex fans must be constructed of high strength steel and so weigh 15 - 45 pounds.

RATING:

A flex fan is evaluated by the amount of air it moves at low and high RPM, as well as sound level and fatigue life.

DATA

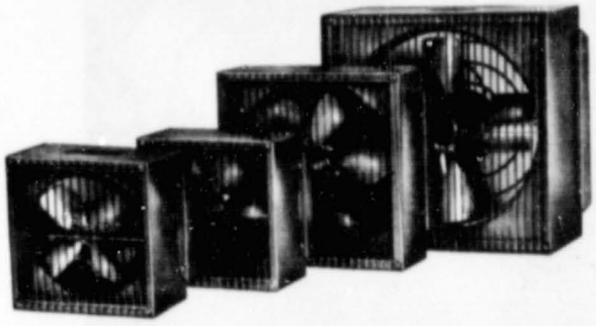
A replacement flex fan should supply the same CFM at idle and reduce engine load by 1 - 5 horsepower at 3000 RPM. Sound level should not exceed 93 db-A and fatigue life should exceed 30,000 rapid cycles to 6000 RPM.

OPERATING INSTRUCTIONS:

Not required.

HAYDEN INC.
1531 Pomona Road, Corona, California 91720
(714) 735-4900 Outside CA (800) 854-4757

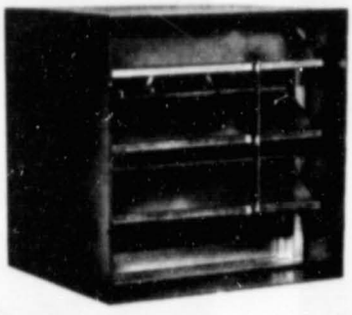
REVERSIBLE FILTER BOX FANS



MODELS 1RB65 — 1RB80 — 1RB100 — 1RB120

Easy to install Filter-Box-Propeller-Fans offer a wide choice of cfm output and great mounting flexibility. Only 4 1/2" deep including dust filter. Can be installed to pressurize or evacuate the electronic enclosure. Compact and economical, they provide a long service free life. Motors are rubber isolated and vibration free.

Models Available:	Four
Air Delivery:	275, 450, 725, 1200 CFM
Overall Width:	8-7/8", 12-1/8" and 15-1/8"
Overall Heighth:	8-7/8", 12-1/8" and 15-1/8"
Depth:	4-1/2" and 7-3/8"
Motor:	115 volts 50/60 cycles, ball bearings. UL approved.
Filter:	available as extra equipment
Guard:	available as extra equipment
Grille:	available as extra equipment



MODEL LA 120

Designed as an option for the 1RB120 filter box fan, this assembly can be utilized as a back draft damper to prevent air or foreign objects from entering an enclosure when the fan is not operating.

The louvre assembly is gravity operated and may be mounted in a horizontal or vertical position. Installation on a McLean filter box fan will not affect the fan's performance.

The louvre assembly is capable of being mounted remotely and motorized to open and close automatically depending upon temperature or airflow conditions.

Specify by name when ordering.

McLEAN ENGINEERING LABORATORIES
70 WASHINGTON ROAD
PRINCETON JCT. N.J. 08550
PHONE 609-799-0100

PANEL MOUNTED FANS



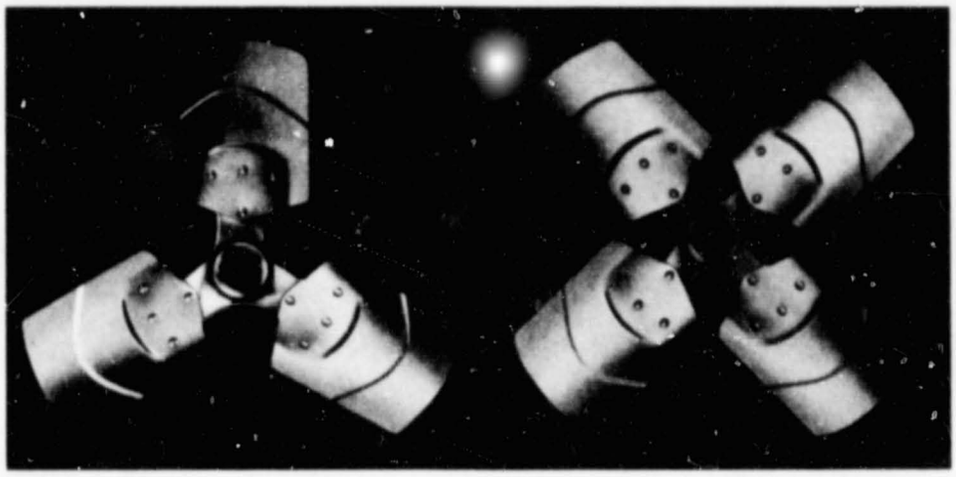
MODELS 1PB65W10 – 1PB65Y10

This McLean series of Panel Fans are self-contained units that can be mounted flush in the cabinet skin. Propeller guard is asssembled inside the orifice. Motor guard is also supplied as an integral part of the fan. These units are complete requiring no extra equipment. Series 1PB65 can be operated in vertical or horizontal position, they are strong, light-weight and will stand shock and vibration.

Models Available:	1PB65Y10 (airflow pull over motor) 1PB65W10 (airflow push over motor)
Air Delivery:	265 cfm
Dimensions:	9" x 9" x 4 1/2"
Motor:	115 volts, 50/60 cycles, Ball Bearings. UL approved.

REVCOR

"G" series fan blades



SIZES:	Diameters from 10″ through 24″. 3 and 4 blade construction.
MATERIALS:	Aluminum blades. Steel spider and hub, zinc plated.
FEATURES:	Most efficient use of a fan's blade area allocation, achieves movement of large air volumes with minimum of axial depth. New structural design of blade adds extra ruggedness. Features Revcor shaved and staked hub, for unitized construction between spider and hub.
APPLICATIONS:	Unitary air conditioners, heat pumps, unit heaters, ventilators, exhaust units.

policy:

Air impellers manufactured by REVCOR, INC. are rated for air performance based on test conditions of applicable published test codes. In the usual air impeller application, the impeller is operated within housings or orifices and deviations from the dimensions of these enclosures from those used in rating REVCOR impellers can substantially affect the air performance. Consequently, the final qualification of the air performance of the impeller in the unit is the responsibility of the user.

Maximum operating speeds, where recommended in the catalog, have been based on experience in relating laboratory over-speed endurance tests with field experience and should assure satisfactory operation in most applications. However, since the air impeller is but part of a system, the performance should be thoroughly evaluated on a prototype unit as to air performance, motor loading, noise and vibration characteristics, with particular emphasis on critical vibration characteristics of the structure with respect to normal exciting frequencies.

REVCOR Air Impellers are manufactured to generally considered normal commercial tolerances and if properly applied should provide satisfactory operation.

Our warranty covers the products only as to materials and workmanship and not for fitness, for purpose or merchantability. In the event that defects in workmanship or materials are found within one year of shipment, the extent of REVCOR's liability will be replacement of product only.

Since the air impeller is only a component of the unit and since satisfactory impeller performance is dependent upon the design parameters of the unit in which it is used and over which REVCOR has no control, the suitability of the correct REVCOR impeller is the responsibility of the customer.

REVCOR INC.
251 Edwards Street • Carpentersville, Illinois 60110 • (312) 428-4411

FUELS SYSTEM COMPONENTS TANKS, LINES, FILTERS, PUMPS (ELECTRIC)

(CODE **FS**)

BUNDY CORPORATION
NORTH AMERICAN TUBING OPERATIONS
12345 E. 9 MILE ROAD
WARREN, MICHIGAN 48090
(313) 758-4511
(800) 521-5614

Product Features

Bundy Electricweld is economically priced single wall, low carbon steel tubing with high burst strength, close tolerance gaging and smooth surfaces.

This high quality tubing is manufactured by continuously forming a single strip of low carbon steel into a tubular shape with butted edges which are then resistance welded. The internal bead is held to a minimum and all external flash is removed. All tubing shipped in coils is pressure tested to assure leak free quality.

Depending on your needs, Electricweld is offered in as-welded, cold-drawn, or annealed forms. Typical surface treatments include terne-coating (nominal 85% lead/15% tin) and super terne-coating (a heavier application of the protective alloy) for automotive applications and copper-flash coating for refrigerator uses.

Electricweld offers excellent formability characteristics. This allows the fabrication of uniformly accurate parts to fit almost any design requirements.

The tubing can be swaged, notched, punched, expanded, compressed, flattened, cut, formed and rolled into almost any form necessary for your application.

Diameter, Length and Tolerances

Electricweld is available in straight lengths, limited only by shipping restrictions. In O.D. sizes up to 3/8 - in., it can be ordered in bulk coils up to 10,000 feet for convenient handling. Custom cut lengths and special packaging may also be specified to suit your needs.

Bundy offers Electricweld in 44 standard combinations of outside diameter sizes and wall thicknesses all held to close tolerance limits.

TOLERANCES - Standard Sizes

Outside Diameter

3/16-in. through 3/8-in. . . . ± .003-in.
7/16-in. through 5/8-in. . . . ± .004-in.
3/4-in. through 1-3/8-in. . . . ± .005 in.

Wall Thickness

all sizes + .002, ± .0035-in.

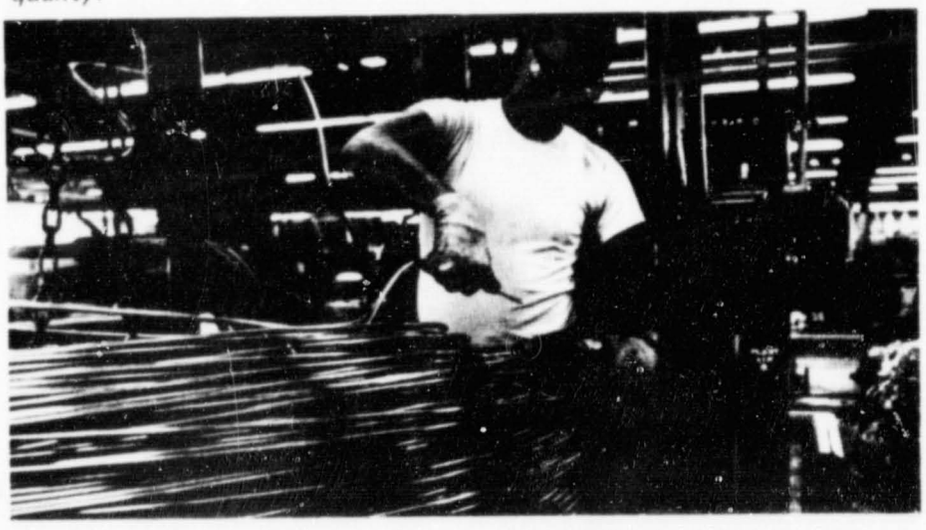
Special Sizes

Some applications require specially sized Electricweld tubing. The benefits available from standard products may be obtained by either sinking or pin-drawing standard tubes to your specifications.

Sinking is generally used when the outside diameter of the tubing must be reduced. The process is accomplished by drawing the tube through a die. The approximate wall thickness of the original tube is maintained yet the O.D. is reduced to the new dimension and can be held to as close as ± .001 - in.

When both the inside and outside diameters of the tubing are critical, the tubing can be pin-drawn. In this case, standard tubing is pulled through a die and over a pin while sizing the outside and inside diameters. The standard tolerance for both the outside and inside diameters of pin-drawn tubing is ± .002 - in. Special sizes can be held to a ± .001 - in. tolerance for both dimensions, if required.

5,000 feet long Electricweld coils are carefully pressure tested to assure quality.



Bundy Electricweld
Dimensions and Specifications

O.D. INCH	mm	THICKNESS INCH	mm	BWG	APPROX. I.D. INCH	CALCULATED NOMINAL VALUES* ULTIMATE BURST STRENGTH, PSI	NOMINAL LB./FT.	NOMINAL FT./LB.
3/16	4.763	.028	.71	22	.131	13,400	.047	21.2
1/4	6.350	.022	.56	24	.206	7,920	.055	18.3
		.028	.71	22	.194	10,100	.063	15.8
		.035	.89	20	.180	12,600	.079	12.7
5/16	7.938	.022	.56	24	.268	6,340	.068	14.8
		.028	.71	22	.256	8,070	.080	12.5
		.035	.88	20	.242	10,100	.102	9.8
3/8	9.525	.028	.56	22	.319	6,720	.100	10.0
		.035	.89	20	.305	8,400	.125	8.0
		.042	1.06	19	.291	10,100	.147	6.8
25/64	10.117	.042	1.06	19	.306	9,670	.156	6.4
7/16	11.113	.030	.76	-----	.377	6,170	.133	7.5
		.035	.89	20	.368	7,200	.149	6.7
		.049	1.24	18	.339	10,100	.196	5.1
1/2	12.700	.020	.50	25	.460	3,600	.112	8.9
		.028	.71	22	.444	5,040	.139	7.2
		.035	.89	20	.430	6,000	.172	5.8
		.042	1.06	19	.416	7,560	.204	4.9
		.049	1.24	18	.402	8,820	.227	4.4
		.060	1.52	-----	.380	10,800	.278	3.6
		.075	1.90	-----	.350	13,500	.333	3.0
9/16	14.288	.028	.71	22	.506	4,480	.149	6.7
		.035	.89	20	.492	5,600	.200	5.0
		.042	1.06	19	.478	6,720	.233	4.3
5/8	15.875	.035	.89	20	.555	5,040	.217	4.6
		.042	1.06	19	.541	6,050	.263	3.8
		.049	1.24	18	.527	7,050	.303	3.3
		.060	1.52	-----	.505	8,640	.362	2.76
11/16	17.460	.035	.889	20	.618	4,580	.244	4.1
3/4	19.050	.028	.71	22	.694	3,360	.200	5.0
		.035	.89	20	.680	4,200	.270	3.7
		.049	1.24	18	.652	5,880	.370	2.7
		.0625	1.59	-----	.625	7,500	.500	2.0
7/8	22.225	.049	1.24	18	.777	5,040	.431	2.32
1	25.4	.035	.89	20	.930	3,150	.360	2.78
		.049	1.24	18	.902	4,400	.498	2.01
		.060	1.52	-----	.880	5,400	.602	1.66
1 1/8	28.575	.035	.89	20	1.055	2,800	.407	2.46
		.049	1.24	18	1.027	3,920	.565	1.77
		.060	1.52	-----	1.005	4,800	.680	1.47
1 1/4	31.750	.035	.89	20	1.180	2,520	.452	2.21
		.049	1.24	18	1.152	3,530	.629	1.59
		.060	1.52	-----	1.130	4,320	.763	1.31
1 3/8	34.925	.049	1.24	18	1.277	3,200	.694	1.44
		.060	1.52	-----	1.255	3,927	.840	1.19

*Calculations made using Barlow's formula: $P = \frac{2St}{d}$

P = internal pressure in psi

S = allowable fiber stress of 45,000 psi

t = wall thickness in inches

d = outside diameter in inches

BUNDY CORPORATION
NORTH AMERICAN TUBING OPERATIONS
12345 E. 9 MILE ROAD
WARREN, MICHIGAN 48090
(313) 758-4511
(800) 521-5614

Fringe Benefits For You

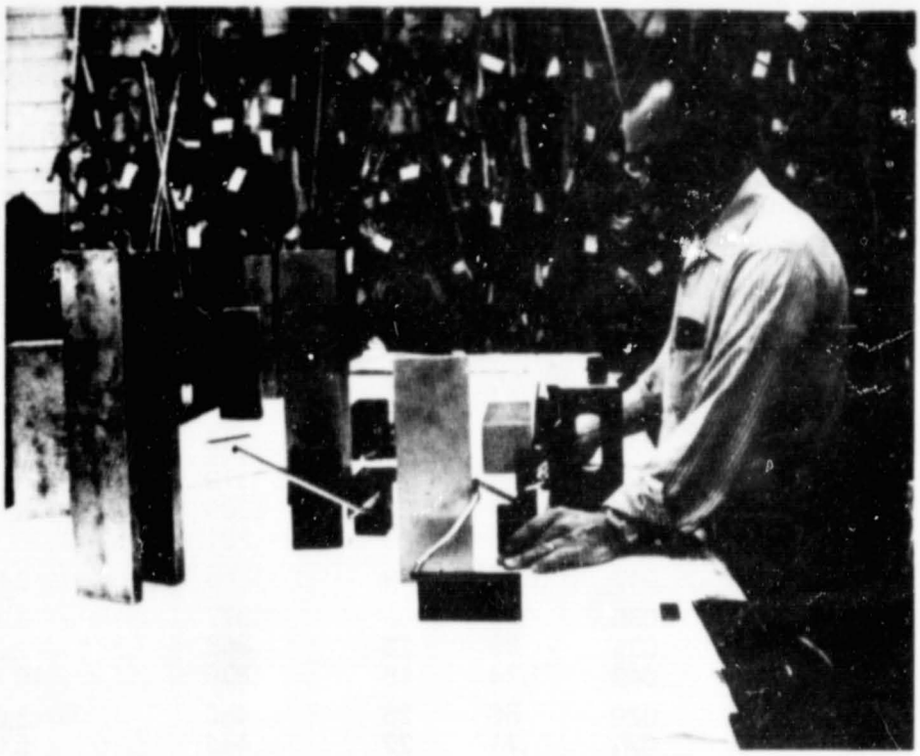
Bundy is the world's largest producer and fabricator of small diameter steel tubing. For over 50 years, the company's engineers, technicians and service personnel have helped meet thousands of application requirements for customers all over the globe. Much of this technical information is available for use to uncover practical, economical solutions to problems confronting Bundy's customers.

You are invited to tap this information. It's available at no cost yet its value may be a major factor in parts, material and production cost savings. You can discuss your tubing specifications and your product design requirements with skilled specialists. Bundy experts can examine your needs and help guide you in the selection of tubing materials which offer the most economical cost performance benefits.

For especially tough problems, customers may have access to other Bundy resources as needed... such as the fully equipped "sample room" used to produce prototypes.

Bundy Tubing products can be used to achieve economical, flexible and dependable results in your products. Have a tubing specialist call on you with a full presentation of the Bundy story. Your time will be well spent.

Contact your nearest Bundy Tubing Distributor or call us direct.
800-521-5651



In Bundy's sample room, skilled technicians hand bend prototype parts prior to mass production fabrication.

Electricweld Applications

Bundy's welded tubing is an accepted standard in the appliance and refrigeration industries. In addition to surpassing internal cleanliness requirements of less than .0035 - grams per square foot on internal surfaces, Bundy's Electricweld's easy formability and strong seams make it a natural for evaporator and condenser coils.

Bundy Electricweld is an economical answer to the problem of transporting liquid or gas. Its light weight and high strength are a plus factor for a wide range of mechanical applications. Countless filler tubes, tubular stress members, pushrods, and housings have been fabricated from this durable tubing.

Other typical uses include condensers and precoolers for refrigerators, evaporators and condensers for freezers, tubular lengths for heating elements, tubular parts for compressors, commercial burner tubes for gas appliances, automotive gas lines, dip sticks, oil lines plus a host of other industrial applications.

BUNDY CORPORATION
NORTH AMERICAN TUBING OPERATIONS
12345 E. 9 MILE ROAD
WARREN, MICHIGAN 48090
(313) 758-4511
(800) 521-5614



Nobody knows more about small diameter steel tube fabrication than Bundy. We operate the world's largest fabricating facilities where hundreds of thousands of parts like these are produced for customers in every segment of industry.

Bundy's tubing fabrication services are a natural progression from the company's leading manufacturing position. This technology, developed through years of experience, is available to help you meet a multitude of application requirements.

Bundy's expertise in fabrication is well-earned. The company manufactures millions of parts each month for the automotive industry according to specifications.

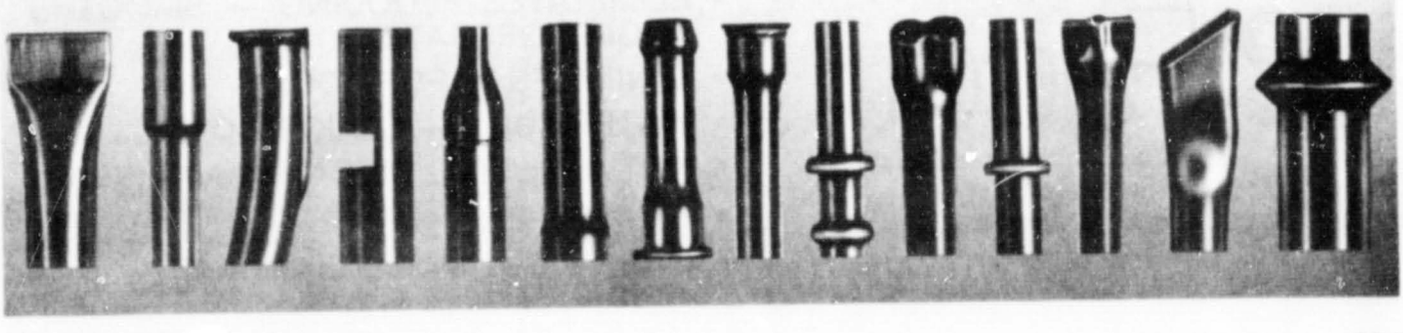
The company specializes in high-volume, high-speed production of intricately fabricated tubing parts. Bundy operates a number of unique, electronically controlled machines which have been built to provide these capabilities. If your product design calls for this kind of special handling, there is no one better equipped to meet your demands than Bundy.

Depending on your needs, Bundy technical service personnel can assist you with engineering guidance for your own fabrication in the production of final tubular parts, complete with fittings, flares, serpentine bends or other custom designs.

Regardless of your fabrication requirements, Bundy can help you.

BUNDY CORPORATION
NORTH AMERICAN TUBING OPERATIONS
12345 E. 9 MILE ROAD
WARREN, MICHIGAN 48090
(313) 758-4511
(800) 521-5614

A variety of fittings, flares, conical upsets and other custom end treatments can be applied to Bundy tubing products.



ORIGINAL PAGE IS
OF POOR QUALITY

Facet Electric Fuel Pumps



- RELIABLE: PROVIDE 2-4 TIMES THE LIFE OF COMPETITIVE ELECTRIC PUMPS
- PERFORMANCE PROVEN IN THE FIELD
- EASY TO INSTALL AND SERVICE
- FASTER STARTS — HOT OR COLD.
- ELIMINATES FLOODING — SMOOTHS ENGINE OPERATION
- MINIMIZES VAPOR LOCK
- WATERTIGHT — LEAKPROOF
- NOT AFFECTED BY CAMSHAFT WEAR.
- U.L. LISTED
- ONE YEAR LIMITED WARRANTY

Facet

Motor Components Division
Facet Enterprises, Inc.
Elmira, N.Y. 14903
(607) 737-8350

FACET ELECTRIC FUEL PUMPS



SOLID STATE PUMPS
Basic Models

Model No.	Pressure (psi)	Voltage	Fuel Fittings
480604	4-6	12	1/8-27 Int
480602	6 Max	12	37° Inv Flare
480610	6 Max	24	37° Inv Flare
480614	1½-3½	12	1/8-27 Int
480615	2½-4½	12	1/8-27 Int
480616	4-6	12	1/8-27 Int

Solid state pumps are used as original equipment on many passenger car and farm equipment applications and have demonstrated an endurance capability which is unsurpassed in the industry. Provide up to 35 gallons per hour delivery at free flow. All solid state pumps are U.L. listed. Available in negative ground models only. Ideal for gasoline engines up to 300 cid, and for diesel priming & transfer. The most reliable electric pump we know of.



STANDARD INTERRUPTER PUMPS
Basic Models

Model No.	Pressure (psi)	Voltage	Ground	Fuel Fittings
476086	4-5	6	Neg	1/8-27 Int
476087	4-5	12	Neg	1/8-27 Int
476088	4-5	24	Neg	1/8-27 Int
476089	4-5	6	Pos	1/8-27 Int
476090	4-5	12	Pos	1/8-27 Int
476091	4-5	24	Pos	1/8-27 Int

These pumps have been the standard of excellence for over 20 years. All standard models incorporate a 74 micron filter, a tamper proof electrical system, and are U.L. listed. All standard interrupter models can be easily converted to either higher or lower pressure settings by simply changing the pressure spring and/or plunger. This conversion feature means that these six models provide coverage for all non-competition fuel pump applications. Interrupter pumps provide up to 33 gallons per hour delivery at free flow and are capable of pumping most fluids. The most reliable pump available, except for our own solid state models.

HIGH PERFORMANCE INTERRUPTER PUMPS
(6½-7½ psi)

Model No.	Voltage	Ground	Fuel Fittings
480534	12	N	1/4-18 Int
480535	12	P	1/4-18 Int

These interrupter pumps were specifically designed to meet the requirements of competition applications. Although their external configuration is identical to the standard interrupter models, the electronics have been modified to meet the demands of racing applications, and they incorporate a special 400 micron filter. They have been used successfully for years by many of the winningest competition teams, on both the domestic and international circuits. They provide up to 45 gallons per hour at free flow.

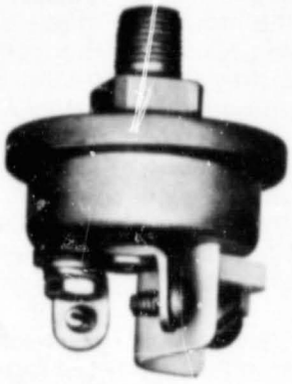
Note: All models of Facet Electric Fuel Pumps can be installed in tandem to either increase the fuel delivery (Parallel Hookup) or the delivery pressure (Series Hookup). Refer to our applications catalog no. FP-8 for more details.

Facet
Motor Components Division
Facet Enterprises, Inc.
Elmira, N.Y. 14903
(607) 737-8350

Facet Electric Fuel Pumps

ACCESSORIES

Safety Shut-Off Switch
Model No. 479809: We recommend the use of a safety shut off switch on all passenger vehicles as a means of preventing excessive fuel spillage in the event of an impact collision or rollover. Unlike a mechanical fuel pump, which stops pumping fuel as soon as the engine stops or stalls, most electric fuel pumps continue supplying fuel as long as voltage is applied. Our safety switch no. 479809 is a single pole, double throw pressure switch which, when installed in the circuit between the pump and the voltage supply, will shut off the pump if the engine should stop or stall. (It is activated by engine oil pressure).





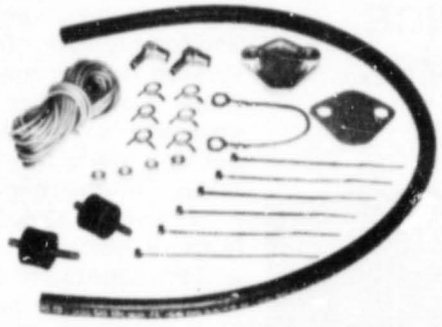
In-Line Filter
Part No. 479735. We recommend the use of a primary filter in line ahead of our solid state pumps. Model No. 479735 is a 74 micron filter which is ideal for this purpose.

Plunger Spring Kit
Part No. 479806. This kit consists of three color coded plunger springs for converting standard interrupter model pumps to higher or lower pressure settings.

Plunger & Spring Kit
Part No. 479104. This kit consists of a special plunger and plunger spring for converting standard interrupter model pumps to extreme low pressure operation.

INSTALLATION KITS

Part No. 479243 (Shown). This kit contains all the parts necessary to complete the best installation of interrupter model pumps. The kit includes 2 mounting studs and 4 lock nuts, ignition wire, ground wire, 2 fuel fittings, 6 wire clamps, flexible fuel hose, 6 hose clamps, and a cover plate and gasket.



Part No. 479802. This kit contains all the parts necessary to complete the best installation of solid state model pumps. It is similar to 479243 except only one fuel fitting is supplied and it includes an in-line filter.

Part No. 479803: Cover Plate & Gasket Kit

Part No. 479804: Fittings Kit - contains two fittings for 5/16" I.D. Hose

Part No. 479805: Fittings Kit - contains two fittings for 3/8" I.D. Hose

Part No. 479807 - Mounting Stud Kit, including lock nuts and ground strap

SERVICE PARTS

Facet Electric Fuel Pumps are designed and built to provide dependable, reliable operation throughout the expected life of most vehicles, and they are backed by what we consider the best warranty in the industry. The only service normally required on interrupter models is a simple cleaning of the fuel inlet cavity and cleaning or replacement of the filter. In the event the cover gasket is damaged during disassembly, it should also be replaced.

The solid state pump is non-serviceable. However, if an in-line filter is used, it should be periodically cleaned or replaced.

Part No. 479136 - Cover Gasket

Part No. 479729 - Filter - 74 Micron - Standard Interrupter

Part No. 479808 - Filter - 400 Micron - High Performance & Diesel

Facet

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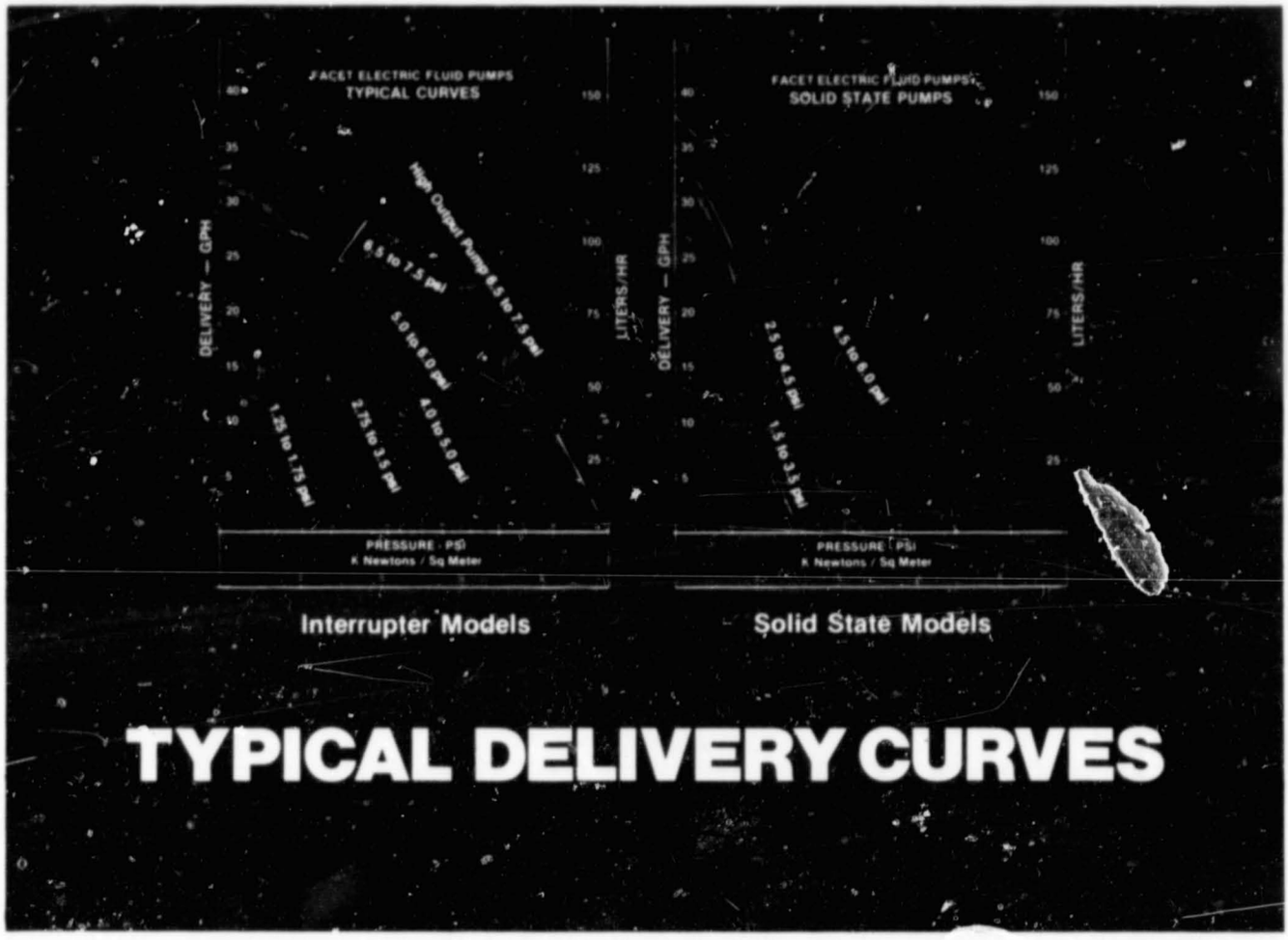
Facet Enterprises, Inc.
Elmira, N.Y. 14903
(607) 737-8350

Facet Electric Fuel Pumps



Facet Electric Fuel Pumps are the preferred electric pumps for most domestic and imported vehicle applications. Passenger cars, trucks, farm, industrial and construction equipment, motor homes, recreational vehicles. For use on all types of engines - gasoline, diesel, multiple fuel, - whatever. Specify Facet Electric Pumps where reliability and performance count.

Facet

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Facet Enterprises, Inc.
Elmira, N.Y. 14903
(607) 737-8350

ZENITH LOW EMISSIONS CARBURETION

The State of California has given "approval" to Zenith carburetion for the models shown with respect to engine displacement. A metal certification tag is attached to each unit identifying it as an approved device for reducing exhaust emissions.

STATE OF CALIFORNIA CLASS AND ENGINE DISPLACEMENT	GASOLINE		LP GAS	
	CARBURETOR MODEL	ENGINE MANUFACTURER	CARBURETOR MODEL	ENGINE MANUFACTURER
CLASS "A2" 50–100 C.I.D.	UPDRAFT 68 DOWNDRAFT	RENAULT –R810-46		
CLASS "A3" 100–140 C.I.D.	UPDRAFT 68 & 267 DOWNDRAFT 28 & 228	CONTINENTAL –Y112 CONTINENTAL –G135 CONTINENTAL –F135 FORD –134 PERKINS –G4-116	UPDRAFT PC1 & PC2	CONTINENTAL –Y112 CONTINENTAL –G135 CONTINENTAL –F135 WAUKESHA –FC133
CLASS "B" 140–200 C.I.D.	UPDRAFT 68 & 267 DOWNDRAFT 28 & 228	ALLIS CHALMERS –153 CHEVROLET –153 CONTINENTAL –F163 CONTINENTAL –G193 FORD –172 FORD –192 HERCULES –163 WAUKESHA –155 WAUKESHA –176	UPDRAFT PC1 & PC2	ALLIS CHALMERS –G153 CONTINENTAL –F162 CONTINENTAL –G193 FORD –172 FORD –192 WAUKESHA –155 WAUKESHA –176
CLASS "C" 200–250 C.I.D.	UPDRAFT 267 DOWNDRAFT 28 & 228	ALLIS CHALMERS –G230 CHEVROLET –250 CHRYSLER –225 CONTINENTAL –227 CONTINENTAL –245 PERKINS –G4-203 PERKINS –G4-236	UPDRAFT PC2	ALLIS CHALMERS –G230 CONTINENTAL –227 CONTINENTAL –245
CLASS "D" 250–300 C.I.D.	UPDRAFT 63 DOWNDRAFT 228	ALLIS CHALMERS –262 CHEVROLET –250 FORD –300		

A vital part of providing good carburetion is the continuous engineering service Zenith provides in developing a well-calibrated carburetor to satisfy your specific needs.

Facet

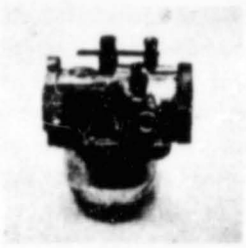
Fuel Devices Division
Facet Enterprises, Inc.

696 Hart Avenue
Detroit, Michigan 48214
(313) 822-7500

GASOLINE CARBURETORS

ZENITH

HORIZONTALS



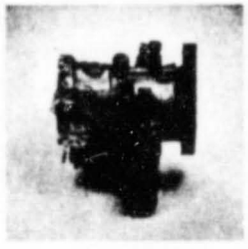
MODEL 1408

Die-cast body with steel fuel bowl, single donut float, fixed venturi sizes 18 – 26 mm; mounting flange 2–3/8"; fixed or adjustable main jet. Engines 1 – 18 HP single cylinder, 40–50 HP four cylinder. High angle operating capability.



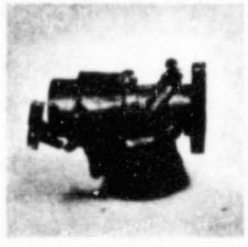
MODEL 1310

All die-cast construction, single barrel, single float, fixed venturi 26 mm; accelerator pump standard; mounting flange 2–11/16". Currently used on U.S. Gov't. M–151 vehicles.



MODEL 16P12

All die-cast construction, single barrel, single float, fixed venturi 36 & 38 mm; accelerator pump standard 2-3/4" flange centers. Has been used on Harley-Davidson 1000 and 1200 cc motorcycles. High angle operating capability. Is currently being used on American Turbo Pak Turbo-Charger Kits for motorcycles.



MODEL 87

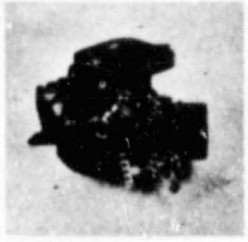
All die cast, single barrel, twin float, venturi sizes 20, 24, and 26 mm; mounting flanges 1–3/16" and 2–3/8"; fixed or adjustable main jet. Engine sizes 100–200 CID.

UPDRAFTS



MODEL 68

All die cast, single barrel, twin float, venturi sizes 14–22 mm; mounting flanges 2–1/4" and 2–3/8"; fixed or adjustable main jet. Engine sizes 25–170 CID.



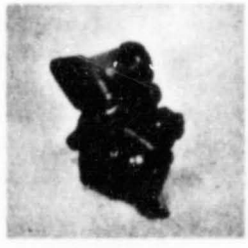
MODEL 267

All die cast, single barrel, twin float, venturi sizes 17–30 mm; mounting flanges 2–3/8";and 2–11/16"; fixed or adjustable main jet; large fuel bowl available. Engine sizes 100–250 CID. Available with an accel. pump.



MODEL 63

All cast iron, single barrel, twin float, main and boost venturi; sizes from 18–46 mm; mounting flanges 2–11/16", 2–15/16", 3–5/16", and 3–9/16"; fixed or adjustable main jet. Engine sizes 100–300 CID.



MODEL 72

All die cast, modified updraft (side mount), single barrel, single horseshoe float, venturi sizes 15–18 mm; mounting flange 1–13/16"; fixed or adjustable main jet. Engine size 30–150 CID.

Facet

Fuel Devices Division
Facet Enterprises, Inc.

696 Hart Avenue
Detroit, Michigan 48214
(313) 822-7500

ZENITH LP GAS CARBURETORS

DOWNDRAFTS



MODEL 33

Single Barrel, single float, venturi sizes range up to 26 mm; will fit SAE 1" or 1-1/4" flange; accelerator pumps and vacuum power system available; fixed or adjustable main jets. Engine sizes: 30 CID to 100 CID.



MODEL 228

Single barrel, single float, venturi sizes range from 21–34 mm; mounting flanges 2–11/16", 2–15/16", and 3–5/16"; accelerator pumps and vacuum power systems available; fixed or adjustable main jets. Engine sizes 95–300 CID.



MODEL 28R

Similar to 228 model but has integral velocity engine speed governor; mounting flange 2–15/16". Used primarily on industrial lift trucks. Straight and V-bead air intakes available.



MODEL 28ADA10

Two barrel, twin float carburetor with venturi size range of 22–30 mm; accelerator pumps and power systems available; air intake for straight and V-bead. Engine sizes up to 500 CID.

PRESSURE



MODEL LP11, 12

Single barrel downdraft carburetor complete with load control and vacuum power jet; can be installed in horizontal and updraft position; venturi sizes 26–37 mm. Engine sizes 150–300 CID.



MODEL LPC1

Carburetor with final regulator; designed for updraft but works equally as well in downdraft position; venturi sizes range from 16–22 mm. Engine sizes 25–170 CID.



MODEL LPC2

Carburetor with final regulator, idle fuel regulator and economizer check valve. Can be used as either updraft or downdraft; venturi sizes 20–28 mm. Engine sizes 100–250 CID.



LP EQUIPMENT

The Zenith LP gas equipment line includes UL approved vaporizers, pressure regulators, filters, water jackets, vacuum and pressure switches, and lock-off valves.

Facet

Fuel Devices Division
Facet Enterprises, Inc.

696 Hart Avenue
Detroit, Michigan 48214
(313) 822-7500

FLEMING

METAL FABRICATORS

INDEX & PRICE LIST

SECTION .1

CATALOG NO. FMF-80

Prices FOB FMF. Prices do not include Federal Excise Tax.

PAGE NO.	ITEM NO.	DESCRIPTION	PART NO.
1.1	1	FLEMING SAFETY GASOLINE TANKS-END FILL	SE-1630-EC
	2		SE-1636-EC
	3		SE-1648-EC
	4		SE-1748-EC
	5		SE-2030-EC
	6		SE-2036-EC
	7		SE-2048-EC
	8		SE-2330-EC
	9		SE-2336-EC
1.2		FLEMING SAFETY GASOLINE TANKS-END FILL Parts Identification, Description & Function	
1.3	1	FLEMING SAFETY GASOLINE TANKS-TOP FILL	ST-1630-EC
	2		ST-1636-EC
	3		ST-1648-EC
	4		ST-1748-EC
	5		ST-2030-EC
	6		ST-2036-EC
	7		ST-2048-EC
	8		ST-2330-EC
	9		ST-2336-EC
1.4		FLEMING SAFETY GASOLINE TANKS-TOP FILL Parts Identification, Description & Function	
1.5	1	FLEMING SAFETY DIESEL TANKS-TOP FILL	STD-1748
	2		STD-2036
	3		STD-2048
	4		STD-2060
	5		STD-2330
	6		STD-2336
1.6		FLEMING SAFETY DIESEL TANKS-TOP FILL Parts Identification, Description & Function	
1.7		TOKHEIM-IN TANK FUEL PUMP-CYLINDRICAL TANKS For Illustrative Purpose Only, Information By Special Request.	
1.8		TOKHEIM-IN TANK FUEL PUMP Parts Description	

FLEMING

CATALOG NO. FMF-80

METAL FABRICATORS

INDEX & PRICE LIST

SECTION 1

Prices FOB FMF. Prices do not include Federal Excise Tax.

PAGE NO.	ITEM NO.	DESCRIPTION	PART NO.
2.1	1	FLEMING RECTANGULAR SAFETY TANKS	SDG50-421621-2SO
	2	DIESEL OR GASOLINE	SDG50-421621-1SO
	3		SDG50-421621-0
2.2		FLEMING RECTANGULAR SAFETY TANKS DIESEL OR GASOLINE **Parts Identification, Description & Function**	
2.3		FLEMING RECTANGULAR SAFETY TANKS DIESEL OR GASOLINE **Parts Identification, Description & Function** DIESEL APPLICATION ONLY	
2.3 THRU 2.4		FLEMING RECTANGULAR SAFETY TANKS DIESEL OR GASOLINE **Parts Identification, Description & Function** GASOLINE APPLICATION ONLY	
3.1		VACUUM TANKS & BRACKETS	

INSTALLATION INSTRUCTIONS

TOKHEIM 12-VOLT ELECTRIC IN-TANK FUEL PUMP

MODEL NO. 558-12

FOR SAFETY TANKS

CYLINDER, SADDLE & STEP TYPES

TOKHEIM

WIRING DIAGRAM

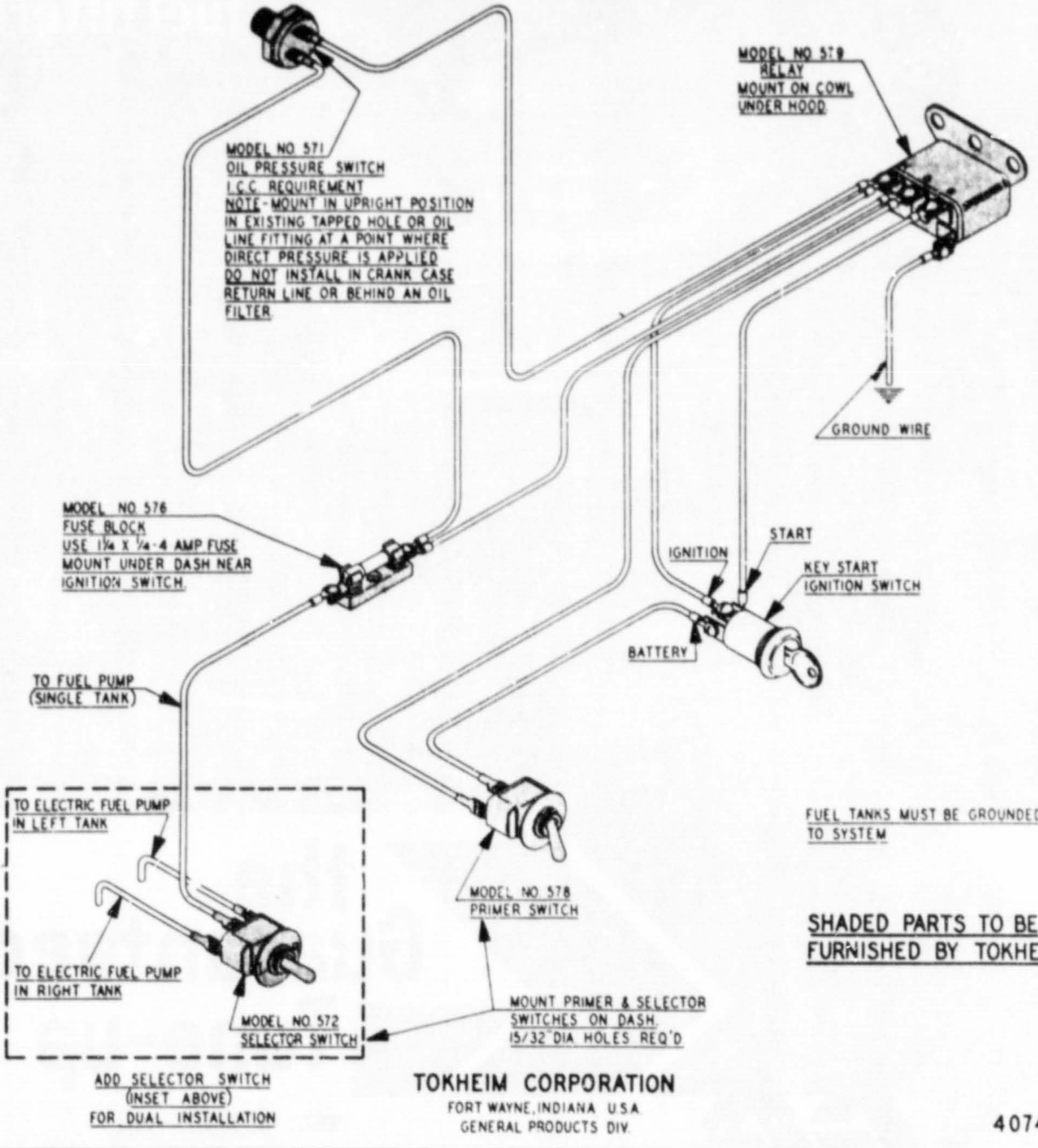
FOR

MODEL NO. 573-12 KIT (SINGLE TANK)

MODEL NO. 574-12 KIT (DUAL TANKS)

WITH RELAY AND PRIMER SWITCH

USE MINIMUM OF 18 GA. STANDARD AUTOMOTIVE WIRE FOR CONNECTING ALL COMPONENTS

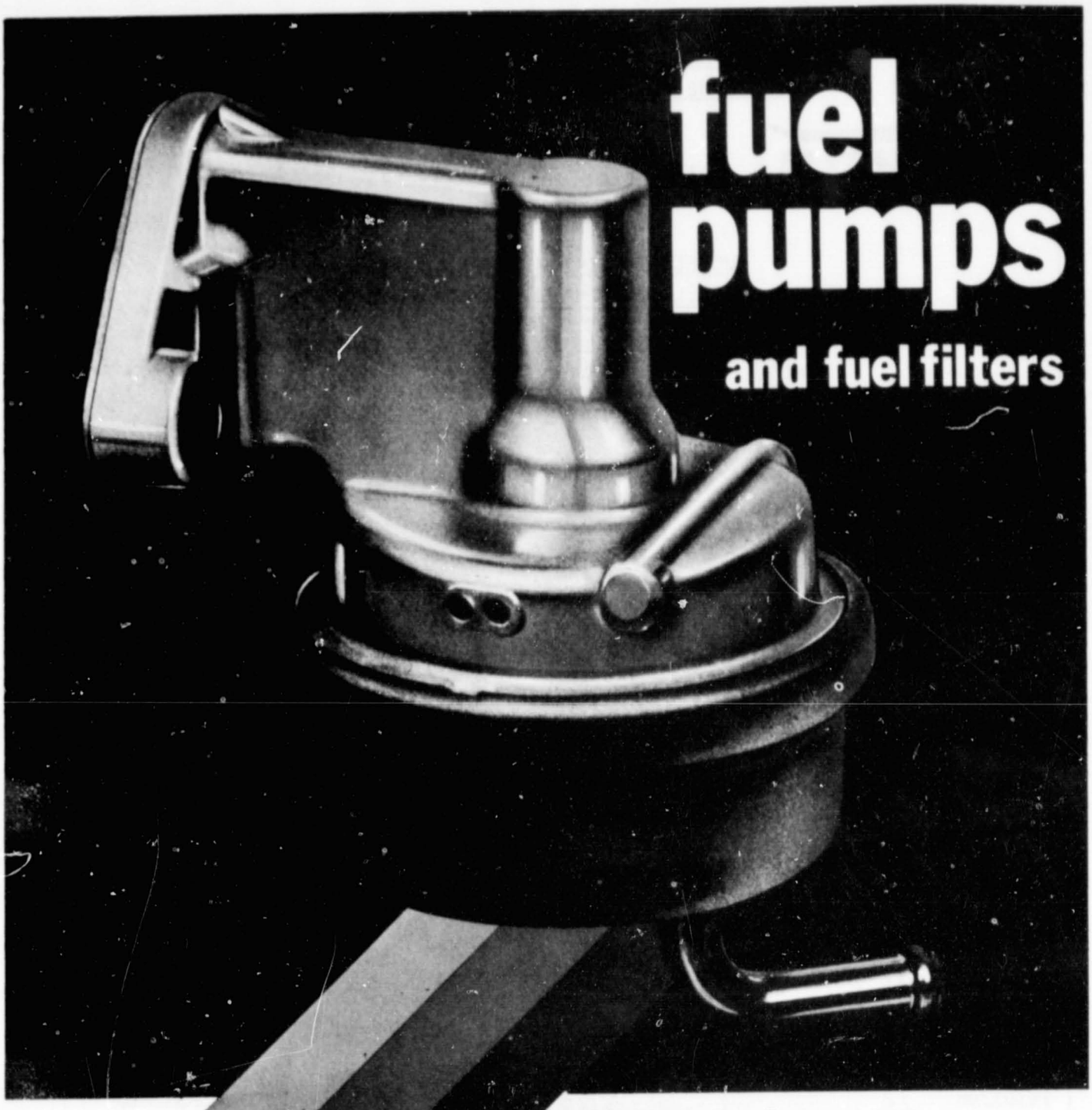


TOKHEIM CORPORATION

FORT WAYNE, INDIANA U.S.A.
GENERAL PRODUCTS DIV.

407470

FLEMING METAL FABRICATORS 2810 S. TANAGER AVE. L. A., CAL. 90040
213 723 8203



fuel pumps

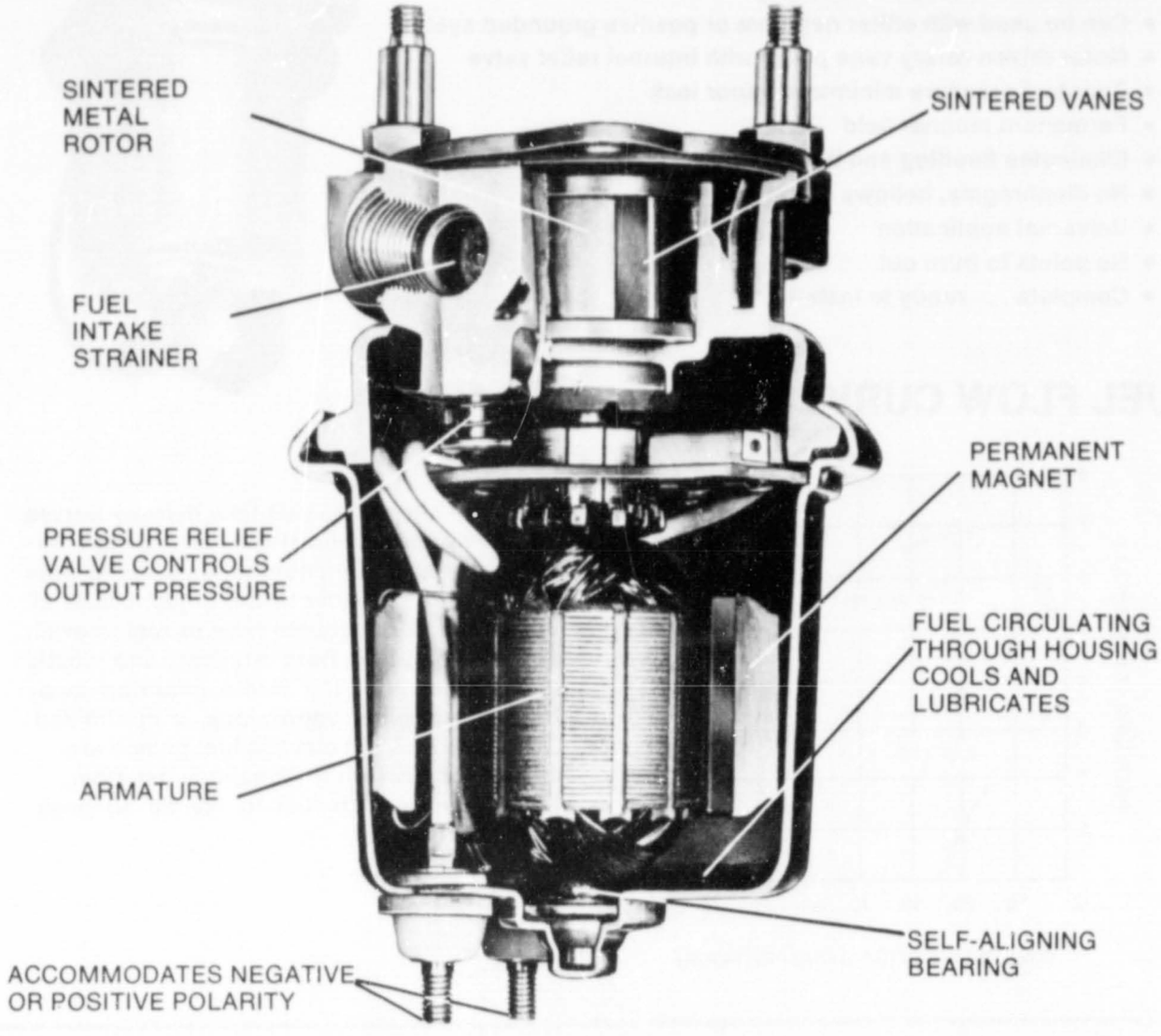
and fuel filters

the Guaranteed Tune-up

TEL: 315-568-5844

Guaranteed Parts Company - Seneca Falls, New York 13148

IN-LINE ELECTRIC FUEL PUMPS



SPECIFICATIONS—Inlet ¼" NPSF—Height 5½"

PART NUMBER	VOLTS	PRINCIPAL MARKET	OUTLET PRESSURE	POLARITY
71-4070	12	FLEET-INDUSTRIAL	4-5¾ PSI	NEG. OR POS.
71-4259	6	FLEET-INDUSTRIAL	4-5¾ PSI	NEG. OR POS.
71-4594	12	HIGH PERFORMANCE	7 PSI	NEG. OR POS.
71-4070 with 71-18-14U *	12	PASSENGER	4-5¾ PSI	NEG. OR POS.
71-4259 with 71-18-14U *	6	PASSENGER	4-5¾ PSI	NEG. OR POS.

TEL: 315-568-5844

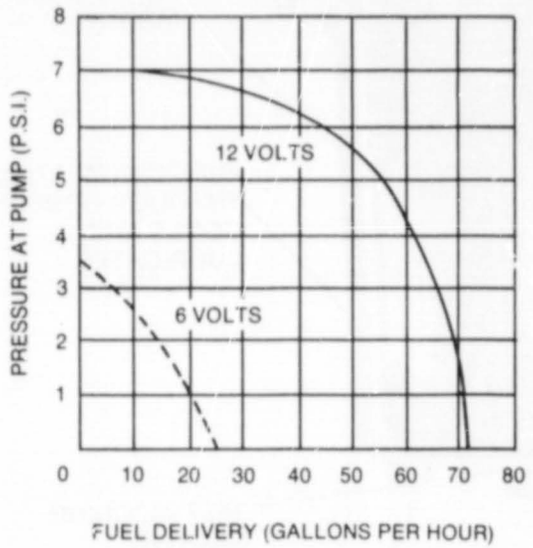
Guaranteed Parts Company - Seneca Falls, New York 13148

ELECTRIC FUEL PUMPS



- Immediate, steady fuel delivery
- Can be used with either negative or positive grounded system
- Motor driven rotary vane pump with internal relief valve
- Constant pressure minimizes vapor lock
- Permanent magnet field
- Eliminates flooding and hard starts
- No diaphragms, bellows or moving seals
- Universal application
- No points to burn out
- Complete . . . ready to install

FUEL FLOW CURVES



The chart shows the free flow delivery curves under normal conditions, and under extremely cold starting conditions when as little as 6 volts is available to the pump. Under all conditions, an adequate flow of fuel is available, eliminating hard starting and costly down time. With the pump mounted away from the engine, vapor lock is minimized. Guaranteed 12 volt electric fuel pumps are capable of delivering 72 gallons per hour. More than enough fuel to handle all peak load conditions.

				
TYPE	**FLEET**	**PASSENGER**	**HI-PERFORMANCE**	**INDUSTRIAL**
12V	71-4070	71-4070* with 71-18-14U	71-4594	71-4070
6V	71-4259	71-4259* with 71-18-14U		71-4259

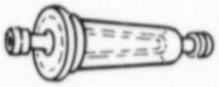
TEL: 315-568-5844

Guaranteed Parts Company - Seneca Falls, New York 13148

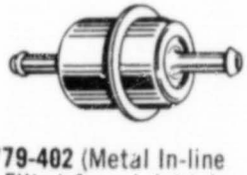
FUEL FILTERS



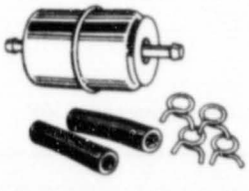
779-400 Sintered Bronze Filter for Carter, Holley, Rochester carbs: GM cars & truck (4, 6, 8) 74-57; Popular Marine applications



779-401 (Universal Nylon In-Line Filter) ¼" inlet tube ¼" outlet tube
ATV
Garden tractors
Golf carts
Lawn Mowers
Motorcycles
Outboard motors
Snowmobiles



779-402 (Metal In-line Filter) 6mm inlet tube 6mm outlet tube
Audi
Fiat 76-67
Opel 70-62
Renault 76-70
Saab 73-66
Volkswagen (Exc. Fuel Inj.)



779-403 Metal In-line Filter w/(2) hoses, 4 clamps
5/16" inlet tube
5/16" outlet tube
American Mtrs. Corp. 75-70
Austin 76-73
Buick Division 66-65
Checker Motors 68-58
Chrysler Division 77-46

779-403 (Cont'd)
Dodge Division 77-46
Ford Courier 74-72
GMC Truck 72-55
IHC Truck 70-57
Jeep Corp. 74-63
Mack Truck
Mazda 76-71
MG 76-73
Plymouth Division 77-64
Snowmobiles & ATV
Subaru 76-71
Sunbeam
Volkswagen (w/Fuel Inj.)
Volvo



779-404 (Pleated Paper Fuel Pump Filter)
Cadillac Seville 76
Chevrolet Trucks 74-60
Dodge Truck 76-60
Ford Motor Co. Cars & Trucks 76-56
GMC Truck 72-60



779-405 (Pleated Paper Filter)
Toyota 72-60
Toyota Fork Lifts



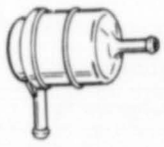
779-406 (Metal In-line Filter)
13 x 1.5 Metric Thread Inlet
13 x 1.5 Metric Thread Outlet
Toyota 72-70



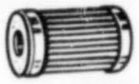
779-407 (Metal In-line Filter)
8mm inlet
13 x 1.5 Metric Thread outlet
Toyota 72-69



779-408 (Metal In-line Filter)
14 x 1.5 Metric Thread Inlet
13 x 1.5 Metric Thread Outlet
Toyota 72-70



779-409 (Molded In-line Filter)
7mm inlet
7mm outlet
Datsun 76-64



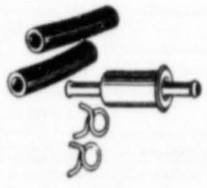
779-410 (Pleated Paper Inlet Filter)
Checker Motors 75-69
GM Cars & Trucks 76-68



779-411 (Pleated Paper & Inlet Filter)
Buick 75-68
Cadillac 75-69
Chevrolet Division 76-75
GMC Truck 75
Oldsmobile Division 76-68



779-412 (Metal In-line Carb. Filter) w/(1) hose 2 clamps
5/16" inlet
1/8"-27 N.P.T.F. outlet
American Motors 69-68
Dodge Colt 75-72
Ford Motor Co. Cars & Trucks 76-66
Jeep Corp. 74-69
Mercury Division 76-67



779-413 (Metal In-line Filter) w/2 clamps
5/16" inlet tube
5/16" outlet tube
Capri 74-71
Pinto 75-71

TEL: 315-568-5844
Guaranteed Parts Company - Seneca Falls, New York 13148

Gulf + Western
Manufacturing Company

Electric Vehicle Components

Bohn Heat Transfer Division

1625 East Voorhees Street
Danville, Illinois 61832
Telephone: 217/446-3710

Heat Exchangers	Air to air, liquid to air and liquid to liquid designs. Custom manufacture.

Michigan Plating & Stamping Division

1860 Alpine Avenue, N.W.
Grand Rapids, Michigan 49504
Telephone: 616/363-4847

Fuel Tanks	Supplier to automotive industry of terneplate stamped and welded tanks.

Automotive Marketing and Engineering Center

Detroit Sales and Engineering Office
24114 Research Drive
Farmington Hills, Michigan 48024
Telephone: 313/478-8140

Relays	Miniaturized 12VDC to control circuits to 20 amperes.
Solenoids	Build to customer requirements.
Switches	Build to customer requirements.
Transducers	Current, Position, Pressure, Speed, Temperature, Torque, Voltage - Build to customer requirements.
Voltage Regulators	12VDC Solid State

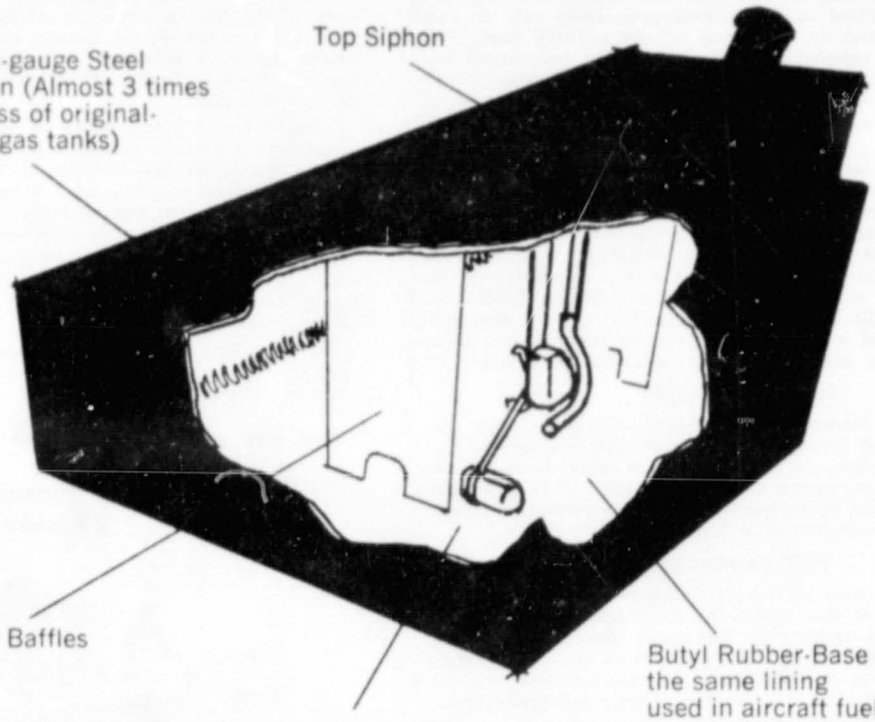
Collyer Insulated Wire Division

100 Higginson Ave.
Lincoln, RI 02865
Telephone: 401/723-7800

Apparatus Cables	**Single conductor, Type A.I.A.** IPCEA S-28-357, NEMA WC-1; Underwriters' Lab. Sizes #4 AWG and larger. Asb. covered, 300V and 600V.
Appliance Wires	**Single conductor** Collyer P-400 THHN/THWN PVC/NYLON in those sizes which are 19W uncompressed. U.L. Listed Rate AWM 105°C Dry and 80°C in oil.
Control Cables	**Single and multi conductor** THERMOPLASTIC: Collyer C-141 — PZR — PE/NYLON condrs. PVC Jacket 600V, 1000V, 75°C. Collyer C-140 — PVC insulated and jacketed 600V. Collyer C-143 — PE/PVC conductors, PVC jacket 600V, 1000V. Collyer C-153 — PE/NYLON, PZR 90°C, PVC jacket 600V, 1000V. Collyer C-154 — THHN/THWN conductors Type T.C. U.L. Listed.

Your best friend on ANY road!

INTERSTATE AUXILIARY GAS TANKS



IT'S THE TANK PEOPLE DEPEND ON

- All tanks have a 1 year warranty
- Interchangeable parts, easy to stock
- Has optional electric changeover valve
- Pressure-tested in the factory
- Easy-to-follow installation instructions for do-it-yourselfer

Models fit most Fords, Chevrolets, GMC's, International and Dodge pickups. (We also have tanks for suburbans and other specialty vehicles)



INTER STATE AUXILIARY TANKS

MANUFACTURED BY

HEIMER INDUSTRIES

3329 S. W. Military Dr.,
San Antonio, Tex. 78211, 512/924-6474

HEIMER TANKS TESTED UNDER RIGID REQUIREMENTS OF FMVSS 301-75

(This is a reprint of article submitted for publication to trade magazines.)

Heimer Industries, Inc., of San Antonio, Texas, recently retained a competent and well-known research firm to conduct fuel tank tests on Interstate gas tank models selected by Heimer, all in an effort to determine if their construction features and mounting parts and procedures complied with the test criteria of FMVSS 301-75. Heimer manufactures these all-steel auxiliary tanks.

Before revelation of the individual test objectives and procedures — and the results — these facts should be noted:

(1) Regardless of the positive aspects of any of the test findings, it cannot be said that the testing agency "certifies" or "endorses" the fuel tanks tested — or, technically, even that they "comply with FMVSS 301-75", because that standard requires an *actual* vehicle crash test. This being highly impractical to perform, the research group used impact sled tests to *simulate* the vehicle crash tests. (Impact sled tests and other simulations are very commonly utilized in determining comparable data on this type of product. And, in the words of the research firm, 'The impact sled tests, reproducing vehicle mounting and typical impact profiles, can demonstrate to vehicle chassis builders and vehicle owners the expected response of these fuel tanks (short of direct impact) during vehicle testing in accordance with FMVSS 301-75".)

(2) The tanks selected by Heimer for testing are representative of their Interstate line. All Interstate auxiliary tanks manufactured by Heimer Industries are of all-steel construction, and their basic design and weld quality are identical. Only those variations occur which are dictated by the location of the installed tank on the vehicle. For instance, there is a standard rear fill model as well as a side neck fill. The models chosen for testing were neck fill models, the reasoning being that, with several more parts and a more complex hookup system, these tanks would surely be the ones to reveal any weakness in testing.

IMPACT PROFILES

Two different deceleration vs. time profiles were used: one to meet the 30 mph (longitudinal) frontal and rear moving barrier crash requirements, the other to meet the requirements of the 20 mph lateral moving barrier crash. Both profiles, as implemented, are, in the experience of the testing agency, representative of light trucks and light truck chassis of less than 10,000 GVWR.

TEST PROCEDURE

A fixture that mounted the test fuel tanks in the same manner as on a vehicle was fabricated by Heimer Industries. The gross weight of this fixture with fuel tanks, fuel and instrumentation was determined and flat steel plates of an equivalent weight were mounted on the sled to adjust sled parameters so that the desired impact profiles could be produced. After satisfactory pulse shapes were obtained, the fixture with a test tank was mounted on the sled.

To reduce the danger of fire and toxic fumes in the laboratory, water was used to fill the tanks during impact tests only. The amount of water used equalled in weight the amount of Stoddard Solvent specified for this test by FMVSS 301-75.

After each tank completed its impact test it was left as mounted — and observed for fuel leakage for 25 minutes. Following this period the tank was removed from the fixture, placed on wooden 2x4 pieces and rolled-over in accordance with requirements. Fuel spillage that occurred during the rollover and during the subsequent dwell at each 90° increment was noted and measured.

To visually confirm the action, all tests were fully documented by high-speed movie cameras.

RESULTS

The testing of these Heimer tanks indicated that tank metal thickness and weld quality are adequate to sustain tank integrity during impact. Heimer Industries is indeed proud of this result.

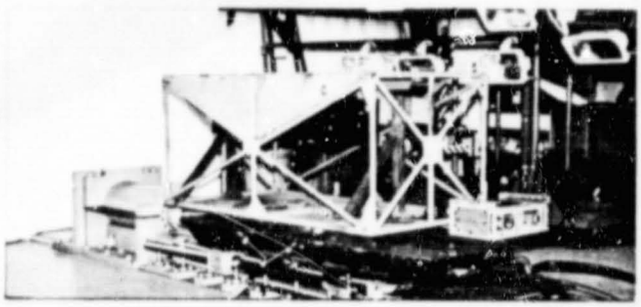
One important correction was found to be necessary on one model tested. During impact in the 30 mph barrier crash test, the tank slid forward on its bracket and hit the Heimer-fabricated fixture; the filler hose tore as a result, permitting some of the tank's contents to spill. (Minor dents comprised the only tank damage observed.)

The research team suggested to Heimer Industries several methods to correct the deficiency of the tank mounts on the model in question — and thus prevent its sliding. One method was to weld metal stops on the tank bottom. Heimer has already made this design alteration and all tanks of this model now being distributed by Heimer boast this improvement.

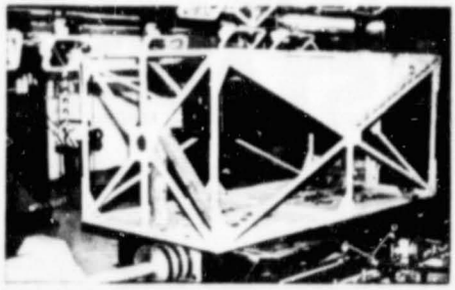
Heimer Industries is satisfied that the rugged construction of their Interstate tanks was upheld in this rigid testing; and Heimer is glad to have been made aware of the correction needed — and now implemented.

(Note: The research firm's Final Report AR1225, with accompanying data and charts, and color slides, are on file in the office of Heimer Industries.)

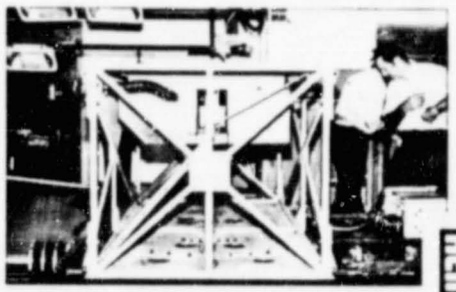
Are you selling tanks that have been TESTED?



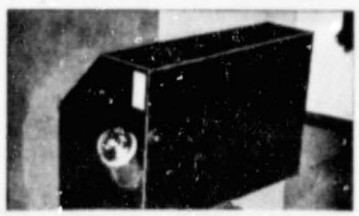
The Heimer-fabricated fixture (representing vehicle chassis) has been mounted on the impact sled in preparation for testing.



Here the fixture is in position to simulate the 30mph front end collision. Note lights, cameras at top of photograph.



The fixture is now being readied for its 20mph lateral moving barrier crash.



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This fuel tank has been removed from the fixture and will now undergo its final test. Placed on wooden 2x4 pieces, it will be rolled-over to note if spillage occurs.

Heimer Interstate Auxiliary Gas Tanks were sample tested, using a controlled crash simulator, to determine their ability to withstand the G forces encountered in testing under S6.1, S6.2, and S6.4 FMVSS No. 301-75.

INTERSTATE TANKS ARE MADE FOR MORE TRUCKS THAN ANY TANKS ON THE MARKET

The BRONCO TANKS shown can be mounted on either the passenger or driver side, and fill through the side of the body with a neck-fill.

The (1973 and Later Model) CHEVY AND GMC TANK can be installed on the driver side only and is available with either a rear-fill or neck-fill.

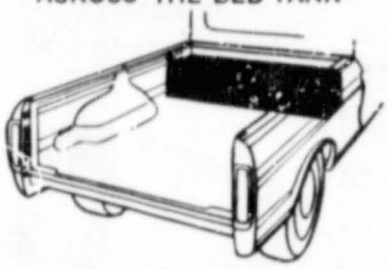
The ACROSS THE BED TANK shown is mounted across the front of the bed and fills on either the right or left side, with a neck-fill.

The SUBURBAN TANK can be mounted so it will not interfere with the existing factory tank, or with any type of trailer hitch. Tank can be mounted on both passenger and driver side.

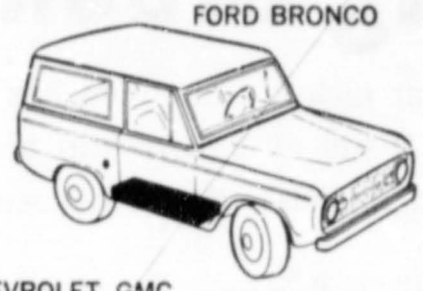
The VAN TANK to fit most popular model Vans, mounts under the body on driver side only, rear fill only.

SPARE TIRE REPLACEMENT TANK is available on some models in a neck-fill model.

ACROSS THE BED TANK



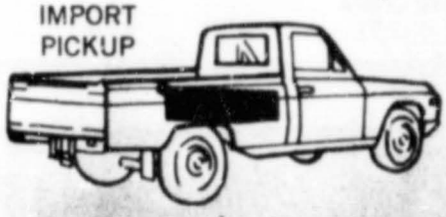
FORD BRONCO



CHEVROLET GMC AND SUBURBAN



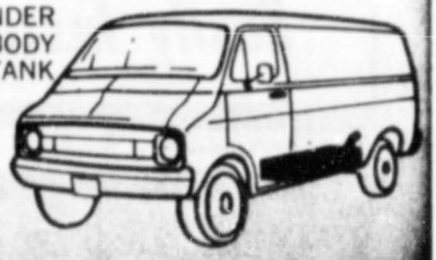
IMPORT PICKUP



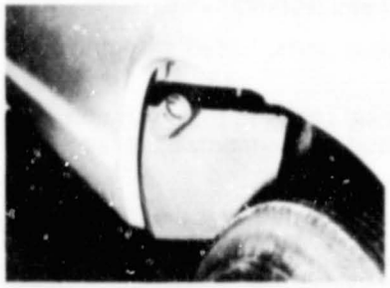
CHEVROLET, GMC AND FORD PICKUPS



UNDER THE BODY VAN TANK



CHOOSE REAR OR SIDE FILL TANKS





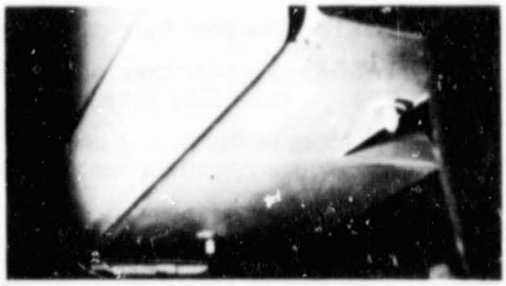
SIDE FILL

REAR FILL

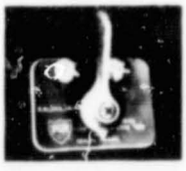
NECK FILL

On the standard rear fill there is no body work required. The low cost optional side fill features a locking side filler door. The inside bed tank is available only as a side neck fill.

EASY INSTALLATION



Simply drill holes in the pickup floor, drop bolts through the tank mounting holes, connect the fuel lines, and the job is done. No straps under the tank to stretch and promote body noise.



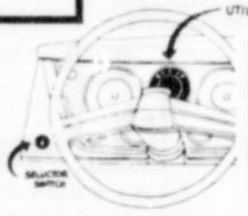
STANDARD

MANUAL CHANGEOVER VALVE IS STANDARD EQUIPMENT

OPTIONAL EXTRA

LOW COST FUEL METERING WITH ELECTRIC CHANGEOVER VALVE.

One switch operates your source of fuel and indicates amount of fuel remaining in the tank being used.



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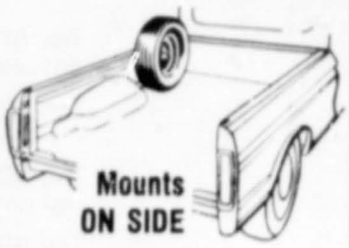
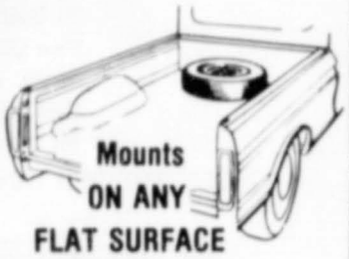
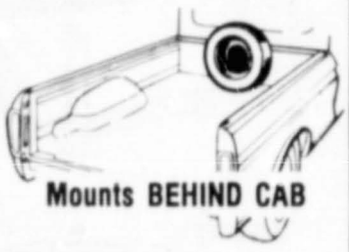
HEIMER ALSO MANUFACTURES

INTER STATE QUALITY

THE UNIVERSAL SPARE TIRE Mounting Bracket







This practical and popular pickup truck item has plated finish, is rust resistant. It fits all size pickup tires and widths (including foreign models). It can be used with standard spare tire locks.

Easily Installed! All Parts Included.

Limited Warranty

on Heimer-manufactured Products

PARTS. One year from date of installation against defects in material and workmanship.

LABOR. One year from date of installation to repair or replace defective parts, based on published labor time schedule.

No other warranty or guarantee is expressed or implied. Consumer negligence in the operation, or use, causing malfunction or destruction, of the product is not the fault of the manfacturer or selling agent.

WARRANTY CLAIMS: Claims on defective workmanship must be sent to factory. All defective materials must be returned via prepaid shipment. Upon inspection and determination of claims warranted, factory will replace material at no charge, return replaced material to customer with delivery charges prepaid and full payment of incoming delivery cost. No materials shall be returned to the factory, its warehouses or distributors without expressed permission from the manufacturer. There will be no payment for repairs made to our tanks without proof of purchase. Merchandise will be returned when permission is granted. Send prepaid, and, upon disposition, material credit and delivery expense will be credited upon decision of the factory.

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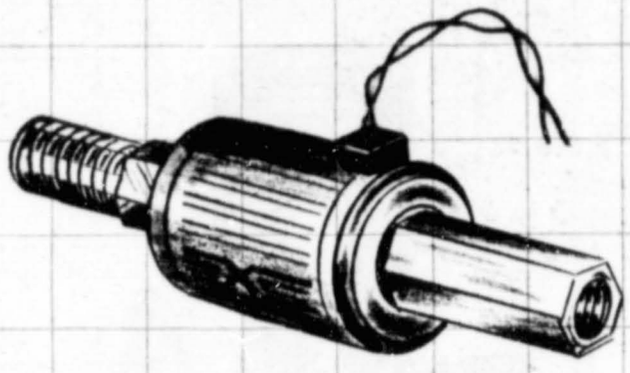
IN LINE VALVE - (GASOLINE)



This is a constant (D.C.) duty, normally closed, in-line valve to be used in gasoline fuel line up to 35 PSIG. Unit is U.L. approved, for in-building safety applications.

Will shut off, electricaily, fuel from fuel pump to carburetor.

OTHER APPLICATIONS: Vacuum control valve, pilot valve, drain valve, other low fluidic control. Anti theft hidden switch etc. 6 volt, 12 volt, 24 volt, 48 volt (D.C.) versions available.

CONTACT ENGINEER - CLARENCE FOX

BORG WARNER Transportation Equipment

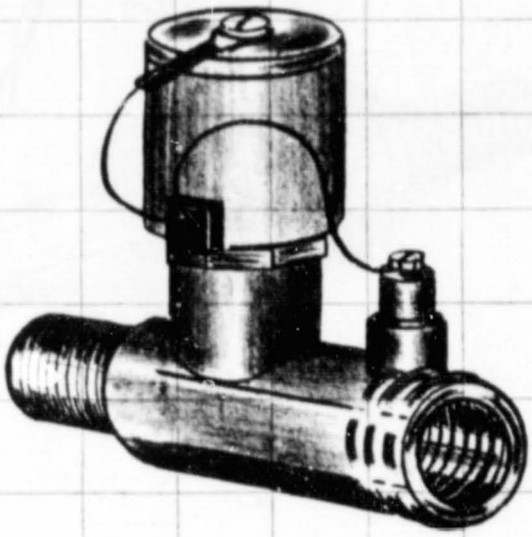
Marvel-Schebler/Tillotson Division

Borg-Warner Corporation
2195 South Elwin Road, Decatur, Illinois 62525
Phone 217/428-4631

DRAWN CEM
CHECKED
APPROVED

SKETCH NUMBER 108

HIGH PRESSURE VALVE



This is a high pressure fuel lock valve, normally closed. Used to shut off or start high pressure fuels such as propane, etc. U.L. approved for in building safety.

Also used on lift trucks and on diesel trucks to control high air pressure flows.

Available as D.C. 6, 12, 24, 48 volts.

CONTACT ENGINEER - CLARENCE FOX

BORG WARNER Transportation Equipment

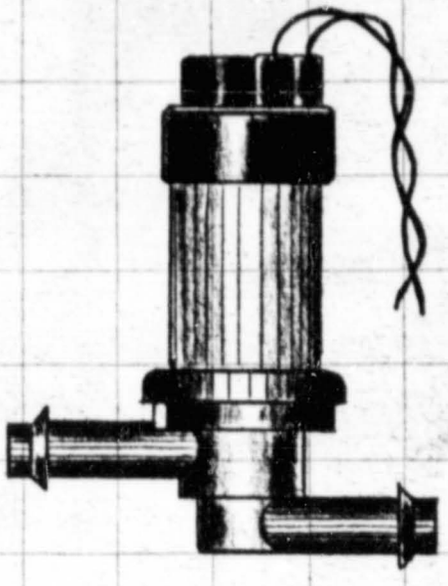
Marvel-Schebler/Tillotson Division

Borg-Warner Corporation
2195 South Elwin Road, Decatur, Illinois 62525
Phone 217/428-4631

DRAWN CEM
CHECKED
APPROVED C. F.

SKETCH NUMBER 109

ELECTRICALLY OPERATED VENT VALVE



The carburetor Float Bowl Vent is a constant duty 12 VDC valve designed for low vacuum application. It is actuated by the ignition circuit and is used as a carburetor bowl vent shut-off device. When the ignition switch is turned off, the valve returns to its normally open de-energized position and vents existing fumes into the charcoal canister.

Mounting bracket, lead wire arrangement design, and normally open or normally closed de-energized position may be varied to meet customer requirements.

CONTACT ENGINEER - CLARENCE FOX

BORG WARNER Transportation Equipment

Marvel-Schebler/Tillotson Division
Borg-Warner Corporation
2195 South Elwin Road, Decatur, Illinois 62525
Phone 217/428-4631

DRAWN C&M
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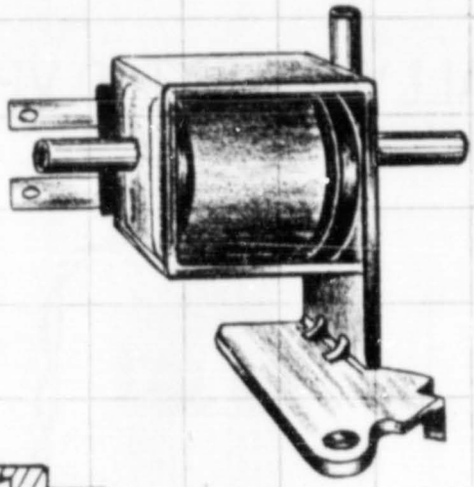
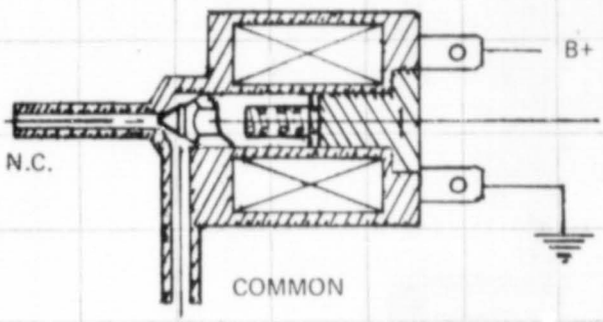
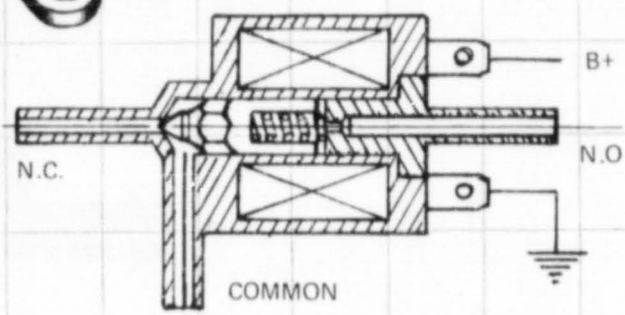
APPROVED

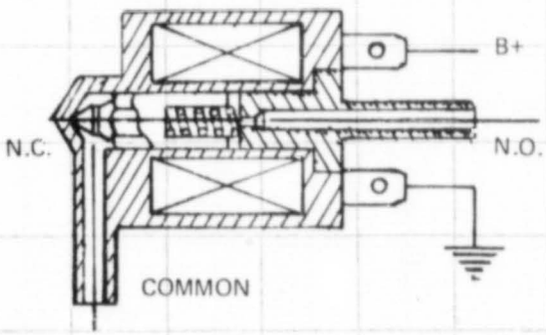
SKETCH NUMBER 110

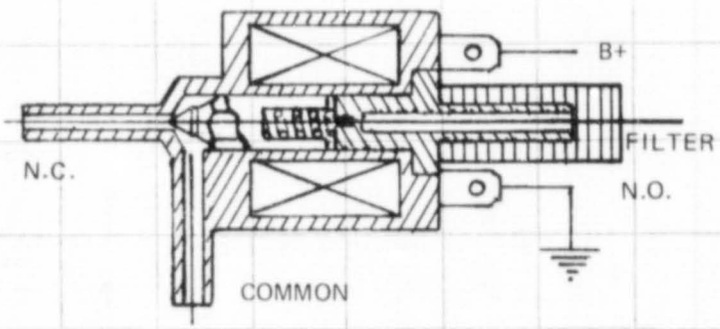
ELECTRICALLY CONTROLLED VACUUM VALVE











This is a constant duty, 12-volt, 3-way,vacuum valve. The valve is used to direct either carburetor spark port vacuum or atmospheric pressure to ignition vacuum advance mechanism of the distributor. All three fittings are made to accept 3/16" inside diameter vacuum hose. The coil and terminals are nylon encapsulated. Two male blade terminals are provided for customer switch connection and remote ground connection. 2-way versions, normally open, or normally closed also available.

These parts can differ in tube size, terminal configuration, atmospheric filters, brackets, coil resistance.

CONTACT ENGINEER - CLARENCE FOX

BORG WARNER Transportation Equipment

Marvel-Schebler/Tillotson Division

Borg-Warner Corporation
2195 South Elwin Road, Decatur, Illinois 62525
Phone 217/428-4631

DRAWN CSM
CHECKED
APPROVED C. Fox

SKETCH NUMBER 111

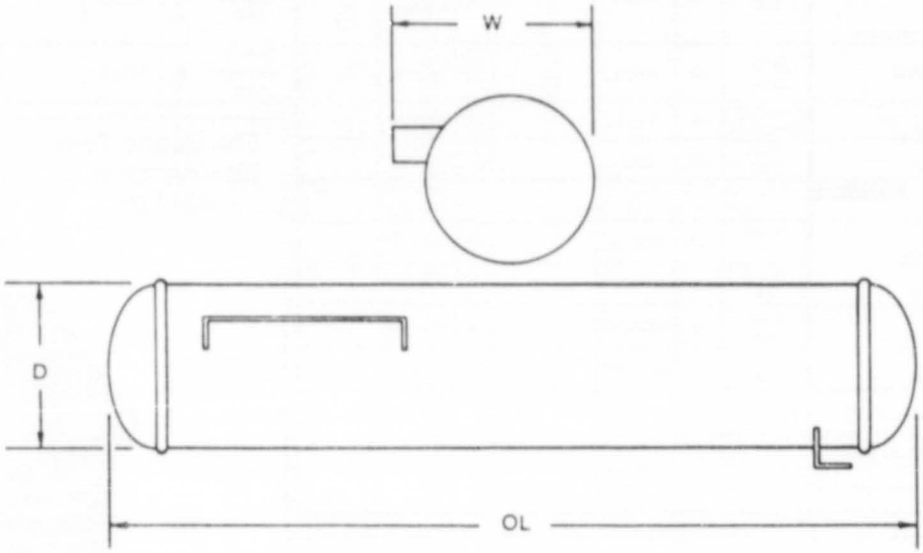
MELBEN PRODUCTS COMPANY, INC.

PRODUCTION DRIVE
HARRISON, OHIO 45030

COMPLETE FABRICATING SERVICE FROM DESIGN TO FINISHED PRODUCT
SHEET STEEL - STAINLESS STEEL - ALUMINUM & OTHER ALLOYS
ASME & NON CODE PRESSURE VESSELS

TELEPHONE: 367-4855
AREA CODE 513

Motor Fuel ASME Tanks



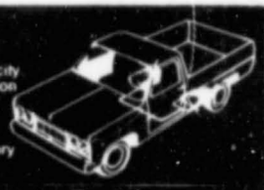
Model No.	Nominal Water Gal.	Propane Gal.	Propane Lbs.	PSI	Dia	Overall Length	Width	Valve Locations	Brackets	Est. Shipping Wt.
1072L23 MC	23	18.8	78.2	250	10"	72"	10.0"	End	Removable Clamps	105
1264L30 MC	30	24.6	102.6	250	12"	67"	12."	End	Removable Clamps	110
1450L32 EC	32	25.5	106.4	250	14"	50"	16.75"	Upper 45° Center	Removable Clamps	120
1456L35 EC	35	29.6	120.1	250	14"	56"	16.75"	Upper 45° Center	Removable Clamps	132
1664L51 ER	51	41.6	173.4	250	16"	64"	19.75"	Upper 45° Center	Welded Brackets Rear	200
1664L51 DB	51	41.6	173.4	250	16"	64"	17.75"	Upper 45° Left	Welded Brackets Bottom	200
1848L49 DB	49	38.7	161.3	250	18"	48"	20.75"	Upper 45° Left	Welded Brackets Bottom	172
2064L81 DB	81	64.79	270.0	250	20"	64"	21.75"	Upper 45° Left	Welded Brackets Bottom	240
2464L112 DB	112	91.8	382.8	250	24"	54"	26.75"	Upper 45° Left	Welded Brackets Bottom	335
1442H26 EA	26	21.1	88.25	312	14"	42"	16.75"	Upper 45° Center	Auto Bracket Mountings	120

econo-tank
THE "UN-METAL" TANK



CHECK THESE OUTSTANDING FEATURES

- Up to 40 gal. increase in fuel capacity
- Seamless, safe, durable construction
- Stronger and lighter than steel
- Easy to order for your vehicle
- Simple, and quick to install
- Can be used on vehicles with factory equipped auxiliary tanks







COMPLETE KIT
Everything you need comes packaged ready for quick installation . . .

Auxiliary Fuel Tanks for Pickups & Vans

Select Single or Dual Tank Kits

U.S. PICKUP TRUCKS

Long wheel base only will not fit stepside, or short wheel base pickup trucks.

SINGLE TANK KITS

Year, Make, Model	Rear Spout	Cap. Gal. (Tot)	Mfrs. Number	Catalog Number	Wt. Lbs.	Sending Unit	Price
1963 - 1972 Chevrolet & GMC 1966 - 1971 Dodge 1963 - 1972 Ford 1973 - 1978 Ford F-250 4WD-High Profile Only	Driver Side	20	1000-L		26	Not Available	
1972 - 1975 Dodge 1973 - 1979 Ford - Including F-250 4W.D. Low Profile	Driver Side	18	3000-L		26	Included	
1980 Ford 1976 - 1980 Dodge	Passenger Side Only	18	3000-R		26	Included	
1973 - 1980 Chevrolet & GMC (*See special valve information below)	Driver Side	32	2000		37	Included	

DUAL TANK KITS

Year, Make, Model	Rear Spout	Cap. Gal. (Tot)	Mfrs. Number	Catalog Number	Wt. Lbs.	Sending Unit	Price
1963 - 1972 Chevrolet & GMC 1966 - 1971 Dodge 1963 - 1972 Ford 1973 - 1978 Ford F-250 4WD-High Profile Only	Driver & Passenger Side	40	1000-D		38	Not Available	
1972 - 1975 Dodge 1973 - 1979 Ford - Including F-250 4W.D. Low Profile	Driver & Passenger Side	36	3000-D		38	Included	

VANS

Note: Van Tanks will not fit vans with rear air conditioning.

Year, Make, Model						Sending Unit	
Long Wheel Base 1970 - 1980 *Ford, Dodge, Plymouth	Driver Side	22	4000 L30		25	Included	
1970 - 1980 *Chevrolet, *GMC (*See special valve information below)	Driver Side	22	4000 L90		25	Included	
Short Wheel Base 1970 - 1980 *Ford, Dodge, Plymouth	Driver Side	15	4000 S30		19	Included	
1970 - 1980 *Chevrolet, *GMC (*See special valve information below)	Driver Side	15	4000 S90		19	Included	

***SIX PORT VALVE KIT** - for fuel return systems on 73-80 GM and 78-80 Ford trucks – can only be used with single auxiliary fuel tank kits – GM: must be used on all 454 engines – Ford and GM: must be used on all engines with 3 fuel lines attached to fuel pump. (2 lines to tank and 1 line to carburetor)

6 PVK	4	.....
6 PEVK	4	

The Econo-Tank Merchandiser . . . SELLS!

Ask your distributor how to get one **Free!**



MOTOR HOME AUXILIARY TANKS

- No rust or fuel contamination
- Extremely lightweight
- Faster installation
- Fully approved



Frame mounted
For all Chassis 1 ton & up
30, 40, 50 gallon capacities

Measure the space you find available on your vehicle. Compare your measurements (depth, width, length) to the dimensions on the chart below and pick the proper size tank to fit. Order by catalogue number.

*All tanks F.H.W.A. certified
*All tanks designed with 5% (minimum) vapor space.

SPECIFICATIONS

Mfrs. Number	Catalog Number	Gallon Capacity	— Dimensions — Depth	Width	Length	Tank Kit Shipping Weight
5030		30	15"	20¼"	28"	37
5040		40	15"	20¼"	37"	42
5050		50	15"	20¼"	46"	47

ORDERING INFORMATION

— Tank Kits — Mfrs. Number	Catalog Number	Price	
5030			Tank Kits include: Mounting brackets with hardware, threaded filler neck assembly, 2" vented gas cap, fuel pick-up tube and installation instructions.
5040			
5050			
— Line Kits — Mfrs. Number	Catalog Number	Price	NOTE: All line kits include valve, fifteen-foot fuel hose, necessary hardware, and installation instructions.
50 MV			Manual Valve Kit
50 EV			Electric Valve Kit
— Fuel Sender Kits — Mfrs. Number	*Catalog Number	Price	Fuel Sender Kits include: Sending unit, switch, necessary hardware and installation instructions.
5078			Ford, Dodge, International
5090			Chevrolet & GMC 1967 - 1980
50240			Stewart Warner Gauges

MANUAL & ELECTRIC FUEL TRANSFER VALVES





MANUAL 4-PORT FUEL TRANSFER VALVE KIT
Kit Includes:
- Manual valve w/spacers
- 3 - ¼" × ⅜" elbows
- 1 - ¼" × ⅜" adapter
- 1 - ¼" plug
- 4 - hose clamps
- Instruction sheet

Mfr. #4 PVK

ELECTRIC FUEL TRANSFER VALVE KIT
Kit Includes:
- Electric valve
- Toggle switch
- Instruction sheet
- "Main-Aux." decal
- 2 - bolts
- 3 - hose clamps
- Wire (25 ft.)

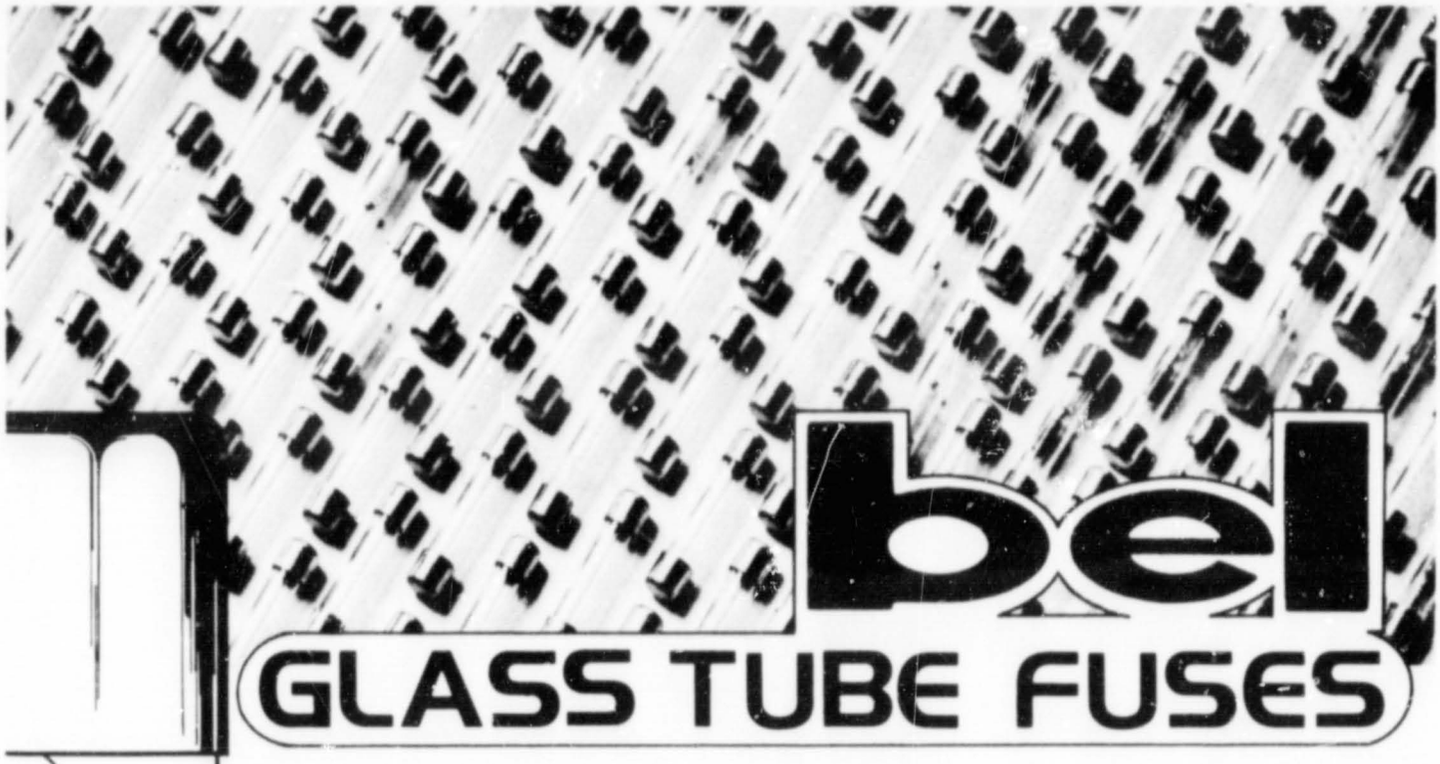
Mfr. #3 PEV

Recreational Products Marketing, Inc.
P.O. Box 7936, Waco, TX. 76710
Tel: 817-754-5687

FUSES

UP TO 300V, AC and DC

(CODE **FX**)



bel GLASS TUBE FUSES

BEL FUSE INC. 198 Van Vorst Street, Jersey City, N.J. 07302 • (201) 432-0463

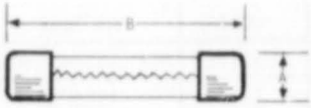
This QUICK REFERENCE SHORT FORM CATALOG lists standard fuses in general use for the protection of electronic circuits. Dimensions and electrical characteristics indicated are for reference only. For specific mechanical tolerance, request a copy of the applicable engineering drawing. For detailed charts on time/current characteristics, ambient derating and general information on fuse selection, request a copy of Bulletin BEL-100. Ratings listed are stock markings. Lower and intermediate ratings are available on special order.

Fuse catalog numbers identified in this catalog with the Underwriters Laboratories and Canadian Standards Association symbols are listed with the Underwriters Laboratories (File No. E20624) and meet the requirements of UL Standard No. 198.6, and are certified by Canadian Standards Association (File No. 39772) and meet the requirements of CSA Standard C22.2 No. 59-1972.

New designs and ratings are continually being submitted to various agencies for certification or listing. Copies of most current listing cards are available upon request.

BEL FUSE INC. 198 Van Vorst Street, Jersey City, N.J. 07302 • (201) 432-0463

TYPE 3AG/3AP NORMAL BLOW FUSES



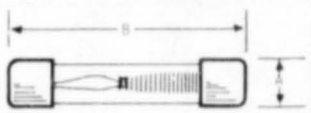
ELECTRICAL	
Rating	Blow time
110%	4 hrs. min.
135%	1 hr. max.
200%	5 sec. max.

MECHANICAL		
	3AG	3AP
Dimensions	Inches (mm)	Inches (mm)
A	.250 (6.35)	.275 (6.99)
B	1.250 (31.75)	1.275 (26.04)
PIGTAILS	1.5 x .032	(38.1 x .813)

CATALOG NO.		RATING	VOLTAGE
PLUG IN	PIGTAIL	AMPERES	SEE LISTING CARD
3AG100	3AP100	1/10	125/250
3AG125	3AP125	1/8	125/250
3AG150	3AP150	15/100	125/250
3AG187	3AP187	3/16	125/250
3AG200	3AP200	2/10	125/250
3AG250	3AP250	1/4	125/250
3AG300	3AP300	3/10	125/250
3AG375	3AP375	3/8	125/250
3AG500	3AP500	1/2	125/250
3AG600	3AP600	6/10	125/250
3AG750	3AP750	3/4	125/250
3AG800	3AP800	8/10	125/250
3AG1	3AP1	1	125/250

CATALOG NO.		RATING	VOLTAGE
PLUG IN	PIGTAIL	AMPERES	SEE LISTING CARD
3AG1.25	3AP1.25	1-1/4	125/250
3AG1.5	3AP1.5	1-1/2	125/250
3AG1.6	3AP1.6	1-6/10	125/250
3AG1.75	3AP1.75	1-3/4	125/250
3AG2	3AP2	2	125/250
3AG2.3	3AP2.3	2-3/10	125/250
3AG2.5	3AP2.5	2-1/2	125/250
3AG3	3AP3	3	125/250
3AG3.5	3AP3.5	3-1/2	125/250
3AG4	3AP4	4	125/250
3AG4.5	3AP4.5	4-1/2	125/250
3AG5	3AP5	5	125/250
3AG6	3AP6	6	125
3AG7	3AP7	7	125

TYPE 3SB/3SBP SLO-BEL FUSES

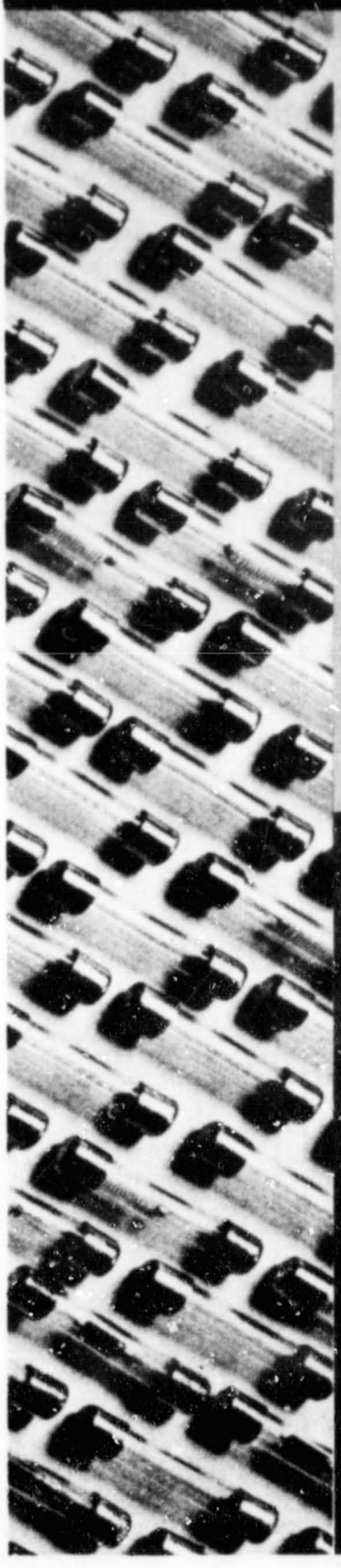


ELECTRICAL	
Rating	Blow time
110%	4 hrs. min.
135%	1 hr. max.
200%	5 sec. min.

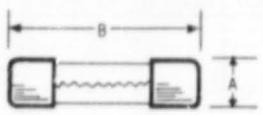
MECHANICAL		
	3SB	3SBP
Dimensions	Inches (mm)	Inches (mm)
A	.250 (6.35)	.275 (6.99)
B	1.250 (31.75)	1.275 (26.04)
PIGTAILS	1.5 x .032	(38.1 x .813)

CATALOG NO.		RATING	VOLTAGE
PLUG IN	PIGTAIL	AMPERES	SEE LISTING CARD
3SB010	3SBP010	1/100	125/250
3SB031	3SBP031	1/32	125/250
3SB040	3SBP040	4/100	125/250
3SB062	3SBP062	1/16	125/250
3SB100	3SBP100	1/10	125/250
3SB125	3SBP125	1/8	125/250
3SB150	3SBP150	15/100	125/250
3SB187	3SBP187	3/16	125/250
3SB200	3SBP200	2/10	125/250
3SB250	3SBP250	1/4	125/250
3SB300	3SBP300	3/10	125/250
3SB375	3SBP375	3/8	125/250
3SB400	3SBP400	4/10	125/250
3SB500	3SBP500	1/2	125/250
3SB600	3SBP600	6/10	125/250
3SB700	3SBP700	7/10	125/250

CATALOG NO.		RATING	VOLTAGE
PLUG IN	PIGTAIL	AMPERES	SEE LISTING CARD
3SB750	3SBP750	3/4	125/250
3SB800	3SBP800	8/10	125/250
3SB1	3SBP1	1	125/250
3SB1.25	3SBP1.25	1-1/4	125
3SB1.5	3SBP1.5	1-1/2	125
3SB1.6	3SBP1.6	1-6/10	125
3SB1.8	3SBP1.8	1-8/10	125
3SB2	3SBP2	2	125
3SB2.25	3SBP2.25	2-1/4	125
3SB2.5	3SBP2.5	2-1/2	125
3SB3	3SBP3	3	125
3SB3.2	3SBP3.2	3-2/10	125
3SB3.5	3SBP3.5	3-1/2	125
3SB4	3SBP4	4	125
3SB4.5	3SBP4.5	4-1/2	125
3SB5	3SBP5	5	125



TYPE 8AG/8AP NORMAL BLOW FUSES

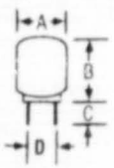


ELECTRICAL	
Rating	Blow time
110%	4 hrs. min.
135%	1 hr. max.
200%	5 sec. max.

MECHANICAL		
	8AG	8AP
Dimensions	Inches (mm)	Inches (mm)
A	.250 (6.35)	.275 (6.99)
B	1.000 (25.4)	1.025 (26.04)
PIGTAILS	1.5 x .032	(38.1 x .813)

CATALOG NO.		RATING	VOLTAGE
PLUG IN	PIGTAIL	AMPERES	SEE LISTING CARD
8AG100	8AP100	1/10	125/250
8AG125	8AP125	1/8	125/250
8AG250	8AP250	1/4	125/250
8AG375	8AP375	3/8	125/250
8AG500	8AP500	1/2	125/250
8AG750	8AP750	3/4	125/250
8AG1	8AP1	1	125
8AG1.5	8AP1.5	1.5	125
8AG2	8AP2	2	125
8AG2.5	8AP2.5	2-1/2	125
8AG3	8AP3	3	125
8AG3.5	8AP3.5	3-1/2	125
8AG4	8AP4	4	125
8AG4.5	8AP4.5	4-1/2	125
8AG5	8AP5	5	125

MICROBEL MICRO FUSES



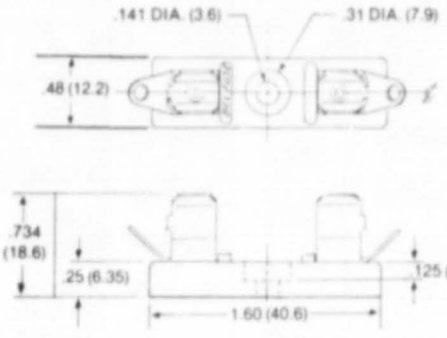
ELECTRICAL	
Rating	Blow time
100%	4 hrs. min.
150%	10 min. max.
200%	1 min. max.

MECHANICAL		
	MB	MBP
Dimensions	Inches (mm)	Inches (mm)
A	.250 (6.35)	.250 (6.35)
B	.348 (8.84)	.348 (8.84)
C	.170 (4.32)	1.000 (25.4)
D	.100 (2.54)	.100 (2.54)

CATALOG NO.		RATING	VOLTAGE
PLUG IN	PIGTAIL	AMPERES	SEE LISTING CARD
MB100	MBP100	1/10	125
MB125	MBP125	1/8	125
MB200	MBP200	2/10	125
MB250	MBP250	1/4	125
MB300	MBP300	3/10	125
MB375	MBP375	3/8	125
MB400	MBP400	4/10	125
MB500	MBP500	1/2	125
MB600	MBP600	6/10	125
MB750	MBP750	3/4	125
MB800	MBP800	8/10	125
MB1	MBP1	1	125
MB1.5	MBP1.5	1-1/2	125
MB2	MBP2	2	125
MB2.5	MBP2.5	2-1/2	125
MB3	MBP3	3	125
MB3.5	MBP3.5	3-1/2	125
MB4	MBP4	4	125
MB4.5	MBP4.5	4-1/2	125
MB5	MBP5	5	125

FUSE MOUNTINGS AND CLIPS

SINGLE BLOCK



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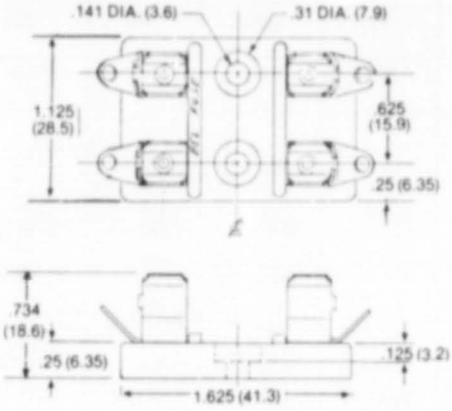
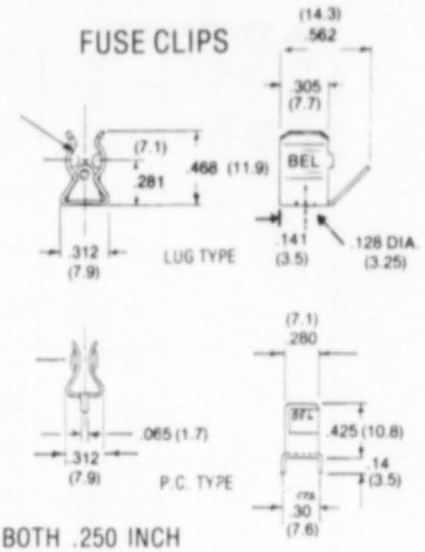


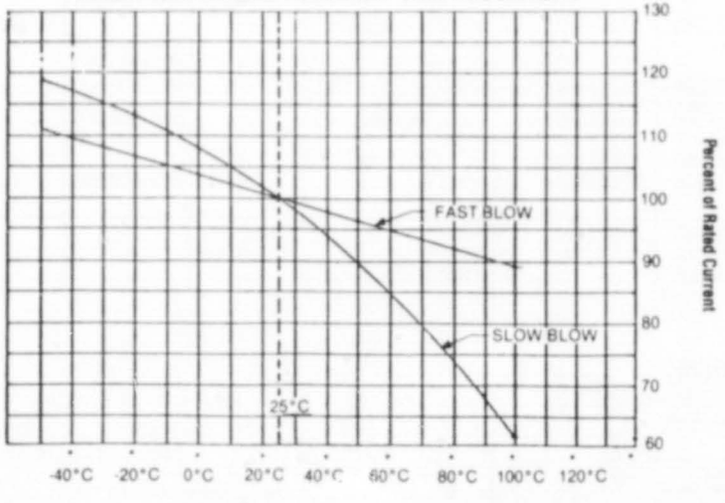
FUSE CLIPS



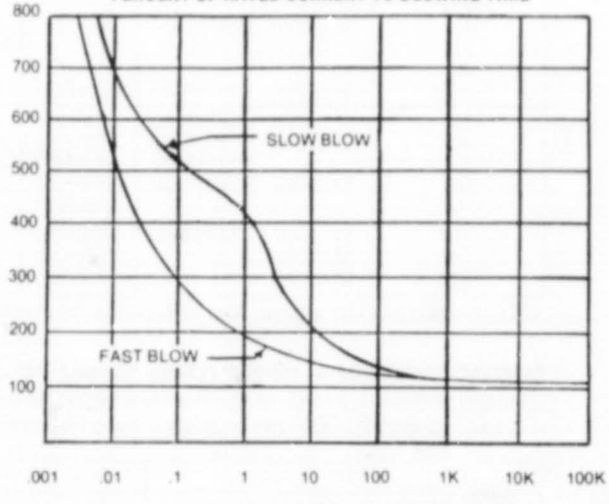
BEL FUSE MANUFACTURES A LARGE SELECTION OF FUSE CLIPS FOR BOTH .250 INCH AND 5MM FUSES. IN ADDITION TO THE CLIPS, BEL FUSE ASSEMBLES MOUNTINGS TO BOTH STOCK CONFIGURATIONS AND TO CUSTOMER SPECIFICATIONS. FOR DETAILS ON MATERIALS, FINISHES AND DESIGNS, REQUEST A COPY OF BULLETIN MTG 78.

TEMPERATURE - TIME/CURRENT CURVES

EFFECT OF
AMBIENT TEMPERATURE ON CURRENT-CARRYING CAPACITY



RELATION OF
PERCENT OF RATED CURRENT TO BLOWING TIME



THE TEMPERATURE AND TIME/CURRENT CURVES ABOVE ARE FOR GENERAL INFORMATION ONLY. FOR MORE DETAILED INFORMATION ON SPECIFIC RATINGS REQUEST BULLETIN BEL-100.

INTERNATIONAL RECTIFIER
SEMICONDUCTOR DIVISION
233 KANSAS STREET, EL SEGUNDO, CALIFORNIA 90245, U.S.A. TELEPHONE: (213) 772-2000

Protective Devices

SEMICONDUCTOR FUSES

These fast-acting protective fuses have an all-welded construction to resist thermal fatigue. An alumina ceramic body prevents charring and arcing when they operate.

U.S. TYPE FUSES

EUROPEAN REPLACEMENT FUSES

Max. V_{RMS} (V)	130	250	500	600	600	700	250		700	
Max. Arc Voltage (V)	220	410	850	1.050	1.050	1.200	410		1.150	
Data Sheet No. (PD-)	8.001	8.002	8.003	8.005	8.006	8.004	8.010		8.010	
Nom. RMS Current (A)										
5	SF13X5	SF25X5	—	SF60C5	SF60X5	—	A-350-5	—	B1000-5	—
7	—	—	—	—	—	—	—	L350-7	—	—
8	—	—	—	—	—	—	—	—	—	E1000-8
10	SF13X10	SF25X10	—	SF60C10	SF60X10	SF70P10	A350-10	L350-10	B1000-10	—
12	—	—	—	—	—	—	—	L350-12	—	E1000-12
15	SF13X15	SF25X15	—	SF60C15	SF60X15	SF70P15	A350-15	—	B1000-15	E1000-15
16	—	—	—	—	—	—	—	L350-16	—	—
20	SF13X20	SF25X20	—	SF60C20	SF60X20	SF70P20	A350-20	—	B1000-20	E1000-20
25	SF13X25	SF25X25	—	SF60C25	SF60X25	SF70P25	—	L350-25	—	E1000-25
30	SF13X30	SF25X30	—	SF60C30	SF60X30	SF70P30	—	L350-30	—	1000-30
35	SF13X35	SF25X35	SF50P35	SF60C35	SF60X35	SF70P35	—	L350-35	—	—
40	SF13X40	SF25X40	SF50P40	SF60C40	SF60X40	SF70P40	—	—	—	E1000-40
45	SF13X45	—	SF50P45	SF60C45	—	—	—	—	—	E1000-45
50	SF13X50	SF25X50	SF50P50	SF60C50	SF60X50	SF70P50	—	—	—	—
55	—	—	—	—	—	—	—	—	—	E1000-55
60	SF13X60	SF25X60	SF50P60	SF60C60	SF60X60	SF70P60	—	L350-60	—	—
65	—	—	—	—	—	—	—	—	EE1000-65	—
70	SF13X70	SF25X70	SF50P70	SF60C70	SF60X70	SF70P70	—	—	—	—
75	—	—	—	—	—	—	—	L350-75	E 1000-75	E1000-75
80	SF13X80	SF25X80	SF50P80	SF60C80	SF60X80	SF70P80	—	—	—	—
90	—	—	SF50P90	SF60C90	SF60X90	SF70P90	—	—	EE1000-90	—
100	SF13X100	SF25X100	SF50P100	SF60C100	SF60X100	SF70P100	—	L350-100	—	—
110	—	—	—	—	—	—	—	—	EE1000-110	—
125	SF13X125	SF25X125	SF50P125	SF60C125	SF60X125	SF70P125	—	L350-125	—	—
150	SF13X150	SF25X150	SF50P150	SF60C150	SF60X150	SF70P150	T350-150	—	EE1000-150	M1000-150
160	—	—	—	—	—	—	—	L350-160	—	—
175	—	SF25X175	SF50P175	SF60C175	SF60X175	SF70P175	—	L350-175	MM1000-175	—
190	—	—	—	—	—	—	—	—	—	M1000-190
2000	SF13X200	SF25X200	SF50P200	SF60C200	SF60X200	SF70P200	T350-200	—	MM1000-200	M1000-200
225	—	SF25X225	—	SF60C225	—	—	—	—	—	—
235	—	—	—	—	—	—	—	—	MM1000-235	—
250	SF13X250	SF25X250	SF50P250	SF60C250	SF60X250	SF70P250	T350-250	—	—	M1000-250
275	—	—	—	—	—	—	—	—	MM1000-275	—
290	—	—	—	—	—	—	—	—	MM1000-290	—
300	SF13X300	SF25X300	SF50P300	SF60C300	SF60X300	SF70P300	T350-300	—	MM1000-300	—
350	SF13X350	SF25X350	SF50P350	SF60C350	SF60X350	—	T350-350	—	MM1000-350	—
400	SF13X400	SF25X400	SF50P400	SF60C400	SF60X400	SF70P400	—	TT350-400	MM1000-400	—
450	—	SF25X450	SF50P450	SF60C450	SF60X450	—	—	—	—	—
500	SF13X500	SF25X500	SF50P500	SF60C500	SF60X500	SF70P500	—	TT350-500	MM1000-500	—
550	—	—	SF50P550	—	—	—	—	—	—	—
600	SF13X600	SF25X600	SF50P600	SF50C600	SF60X600	SF70P600	—	TT350-600	—	—
700	SF13X700	—	SF50P700	SF60C700	—	SF70P700	—	TT350-700	—	—
800	SF13X800	—	SF50P800	SF60C800	—	SF70P800	—	—	—	—

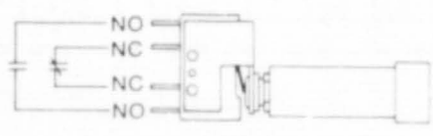
NOTE: For maximum DC voltage, refer to individual data sheets.

MICROSWITCH — SFS2 (Data Sheet PD-8.009)

IR is also offering a microswitch with adapter as a companion to I700 and I1000 Fuse Indicator (see Figures 6 and 7).

TYPE	SFS2	UNITS
Contact Rating:		
AC 60 Hz resistive load @ 250 VRMS	4	A RMS
AC 60 Hz resistive load @ 127 VRMS	6	A RMS
DC resistive load @ 110 Vdc	0.7	Adc
DC resistive load @ 30 Vdc	2	Adc
Maximum Working Voltage:		
Contact-to-contact	1000	VRMS
Contact-to-bracket	1500	VRMS

FIG. 6



Terminal Arrangement of Microswitch

233 KANSAS STREET, EL SEGUNDO, CALIFORNIA 90245, U.S.A. TELEPHONE: (213) 772-2000

FIG. 7

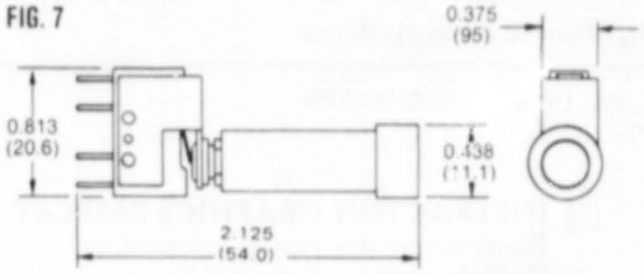


FIG. 8

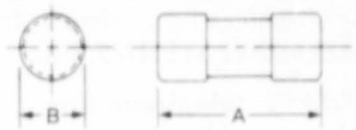


FIG. 9

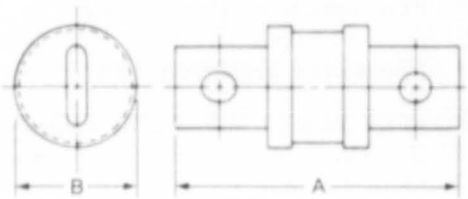


FIG. 10

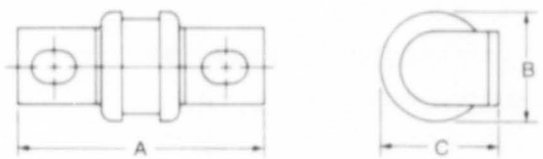


FIG. 11

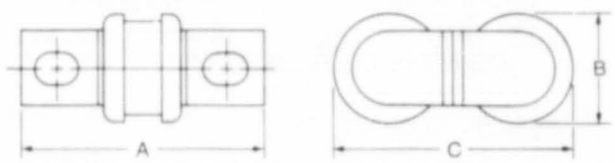
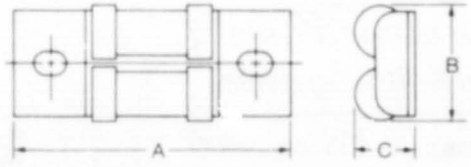


FIG. 12



SEMICONDUCTOR FUSE DIMENSIONS

Part Number	Fig	A in.	A (mm)	B in.	B (mm)
SF13X5 to 30	8	1.500	(38.1)	0.406	(10.3)
SF13X35 to 60	8	2.000	(50.8)	0.812	(20.6)
SF13X70 to 400	9	2.656	(67.5)	1.000	(25.4)
SF13X500 to 800	9	3.500	(88.9)	1.500	(38.1)
SF25X5 to 30	8	2.000	(50.8)	0.562	(14.3)
SF25X35 to 60	9	3.188	(81.0)	0.812	(20.6)
SF25X70 to 200	9	3.725	(97.6)	1.218	(30.9)
SF25X225 to 600	9	3.844	(97.6)	1.531	(38.9)
SF50P35 to 60	9	3.188	(81.0)	0.818	(20.8)
SF50P70 to 100	9	3.625	(92.1)	0.947	(24.1)
SF50P125 to 200	9	3.625	(92.1)	1.218	(30.9)
SF50P250 to 400	9	4.344	(110.3)	1.525	(38.7)
SF50P450 to 600	9	4.469	(113.5)	2.060	(52.3)
SF50P700 to 800	9	6.469	(164.3)	2.500	(63.5)
SF60C5 to 30	9	2.875	(73.0)	0.563	(14.3)
SF60C35 to 60	9	4.375	(111.1)	0.813	(20.7)
SF60C70 to 100	9	5.000	(127.0)	0.938	(23.8)
SF60C125 to 200	9	5.500	(139.7)	1.531	(38.9)
SF60C225 to 400	9	6.250	(158.8)	2.000	(50.8)
SF60C450 to 800	9	6.250	(158.8)	2.500	(63.5)
SF60X5 to 30	8	5.000	(127.0)	0.813	(20.7)
SF60X35 to 60	9	4.375	(111.1)	0.813	(20.7)
SF60X70 to 100	9	4.406	(112.0)	1.000	(25.4)
SF60X125 to 200	9	4.406	(112.0)	1.219	(31.0)
SF60X250 to 400	9	5.094	(129.4)	1.532	(38.9)
SF60X450 to 600	9	5.094	(129.4)	2.000	(50.8)
SF70P10 to 30	8	2.000	(50.8)	0.563	(14.3)
SF70P35 to 60	9	4.325	(109.9)	0.818	(20.8)
SF70P70 to 100	9	4.406	(111.9)	0.917	(23.3)
SF70P125 to 200	9	5.063	(128.6)	1.525	(38.7)
SF70P250 to 400	9	5.063	(128.6)	2.000	(50.8)
SF70P500 to 800	9	7.094	(180.2)	2.500	(63.5)

Part No.	Fig.	A in.	A (mm)	B in.	B (mm)	C in.	C (mm)
A350	10	1.87	47.5	0.31	7.9	0.34	8.6
L350	10	2.19	55.6	0.66	16.8	0.73	18.5
T350	10	3.25	82.6	1.5	38.1	1.61	40.9
TT350	11	3.25	82.6	1.5	38.1	3.25	82.6
B1000	10	2.8	71.1	0.31	7.9	0.34	8.6
E1000	10	3.08	78.2	0.66	16.8	0.76	19.3
EE1000	12	3.69	93.7	1.41	35.8	0.78	19.8
M1000	10	4.45	113.0	1.41	35.8	1.61	40.09
MM1000	11	4.45	113.0	1.41	35.8	3.25	82.6

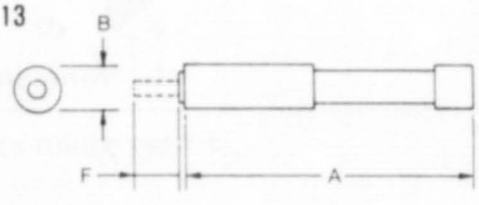
Dimensions in Inches and (Millimeters)

FUSE INDICATORS (Data Sheet PD-8.009)

International Rectifier has available two cleared fuse indicators; type I700 rated at 500 volts RMS, and type I1000, rated at 700 volts RMS. The indicators should be connected in parallel with a semiconductor protective fuse (see Figure 13).

Part Number	A in.	A (mm)	B in.	B (mm)	F in.	F (mm)
I700	1.812	46.0	0.25	6.35	0.25	6.4
I1000	2.187	60.3	0.25	6.35	0.25	6.4

FIG. 13



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No. 9884-2

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30A-125V **U.L. Listed**

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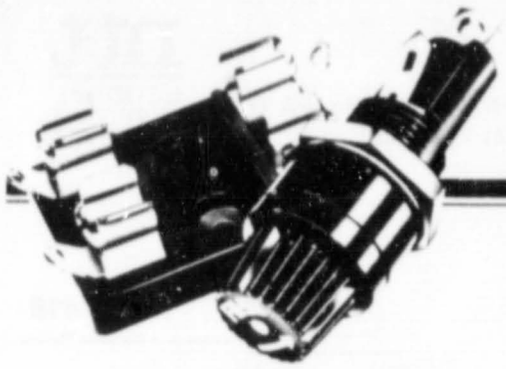

Fuse Holders

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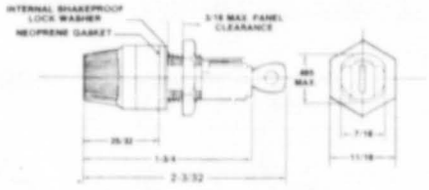
Phone (814) 724-6440

NATIONAL TELTRONICS
Division of EAD

PANEL MOUNTED FUSE HOLDERS

450R 450F



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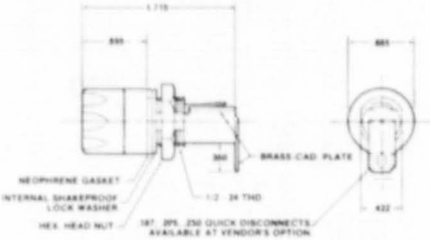

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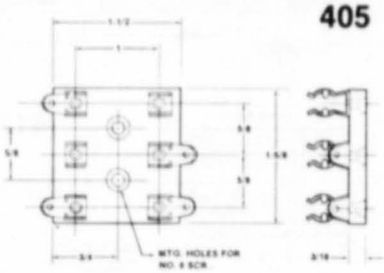
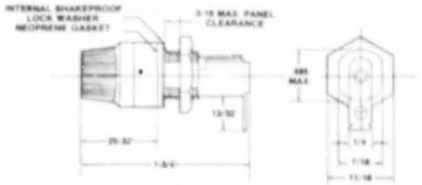
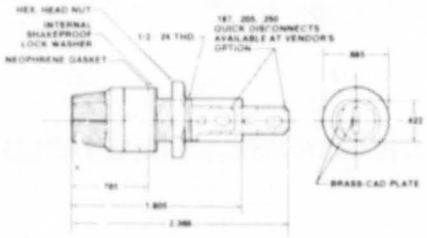


450RA 450FA



R — RIBBED CAP F — FLUTED CAP
RIBBED CAP SHOWN ABOVE

440



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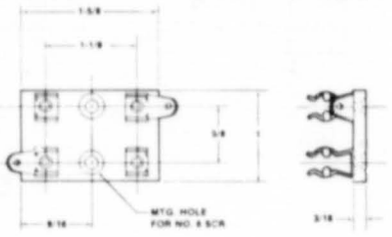
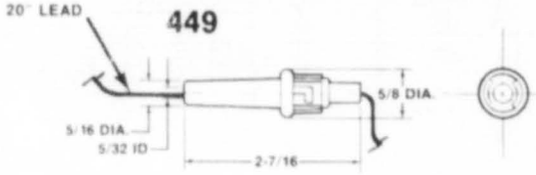


IN LINE FUSE HOLDER

449

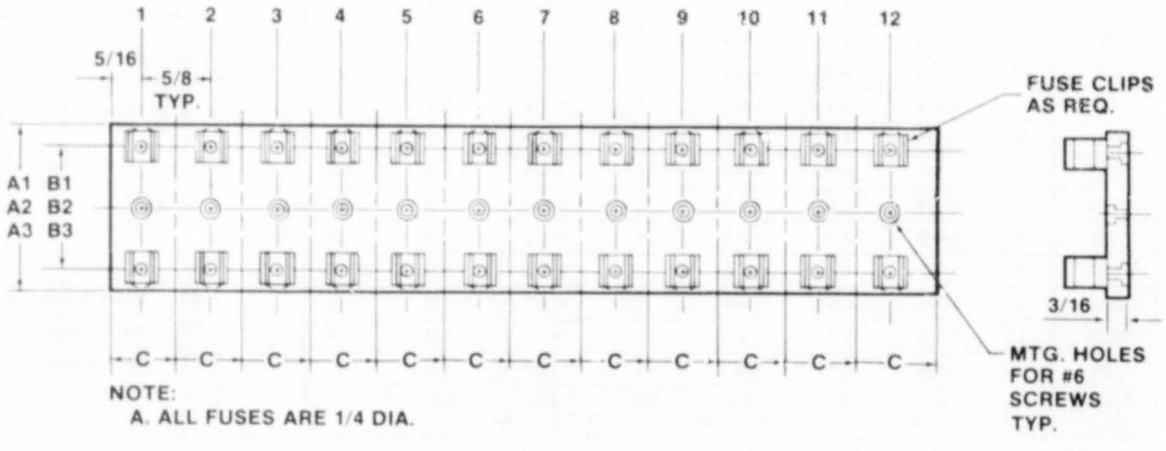


HOW TO ORDER:

Specify the part number from the chart which corresponds to the number of fuses you need, followed by the two digit terminal style identifier. Next, select the alpha-numerical indicator for the fuse length desired.

Example: A 423-04-A1 would indicate a solder style mounting base capable of holding three 1" fuses.

LOCATION AND NUMBER OF FUSES



NOTE:
A. ALL FUSES ARE 1/4 DIA.

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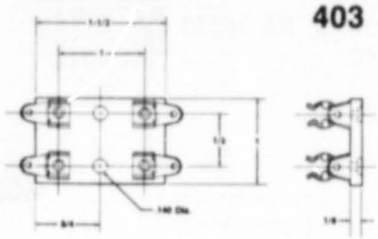
Phone (814) 724-6440

ntt NATIONAL TEL-TRONICS Division of EAD

BASE MOUNTED FUSE HOLDERS

403



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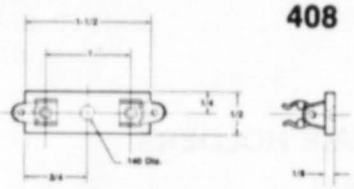

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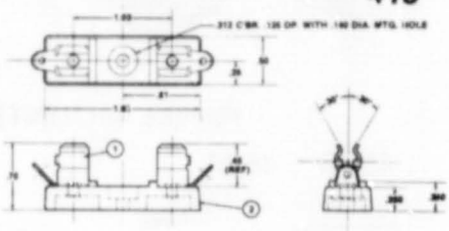

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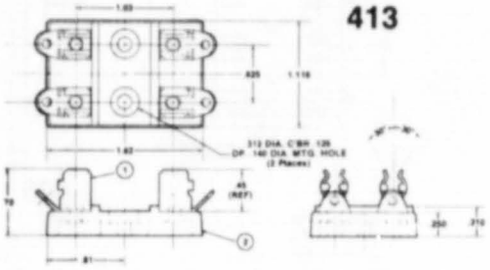

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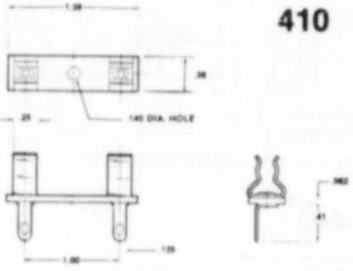

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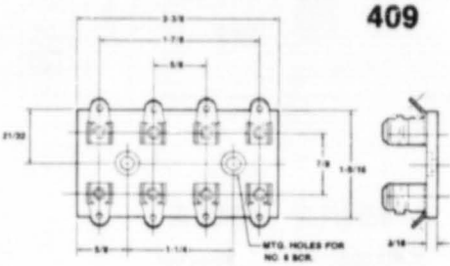
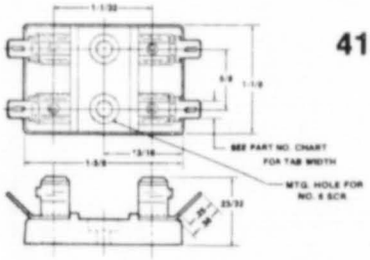


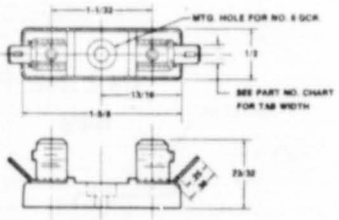
QUICK DISCONNECT FUSE HOLDERS

413-1



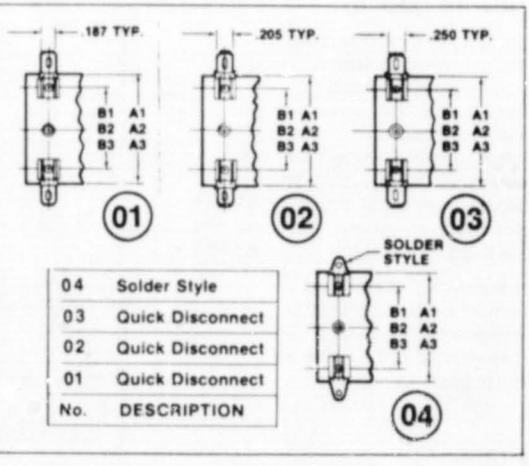
Part No.	Width of Tab
413-1	.187
413-2	.205
413-3	.250

418-1



Part No.	Width of Tab
418-1	.187
418-2	.205
418-3	.250

PART NO.	Fuse Posit.	A1 1" Fuse	B1	A2 1-1/4" Fuse	B2	A3 1-3/8" Fuse	B3	C
432	12	1-1/8	3/4	1-3/8	1	1-1/2	1-1/8	7-1/2
431	11	1-1/8	3/4	1-3/8	1	1-1/2	1-1/8	6-7/8
430	10	1-1/8	3/4	1-3/8	1	1-1/2	1-1/8	6-1/4
429	9	1-1/8	3/4	1-3/8	1	1-1/2	1-1/8	5-5/8
428	8	1-1/8	3/4	1-3/8	1	1-1/2	1-1/8	5
427	7	1-1/8	3/4	1-3/8	1	1-1/2	1-1/8	4-3/8
426	6	1-1/8	3/4	1-3/8	1	1-1/2	1-1/8	3-3/4
425	5	1-1/8	3/4	1-3/8	1	1-1/2	1-1/8	3-1/8
424	4	1-1/8	3/4	1-3/8	1	1-1/2	1-1/8	2-1/2
423	3	1-1/8	3/4	1-3/8	1	1-1/2	1-1/8	1-7/8
422	2	1-1/8	3/4	1-3/8	1	1-1/2	1-1/8	1-1/4
421	1	1-1/8	3/4	1-3/8	1	1-1/2	1-1/8	5/8



Packard Electric

Division of General Motors Corporation
P.O. Box 431 Warren, Ohio 44486
Tel. 216-373-2633

Product Index

Pack-X Primary Cable	59 Series Female Terminals
PVC Battery Cable	59 Series Connectors
Pack-X Battery Cable	Pack Con Female Terminals
56 Series Female Terminals	Pack Con Male Terminals
56 Series Male Terminals	Pack Con Female-H.D. Terminals
56 Series Connectors	Pack Con Male-H.D. Terminals
	Pack Con II Female Terminals

Packard Electric

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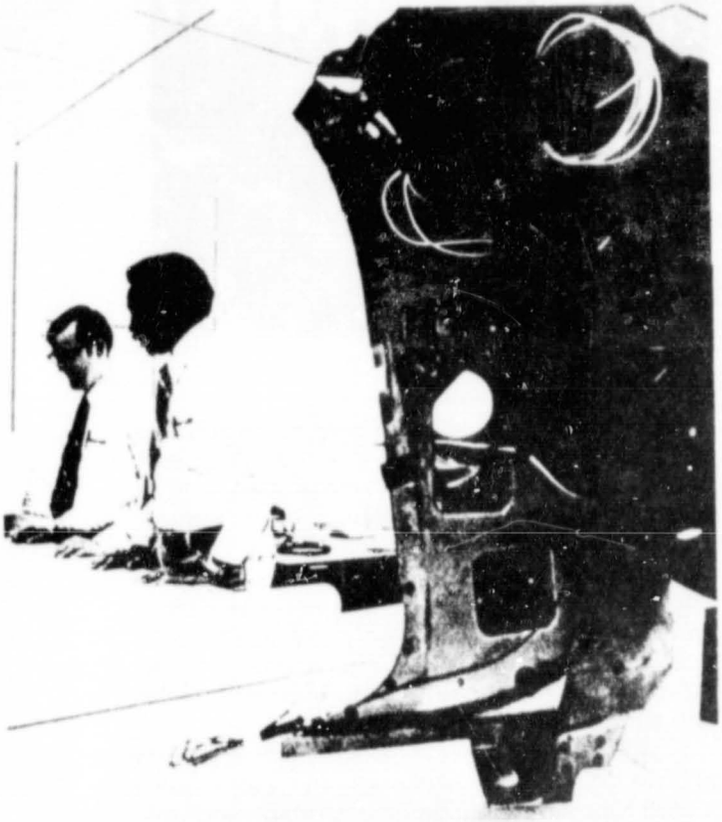
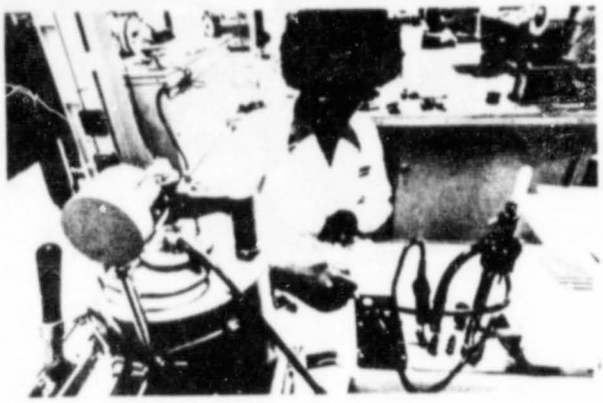
Product Index

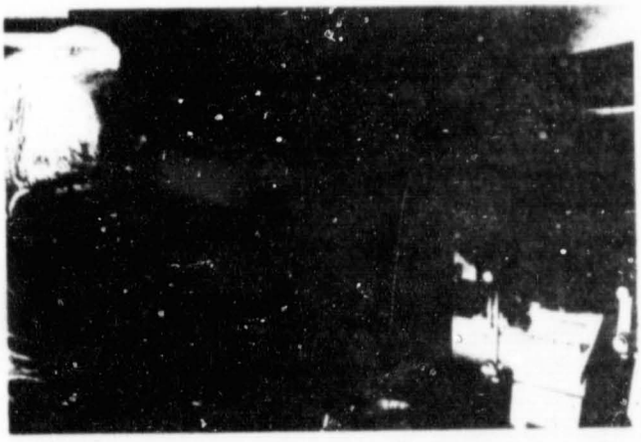
Pack Con Series Connectors	Ignition Cable
Pack Con II Series Connectors	Ignition Terminals
Auto Fuseblocks	Ignition Boots and Nipples
Auto Fuseblock Terminals	Punch-Pack Ring-Spade Terminals
Twist Lock Lamp Sockets	Speed-O-Matic Tooling
Wedge Base Lamp Sockets	Low Profile Lamp Sockets

PACKARD ELECTRIC...

remarkable capability at your call.







In engineering, in design and in manufacturing capacity, few if any producers of automotive energy distribution systems can match Packard Electric.

Or offer you the servicing, counseling, technical knowledge, and broad experience of the Packard team.

Your own task force

The task force concept gives you the best of both worlds: manufacturing, testing and engineering facilities combined with a responsive, no-red-tape capability usually found only in smaller companies.

A qualified Packard sales engineer is available to answer questions, supply additional data and provide the basis for a relationship that results in substantial savings in time, production and dollars.

Testing Facilities

When you choose Packard, you'll also acquire testing facilities that include engineering labs, a fleet of vehicles that log over a quarter of a million miles per year, and access to all General Motors proving grounds and test facilities.

PACKARD ELECTRIC

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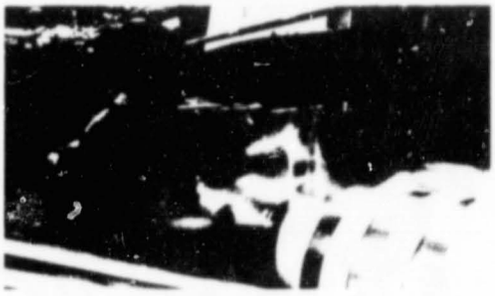
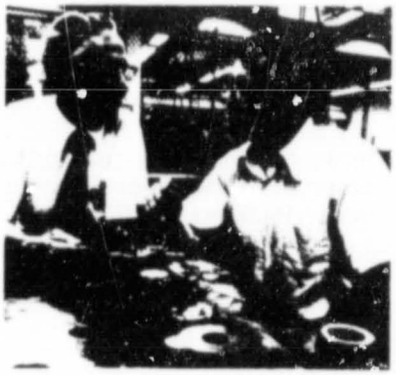
PACKARD ELECTRIC...

remarkable capability at your call.









Manufacturing capacity

Judge for yourself—this is what we produce daily: 98,000 miles of drawn wire, 35 million feet of cable extrusion, 16 million metal parts, 5 million molded parts, over a million feet of conduit extrusion and 820,000 rubber parts.

We process more silicone compound than any facility in the world and annually use 58 million fuses, 5 million pounds of steel, 57 million pounds of copper, 9 million pounds of brass, 46 million pounds of plastic compounds and 53 million automotive lamps.

The engineering and manufacturing benefits of Packard Electric are myriad—and can result in substantial savings in time, production and dollars to Packard customers.

Innovation is our tradition.

Our leadership in vehicle wiring is widely acknowledged. Packard was among the first to use plastic insulation, nylon jacketing, cross-linked polyethylene and aluminum core cable in automotive applications.

We pioneered the use of electronic modules in wiring harnesses, the use of special wiring in place of block resistors, and printed circuits on mylar.

Fiber optics, High Energy Ignition wiring, side terminals for batteries, fuse blocks, convoluted conduit, high performance connectors—this is but a small sampling of the innovation, the progressiveness and leadership of Packard and its people.

PACKARD ELECTRIC

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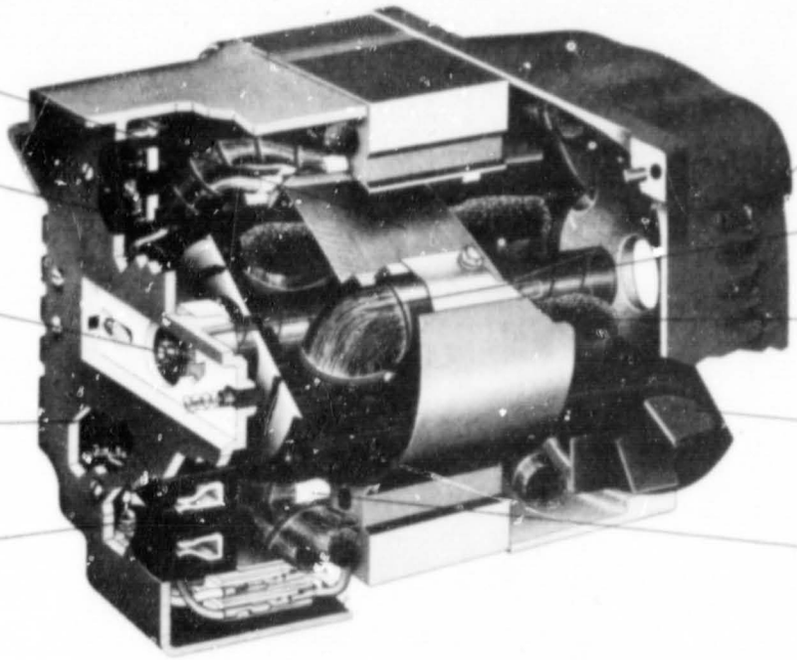
Tel. 216-373-2633

GENERATORS

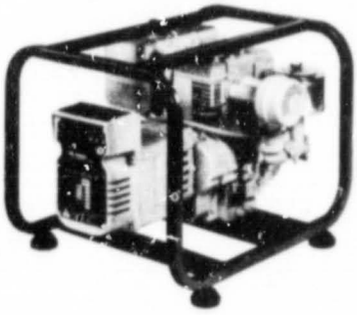
(CODE **GN**)

Ag-Tronic Portable Electric Generators



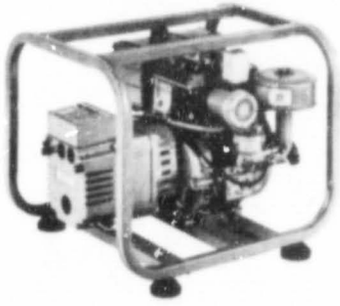
1,000 to 7,000 watts

"51 SERIES"



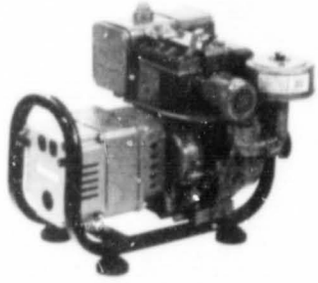
Briggs & Stratton I/C engine, aluminum endbell, circuit breakers, grounding lug, industrial cradle.

"52 SERIES"



Standard B&S engine, small endbell, fused circuits, grounding lug, industrial cradle.

"53 SERIES"



Standard B&S engine, small endbell, fused circuits, grounding lug, small cradle.

Ag-Tronic® uses advanced technology to manufacture superior rotary field generators from 1,000 to 7,000 watts, 50 or 60 Hz, in any required voltage and phase. Two bearing models available in all sizes for belt drive.

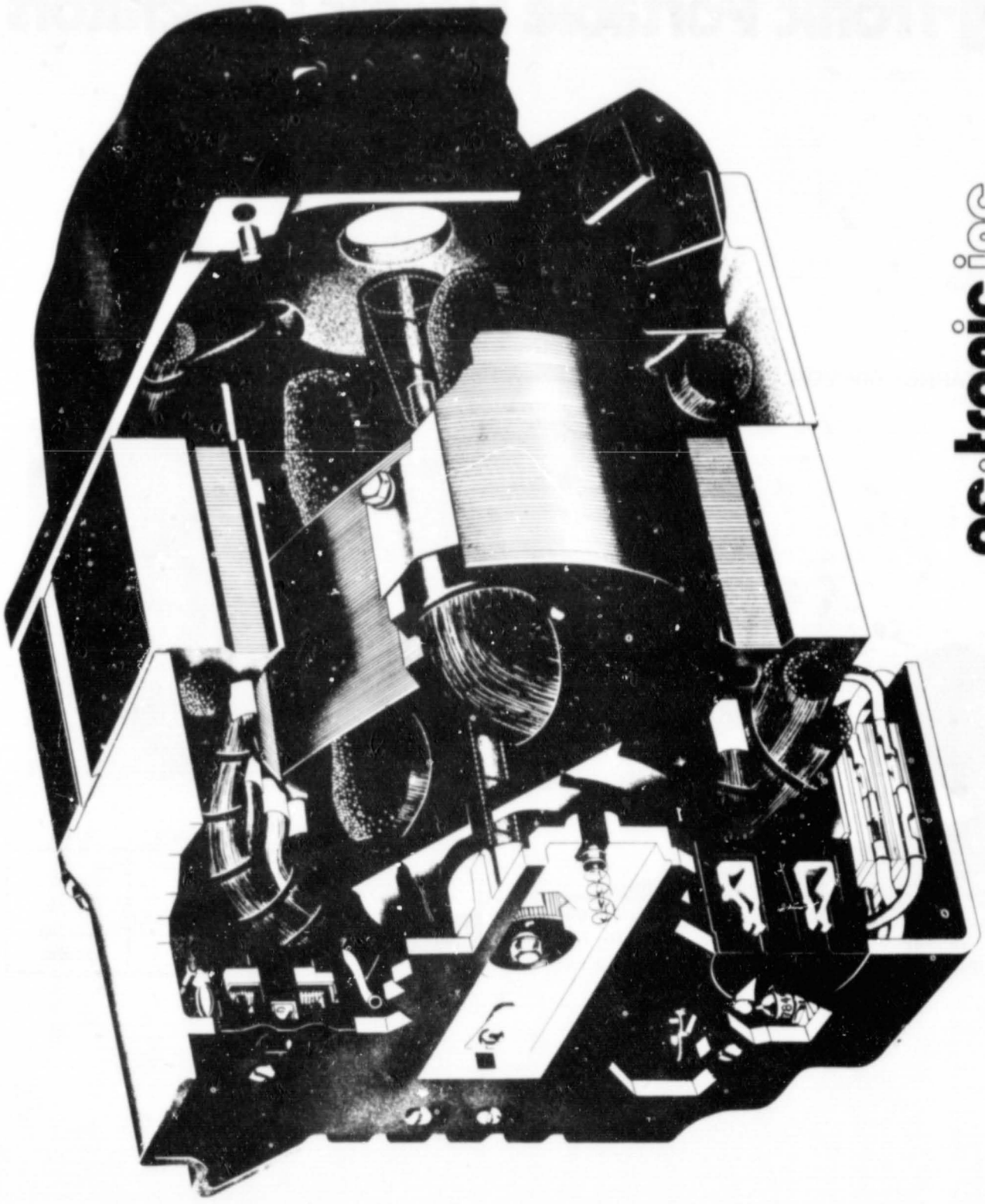
Available options on all models include your choice of receptacles, battery charger, idle control, and electric start on 7 HP or larger engines. A two-wheel portability kit is available for all units with an industrial cradle.

Ag-Tronic International, Inc.

P.O. Box 1106, Hastings, Nebraska 68901 U.S.A.

PHONE: 402-462-2181

Ag-Tronic Portable Electric Generators



ag-tronic inc.
we manufacture progress

KEARNEY DIVISION, 364 Airport Road, Kearney, Nebraska 68847 U.S.A. Phone 308-237-2181

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Ag-Tronic Portable Electric Generators

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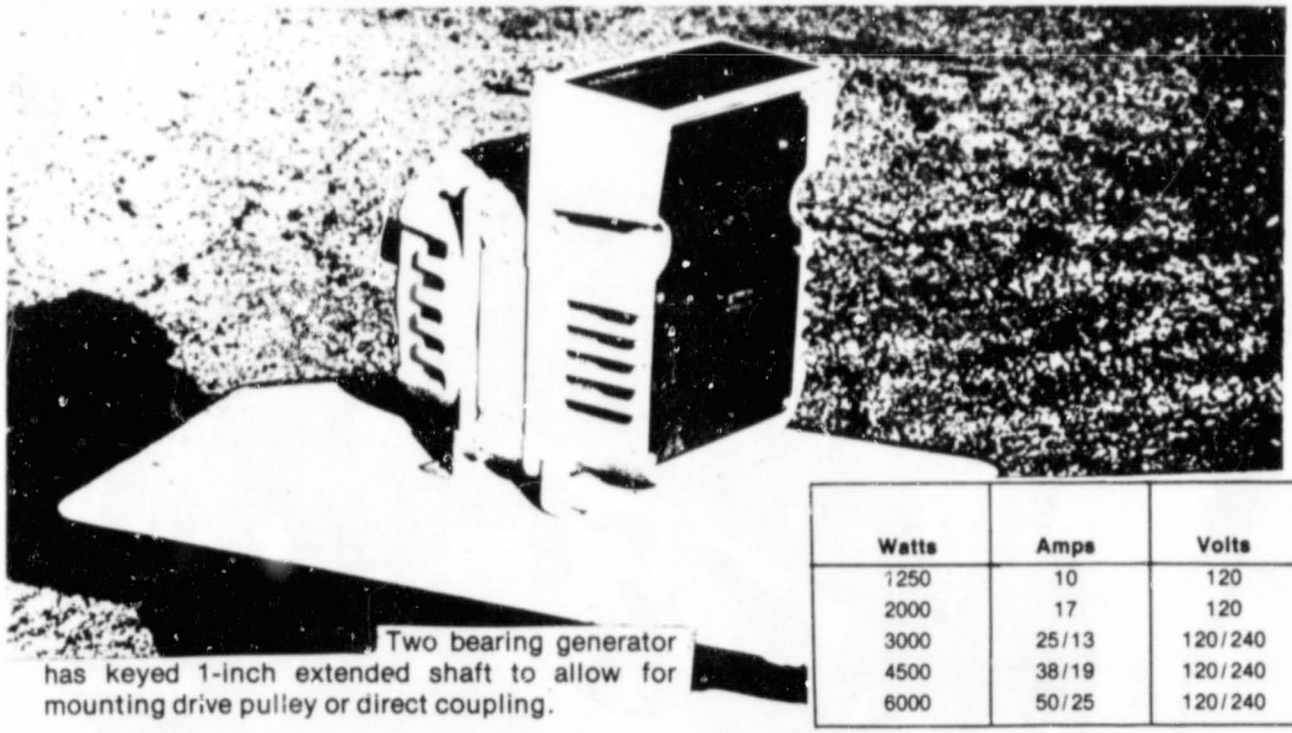


Two bearing generator has keyed 1-inch extended shaft to allow for mounting drive pulley or direct coupling.

Watts	Amps	Volts
1250	10	120
2000	17	120
3000	25/13	120/240
4500	38/19	120/240
6000	50/25	120/240

REDI-LINE®
MOTOR GENERATORS

Model CN
DC to DC

Silent, dependable power . . . no environmental pollution.



Exclusive, automatic start feature provides instant 120 VDC power on demand.

The exclusive, patented automatic starting circuit allows the REDI-LINE Motor Generator to be controlled by the off-on switch of the power tool or appliance. Current is only drawn when the equipment is in use, thus conserving the battery charge. REDI-LINE Models are available which can convert either 12, 24 or 36 VDC to 120 VDC electrical power.

The CN models are best suited for non-variable speed tools with brush-type motors and high ampere rating (6 to 10 amps) such as saws, sanders, electric wrenches and rigidmills. Brush-type motors actually run better on DC than on AC power.

The lightweight portability of the Model CN REDI-LINE Motor Generator provides shop convenience in remote sites away from a main power source. You merely connect the unit to a vehicle battery or a battery pack. This eliminates the inconvenience of stringing long extension cords and the attendant problem of voltage drop in the cords. Vehicle engine need not run while motor generator is being used. REDI-LINE Motor Generators run quietly and do not pollute the environment.

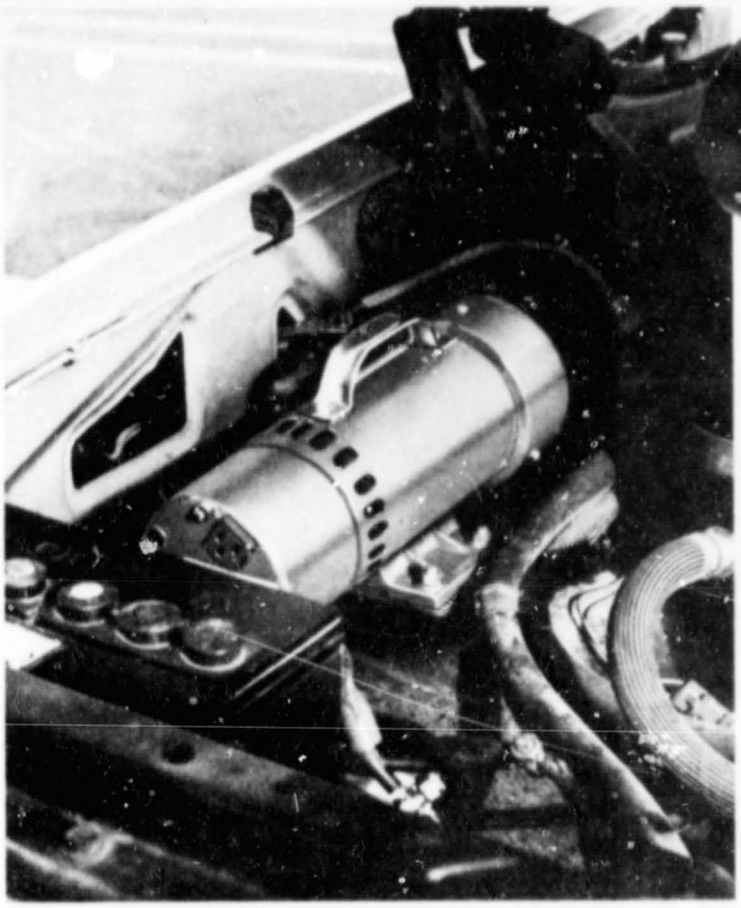
The Model CN Motor Generators are very popular with contractors (building, plumbing, heating, air conditioning), farmers, equipment repairmen and maintenance men.

Honeywell

HONEYWELL MOTOR PRODUCTS P.O. Box 106, Rockford, IL 61105 Phone 815/966-3600

REDI-LINE MOTOR GENERATORS

A practical way to power electrical equipment in remote areas





Model CN with
automatic start
—120 VDC output—up to 1100 watts

Length 16⅜"—Diameter 5⅛"
Weight 23 lbs.—Standard 3-prong receptacle

Easy installation in trucks, vans, tractors, RV's, boats and campers.

The REDI-LINE Motor Generator is **connected directly** to a battery or any D.C. power source. In the standard installation, the REDI-LINE is bolted to any available surface inside the engine compartment nearest the battery. Connect two leads between battery and unit. Specific installation instructions are included with every unit.

Model CN REDI-LINE Motor Generator ratings

Model	Battery Voltage	REDI-LINE Output		
	Volts	Volts	Amps.	Watts
CN12U	12	120 VDC	10	1000
CN24U	24	120 VDC	10	1000
CN36U	36	120 VDC	11	1100

Simple, compact design features permanent magnet field

REDI-LINE Motor Generators have a rotating armature with two commutators and a permanent magnet field. The armature has a low voltage and a high voltage winding. The low voltage operates as a DC motor. The high voltage winding operates as a generator. The efficiency of this construction provides instant 120 volt AC or DC power in a compact, lightweight package. Outputs from 500 to 1600 watts are available depending on the model selected. For information on Model DA REDI-LINE Motor Generators with 120 VAC output refer to Bulletins PM486 and PM456-7, PM478

Honeywell

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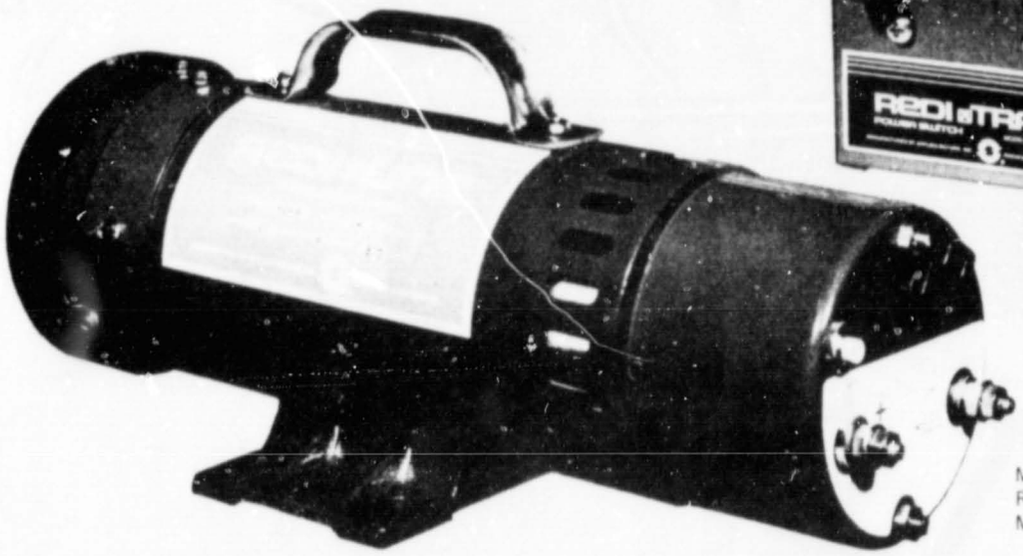
REDI-TRAN™

POWER BOOST SYSTEM



Model DA-2
REDI-TRAN
Power Switch



Model DA-24A
REDI-LINE
Motor Generator

The ultimate in portable or back-up 120Vac Power

- **60% more power . . . run power tools and appliances up to 800 watts.**
- **Twice the ampere hour capacity . . . run power tools longer.**
- **Automatic charging from 12-Volt generator.**
- **Uses power only when power tool or appliance is on.**

REDI-TRAN Power Boost System consists of:

REDI-LINE Model DA-24A	REDI-TRAN Model DA-2
Motor Generator	Power Switch
length 15-21/32"	4-1/2" wide
dia. 5-1/16"	3-3/4" deep
	8" high

Power Source (not furnished)
1 12Vdc main battery
1 12Vdc auxiliary battery

The new REDI-TRAN Power Boost System provides the ultimate in portable 120Vac power. Two 12Vdc batteries are connected in series giving the advantages of a 24Vdc power source. Battery current is dropped by one half, reducing losses and improving battery efficiency. Ampere hour capacity is doubled to allow longer use of power tools or appliances.

The Model DA-24A REDI-LINE Motor Generator is designed for maximum power output. It is rated at 800 watts as compared to 500 watts for the Model DA-12A, thus providing 60% more usable power. Heavy-duty power tools such as 10" cross cut saws, or appliances using up to 800 watts, such as micro wave ovens, can be operated efficiently.

Honeywell

HONEYWELL MOTOR PRODUCTS P.O. Box 106, Rockford, IL 61105 Phone 815/966-3600

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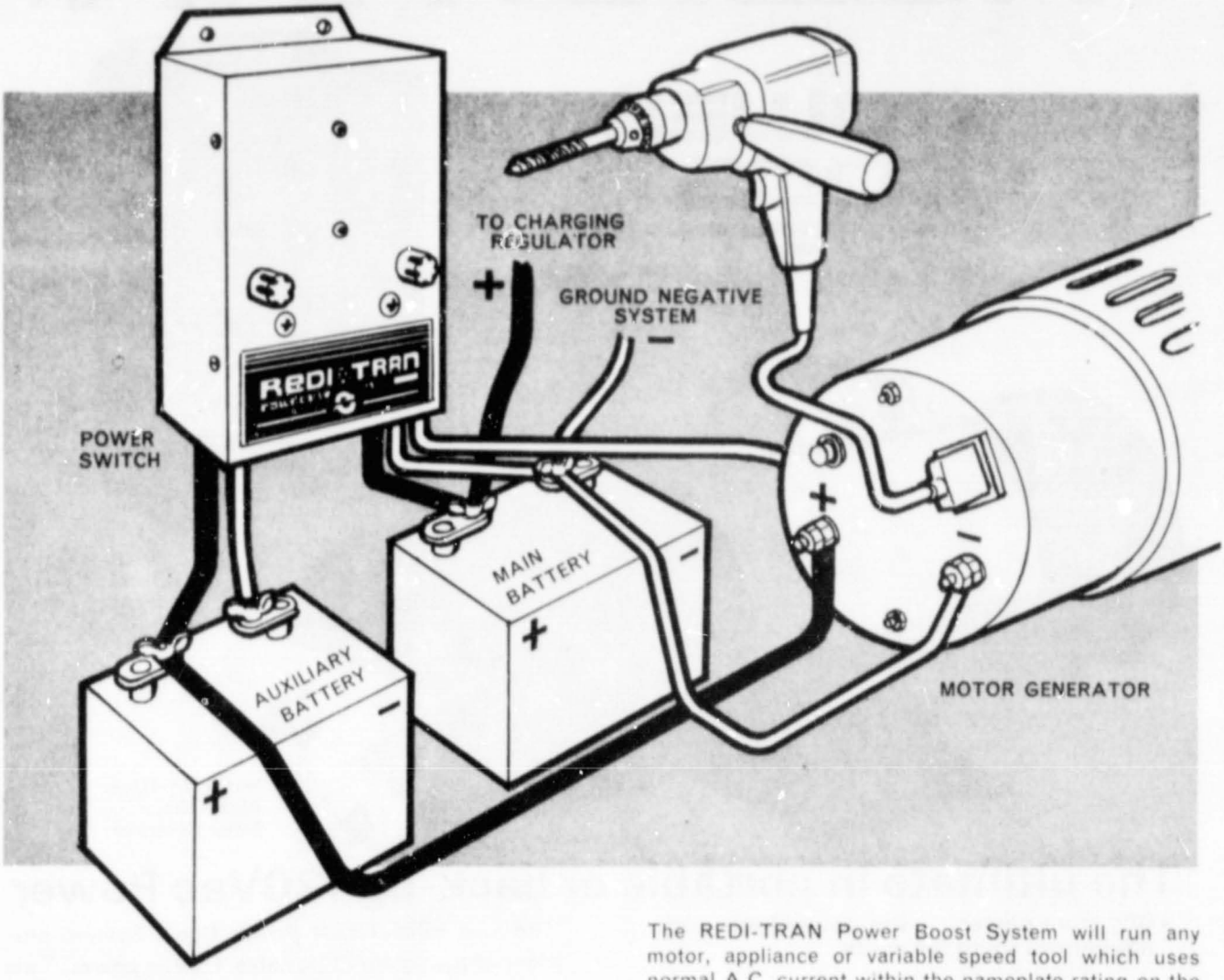
REDI-TRAN™ POWER BOOST SYSTEM



- **Power on remote Job Sites**
- **Emergency Back-up Power**
- **Auxiliary Power in Boats and Recreational Vehicles**
- **120Vac power to run . . .**

  Power Tools (up to 12 amps)
  Furnace Motors
  Freezers
  Sump Pumps
  Communications Equipment
  Television Sets
  Microwave Ovens

The REDI-TRAN Power Boost System will run any motor, appliance or variable speed tool which uses normal A.C. current within the nameplate rating on the generator. The automatic starting feature of the REDI-LINE Motor Generator enabies you to control the power with the "off and on" switch on the tool or appliance.

When power is demanded, the REDI-TRAN Power Switch automatically switches the main battery and auxiliary battery into a series connection providing a 24Vdc power source, thus doubling the ampere hour capacity. The REDI-LINE Motor Generator converts this 24Vdc power into 120Vac power for operating a wide variety of power tools and appliances. When the tool is shut off, the REDI-TRAN Power Switch automatically goes to the charging mode by reconnecting the batteries in a parallel connection to permit recharging from a standard 12 volt generator. All electrical loads must be removed to allow the system to go to the charging mode.

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HEAT ENGINES

(10-75 HP)

WITH AUXILIARY COMPONENTS

(CODE **HE**)

STANDARD ENGINE EQUIPMENT

VERTICAL CRANKSHAFT

As Illustrated	5.0 HP Model 131922 Type 0111-01	3.0 HP Model 81232 Type 0102-01	3.0 HP Model 81332 Type 0624-01	5.0 HP Model 131232 Type 0111-01	5.0 HP Model 131432 Type 0112-01
Air Cleaner	Dual Element	Dual Element	Dual Element	Dual Element	Dual Element
Bearings, Main	1 Plain, 1 Ball	1 Roller, 1 Ball	1 Roller, 1 Ball	2 Ball	2 Ball
Breather	Vent thru Air Cleaner	Vent thru Air Cleaner	Vent to Atmosphere	Vent thru Air Cleaner	Vent to Atmosphere
Control	Remote with Choke-A-Matic	Adjustable Governor	Adjustable Governor	Adjustable Governor	Adjustable, Manual Friction, Remote
Crankshaft	#260959	#260932	#260932	#260958	#260958
Crankshaft Rotation	CCW	CCW	CCW	CCW	CCW
Cylinder	Cast Iron Sleeve	Cast Iron Sleeve	Cast Iron Sleeve	Cast Iron Sleeve	Cast Iron Sleeve
Muffler	Lo-Tone	Oval Lo-Tone	Oval Lo-Tone	Lo-Tone	Lo-Tone
Fuel Tank Capacity	2 Quarts 1.89 Liters	2 Quarts 1.89 Liters	3 Quarts 2.84 Liters	3 Quarts 2.84 Liters	4 Quarts 3.79 Liters
Gear Reduction Ratio 6:1	—	Available	Available	Available	Available
Governor	Mechanical	Pneumatic	Pneumatic	Mechanical	Mechanical
Mounting	—	Flange	Flange	Flange	Flange
Oil Capacity	1.75 Pints .83 Liter	1.25 Pints .59 Liter	1.25 Pints .59 Liter	1.25 Pints .59 Liter	1.25 Pints .59 Liter
Oil Drain	Carb. Side	Dual	Dual	Dual	Dual
Oil Fill	Carb. Side	Dual	Dual	Dual	Dual
Paint	Industrial Gray	Industrial Gray	Industrial Gray	Industrial Gray	Industrial Gray
Piston	Aluminum	Aluminum	Aluminum	Aluminum	Aluminum
Piston Rings	Cast Iron	Cast Iron	Cast Iron	Cast Iron	Cast Iron
Rewind Starter Position	3 o'clock	10 o'clock	10 o'clock	10 o'clock	10 o'clock
Speed Set — No Load	3500 RPM	3300 RPM	3300 RPM	3600 RPM	3600 RPM
Valves	Stellite® Exhaust with Rotator	Stellite® Exhaust with Rotator	Stellite® Exhaust with Rotator	Stellite® Exhaust with Rotator	Stellite® Exhaust with Rotator
Weight, Net	30.25 Lb. 13.72 Kg	24.50 lb. 11.0 Kg	25.75 Lb. 11.68 Kg	30 Lb. 13.60 Kg	31.75 Lb. 14.40 Kg

ALL I/C SERIES ENGINES ARE EQUIPPED WITH CAST IRON SLEEVE.

BRIGGS & STRATTON CORPORATION
Post Office Box 702 • Milwaukee, Wisconsin 53201 U.S.A.
TEL: 414-259-5333

HORIZONTAL CRANKSHAFT

8.0 HP Model 195432 Type 0111-01	10.0 HP Model 221432 Type 0111-01	9.0 HP Model 233431 Type 0611-01	10.0 HP Model 243431 Type 0610-01	16.0 HP Model 326431 Type 0110-01	16.0 HP Model 402431 Type 0110-01	18.0 HP Model 422431 Type 0110-01
Dual Element	Dual Element	Dual Element	Dual Element	Dual Element	Dual Element	Dual Element
2 Ball	2 Ball	2 Ball	2 Ball	2 Ball	2 Ball	2 Ball
Vent thru Air Cleaner	Vent thru Air Cleaner	Vent thru Air Cleaner	Vent thru Air Cleaner	Vent thru Air Cleaner	Vent thru Air Cleaner	Vent thru Air Cleaner
Adjustable Governor	Remote	Adjustable Governor	Remote	Remote	Remote	Remote
#261436	#261497	#260152	#260895	#261218	#261506	#261579
CCW	CCW	CCW	CCW	CCW	CCW	CCW
Cast Iron Sleeve	Cast Iron Sleeve	Cast Iron	Cast Iron	Cast Iron	Cast Iron Sleeve	Cast Iron Sleeve
Round Lo-Tone	Square Lo-Tone	Square Lo-Tone	Square Lo-Tone	Standard	Optional	Optional
4 Quarts 3.79 Liters	6 Quarts 5.68 Liters	6 Quarts 5.68 Liters	6 Quarts 5.68 Liters	6 Quarts 5.68 Liters	Less Fuel Tank	Less Fuel Tank
Available	Available	Available	—	—	—	—
Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical	Mechanical
Flange	Flange	Flange	Flange	Flange	Flange	Flange
2.75 Pints 1.30 Liters	3 Pints 1.42 Liters	4 Pints 1.89 Liters	4 Pints 1.89 Liters	4 Pints 1.89 Liters	3 Pints 1.42 Liters	3 Pints 1.42 Liters
Dual	Dual in Crankcase with Additional in Crankcase Cover	Carb. Side	Carb. Side	Carb. Side	PTO Side, Opp. Starter, Bottom	PTO Side, Opp. Starter, Bottom
Dual	Extended	Carb. Side	Carb. Side	Carb. Side	Extended	Extended
Industrial Gray	Industrial Gray	Industrial Gray	Industrial Gray	Industrial Gray	Industrial Gray	Industrial Gray
Aluminum	Aluminum	Aluminum	Aluminum	Aluminum	Aluminum	Aluminum
Cast Iron	Cast Iron	Cast Iron	Cast Iron	Cast Iron	Cast Iron	Cast Iron
10 o'clock	10 o'clock	Rope	Rope	Rope	Rope	Rope
3600 RPM	3600 RPM	2900 RPM	2900 RPM	2900 RPM	3600 RPM	3600 RPM
Stellite® Exhaust with Rotator	Stellite® Exhaust with Rotator	Stellite® Exhaust with Rotator	Stellite® Exhaust with Rotator	Stellite® Exhaust with Rotator	Stellite® Exhaust with Rotator	Stellite® Exhaust with Rotator
46.50 Lb. 21.09 Kg	63.25 Lb. 28.69 Kg	92 Lb. 41.73 Kg	96 Lb. 43.54 Kg	106.50 Lb. 48.30 Kg	80.50 Lb. 36.51 Kg	82 Lb. 37.20 Kg

POWER DATA: The horsepower ratings shown herein are established in accordance with the Society of Automotive Engineers Code - J607.

Power curves are corrected to standard conditions of sea level barometer and temperature of 60°F (15.6°C) and are developed from laboratory test engines equipped with standard air cleaner and muffler.

The "Maximum BHP" curve represents performance of laboratory test engines. Production engines will develop not less than 95% of the "Maximum BHP" when tested after run-in to reduce friction and after cleanout of combustion chamber, with valves, carburetor and ignition system adjusted to laboratory standards.

Production engines when shipped, will develop not less than 85% of the "Maximum BHP."

Engine power will decrease 3½% for each 1,000 ft. (304.8 m) above sea level and 1% for each 10°F (5.6°C) above standard temperature of 60°F (15.6°C).

For practical operation, BHP load and speed should be within the limits shown in the "Recommended Maximum Operating BHP" curve. Complete details of installations requiring operation at other than the recommended speeds should be referred to the factory for approval.

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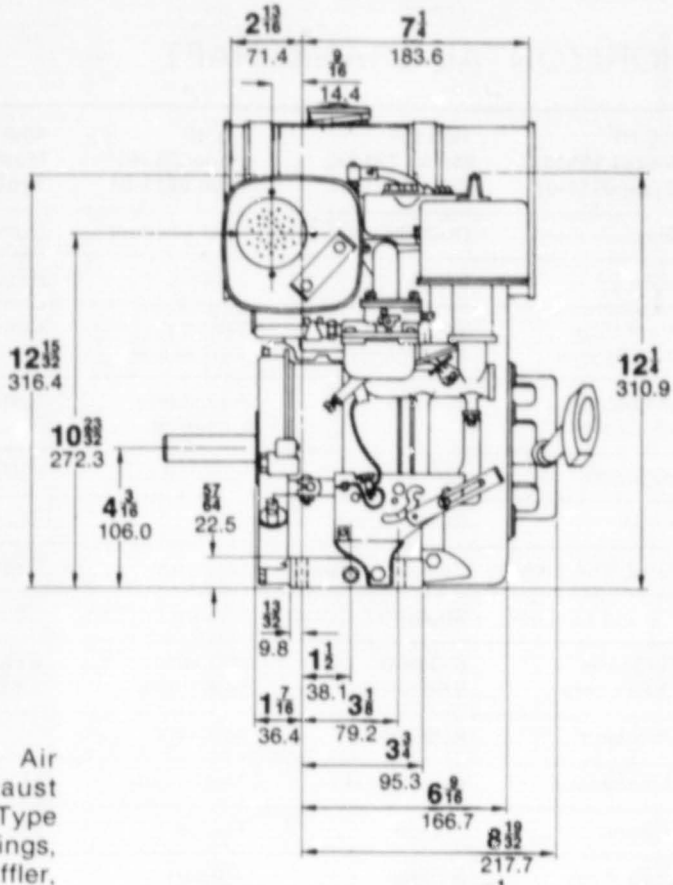
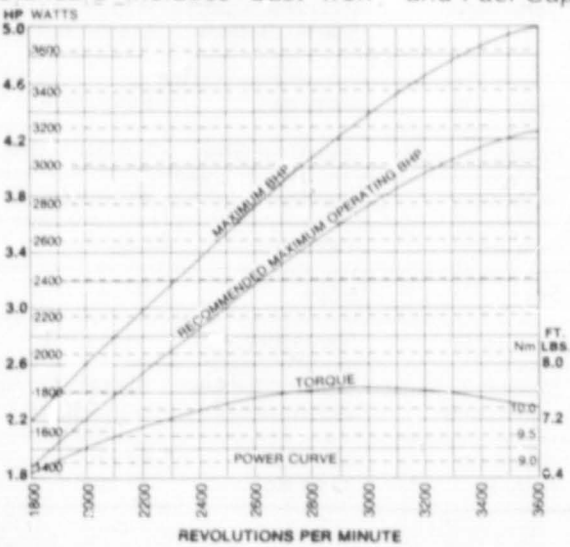
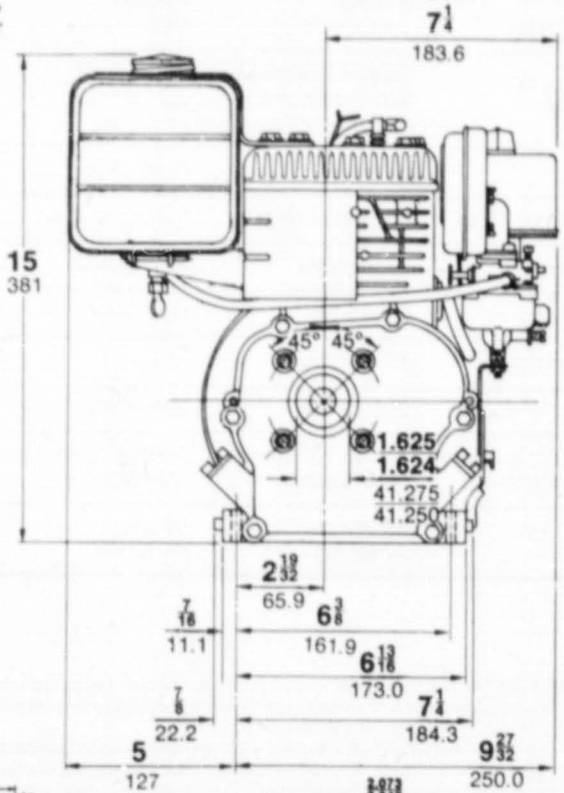


Model 131432

Type No. 0112-01 — Horizontal Crankshaft — 5.00 HP @ 3600 RPM — Bore 2 9/16", Stroke 2 7/16", Displacement 12.57 cu. in. — 206.0 cc. Flo-Jet Carburetor. Standard includes Cast Iron Sleeve, Dual Element Air Cleaner, Stellite® Exhaust Valve and Seat, Positive Type Rotator, Two Ball Bearings, Aluminized Lo-Tone Muffler, Chromed Air Cleaner Cover and Fuel Cap.





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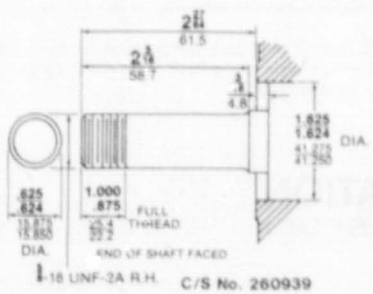

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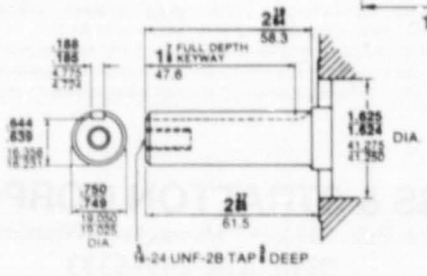

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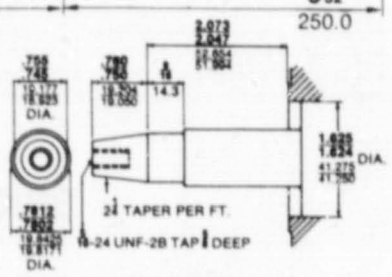

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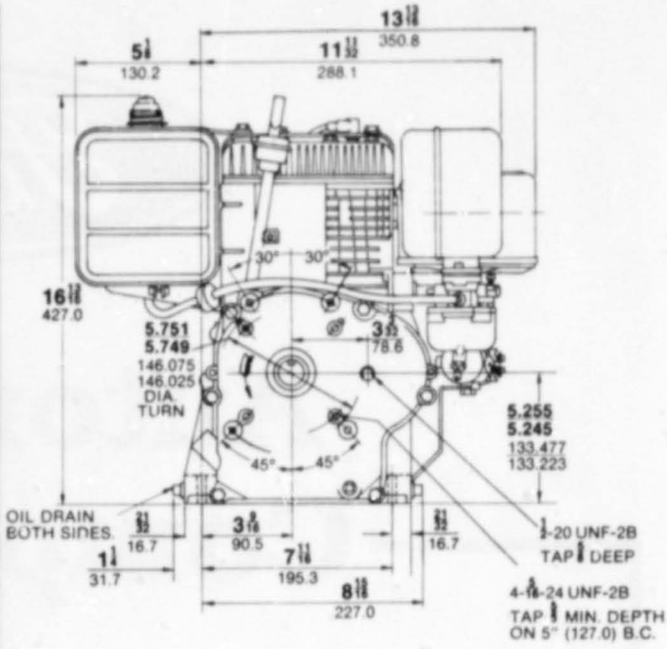
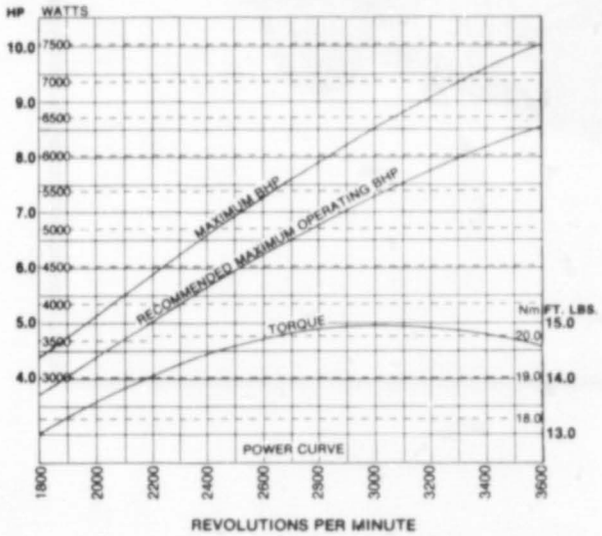
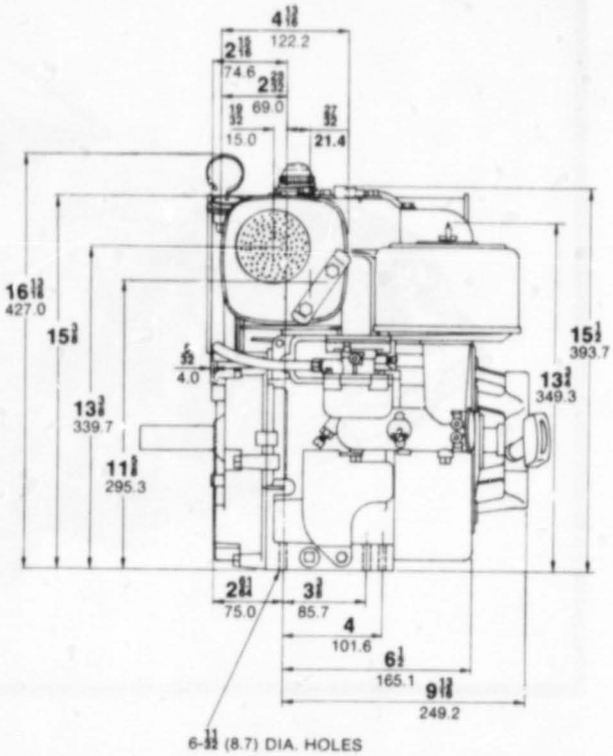


Model 221432

Type No. 0111-01 — Horizontal Crankshaft — 10.00 HP @ 3600 RPM — Bore 3 7/16", Stroke 2 3/8", Displacement 22.04 cu. in. — 361.3 cc. Flo-Jet Carburetor. Standard includes Cast Iron Sleeve, Dual Element Air Cleaner, High Oil Fill with Dipstick, Stellite® Exhaust Valve and Seat, Positive Type Valve Rotator, Two Ball Bearings, Aluminized Square Lo-Tone Muffler, Chromed Air Cleaner Cover, and Fuel Cap.





BRIGGS & STRATTON CORPORATION
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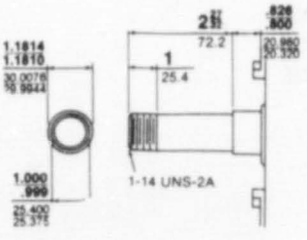
TEL: 414-259-5333



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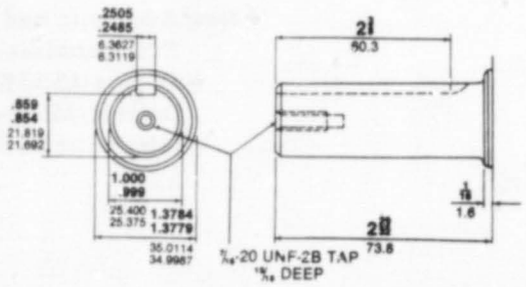

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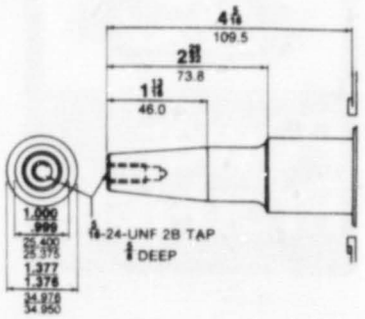
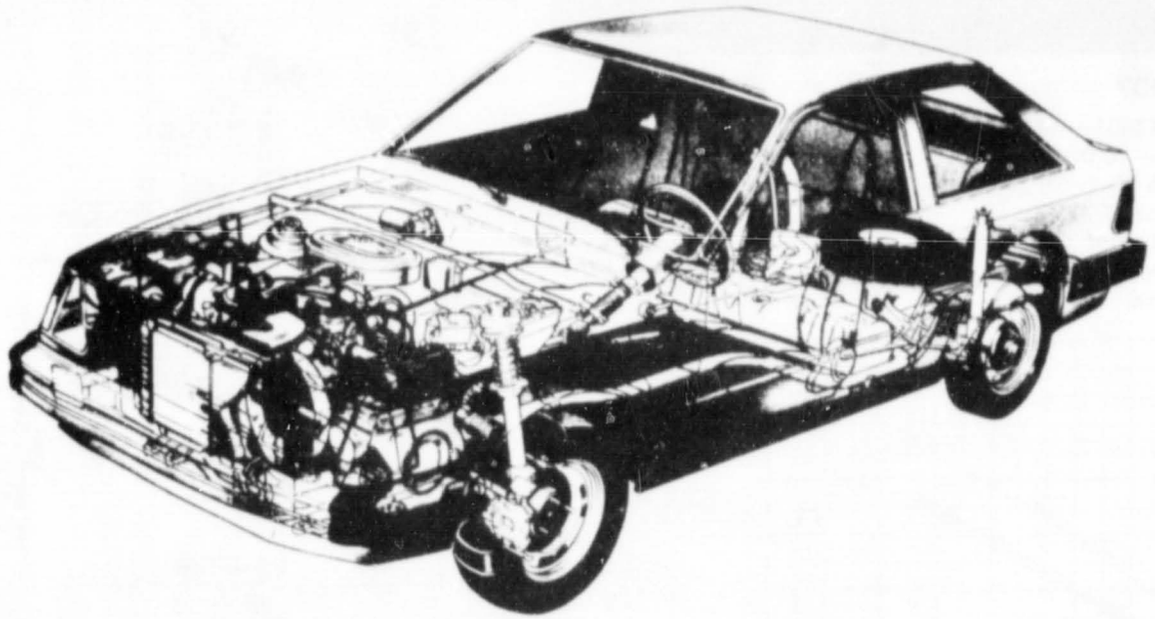


C/S No. 261510

Automotive Components



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Industrial Engine Operations
Ford Parts and Service Division
300 Renaissance Center, Suite 1800
P.O. Box 43338
Detroit, Michigan 48243
Telephone 313/568-7435

Ford
Power Products

THE STIRLING ENGINE COMES OF AGE

The search for new power sources for a fuel-hungry and environmentally conscious world has focused on the Stirling engine—technology has now made this remarkable powerplant one of the most attractive alternatives to the internal combustion engine.

External combustion: quiet, multifuel, versatile

The Stirling is an *external* combustion engine that converts heat into driving power by continuous heating and cooling of a captive working gas. It can be adapted to run on almost any fuel—liquid, solid or gas—or even solar energy.

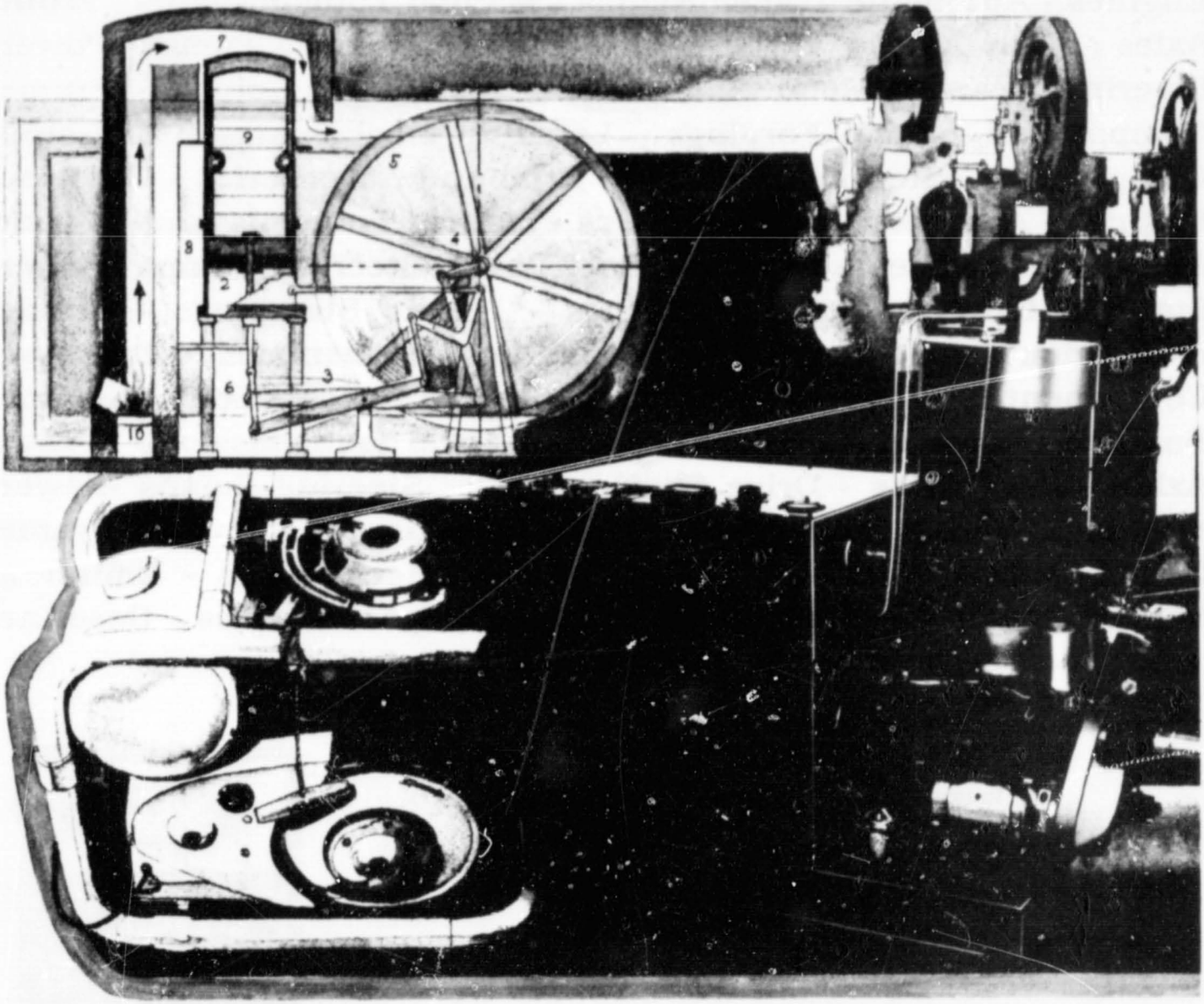
Continuous combustion at high temperatures results in complete combustion—virtually pollution-free. Nitrogen oxide levels are very low. Carbon monoxide and unburned hydrocarbons are almost nonexistent. And, without the rapid-fire explosions that take place in reciprocating internal combustion engines, the Stirling runs whisper-quiet.

Potential uses are almost limitless. Stirling engines have been tested in automobiles and boats. They can also be used to power portable electric generating sets, water pumps, heating systems and refrigeration units.

A Stirling engine is the heart of a new total energy system—the Stirling Power Pack. It provides a clean, quiet and completely independent source of power for electrical equipment, lighting, heating and cooling.

Robert Stirling's design, 1816.

Rider water-pumping engine, about 1900.



N.V. Philips generator set, 1952.

Swedish Stirling Engine generator set prototype, 1972.

STIRLING POWER SYSTEMS CORP., P.O.BOX 1187, 7101 JACKSON RD.
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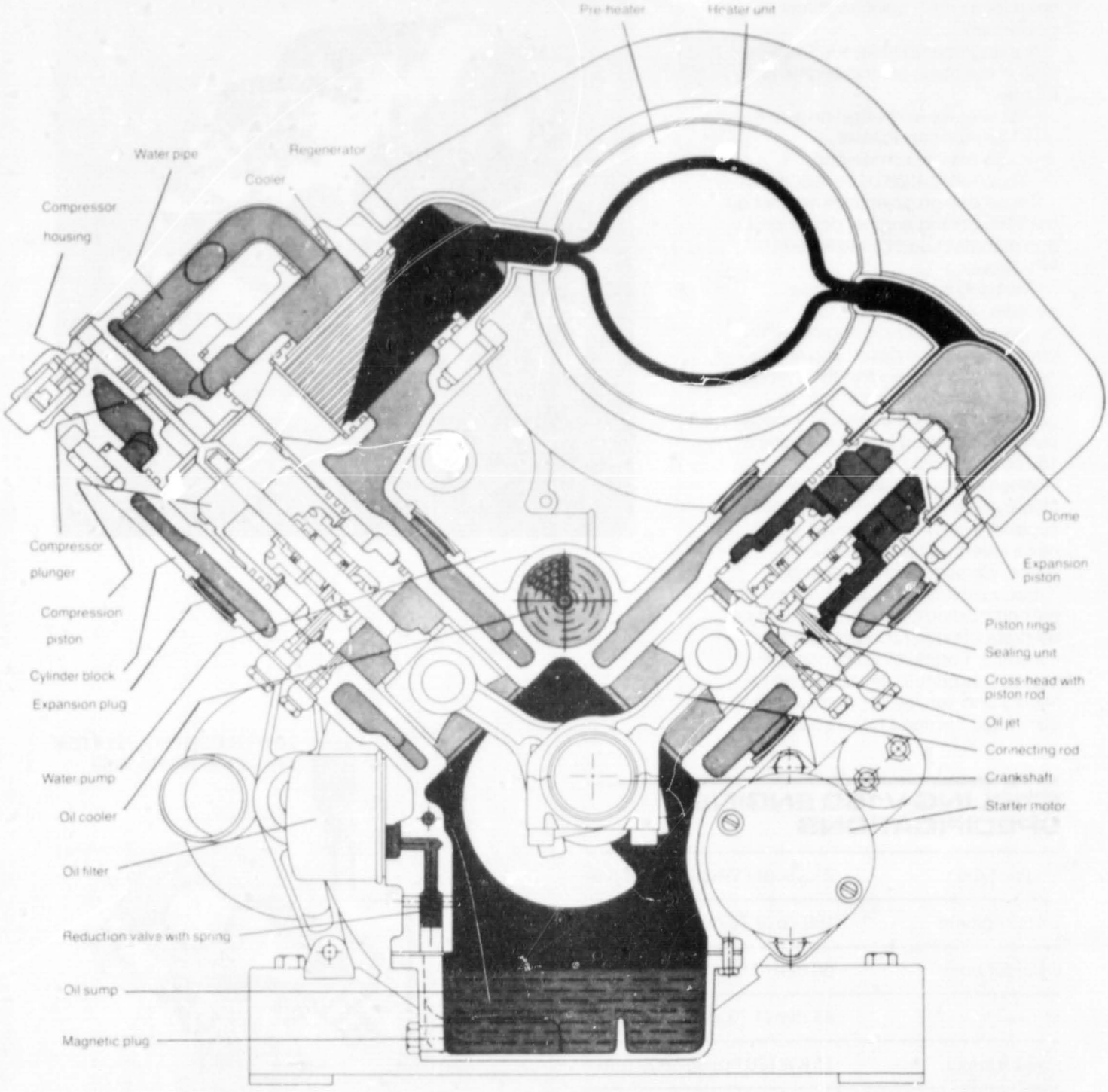
STIRLING V160 ENGINE
CROSS SECTION



STIRLING POWER SYSTEMS CORP., P.O.BOX 1187, 7101 JACKSON RD.
ANN ARBOR, MI 48106 TEL: 313-665-6767

EFFICIENT POWER, WHEN AND WHERE YOU NEED IT

Today's production model Stirling V160 engine was designed to fill the need for a small, quiet, multifuel powerplant.

It is engineered to take full advantage of the basic Stirling engine attributes:

—Low noise and vibration levels
—Multifuel capabilities
—Low exhaust emissions
—Low lubrication oil consumption

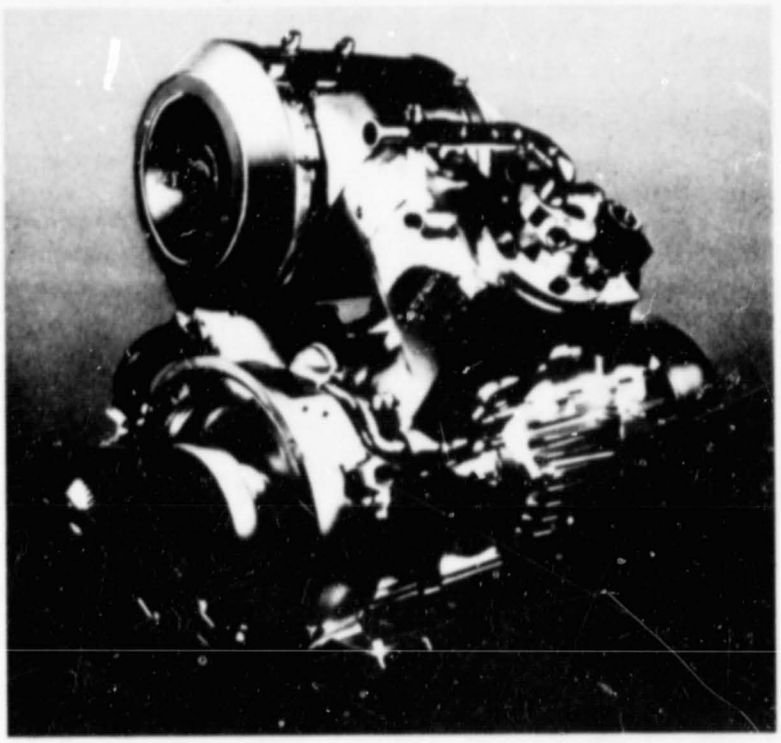
Those design objectives are met by the V160 Stirling engine, developed and manufactured by the Swedish FFV Group.

The V160 is a 90 degree, two-cylinder, V-type engine. It is a "single-acting" Stirling engine, with one compression piston and one expansion piston. Between the cylinders are the combustion chamber, regenerator and gas cooler. The model number is derived from the engine's 160 cc swept volume.

When compared with the standard Otto-cycle engine, the Stirling V160 is superior in several important areas: noise levels, exhaust emissions, odors, vibration and fuel economy.

Because fuel is burned in an external combustion chamber, combustion by-products don't contact pistons or cylinders. Engine oil is not contaminated. This contributes to engine reliability and service life, and virtually eliminates the need for oil changes.

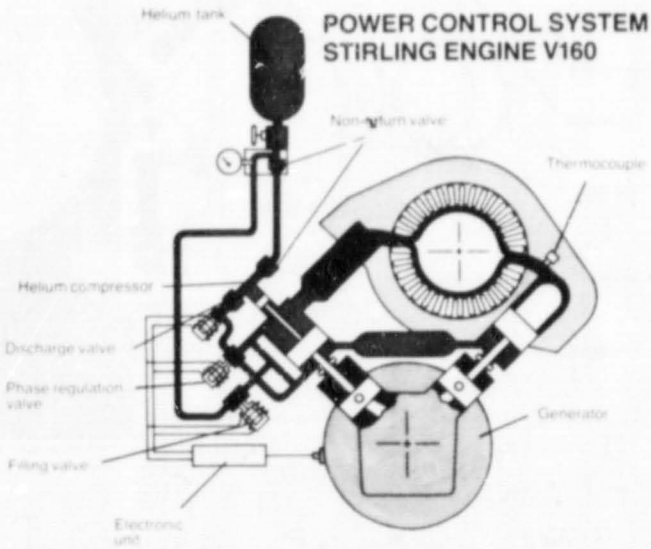
STIRLING ENGINE V160



STIRLING V160 ENGINE SPECIFICATIONS

Engine type	2-cylinder V-type, 90 degree
Swept volume	160 cc (9.76 cu. in.)
Cylinder bore	68 mm (2.68 in.)
Stroke	44 mm (1.73 in.)
Power (max.)	15 KW (20 hp) @ 3600 rpm
Weight	100 Kg (220 lbs)

POWER CONTROL SYSTEM STIRLING ENGINE V160



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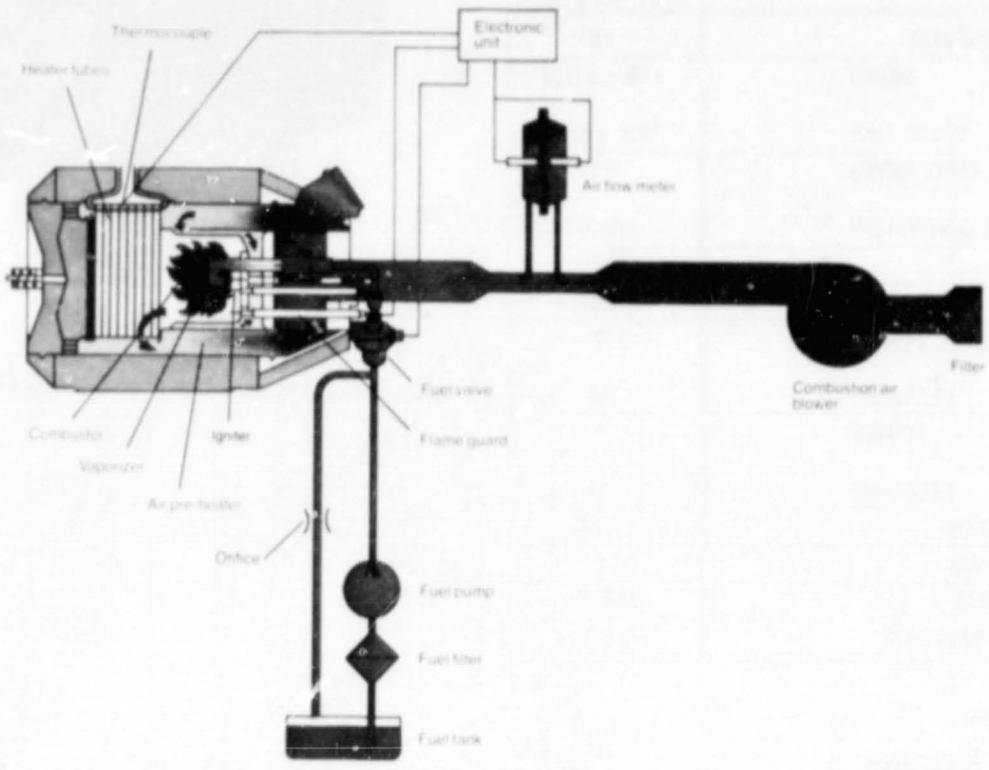
AIR-FUEL SYSTEM
STIRLING ENGINE V160



ASK US ABOUT STIRLING POWER

The Stirling engine is a thoroughly researched, carefully designed and tested product.

Developed and manufactured by the FFV Group, the V160 Stirling engine is ready for installation in a wide variety of applications requiring output of 15 KW (20 hp) or less.

The V160 is available as a bare engine or can be supplied in the Stirling Power Pack—a modular unit complete with an electrical generator.

In either configuration, it offers the well-established Stirling engine benefits: low sound levels; multifuel capabilities; low exhaust emissions; no odors; minimal lubrication requirements; long engine life; and low maintenance demands.

Stirling power engineers, designers and application specialists will be happy to provide detailed information and discuss your specific power needs.

Please contact Stirling Power Systems in North America, or FFV Industrial Products in Sweden.

Stirling Power Systems Corp.
P.O. Box 1187
7101 Jackson Road
Ann Arbor, Mi 48106
Tel: (313) 665-6767

FFV Industriprodukter AB
S-581 82 Linkoping
Sweden
Tel: (13) 2996 00
Telex: 50071 ffvipro s

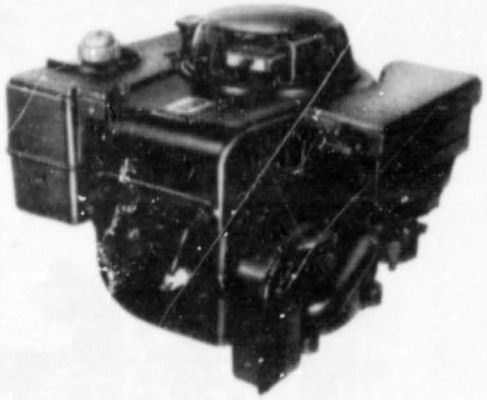
STIRLING POWER

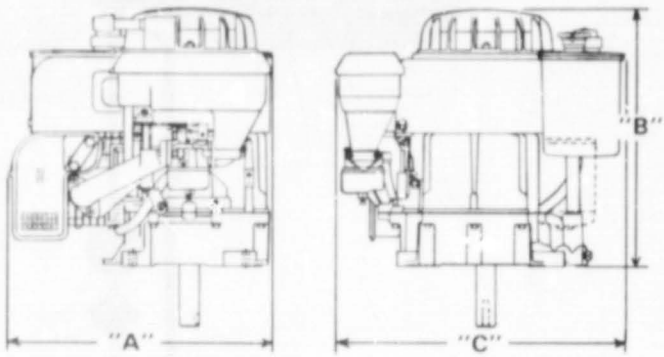
FFV Industri-produkter AB

8 HORSEPOWER (MEDIUM FRAME)
RIDER APPLICATION

STANDARD EQUIPMENT & DIMENSIONS

MODEL	VM80 CAST IRON BORE
HORSEPOWER @ 3600 RPM	8.0
BORE & STROKE — INCHES	3-1/8 x 2-17/32
BORE & STROKE — MILLIMETERS	79.38 x 64.31
DISPLACEMENT — CUBIC INCHES	19.41
DISPLACEMENT — CUBIC CENTIMETERS	318.27
LUBRICATION	Pump
GOVERNOR	Mechanical
OIL CAPACITY — OUNCES	32
OIL CAPACITY — MILLILITERS	950
NET WEIGHT (APPROX.) — POUNDS	41
NET WEIGHT (APPROX.) — KILOGRAMS	18.6
LENGTH "A" (IN INCHES)	13-35/64
HEIGHT "B" (IN INCHES)	13-5/16
WIDTH "C" (IN INCHES)	14-57/64
BOLT MTG. CIRCLE (IN INCHES)	8 & 10





ENGINE VARIATIONS

CRANKSHAFT
Length of crankshaft is measured from mounting face of flange to end of shaft.

SERVICE NUMBER	PART NUMBER	DIAMETER	LENGTH	OTHER CRANKSHAFT SPECIFICATIONS	COMPOSITE DESIGN	AUXILIARY P.T.O. SHAFT	EXHAUST DIRECTION	FUEL TANK CAPACITY IN QUARTS	CARBURETOR	CONTROLS	STARTER	MAGNETO FEATURE	AIR CLEANER REGULATOR	OIL FILLER TUBE	OIL DRAIN	CAST IRON	SEE NOTES	FAST MOVING ENGINES
SERIES 808000 (VERTICAL 8.0 H.P.)																		
808700	33644A	1"	3-5/32"	3/8-24 Tap, 1/4 x 2-11/16Kw No. 6WK	X		SD	2.5	FI	R	Re			K	X	S		STD■	✓
808760A	33644A	1"	3-5/32"	3/8-24 Tap, 1/4 x 2-11/16Kw No. 6WK	X		SD		FI	R	Re			K		S		McD‡	✓
808761A	33644A	1"	3-5/32"	3/8-24 Tap, 1/4 x 2-11/16Kw No. 6WK	X		SD		FI	R	E	3amp		K		S		McD‡	✓
808762	33644A	1"	3-5/32"	3/8-24 Tap, 1/4 x 2-11/16Kw			SD	2.5	FI	R	Re	RG		K	X	FR		A‡ 11	✓
808763	33644A	1"	3-5/32"	3/8-24 Tap, 1/4 x 2-11/16Kw			SD	2.5	FI	R	E-Re	3amp		K	X	FR		A‡	✓

NOTES

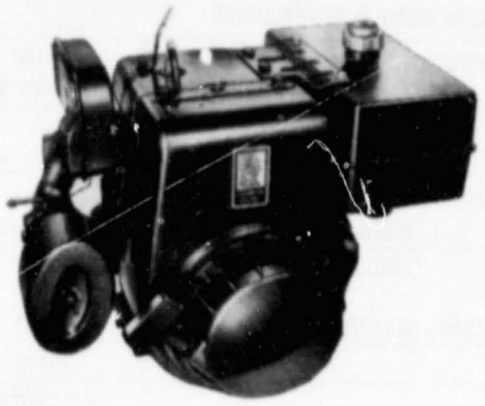
A	Ariens
E	Electric starter
FI	Float carburetor
FR	Front oil drain
K	Kleen-Aire
Kw	Keyway
McD	McDonough
R	Remote control
Re	Rewind starter
RG	Ring gear on flywheel
S	Side oil drain
SD	Side discharge
STD	Standard Engine
WK	Woodruff Keyslot
‡	This engine is not eligible for after-market O.E.M. Discount.
■	This engine is not eligible for return.
11	No. 33329B - 120 Volt Electric Starter and 33635A Blower Housing can be installed.

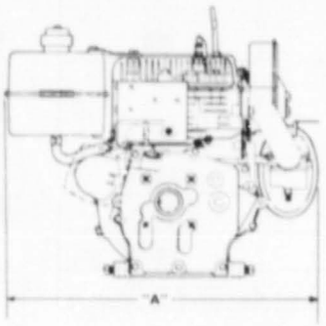
TECUMSEH PRODUCTS COMPANY
Parts Depot Division Grafton, Wisconsin 53024
TEL: 414-377-2700

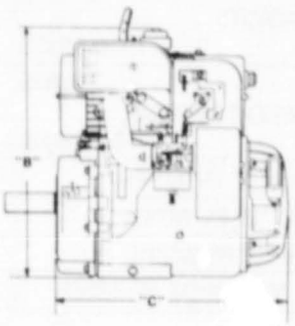
8 HORSEPOWER (MEDIUM FRAME) TRACTOR APPLICATION

STANDARD EQUIPMENT & DIMENSIONS

MODEL	HM80 CAST IRON BORE
HORSEPOWER @ 3600 RPM	8.0
BORE & STROKE — INCHES	3-1/8 x 2-17/32
BORE & STROKE — MILLIMETERS	79.38 x 64.31
DISPLACEMENT — CUBIC INCHES	19.41
DISPLACEMENT — CUBIC CENTIMETERS	318.27
LUBRICATION	Splash
GOVERNOR	Mechanical
OIL CAPACITY — OUNCES	24
OIL CAPACITY — MILLILITERS	710
NET WEIGHT (APPROX.) — POUNDS	46
NET WEIGHT (APPROX.) — KILOGRAMS	20.9
LENGTH "A" (IN INCHES)	17-17/32
HEIGHT "B" (IN INCHES)	15-1/64
WIDTH "C" (IN INCHES)	12-25/32
BOLT MTG. CIRCLE (IN INCHES)	3-5/8







ENGINE VARIATIONS

CRANKSHAFT — Length of crankshaft is measured from drilled and tapped face on the cover plate to end of shaft.

SERVICE NUMBER	PART NUMBER	DIAMETER	LENGTH	OTHER CRANKSHAFT SPECIFICATIONS	AUXILIARY P.T.O. SHAFT	EXHAUST DIRECTION	FUEL TANK CAPACITY IN QUARTS	PULSE TYPE FUEL PUMP	CARBURETOR	CONTROLS	BALL BEARING	STARTER	MAGNETO FEATURE	AIR CLEANER REGULATOR	OIL FILLER TUBE	OIL DRAIN	BOLT MTG. CIRCLE CAST IRON	SEE NOTES	SEE NOTES	FAST MOVING ENGINES	
SERIES 908000 (HORIZONTAL) 8.0 H.P.																					
908500	33365B	1"	2-57/64"	3/8-24 Tap, 1/4 x 2-1/4Kw Spotted		CS	4	PP	FI	R		E-Re	7amp	X	P		DS			STD■	✓
908560	33365B	1"	2-57/64"	1/4 x 2-1/4Kw		CS			FI	R		E	7amp	X	P	X	DS			MF‡	✓

NOTES

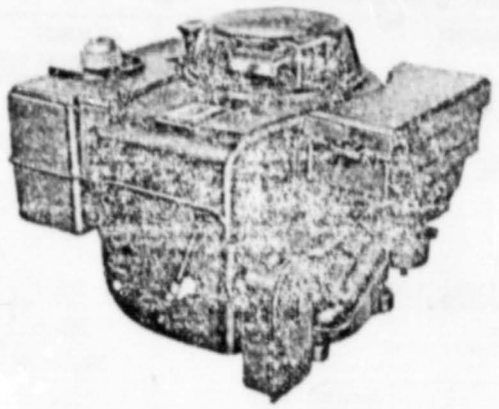
CS	Carburetor side
DS	Dual sides oil drain
E	Electric starter
FI	Float carburetor
Kw	Keyway
MF	Massey - Ferguson
P	Paper air cleaner
PP	Provision for pulse type fuel pump
R	Remote control
Re	Rewind starter
STD	Standard Engine
‡	This engine is not eligible for after-market O.E.M. Discount.
■	This engine is not eligible for return.

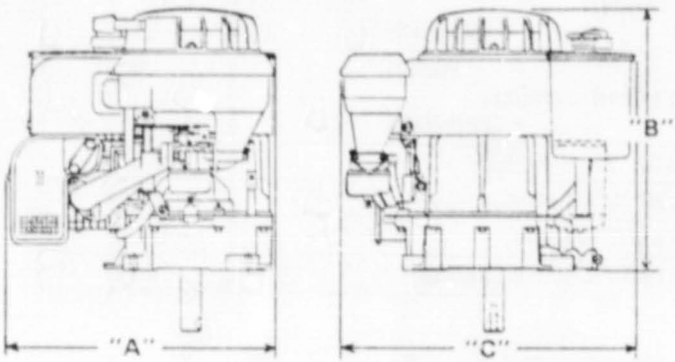
TECUMSEH PRODUCTS COMPANY
Parts Depot Division Grafton, Wisconsin 53024
TEL: 414-377-2700

10 HORSEPOWER (MEDIUM FRAME) RIDER APPLICATION

STANDARD EQUIPMENT & DIMENSIONS

MODEL	VM100 CAST IRON BORE
HORSEPOWER @ 3600 RPM	10.0
BORE & STROKE — INCHES	3-3/16 x 2-17/32
BORE & STROKE — MILLIMETERS	80.96 x 64.31
DISPLACEMENT — CUBIC INCHES	20.20
DISPLACEMENT — CUBIC CENTIMETERS	331.06
LUBRICATION	Pump
GOVERNOR	Mechanical
OIL CAPACITY — OUNCES	32
OIL CAPACITY — MILLILITERS	950
NET WEIGHT (APPROX.) — POUNDS	41
NET WEIGHT (APPROX.) — KILOGRAMS	18.6
LENGTH "A" (IN INCHES)	13-35/64
HEIGHT "B" (IN INCHES)	13-5/16
WIDTH "C" (IN INCHES)	14-57/64
BOLT MTG. CIRCLE (IN INCHES)	8 & 10





ENGINE VARIATIONS

CRANKSHAFT
Length of crankshaft is measured from mounting face of flange to end of shaft.

SERVICE NUMBER	PART NUMBER	DIAMETER	LENGTH	OTHER CRANKSHAFT SPECIFICATIONS	COMPOSITE DESIGN	AUXILIARY P.T.O. SHAFT	EXHAUST DIRECTION	FUEL TANK CAPACITY IN QUARTS	CARBURETOR	CONTROLS	STARTER	MAGNETO FEATURE	REGULATOR	AIR CLEANER	OIL FILLER TUBE	OIL DRAIN	CAST IRON	SEE NOTES	FAST MOVING ENGINES	
SERIES 810000 (VERTICAL 10 FLY)																				
810700	33644A	1"	3-5/32"	3/8-24 Tap, 1/4 x 2-11/16Kw No. 6WK	X		SD		FI	R	E	7amp	X	K		S		STD■		✓
810701	33644A	1"	3-5/32"	3/8-24 Tap, 1/4 x 2-11/16Kw No. 6WK	X		SD	2.5	FI	R	Re	RG		K	X	S		STD■ 8		✓

NOTES

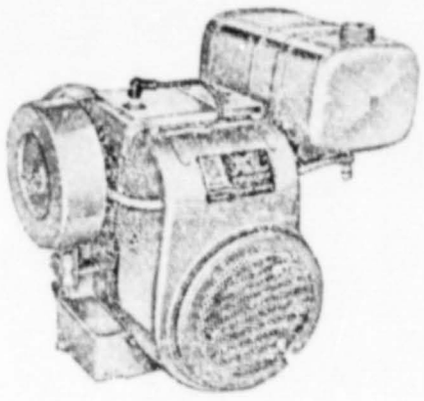
E	Electric starter
FI	Float carburetor
K	Kleen-Aire
Kw	Keyway
R	Remote control
Re	Rewind starter
RG	Ring gear on flywheel
S	Side oil drain
SD	Side discharge
STD	Standard Engine
WK	Woodruff Keyslot
■	This engine is not eligible for return.
8	No. 333290 - 120 Volt Electric Starter can be installed.

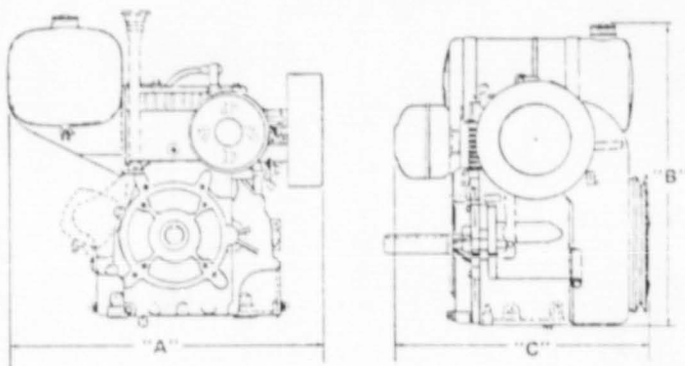
TECUMSEH PRODUCTS COMPANY
Parts Depot Division Grafton, Wisconsin 53024
TEL: 414-377-2700

10 HORSEPOWER (LARGE FRAME) INDUSTRIAL APPLICATION

STANDARD EQUIPMENT & DIMENSIONS

MODEL	HH100 CAST IRON
HORSEPOWER @ 3600 RPM	10.0
BORE & STROKE — INCHES	3-5/16 x 2-3/4
BORE & STROKE — MILLIMETERS	84.14 x 69.85
DISPLACEMENT — CUBIC INCHES	23.70
DISPLACEMENT — CUBIC CENTIMETERS	388.38
LUBRICATION	Splash
GOVERNOR	Mechanical
OIL CAPACITY — OUNCES	52
OIL CAPACITY — MILLILITERS	1540
NET WEIGHT (APPROX.) — POUNDS	84
NET WEIGHT (APPROX.) — KILOGRAMS	38.1
LENGTH "A" (IN INCHES)	18-1/8
HEIGHT "B" (IN INCHES)	17-13/16
WIDTH "C" (IN INCHES)	14-15/16
BOLT MTG. CIRCLE (IN INCHES)	5 & 6-1/2





ENGINE VARIATIONS

CRANKSHAFT

Length of crankshaft is measured from drilled and tapped face on the cover plate to end of shaft.

SERVICE NUMBER	PART NUMBER	DIAMETER	LENGTH	OTHER CRANKSHAFT SPECIFICATIONS	AUXILIARY P.T.O. SHAFT	EXHAUST DIRECTION	FUEL TANK CAPACITY IN QUARTS	PULSE TYPE FUEL PUMP	CARBURETOR	CONTROLS	ROLLER BEARING	STARTER	MAGNETO FEATURE	REGULATOR	AIR CLEANER	OIL FILLER TUBE	OIL DRAIN	BOLT MTG. CIRCLE CAST IRON	SEE NOTES	SEE NOTES	FAST MOVING ENGINES	
SERIES "H100" HORIZONTAL 10.0 H.P.																						
910200	33397	1"	3-1/4"	3/8-24 Tap, 1/4 x 2-7/16Kw		PS	6	PP	FI	R	X	Rope	SS		P		DS	X		STD■ 7		
910210	33411	1"	3-29/64"	1-14 Thread		PS	6		FI	M	X	Rope	SS		P	X	DS	X		STD■		
910211	33397	1"	3-1/4"	3/8-24 Tap, 1/4 x 2-7/16Kw		PS	6	PP	FI	M	X	E	SS20 amp	X	P		DS	X		STD■ 15		✓

NOTES

DS	Dual sides oil drain	P	Paper air cleaner	STD	Standard Engine
E	Electric starter	PP	Provision for pulse type fuel pump	■	This engine is not eligible for return.
FI	Float carburetor	PS	P.T.O. side	7	No. 730133 - 12 Volt Electric Starter can be installed.
Kw	Keyway	R	Remote control		
M	Manual control	SS	Solid State	15	Engine includes 730198 switch panel

TECUMSEH PRODUCTS COMPANY
Parts Depot Division Grafton, Wisconsin 53024
TEL: 414-377-2700

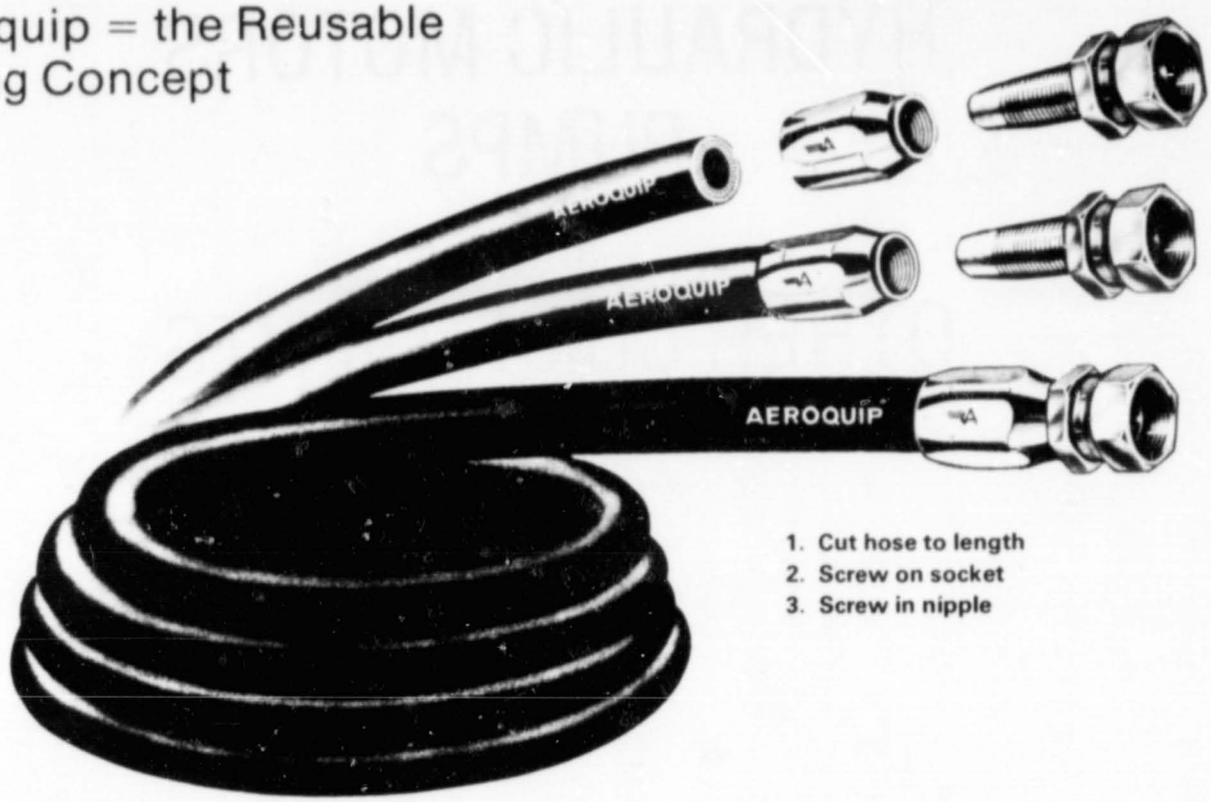
HYDRAULIC MOTORS
PUMPS
and
OTHER COMPONENTS

(CODE **HM**)

Aeroquip

INDUSTRIAL DIVISION
1225 W. Main Street, VAN WERT, OH 45891
Phone: 419-238-1190

Aeroquip = the Reusable Fitting Concept



1. **Cut hose to length**
2. **Screw on socket**
3. **Screw in nipple**

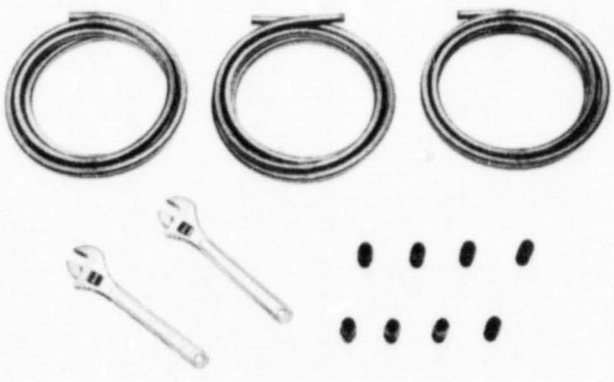
Benefits of Aeroquip Bulk Hose and Reusable Fittings

1. Reduce downtime on equipment when hose line replacement is needed by reusing the fittings with bulk hose.
2. When fitting replacement is necessary a few fittings with bulk hose provide the ability to make any needed hose line.
3. All types of equipment can be serviced with the same small hose and fitting inventory.
4. Hose assemblies can be made on the job using hand tools.
5. Equipment plumbed with reusable fitting hose assemblies carries a built-in fitting inventory when hose must be replaced.

Aeroquip Corporation was founded in 1940 to manufacture and sell a new type of reusable fitting for high pressure hose lines. The idea then, as now, was that a reusable fitting would reduce the cost of replacement hose lines and through its field assembly capability, reduce equipment downtime when a hydraulic hose line needed replacement.

The origination of the reusable hose fitting concept was particularly timely as the nation was about to become involved in a war in which keeping our aircraft operational was vitally important. It was practically impossible to stock the many lengths and types of made up hose lines world wide. To ground a plane for a failed hose line while a replacement factory assembled line was shipped from "the States" was unthinkable. Today it is equally unthinkable to stop a production line or deadline an expensive piece of construction equipment while a hose line is shipped from the factory.

Even though, over the years, the Aeroquip product line has been expanded to include factory crimped and field crimped hose lines, the Aeroquip Reusable Fitting remains the best insurance against downtime due to fluid line failures on expensive equipment. And, while sophisticated equipment is available for high volume hose and fitting assembly operations, you can still put Aeroquip fittings and hose together with a few simple hand tools.



Aeroquip
INDUSTRIAL DIVISION
1225 W. Main Street, VAN WERT, OH 45891
Phone: 419-238-1190

A Q P™

The evolution of the scientifically superior hose

Working together over a seven year period, a team of Aeroquip chemists developed and discarded over a thousand rubber materials before discovering the material used in Aeroquip AQP Hose. In their search they had a single goal—to develop the finest possible hose for industrial applications—the ultimate product possible with currently available fabrication techniques, at a competitive cost.

The impressive results of these efforts are shown below in terms of superior operating characteristics.

Aeroquip FC194 AQP Hose (exceeds SAE100R1)

FC194 AQP Hose is designed for the medium pressure range of hydraulic applications as set forth in the SAE100R1 specifications. In these applications, comparative testing proves it to be superior to standard SAE100R1 hoses. FC194 AQP Hose has withstood 1,000,000 impulse cycles at continuous +300°F. fluid test temperature and SAE100R1 impulse pressures. (The SAE100R1 standard requires only 150,000 cycles at +200°F. fluid temperature.)



Aeroquip FC195 Blue AQP Hose (exceeds SAE100R2)

FC195 AQP Hose has withstood a minimum of 1,000,000 impulse cycles at continuous +300°F. fluid temperature, at standard SAE100R2 test pressures in all sizes.

Here it should be stressed that while certain other SAE100R2A hose constructions, under the same test conditions, will sometimes approach 1,000,000 cycles the tubes of these hoses by then, have hardened into a brittle, nonelastomeric material. Flexing of the hose will produce cracks in the tubes. The FC195 AQP inner tube after 1,000,000 impulse cycles at +300°F. only gains a few points in Durometer hardness, and still retains its elastomeric quality.



Aeroquip FC300 Blue AQP Hose (exceeds SAE100R5)

FC300 AQP Hose far excceds the impulse test requirements of SAE100R5, having withstood over 1,000,000 impulse cycles at a continuous +300°F. fluid temperature. It outlasted standard SAE100R5 hoses under the same impulse test conditions by factors of from 10 to 1 up to 40 to 1, depending on size. (The SAE100R5 specification only requires 150,000 cycles at +200°F.)

Under long-term test conditions of +300°F. circulating engine-oil, combined with flexing and high ambient temperatures, FC300 AQP Hose outlasted competitive SAE100R5 and SAEJ1402 constructions by a minimum of two to one, and in some cases as high as five to one.



Aeroquip FC350 AQP Hose (meets DOT FMVSS 106)

Aeroquip FC350 AQP Hose incorporates a tube made from the AQP compound, and includes a new textile inner braid and cover which are much more heat and abrasion resistant than the conventional cotton inner braid and covers used in most truck hoses. It has a single wire braid reinforcement.

Laboratory tests such as circulation-flex, abrasion and +300°F. aging show that FC350 AQP hose can last up to five times longer than other conventional hoses.

AQP hoses withstand long exposure to fluids, including lubricating oils and fuels.



Aeroquip 2661 Blue AQP Hose (exceeds SAE100R4)

2661 AQP Hose has been extensively field tested in chemical plants and tank truck applications to assure its flexibility, good strength, abrasion and weather resistance, and excellent fluid compatibility. The tube has proved resistant to most chemicals, concentrated acids, solvents, petroleum products, as well as petroleum based and fire resistant hydraulic fluids, many of which could break down common rubber compounds. It also has proved ideal for SAE100R4 hydraulic return line applications handling most types of hydraulic fluid.



Aeroquip

Aeroquip

QUICK DISCONNECT COUPLINGS

Aeroquip

INDUSTRIAL DIVISION
1225 W. Main Street, VAN WERT, OH 45891
Phone: 419-238-1190

Leadership in fluid system components



Design

Research and development have always been, and continue to be, important activities at Aeroquip. Aeroquip has pioneered with precharging couplings for refrigerant applications, automatic fueling couplings, connect under pressure couplings for farm equipment applications and high pressure couplings for severe water blasting applications. Many other developments and product variations result in the most complete line of fluid connections for the largest variety of fluids and applications offered by any manufacturer.

Aeroquip

For more than thirty years Aeroquip has been the leading supplier of flexible hose lines and quick disconnect couplings to industry and the military. Hose lines with Aeroquip quick disconnect couplings were an Air Force standard in World War II for aircraft brake applications which needed frequent takedown and service. This advantage plus proven reliability soon made Aeroquip quick disconnect couplings the industrial leader.

Aeroquip

INDUSTRIAL DIVISION
1225 W. Main Street, VAN WERT, OH 45891
Phone: 419-238-1190



BUNDY CORPORATION
NORTH AMERICAN TUBING OPERATIONS
12345 E. 9 MILE ROAD
WARREN, MICHIGAN 48090
(313) 758-4511
(800) 521-5614

Product Features

Bundy Electricweld is economically priced single wall, low carbon steel tubing with high burst strength, close tolerance gaging and smooth surfaces.

This high quality tubing is manufactured by continuously forming a single strip of low carbon steel into a tubular shape with butted edges which are then resistance welded. The internal bead is held to a minimum and all external flash is removed. All tubing shipped in coils is pressure tested to assure leak free quality.

Depending on your needs, Electricweld is offered in as-welded, cold-drawn, or annealed forms. Typical surface treatments include terne-coating (nominal 85% lead/15% tin) and super terne-coating (a heavier application of the protective alloy) for automotive applications and copper-flash coating for refrigerator uses.

Electricweld offers excellent formability characteristics. This allows the fabrication of uniformly accurate parts to fit almost any design requirements.

The tubing can be swaged, notched, punched, expanded, compressed, flattened, cut, formed and rolled into almost any form necessary for your application.

Diameter, Length and Tolerances

Electricweld is available in straight lengths, limited only by shipping restrictions. In O.D. sizes up to 3/8 - in., it can be ordered in bulk coils up to 10,000 feet for convenient handling. Custom cut lengths and special packaging may also be specified to suit your needs.

Bundy offers Electricweld in 44 standard combinations of outside diameter sizes and wall thicknesses all held to close tolerance limits.

TOLERANCES - Standard Sizes

Outside Diameter

3/16-in. through 3/8-in.
. . . ± .003-in.
7/16-in. through 5/8-in.
. . . ± .004-in.
3/4-in. through 1-3/8-in.
. . . ± .005 in.

Wall Thickness

all sizes + .002, ± .0035-in.

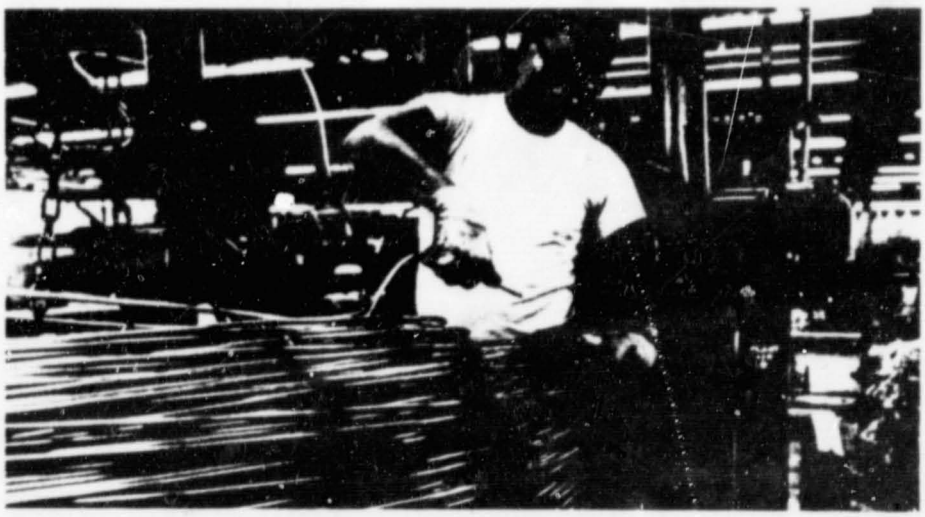
Special Sizes

Some applications require specially sized Electricweld tubing. The benefits available from standard products may be obtained by either sinking or pin-drawing standard tubes to your specifications.

Sinking is generally used when the outside diameter of the tubing must be reduced. The process is accomplished by drawing the tube through a die. The approximate wall thickness of the original tube is maintained yet the O.D. is reduced to the new dimension and can be held to as close as ± .001 - in.

When both the inside and outside diameters of the tubing are critical, the tubing can be pin-drawn. In this case, standard tubing is pulled through a die and over a pin while sizing the outside and inside diameters. The standard tolerance for both the outside and inside diameters of pin-drawn tubing is ± .002 - in. Special sizes can be held to a ± .001 - in. tolerance for both dimensions, if required.

5,000 feet long Electricweld coils are carefully pressure tested to assure quality.



Bundy Electricweld
Dimensions and Specifications

O.D. INCH	mm	THICKNESS INCH	mm	BWG	APROX. I.D. INCH	CALCULATED NOMINAL VALUES* ULTIMATE BURST STRENGTH, PSI	NOMINAL LB./FT.	NOMINAL FT./LB.
3/16	4.763	.028	.71	22	.131	13,400	.047	21.2
1/4	6.350	.022	.56	24	.206	7,920	.055	18.3
		.028	.71	22	.194	10,100	.063	15.8
		.035	.89	20	.180	12,600	.079	12.7
5/16	7.938	.022	.56	24	.268	6,340	.068	14.8
		.028	.71	22	.256	8,070	.080	12.5
		.035	.88	20	.242	10,100	.102	9.8
3/8	9.525	.028	.56	22	.319	6,720	.100	10.0
		.035	.89	20	.305	8,400	.125	8.0
		.042	1.06	19	.291	10,100	.147	6.8
25/64	10.117	.042	1.06	19	.306	9,670	.156	6.4
7/16	11.113	.030	.76	-----	.377	6,170	.133	7.5
		.035	.89	20	.368	7,200	.149	6.7
		.049	1.24	18	.339	10,100	.196	5.1
1/2	12.700	.020	.50	25	.460	3,600	.112	8.9
		.028	.71	22	.444	5,040	.139	7.2
		.035	.89	20	.430	6,300	.172	5.8
		.042	1.06	19	.416	7,560	.204	4.9
		.049	1.24	18	.402	8,820	.227	4.4
		.060	1.52	-----	.380	10,800	.278	3.6
		.075	1.90	-----	.350	13,500	.333	3.0
9/16	14.288	.028	.71	22	.506	4,480	.149	6.7
		.035	.89	20	.492	5,600	.200	5.0
		.042	1.06	19	.478	6,720	.233	4.3
5/8	15.875	.035	.89	20	.555	5,040	.217	4.6
		.042	1.06	19	.541	6,050	.263	3.8
		.049	1.24	18	.527	7,050	.303	3.3
		.060	1.52	-----	.505	8,640	.362	2.76
11/16	17.460	.035	.889	20	.618	4,580	.244	4.1
3/4	19.050	.028	.71	22	.694	3,360	.200	5.0
		.035	.89	20	.680	4,200	.270	3.7
		.049	1.24	18	.652	5,880	.370	2.7
		.0625	1.59	-----	.625	7,500	.500	2.0
7/8	22.225	.049	1.24	18	.777	5,040	.431	2.32
1	25.4	.035	.89	20	.930	3,150	.360	2.78
		.049	1.24	18	.902	4,400	.498	2.01
		.060	1.52	-----	.880	5,400	.602	1.66
1 1/8	28.575	.035	.89	20	1.055	2,800	.407	2.46
		.049	1.24	18	1.027	3,920	.565	1.77
		.060	1.52	-----	1.005	4,800	.680	1.47
1 1/4	31.750	.035	.89	20	1.180	2,520	.452	2.21
		.049	1.24	18	1.152	3,530	.629	1.59
		.060	1.52	-----	1.130	4,320	.763	1.31
1 3/8	34.925	.049	1.24	18	1.277	3,200	.694	1.44
		.060	1.52	-----	1.255	3,927	.840	1.19

*Calculations made using Barlow's formula: $P = \frac{2St}{d}$

P = internal pressure in psi

S = allowable fiber stress of 45,000 psi

t = wall thickness in inches

d = outside diameter in inches

BUNDY CORPORATION
NORTH AMERICAN TUBING OPERATIONS
12345 E. 9 MILE ROAD
WARREN, MICHIGAN 48090
(313) 758-4511
(800) 521-5614

Fringe Benefits For You

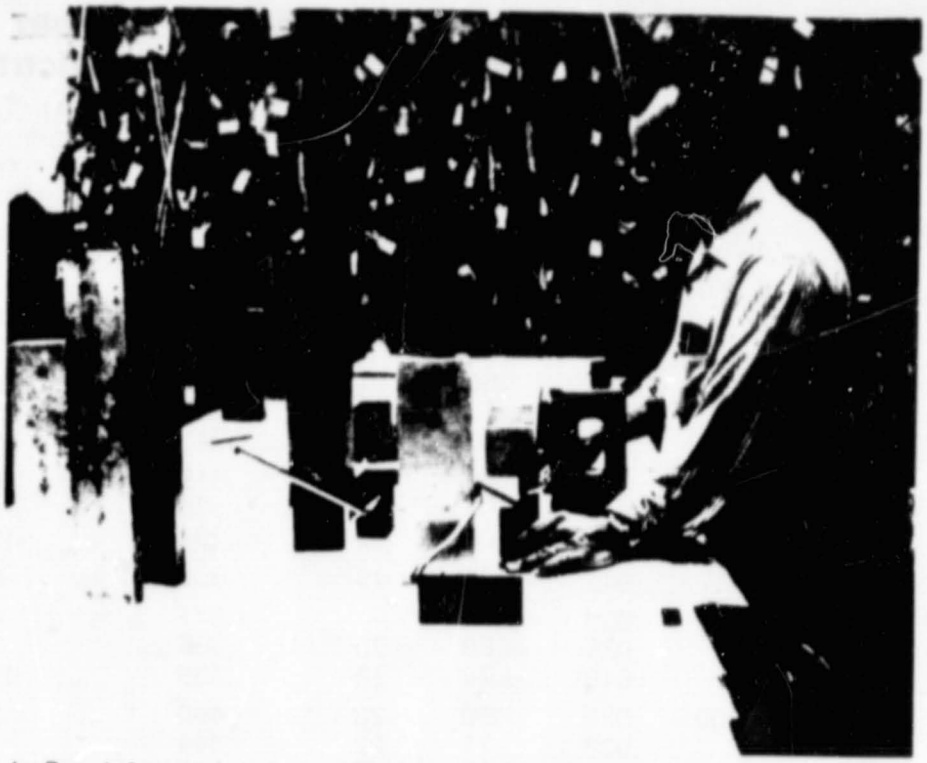
Bundy is the world's largest producer and fabricator of small diameter steel tubing. For over 50 years, the company's engineers, technicians and service personnel have helped meet thousands of application requirements for customers all over the globe. Much of this technical information is available for use to uncover practical, economical solutions to problems confronting Bundy's customers.

You are invited to tap this information. It's available at no cost yet its value may be a major factor in parts, material and production cost savings. You can discuss your tubing specifications and your product design requirements with skilled specialists. Bundy experts can examine your needs and help guide you in the selection of tubing materials which offer the most economical cost performance benefits.

For especially tough problems, customers may have access to other Bundy resources as needed... such as the fully equipped "sample room" used to produce prototypes.

Bundy Tubing products can be used to achieve economical, flexible and dependable results in your products. Have a tubing specialist call on you with a full presentation of the Bundy story. Your time will be well spent.

Contact your nearest Bundy Tubing Distributor or call us direct.
800-521-5651



In Bundy's sample room, skilled technicians hand bend prototype parts prior to mass production fabrication.

Electricweld Applications

Bundy's welded tubing is an accepted standard in the appliance and refrigeration industries. In addition to surpassing internal cleanliness requirements of less than .0035 - grams per square foot on internal surfaces, Bundy's Electricweld's easy formability and strong seams make it a natural for evaporator and condenser coils.

Bundy Electricweld is an economical answer to the problem of transporting liquid or gas. Its light weight and high strength are a plus factor for a wide range of mechanical applications. Countless filler tubes, tubular stress members, pushrods, and housings have been fabricated from this durable tubing.

Other typical uses include condensers and precoolers for refrigerators, evaporators and condensers for freezers, tubular lengths for heating elements, tubular parts for compressors, commercial burner tubes for gas appliances, automotive gas lines, dip sticks, oil lines plus a host of other industrial applications.

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Nobody knows more about small diameter steel tube fabrication than Bundy. We operate the world's largest fabricating facilities where hundreds of thousands of parts like these are produced for customers in every segment of industry.

Bundy's tubing fabrication services are a natural progression from the company's leading manufacturing position. This technology, developed through years of experience, is available to help you meet a multitude of application requirements.

Bundy's expertise in fabrication is well-earned. The company manufactures millions of parts each month for the automotive industry according to specifications.

The company specializes in high-volume, high-speed production of intricately fabricated tubing parts. Bundy operates a number of unique, electronically controlled machines which have been built to provide these capabilities. If your product design calls for this kind of special handling, there is no one better equipped to meet your demands than Bundy.

Depending on your needs, Bundy technical service personnel can assist you with engineering guidance for your own fabrication in the production of final tubular parts, complete with fittings, flares, serpentine bends or other custom designs.

Regardless of your fabrication requirements, Bundy can help you.

BUNDY CORPORATION
NORTH AMERICAN TUBING OPERATIONS
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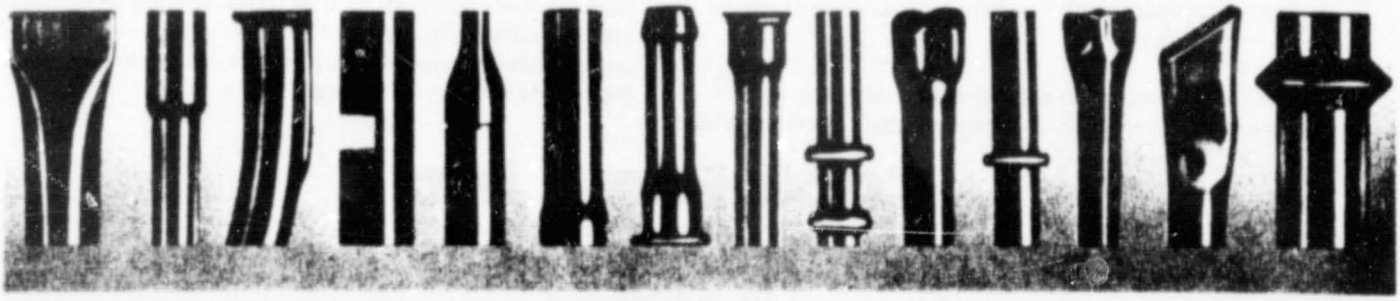
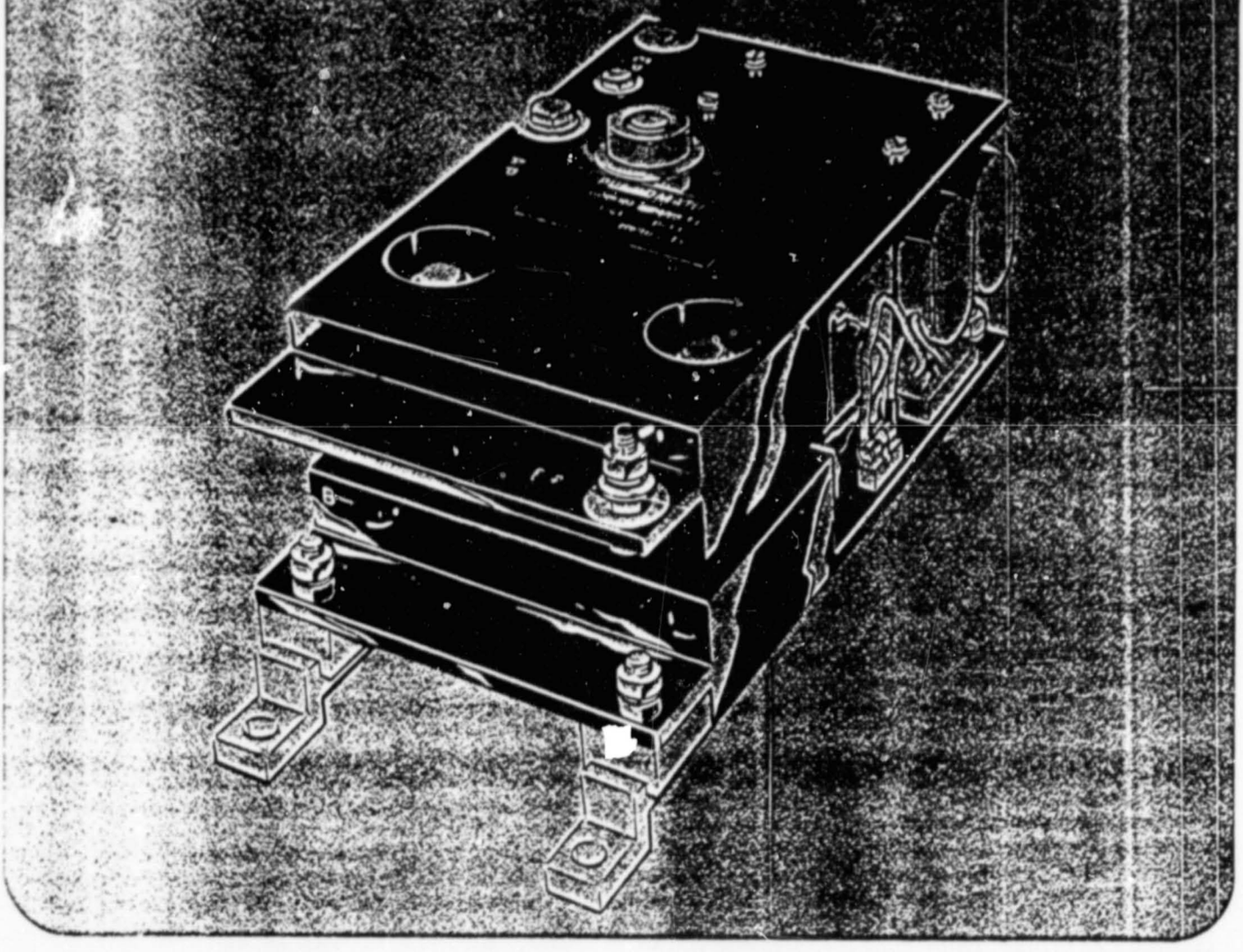
A variety of fittings, flares, conical upsets and other custom end treatments can be applied to Bundy tubing products.



ORIGINAL PAGE IS
OF POOR QUALITY

4300 series
Pump Controllers

cableform



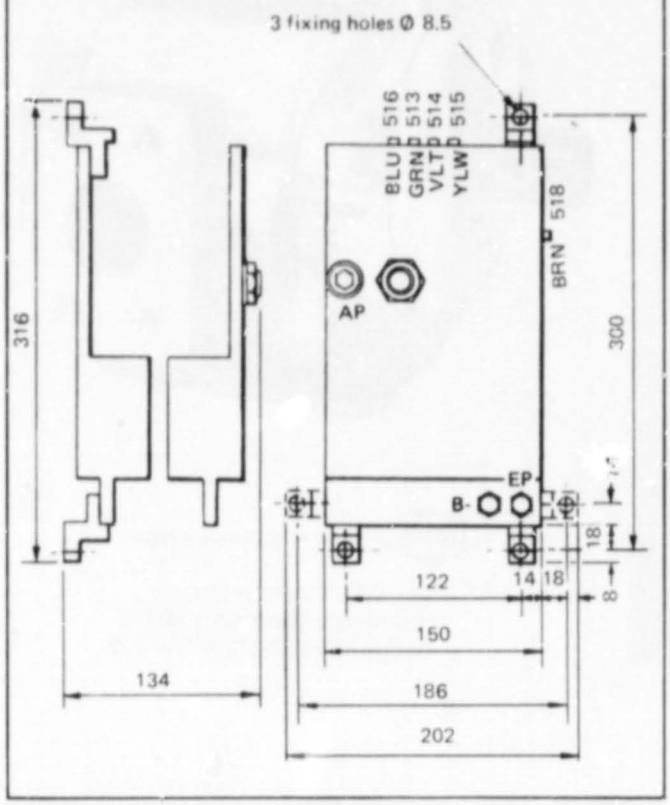
Hydraulic systems are big energy gobblers particularly on reach trucks and narrow-aisle stackers where hydraulics consume up to 90% of battery energy.

Cableform 4300 Series pump controllers are designed to convert the battery voltage to a voltage compatible with the load demand on the hydraulic pump motor. This ensures that the pump delivers optimum oil flow independently of load and state of battery. This form of control leads to most efficient use of battery charge, notably on fork lift trucks fitted with high masts and fast lift speeds.

Cableform Inc.

ZION CROSS ROADS
TROY,Va 22974
Tel: (804) 589-8224

INSTALLATION



SPECIFICATION

Environmental
Temperature – 40°C to +50°C at 95% RH
Fully Tropicalised.

Operational –
Maximum motor current 600 amps.
Voltage Range – 24V to 140V.

APPLICATION

The Controller carries all the components required to control the voltage applied to the Hydraulic Pump Motor. Control may be either continuous by Potentiometer or in discreet steps by switching of fixed resistors.

CONSTRUCTION

The advanced circuit design is aimed at high reliability. The minimum number of components of the best quality available have been used. Semi-conductors are all silicon devices, Resistors are high stability metal oxide. Capacitors are tantalum or polycarbonate film.

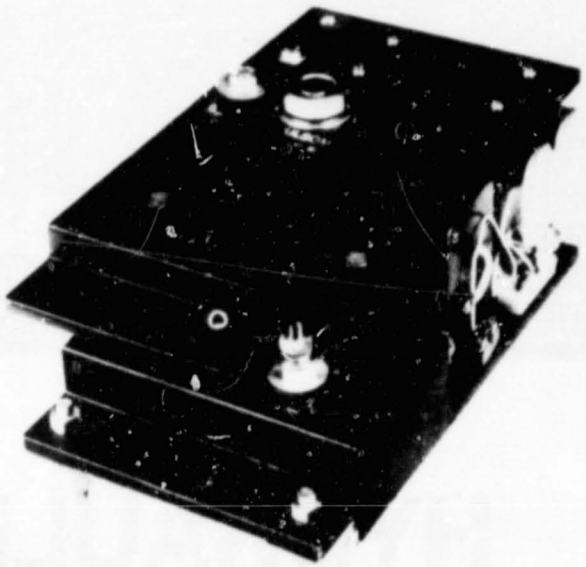
ELECTRONIC PUMP CONTROLLER

An Electronic Pump Controller is a desirable addition to the Electric Vehicle in the role of energy-saver.

* Allows Pump to deliver optimum oil flow for varying functions.

* Extends Battery life.

The oil supply is maintained at the controlled optimum required by different functions. Thus, power losses, incurred by returning excess oil to the reservoir are minimised.



ORDER WRITING INFORMATION

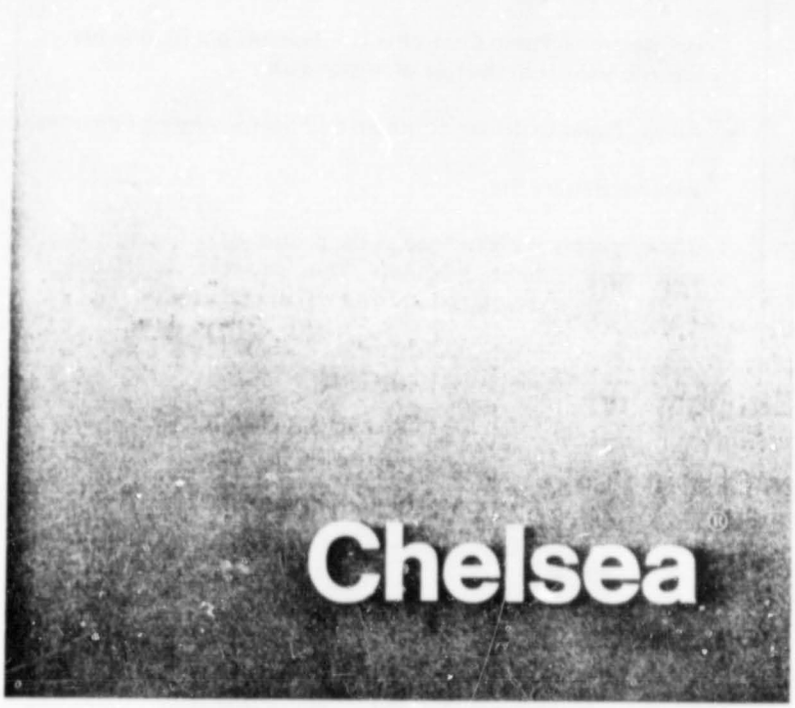
Please specify:- Nominal Battery Voltage

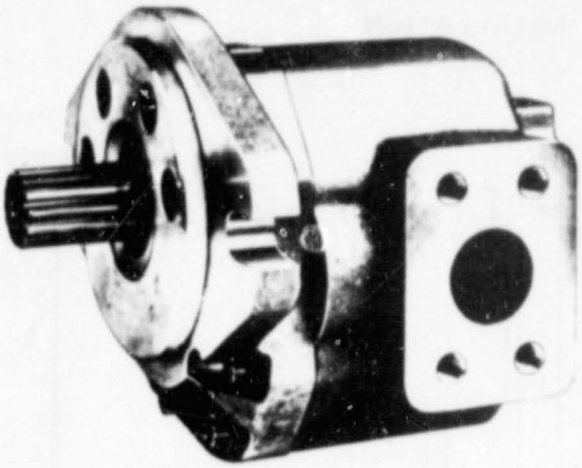
Model Number 4321 (24V)
Model Number 4322 (36 - 80V)
Model Number 4323 (84 - 140V)

For control by discreet steps, the values of the fixed resistors (R2, R3 and R4) differ for each application. Please contact our representative.

Cableform policy is one of continuous development. New and improved designs are regularly added to our range. The information on this leaflet may not include our latest product. Your enquiries are invited.

Cableform Inc.
ZION CROSS ROADS
TROY, Va 22974
Tel: (804) 589-8224

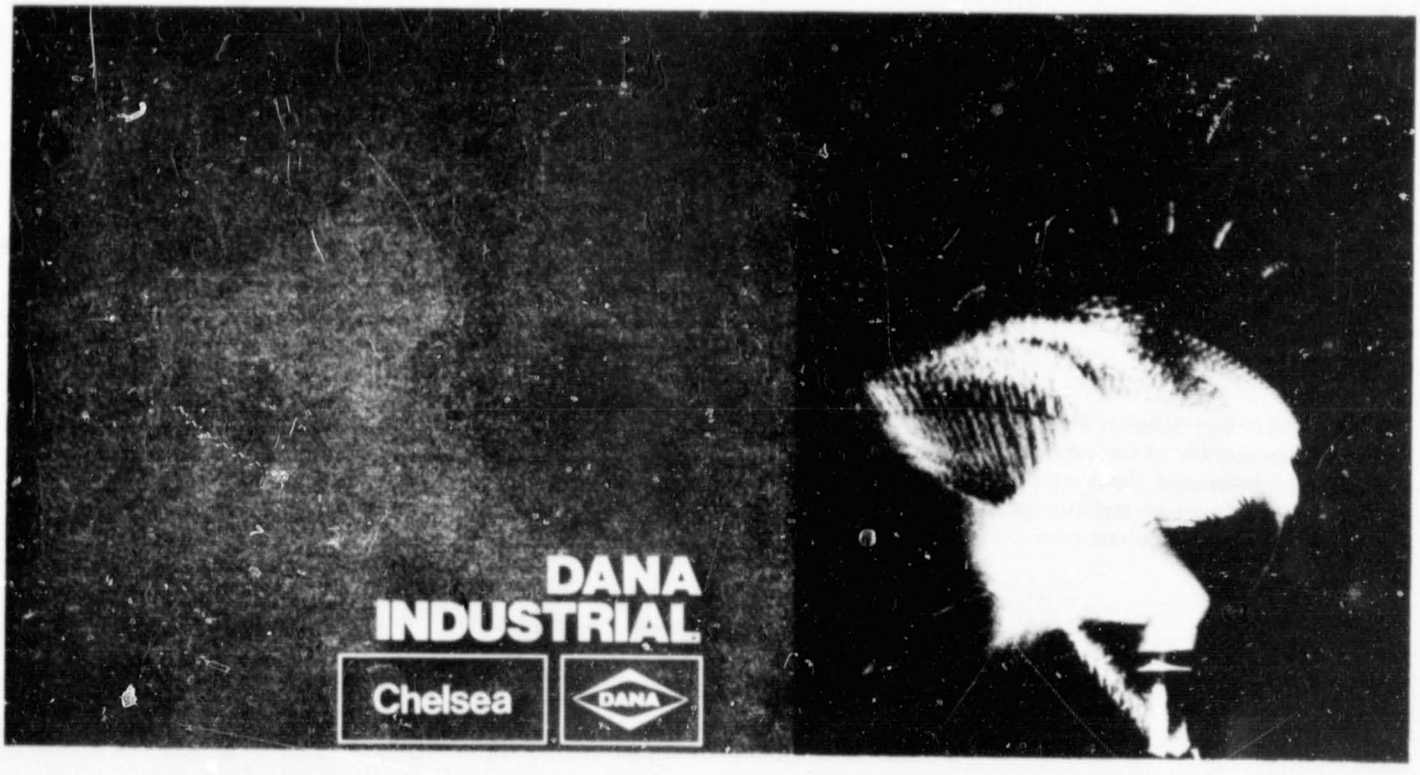




DANA DANA CORPORATION

411 Will Carlton Road
Hillsdale, Michigan 49242
Telephone: (517) 437-4493

HYDRAULIC PUMPS



Chelsea

1438 Series Hydraulic Pump

Features

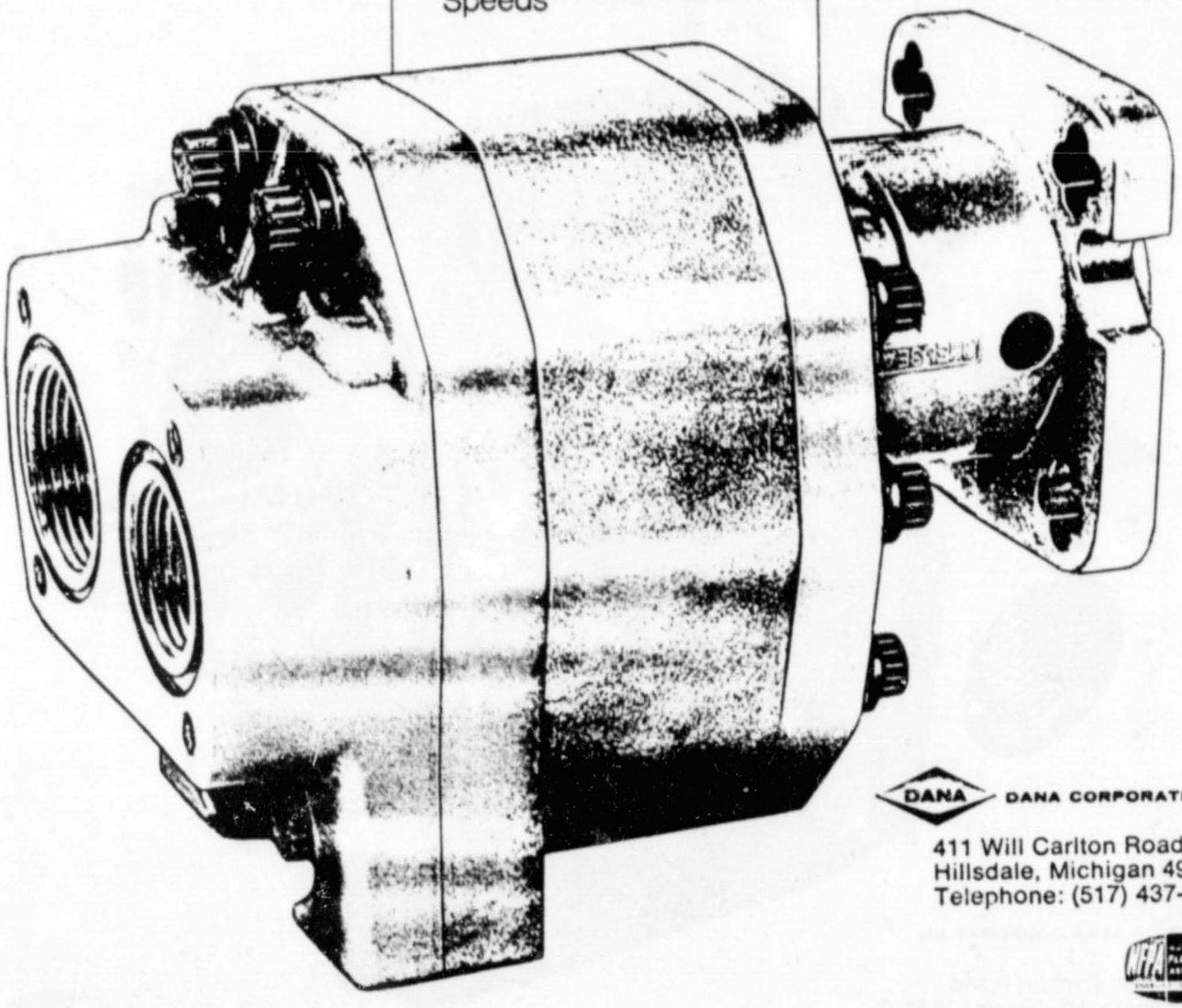
- 7, 10, 12, 15 and 17 GPM Models Available
- Three-Piece Aluminum Construction
- Pressure Balanced Bi-Metal Wear Plates
- One-Piece Hardened Steel Gear and Shaft Assemblies
- Double Lip Shaft Seals
- Oversize, High Load Capacity Bushings

Benefits

- Capable of Continuous Operation
- Lightweight, Dowled to Assure Proper Alignment
- Maintains Pump Efficiency at All Operating Pressures
- Better Strength and Serviceability
- Reduces Risk of Pump Contamination Through Shaft Seal
- Maintains Shaft Integrity at Maximum Operating Speeds

Applications

- Built for On and Off-Highway Use
- Aerial Equipment
- Backhoes
- Blowers
- Dump Trucks
- Goose Neck Trailers
- Loaders
- Refuse Collectors
- Scrapers
- Snow Plows
- Spreaders



DANA DANA CORPORATION

411 Will Carlton Road
Hillsdale, Michigan 49242
Telephone: (517) 437-4493

Chelsea

1437 Series Hydraulic Pump

Features

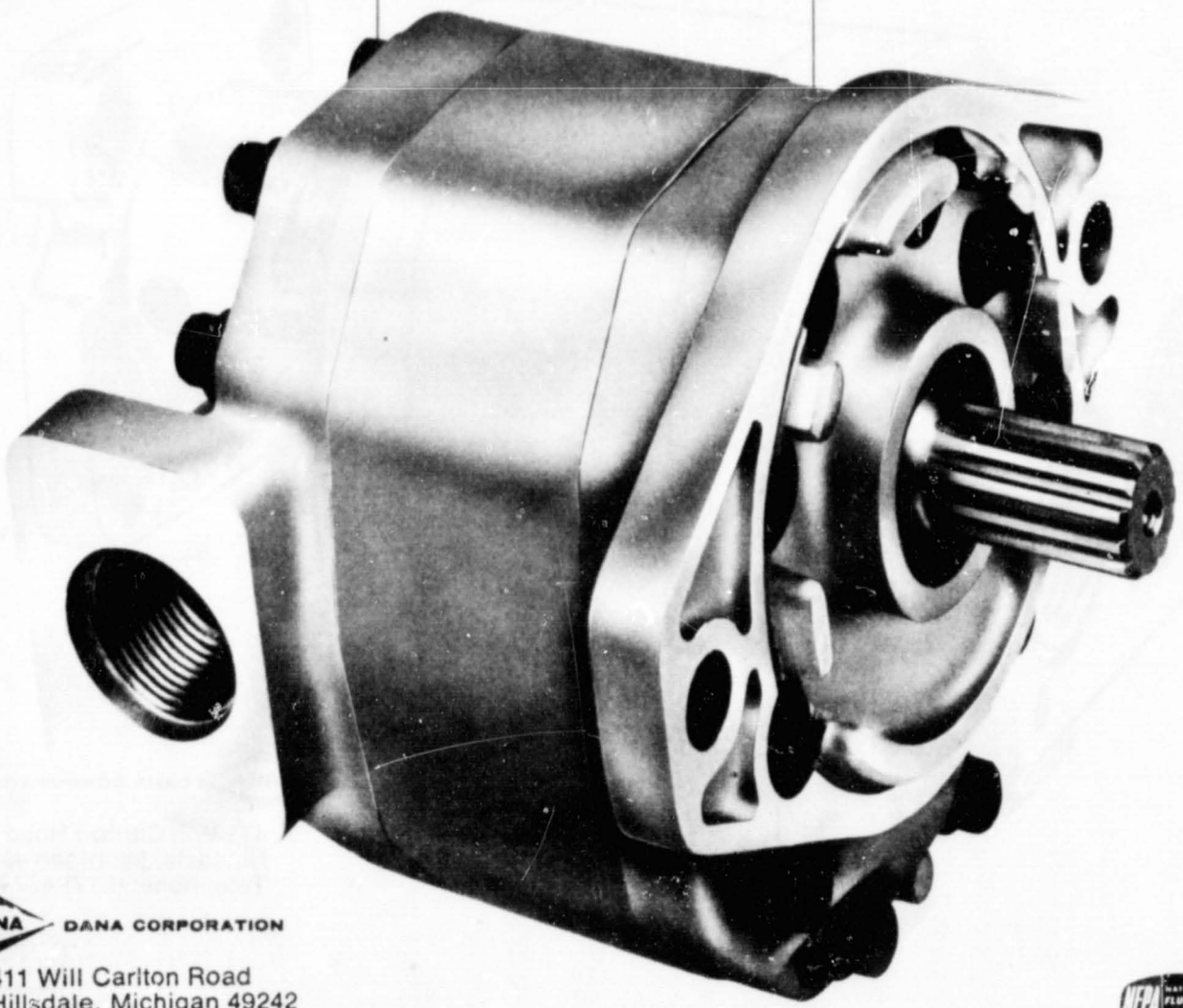
- 7, 10, 12, 15 and 17 GPM Models Available
- Three-Piece Aluminum Construction
- Pressure Balanced Bi-Metal Wear Plates
- One-Piece Hardened Steel Gear and Shaft Assemblies
- Double Lip Shaft Seals
- Oversize, High Load Capacity Bushings

Benefits

- Capable of Continuous Operation
- Lightweight, Dowled to Assure Proper Alignment
- Maintains Pump Efficiency at All Operating Pressures
- Better Strength and Serviceability
- Reduces Risk of Pump Contamination Through Shaft Seal
- Maintains Shaft Integrity at Maximum Operating Speeds

Applications

- Built for On and Off-Highway Use
- Aerial Equipment
- Backhoes
- Blowers
- Dump Trucks
- Goose Neck Trailers
- Loaders
- Refuse Collectors
- Scrapers
- Snow Plows
- Spreaders



DANA CORPORATION

411 Will Carlton Road
Hillsdale, Michigan 49242
Telephone: (517) 437-4493

Chelsea

M2400 Series
Bi-Directional Hydraulic Motor

Features

- Bi-Directional Rotation
- 7, 10, 12, 15 and 17 GPM Models Available
- Three-Piece Aluminum Construction
- Pressure Balanced Bi-Metal Wear Plates
- One-Piece Hardened Steel Gear and Shaft Assemblies
- Double Lip Shaft Seals
- Oversize, High Load Capacity Bushings

Benefits

- Reduces Stocking Inventory
- Capable of Continuous Operation
- Lightweight, Dowled to Assure Proper Alignment
- Maintains Maximum Efficiency at All Operating Pressures
- Better Strength, and Serviceability
- Reduces Risk of Motor Contamination Through Shaft Seal
- Maintains Shaft Integrity at Maximum Operating Speeds

Applications

- Spreaders
- Spinners
- Winches
- Augers
- Fans
- Rotators
- Indexing
- Blowers

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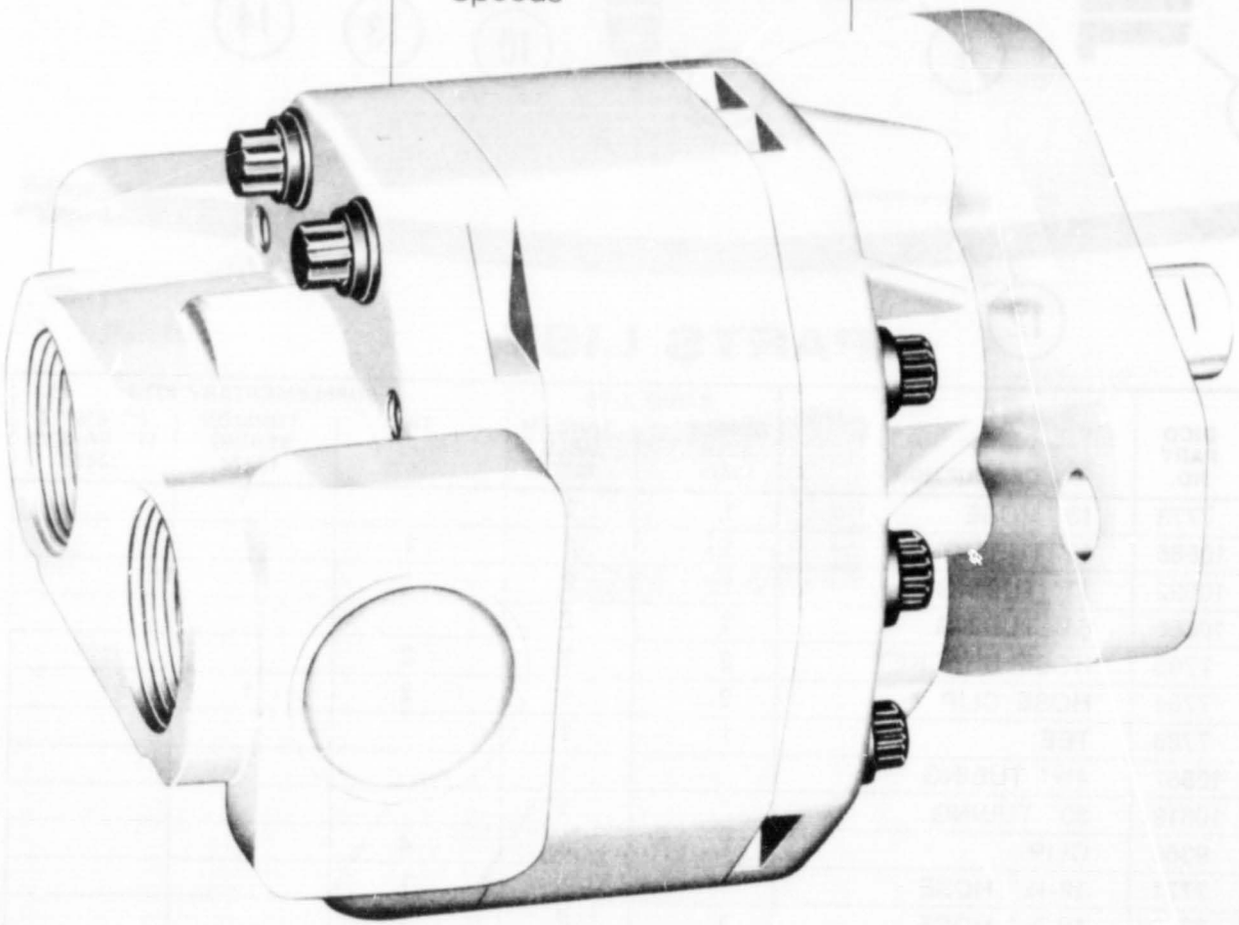
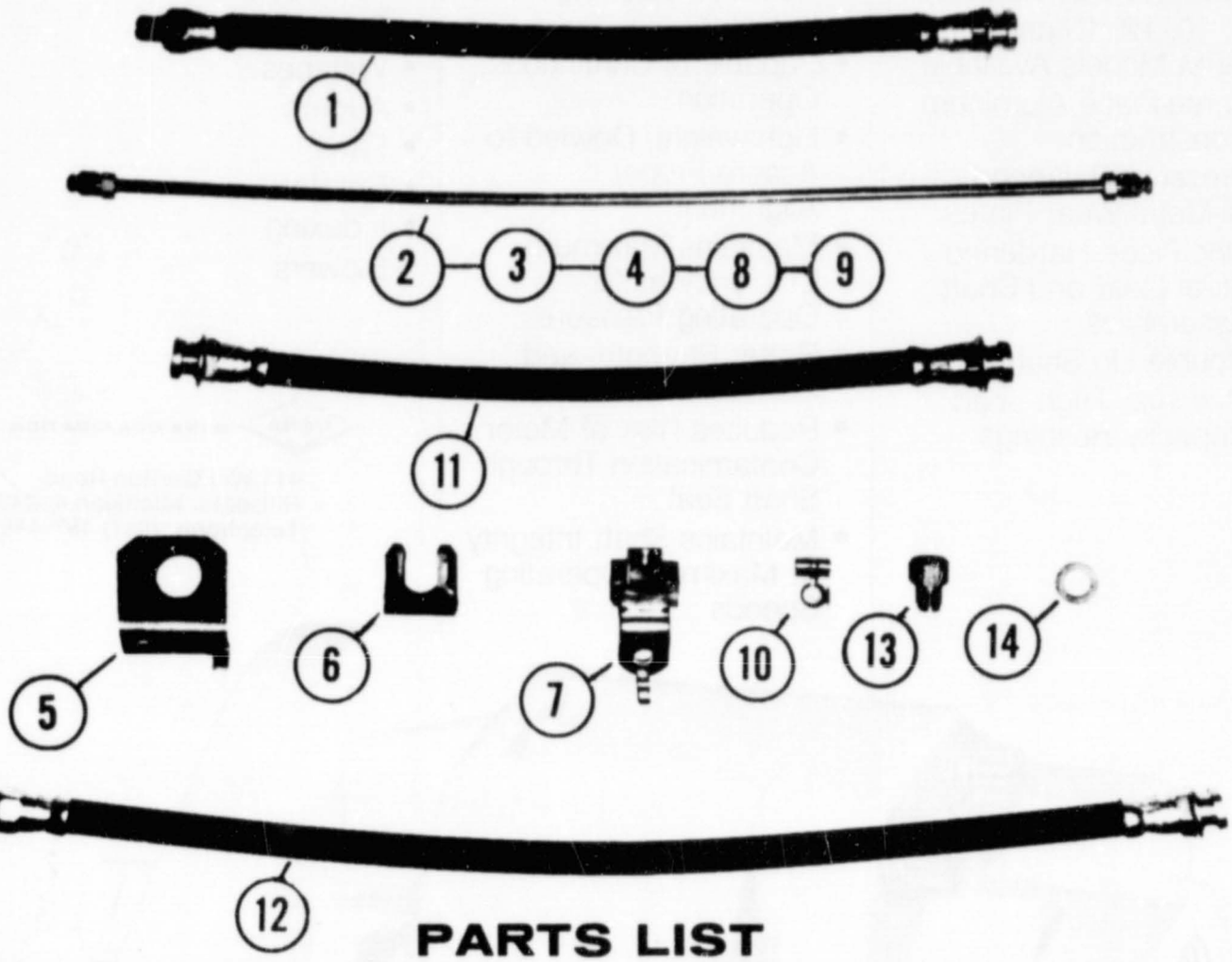
411 Will Carlton Road
Hillsdale, Michigan 49242
Telephone: (517) 437-4493



DICO

Dico Company, Inc.
A Subsidiary of Dyneer Corporation
200 S.W. 16th Street
P.O. Box 1344
Des Moines, IA 50305
515/244-7286

Hydraulic Fitting & Tubing Kits



PARTS LIST

KEY	DICO PART NO.	DESCRIPTION	BASIC KITS		SUPPLEMENTARY KITS		
			SINGLE AXLE 10871	TANDEM AXLE 10872	TILT FRAME 10873	TORSION SPRING 10874	7", 8½" & 11" BRAKES 10875
1	7773	13" HOSE	1	1			
2	10865	15' TUBING	1	1	1		
3	10622	17" TUBING	1	2			
4	10866	66" TUBING	1	2			
5	7763	HOSE BRACKET	2	3	2	1	
6	7764	HOSE CLIP	2	3	2	1	
7	7785	TEE	1	3			
8	10867	4½" TUBING		1			
9	10619	30" TUBING		1			
10	9366	CLIP	4	8	4		
11	7771	12-⅛" HOSE			1		
12	7765	18-⅞" HOSE	1	2	1		
13	7762	CONNECTOR					2
14	7761	GASKET					2

Fluid Controls, Inc.

8341 TYLER BLVD.
MENTOR, OH 44060
Phone 216-255-9711



manufacturing

Fluid Controls' Corporate Headquarters and Controls Division are situated on 16 acres in Mentor, Ohio's Industrial Park. Here we design, manufacture and market hydraulic controls, engineered for equipment requiring "state-of-the-art" quality and technology.

Our Hynautic Division, located in Osprey, Florida, manufactures marine hydraulics for the commercial and pleasure boat industry. This includes steering systems and engine and transmission controls.

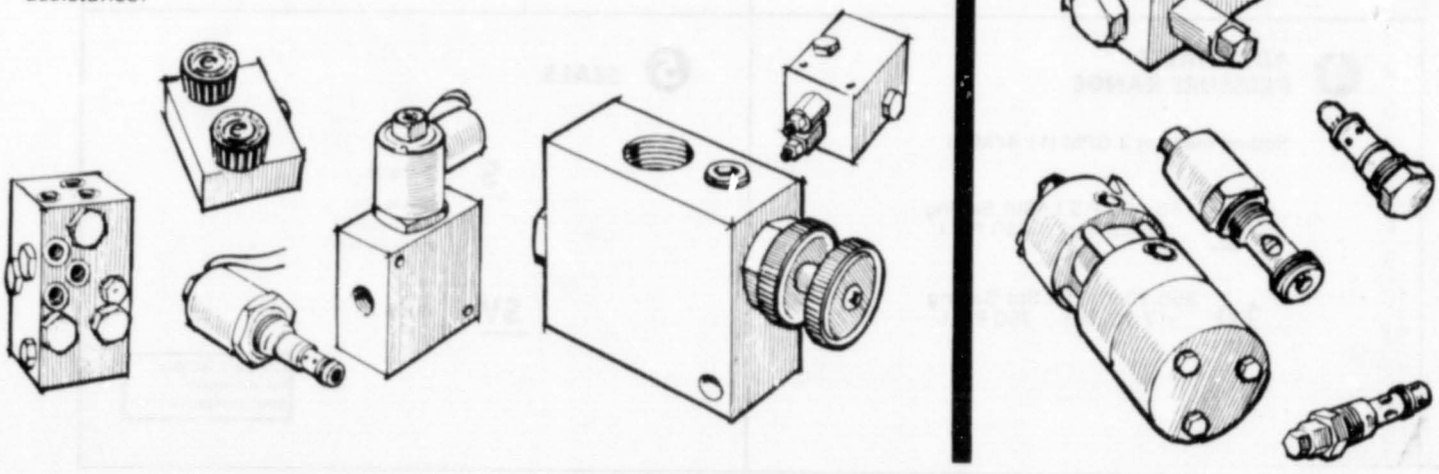
EMCON, our newest Division, located in South Carolina, manufactures electro-mechanical controls including our solenoid directional valves and cartridges, and the Hydra Tach product line.

products to fill customer's needs

Fluid Controls has over 3500 hydraulic components to offer the industry, pressure controls, flow controls, motion controls, directional controls and hydraulic integrated circuitry. The valve bodies are constructed of high strength aluminum. This provides strength with minimum weight. The internal parts are of steel for long dependable life. The sleeves and spools, poppets and pistons, and other working parts are hardened, ground and polished or honed, for highly accurate performance and reliability. Our cartridge construction models allow easy field maintenance and economical use in a customer's own manifold. Quality control is assured throughout production, and all products are functionally tested before shipment to customers.

Many times a catalog or standard valve is not exactly what is required. The use of aluminum bar stock, our cartridge construction, and a vast selection of proven components, gives us the flexibility and speed in modifying our standard products to suit a customer's specific needs. Our specialty "Hydraulic Integrated Circuits" is a combining of two or more hydraulic functions into one single valve body, for simplification of hydraulic circuits. This greatly reduces components costs, plumbing costs, installation time, and results in a more efficient circuit.

If you have a particular problem, a different circuit requirement, or need help with an application, call your local distributor or Fluid Controls direct for assistance.



RELIEF VALVES

DIRECT ACTING
GUIDED POPPET STYLE
FOR OIL - TO 25 G.P.M. (95 L/MIN), 1000 P.S.I. (70 bar)

Fluid Controls, Inc.

8341 TYLER BLVD.
MENTOR, OH 44060
Phone 216-255-9711

PART NUMBER EXAMPLE:

1D41- P 3 -10 S

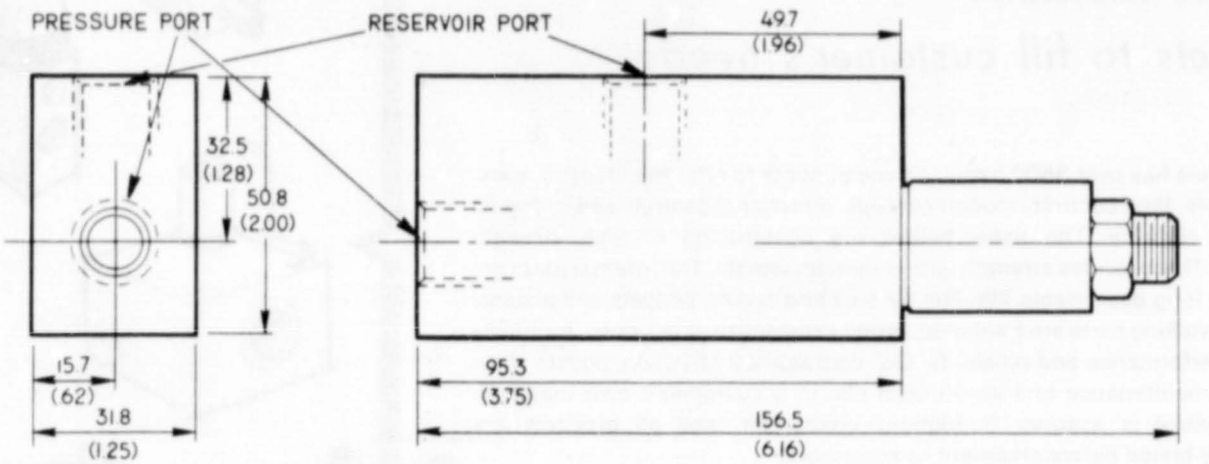
❶ ❷ ❸ ❹ ❺

Setting made at
3 GPM (11.4/MIN)

Where measurements are critical - request certified drawings.

❶ 1D41

WEIGHT – 1 LB. 2 OZ. (.51 Kg)



❷ ADJUST MEANS

P Leakproof Screw Adjustment

R Handknob Adjustment

❸ PORT SIZE

3	3/8" NPTF	**6T**	3/8" SAE	**3W**	3/8" BSPPL
4	1/2" NPTF	**8T**	1/2" SAE	**4W**	1/2" BSPPL
6	3/4" NPTF			**6W**	3/4" BSPPL

❹ ADJUSTABLE PRESSURE RANGE

Setting made at 3 GPM (11.4/MIN)

4	50-400 P.S.I. (35-28 bar)	Std. Setting 250 P.S.I.
10	250-1000 P.S.I. (17-70 bar)	Std. Setting 750 P.S.I.

❺ SEALS

S Buna N
For use with most Industrial Hydraulic Oils

SV Viton A

Consult factory for absolute seal compatibility.

RELIEF VALVES

DIRECT ACTING
GUIDED POPPET STYLE
FOR OIL - TO 25 G.P.M. (95 L/MIN), 1000 P.S.I. (70 bar)

Fluid Controls, Inc.

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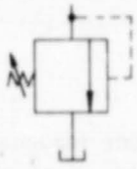
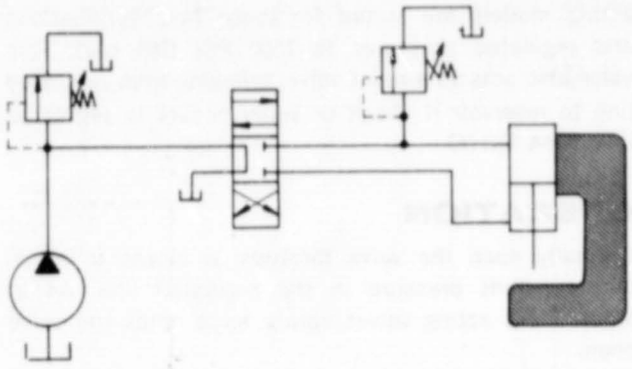


USE

The 1D41 series is best suited for continuous duty application where stable performance, fast response and economy are considerations.



OPERATION

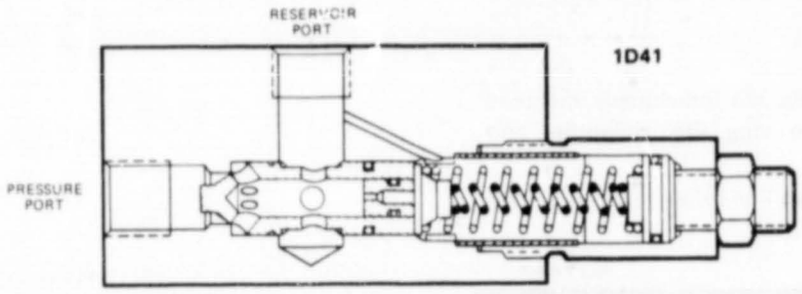
Poppet is held against seat by spring force. Inlet pressure acts against nose of piston and when setting is exceeded the poppet moves from seat allowing relief flow to tank.

FEATURES

Fast acting reliable operation.

Economical in all quantities.

Excellent pressure vs. flow characteristic for direct acting style

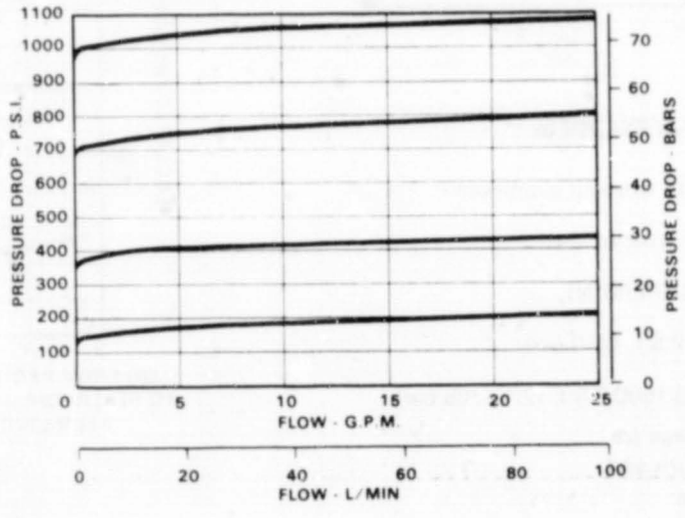


SPECIFICATIONS

MATERIALS: Body, hi-strength wrought aluminum alloy
Housing, steel Internal parts, hardened steel

RATED FLOW & WORKING PRESSURE: 1D41 To 25 G.P.M. (95 L/MIN), 1000 P.S.I. (70 bar)

RESEAT: 4 Range 70% of set pressure
10 Range 80% of set pressure



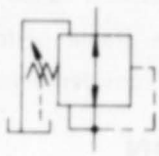
Fluid Controls, Inc.
8341 TYLER BLVD.
MENTOR, OH 44060
Phone 216-255-9711

PRESSURE REDUCING VALVES with BUILT-IN RELIEVING FEATURE

DIRECT ACTING - FOR OIL
TO 5 G.P.M. (19 L/MIN) REDUCING and RELIEVING
TO 3000 P.S.I. (210 bar) INLET, 1500 P.S.I. (105 bar) REGULATED

USE

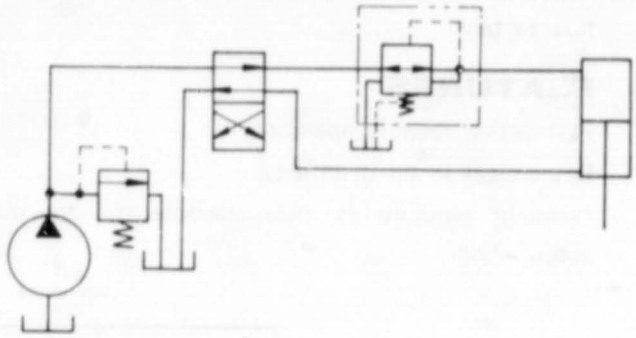
To provide an adjustable regulated pressure which is lower than supply pressure, as when more than one operating pressure is required from one pump. Direct acting models are suited for lower flow applications and regulated pressures to 1500 PSI (105 bar). This valve also acts as a relief valve, relieving from regulated line to reservoir if shock or surge occurs in regulated line. (See Curve)



OPERATION

Normally open the valve throttles or closes to maintain constant pressure in the regulated line. As in other direct acting valves spring force holds the valve open.

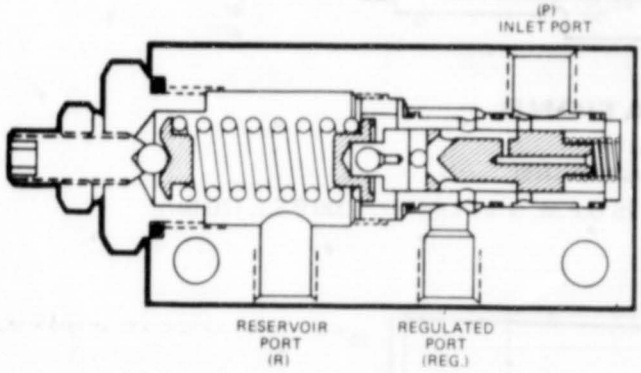
In the built-in reverse free flow check model, the check is held open, when pressure is applied, to allow free-flow in the reverse direction.

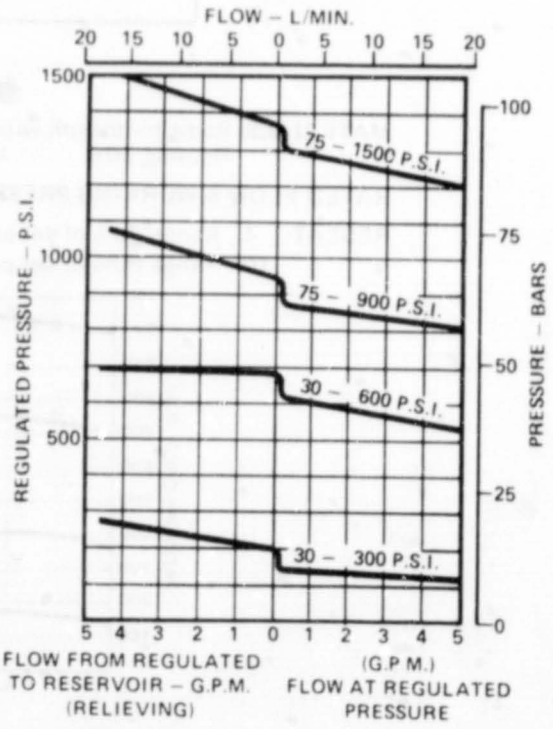


FEATURES

Hardened steel working parts are individually matched and hand honed to assure long life, reliability and highest accuracy.

Free flow check and regulated line relief model available.





SPECIFICATIONS

MATERIALS: Body, hi-strength wrought aluminum alloy
Internal parts, hardened steel

RATED FLOW: To 5 G.P.M. (19 L/MIN)

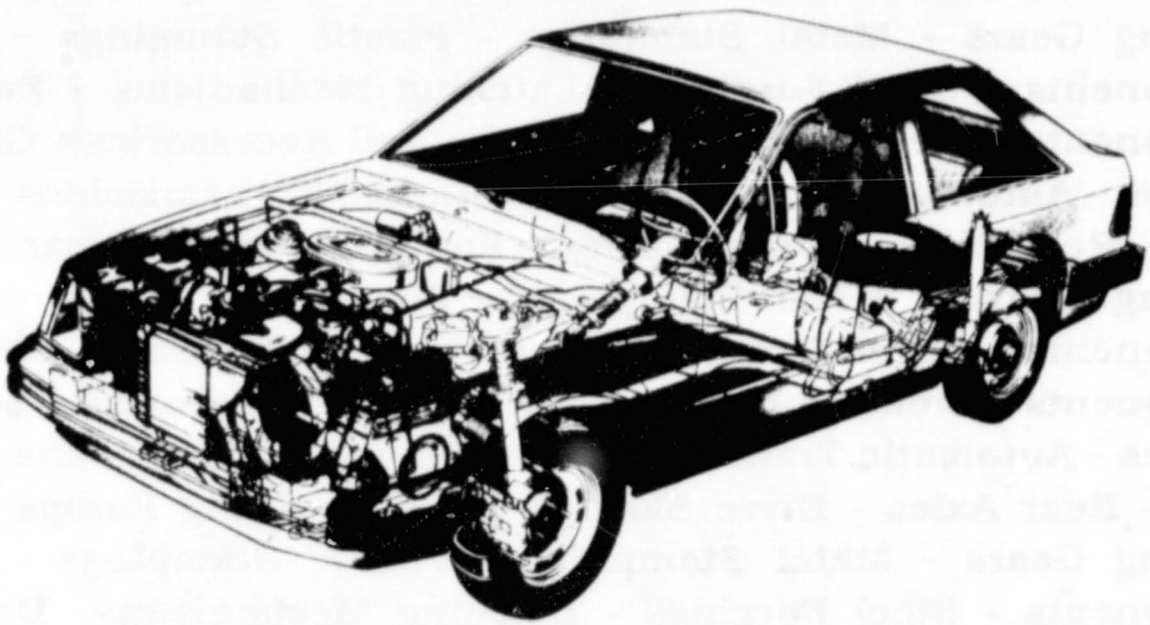
INLET PRESSURE: To 3000 P.S.I. (210 bar)

REGULATED PRESSURE: 30-1500 P.S.I. (2.1–105 bar)

Approximately .05 GPM leakage to tank @ 3000 PSI inlet pressure and mid-range regulated pressure.

Ford

Automotive Components



Ford

Power Products

New Accounts and Contract Sales
300 Renaissance Center
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Detroit, Michigan 48243
Telephone 313.568-7435

Avoid Unnecessary Design and Tooling Expense . . . Take Advantage of Proven Ford Automotive Components

Gasoline Engines - Automatic Transmissions - Manual Transmissions - Front Axles - Rear Axles - Drive Shafts - Power Steering Pumps -Power Steering Gears - Metal Stampings - Plastic Stampings - Frame Components - Steel Forgings - Latching Mechanisms - Emission Components - Steering Columns - Trim and Accessories - Gasoline Engines - Automatic Transmissions - Manual Transmissions - Front Axles - Rear Axles - Drive Shafts - Power Steering Pumps -Power Steering Gears - Metal Stampings - Plastic Stampings - Frame Components - Steel Forgings - Latching Mechanisms - Emission Components - Steering Columns - Trim and Accessories - Gasoline Engines - Automatic Transmissions - Manual Transmissions - Front Axles - Rear Axles - Drive Shafts - Power Steering Pumps -Power Steering Gears - Metal Stampings - Plastic Stampings - Frame Components - Steel Forgings - Latching Mechanisms - Emission Components - Steering Columns - Trim and Accessories - Gasoline Engines - Automatic Transmissions - Manual Transmissions - Front Axles - Rear Axles - Drive Shafts - Power Steering Pumps -Power Steering Gears - Metal Stampings - Plastic Stampings - Frame Components - Steel Forgings - Latching Mechanisms - Emission Components - Steering Columns - Trim and Accessories - Gasoline

Industrial Engine Operations
Ford Parts and Service Division
300 Renaissance Center, Suite 1800
P.O. Box 43338
Detroit, Michigan 48243
Telephone 313/568-7435

Ford
Power Products

the new EV-1 Controls

High Power Performance
- High starting torque
- Fast acceleration
- Full power on ramps
- High thermal capacity

Easy Maintenance
- Quick accessibility
- Easy card removal
- Stab-in terminal boards

Smooth Operation
- Smooth creep speed
- Stepless acceleration
- Smooth reversing
- Positive ramp start



High Reliability
- Thermal protection
- All solid-state
- Overcurrent protection
- Component encapsulation

GENERAL ELECTRIC
INDUSTRIAL CONTROL DEPARTMENT
P.O.Box 8106, Charlottesville, VA 22906
TEL: 804-973-1851

Traction control with regenerative braking

This EV-1 control returns energy to the battery during electrical braking instead of dissipating energy in the motor.

Key benefits are:
- More work per-battery-charge because of energy being returned to the battery during braking
- Longer motor and brush life because of lower currents during braking
- Smoother braking
- Driver control of stopping distance using the accelerator pedal
- Serviceable with standard EV-1 Analyzer

Traction control for dual-motor vehicles

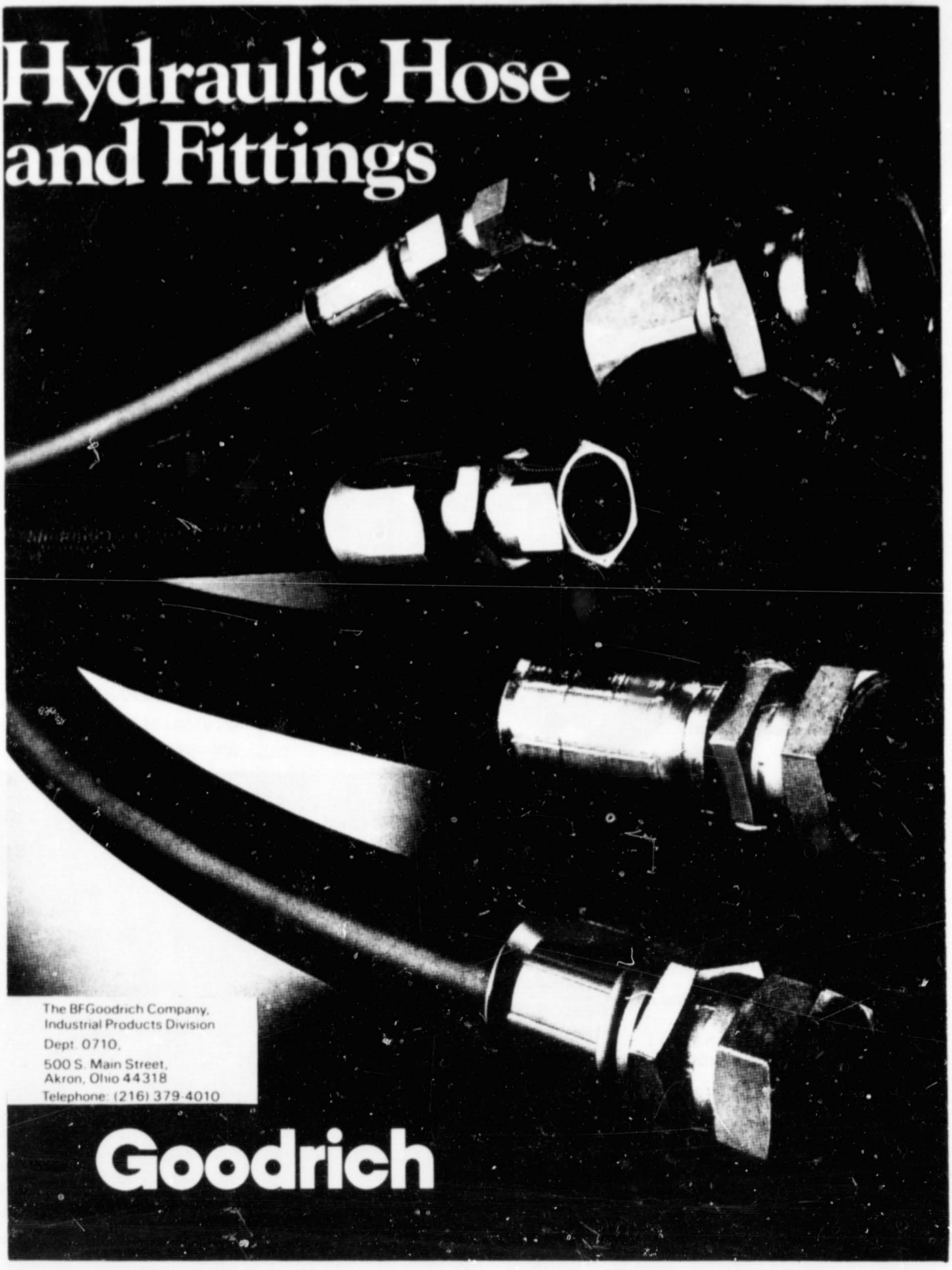
This control for dual-motor trucks (3 or 4 wheel) proportions the power smoothly and automatically to each motor as a function of steering angle. This forms an "electrical differential" where the inside wheel is actually reversed in a very tight turn.

Key benefits are:
- More traction power during turns
- Reduced tire wear because inboard wheel does not skid
- Driver control of stopping distance by position of accelerator pedal
- Maximum power with no by-pass contactor
- Serviceable with standard EV-1 Analyzer

Hydraulic pump motor control system

This control permits step-less control of the lift, tilt and auxiliary hydraulic functions.

Major features and benefits are:
- Reduced noise
- More accurate fork positioning
- Less battery drain
- Less brush arcing and [illegible] motor temperature for reduced maintenance and longer motor life
- Reduced oil heating improves driver control and accurate [illegible] of motors and controls
- [illegible]


Hydraulic Hose
and Fittings
The BFGoodrich Company,
Industrial Products Division
Dept. 0710,
500 S. Main Street,
Akron, Ohio 44318
Telephone: (216) 379-4010
Goodrich

How to Select Hose

Selection of hose for any given application must be based on full consideration of all service conditions. Specific rating values have been established for major characteristics such as dimensions, length stability under pressure, temperature range, working pressure, and minimum bend radius. Performance capability ratings are substantiated by design verification testing. Use of the hose in applications exceeding recommended values in severity will materially reduce the life of the hose.

Selection must be made with due consideration of the following:

1. Compatibility with the system fluid.
2. Normal pressure service not exceeding the recommended maximum working pressure.
3. Normal temperature (fluid and ambient). Not to exceed the rated values, with special consideration when the hose is routed near hot manifolds or other heat sources, or there are repetitive brief surges.
4. Adequate size to prevent excessive flow rates, with resulting high turbulance and pressure loss.
5. Potential mechanical stress such as twist, vibration, excessive bending or kinking, compressive forces, or pinching.
6. Environmental factors which might produce accelerated degradation, such as ozone, ultra-violet light, salt water, chemicals, or corrosive pollutants.
7. Potential abrasion due to installation near other components.
8. Compatibility with end fittings.
9. Sufficient length to allow for length variation induced by pressure and geometric configuration resulting from motion of the hose (but not to violate minimum bend radius).

The chart below lists maximum rated working pressure in pounds per square inch (psi) and mega pascals (MPa) for each size and type included in this catalog. (Example — for Type 101, 3/16" ID hose $\frac{3000}{20.7}$ means 3000 psi and 20.7 mega pascals.
1 psi = 0.0068948 mega pascals.)

MAXIMUM RECOMMENDED WORKING PRESSURE OF SIZE $\frac{\text{psi}}{\text{MPa}}$

Nominal Hose I.D. Size In.	101 101AT	102 102AT	103	105	109	110
3/16	3000 20.7	5000 34.5	1500 10.3	3000 20.7		10000 68.9
1/4	2750 19.0	5000 34.5	1250 8.6	3000 20.7		8750 63.3
5/16	2500 17.2	4250 29.3	1200 8.3	2250 15.5		
3/8	2250 15.5	4000 27.6	1125 7.8		4500 31.0	7500 51.7
13/32	2250 15.5			2000 13.8		
1/2	2000 13.8	3500 24.1	1000 6.9	1750 12.1	4000 27.6	6250 43.1
5/8	1500 10.3	2750 19.0	875 6.0	1500 10.3		
3/4	1250 8.6	2250 15.5	750 5.2		3000 20.7	5000 34.5
7/8	1125 7.8	2000 13.8		800 5.5		
1	1000 6.9	2000 13.8	565 3.9		3000 20.7	4000 27.6
1 1/8				625 4.3		
1 1/4	625 4.3	1625 11.2	375 2.6		2500 17.2	3000 20.7
1 3/8				500 3.4		
1 1/2	500 3.4	1250 8.6			2000 13.8	2500 17.2
1 13/16				350 2.4		
2	375 2.6	1125 7.8			2000 13.8	2500 17.2

The BFGoodrich Company
Industrial Products Division
Dept. 0709
500 S. Main Street
Akron, Ohio 44318
Telephone (216) 379-2114

Fluid Flow Chart

This chart may be used to determine proper hose size for a desired flow rate. It is recommended that fluid velocity be kept to 15 ft./sec. or less except for slight increases which may occur in the restricted area of the hose fitting.

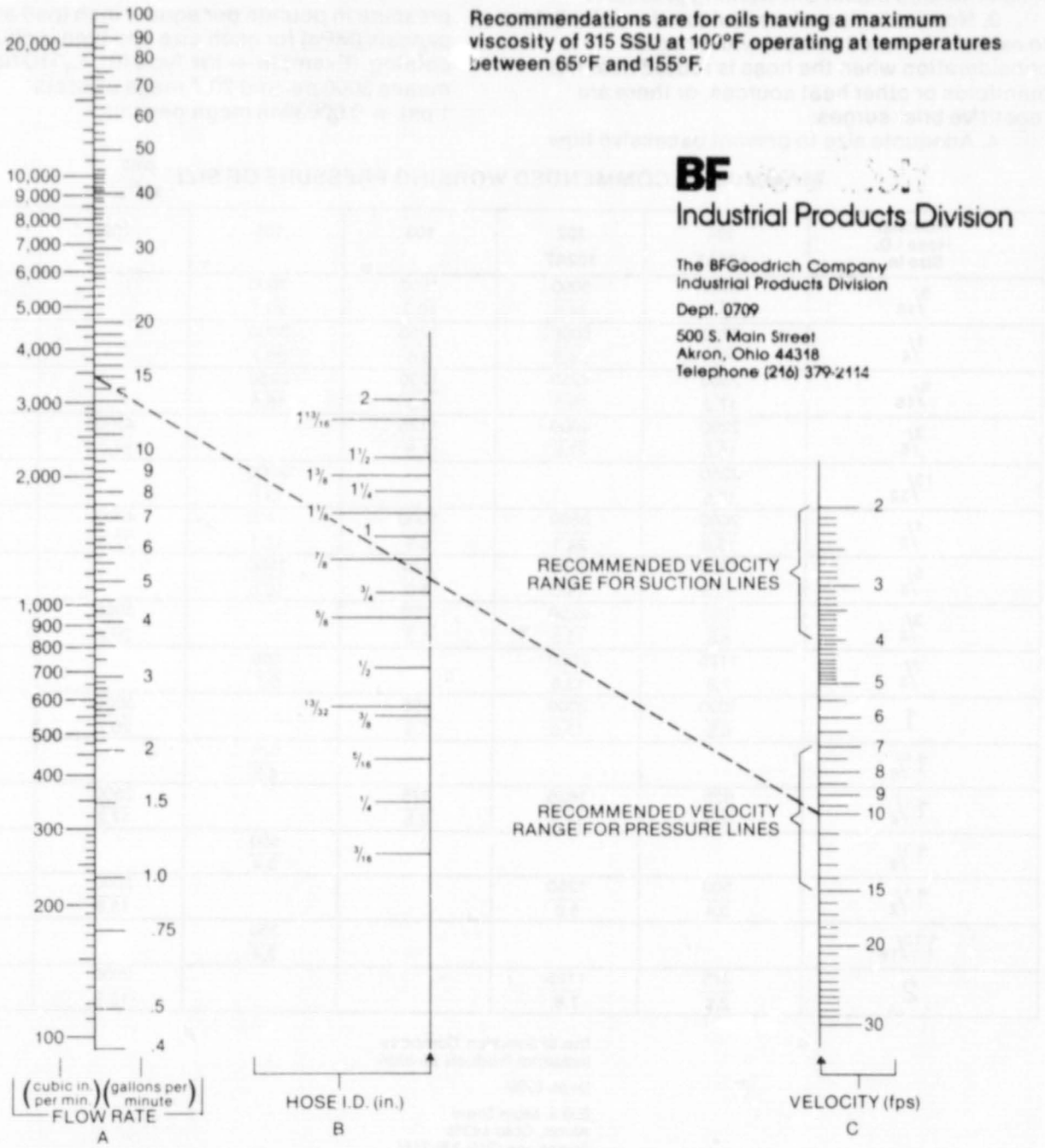
To use the chart (see example) locate a point on column A which represents the flow in gallons per minute. Connect that point, using a straight edge, to a location on column C representing the desired velocity rate in feet per second. Read the appropriate hose size in column B at the point where the straight edge intersects the column line, adjusting to the nearest numerical size which keeps the velocity rate under 15 ft./sec.

Example: For 15 gpm at 10 ft./sec. velocity the point of intersection in column B is slightly greater than $\frac{3}{4}$". Use $\frac{3}{4}$" hose which will yield a velocity of approximately 11 ft./sec.

This chart is based on the following relationship:

$$\text{Cross-sectional area (in}^2\text{)} = \frac{\text{gpm x 0.3208}}{\text{velocity (fps)}}$$

Recommendations are for oils having a maximum viscosity of 315 SSU at 100°F operating at temperatures between 65°F and 155°F.



BF
Industrial Products Division

The BFGoodrich Company
Industrial Products Division
Dept. 0709
500 S. Main Street
Akron, Ohio 44318
Telephone (216) 379-2114

Your BFGoodrich Hydraulic Hose Distributor

This cataiog will assist you in solving your hydraulic hose problems. But it can only do so much. And that's where your BFGoodrich Distributor comes in.

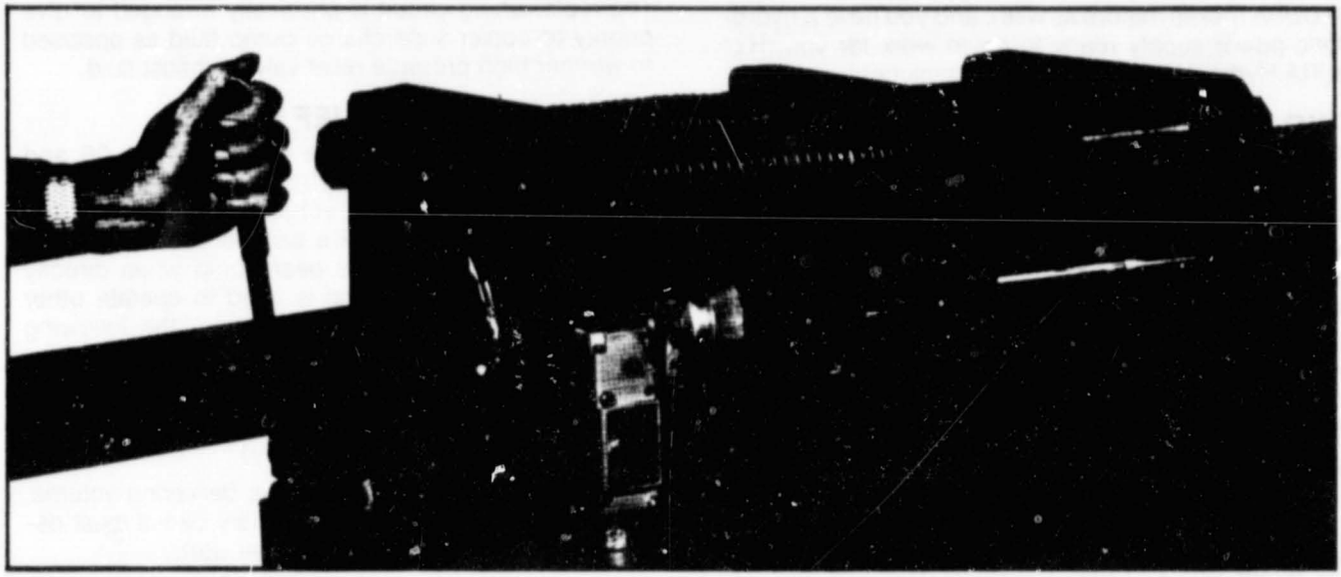
He's more than just a source of hydraulic hose and fittings. He's also a source of hydraulic hose and fitting capability.

If you wish, he'll make a thorough survey of your operation and recommend exactly the right hose for each application.

Then, he'll cut the hose to length, install the correct fittings, check the assembly on special testing equipment, and deliver it where and when you want it.

Since he keeps an ample supply of each type of BFGoodrich hydraulic hose on hand, he can provide fast, efficient service.

Should there ever be a question your BFGoodrich Distributor can't answer, he can contact the BFG engineering staff in Akron or Marion, Ohio. One of our experienced hydraulic hose engineers will gladly provide a solution.



U.S.A. SALES OFFICES

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Akron, OH 44318
Telephone: (216) 379-2030

Atlanta District
2301 Parklake Drive, NE
Atlanta, GA 30345
Telephone: (404) 934-4021

Chicago District
10701 W. Belmont Avenue
Franklin Park, IL 60131
Telephone: (312) 455-6600

Dallas District
1111 Mockingbird Lane, West
Suite 1530
Dallas, TX 75247
Telephone: (214) 630-5601

Denver District
2500 West 8th Avenue
Denver, CO 80201
Telephone: (303) 825-7671

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30200 Telegraph Rd.
Birmingham, MI 48011
Telephone: (313) 357-3939

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Minneapolis, MN 55441
Telephone: (612) 559-0535

Northeast District
1661 Worcester Road
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Telephone: (617) 875-7408

Philadelphia District
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Telephone: (215) 638-3000

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Suite 305
San Mateo, CA 94402
Telephone: (415) 573-0500

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Telex: 519565

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Los Angeles, CA 90051
Telephone: (213) 726-6600

New York
New York
277 Park Avenue
New York, NY 10017
Telephone: (212) 826-2500

BF Goodrich
Industrial Products Division

The BFGoodrich Company
Industrial Products Division

Dept. 0709

500 S. Main Street
Akron, Ohio 44318
Telephone (216) 379-2114

The Oilgear Company
2304 South 51st Street, Milwaukee, WI USA 53219
Phone: (414) 327-1700

From Hydura* . . . Standard Hydrostatic Pumps

YOU BENEFIT FROM HYDURA'S PREPACKAGED DESIGN !!!

It's all there in a neat compact package — you only connect two pressure lines to a hydraulic motor (and HYDURA makes motors as well), and you have a hydrostatic power supply ready to go to work for you. HYDURA Hydrostatic Pump package includes: —

TWO-WAY VARIABLE DELIVERY HIGH PRESSURE PUMP

You will get high horsepower output from a small efficient light weight package — and you'll get it quietly. (See bulletins on individual standard pumps for more information on performance and noise levels). Fewer components and use of modern manufacturing technology result in lower initial cost plus lower maintenance costs. These piston-type variable delivery units are designed with optimum balancing of hydraulic forces for long bearing life.

PROPORTIONALIZING CONTROL PLUS

A lever can be attached to a pintle on top of control to vary delivery proportional to lever movement (angle). The pintle can be rotated in either direction for flow from one or the other port (two-way delivery). The unit design eliminates use of troublesome control yoke bearings to provide smooth (stepless), reliable, and fast control action. Pumps are also available with any of the other pump controls offered by HYDURA.

ADJUSTABLE HIGH PRESSURE RELIEF VALVES

Relief valves are furnished for each pressure port to protect the pump and hydraulic drive unit against overloads. Each relief valve is adjustable over a wide range (minimum setting depends on circuit flow and other application characteristics). The relief valve exhaust is circuited to the supercharge circuit where it will either pass through the supercharge relief valve or be mixed with cool supercharge fluid before replenishing the piston pump. A more compact arrangement, with non-adjustable high pressure relief valves, is also available.

SUPERCHARGE CHECK VALVES

A check valve circuited to each pump port automatically provides replenishing volume (from gear pump circuit) to the low pressure side of the pump circuit. The replenishing circuit is physically arranged to give priority to cooler supercharge pump fluid as opposed to warmer high pressure relief valve exhaust fluid.

SUPERCHARGE RELIEF VALVE

Normal supercharge pressure is 60 psi (size 06 and 10), 120 psi (size 15 and 20), 240 psi (size 32 and 42), depending on the volume of fluid passing through the valve. The valve can be used to provide overload protection for the gear pump when directly circuited to it. If gear pump is used to operate other auxiliary devices (at higher pressures) the following conditions must be met.

1. The fixed delivery pump cannot be used to operate auxiliary devices except when variable delivery pump is at neutral (zero delivery).
2. When variable delivery pump is delivering volume, the fixed delivery pump or auxiliary circuit must deliver fluid to the supercharge inlet port.
3. Other conditions (circuits) must be approved by HYDURA's Factory Sales.

FIXED DELIVERY PUMP

A number of gear pump sizes are available. The gear pump is directly coupled to rear of piston pump driveshaft. For fixed delivery pump circuit conditions, see previous paragraph. The fixed pump's delivery can be piped to an auxiliary circuit or connected through a filter (and cooler if necessary) to the supercharge port. This allows free suction — to avoid cavitation in cold weather — while supplying conditioned fluid to the main drive circuit from a filter that can be located for easy servicing.

In addition to those shown in this bulletin, dual hydrostatic pumps with dual fixed delivery pumps can also be supplied.

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Specifications

The Oilgear Company
2304 South 51st Street, Milwaukee, WI USA 53219
Phone: (414) 327-1700

		PISTON PUMP SIZES					
		06	10	15	20	32	42
Theo. Displacement	— cipr	0.85	1.44	2.05	2.82	4.41	5.67
	— ml/rev.	13,9	23,6	33,6	46,2	72,3	93,0
Operating Speed†	— rated	1800	1800	1800	1800	1800	1800
	— max.	3000*	2400	3000*	2400*	2400	2400
Rated Continuous Pressure	— PSI	3000	2000	3000	2000	3000	2000
	— bar	206,9	137,9	206,9	137,9	206,9	137,9
Maximum Pressure†	— PSI	3500	2500	3500	2500	3500	2500
	— bar	241,4	172,5	241,4	172,5	241,4	172,5
Delivery at rated rpm & pressure	— gpm	6	10	15	20	32	42
	— l/min	22,7	37,9	56,9	75,8	121,3	159,2
Supercharge Minimum pressure	— PSI	60	60	120	120	240	240
	— bar	4,1	4,1	8,3	8,3	16,6	16,6
Power input at rated press. & rpm	— hp	13	15	33	30	68	60
	— kw	9,7	11,2	24,6	22,4	50,7	44,8
Weight	— lbs	41	41	91	91	126	126
	— kg	18,6	18,6	41,4	41,4	57,3	57,3

		GEAR PUMP SIZES					
		02	04	05	07	10	15
Theo. Displacement	— cipr	0.203	0.415	0.501	0.703	1.00	1.49
	— ml/rev.	3,3	6,8	8,2	11,5	16,4	24,4
Operating Speed†	— rated	1800	1800	1800	1800	1800	1800
	— max.	3000	3000	2400	3000	3000	2400
Rated Continuous Pressure†	— PSI	1000	1500	500	150	750	750
	— bar	68,9	103,4	34,5	10	51,7	51,7
Delivery at rated rpm & pressure	— gpm	1.4	2.9	3.5	5.0	7.	10.5
	— l/min	5,3	11,0	13,3	19	26,5	49,8
Power input at rated press. & rpm (Add to piston pump)	— hp	1.0	3.5	1.3	5.5	4.0	6.0
	— kw	0,8	2,6	1,0	4,1	3,0	4,5
Weight (Add to piston pump)	— lbs	4.5	12.0	6.5	13.0	14.0	15.5
	— kg	2,0	5,5	3,0	5,9	6,4	7,0

† Higher speeds and pressures may be used on applications approved by Hydura Products.

*Preliminary data — subject to change.

HYDURA Type "MFQ" and "MVQ"
Hydraulic Motors

HYDURA™ PRODUCTS

The Oilgear Company
2304 South 51st Street, Milwaukee, WI USA 53219
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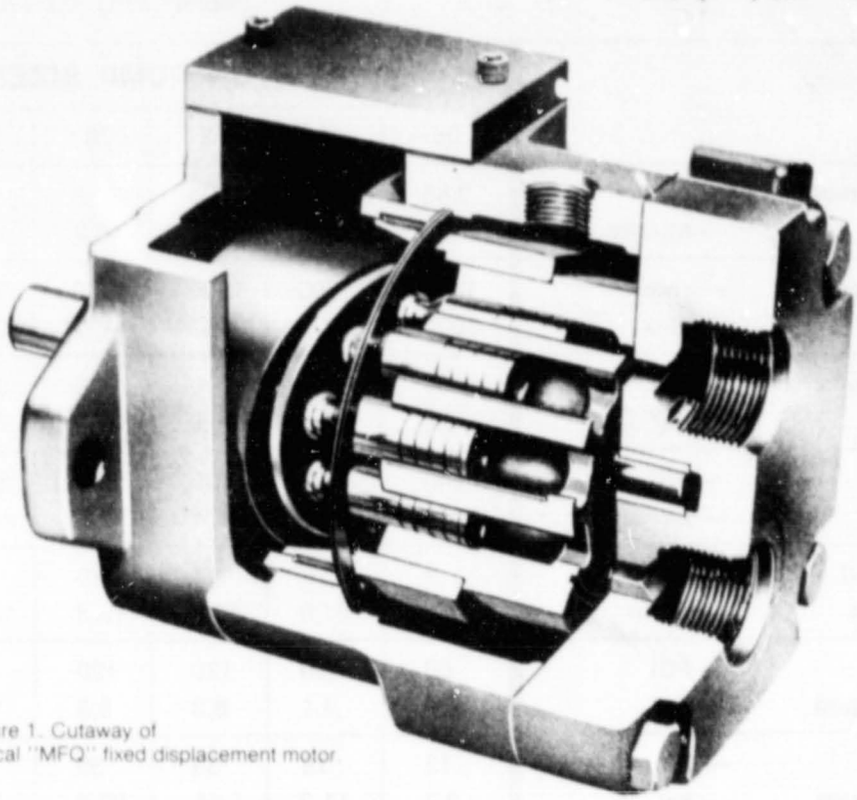

Figure 1. Cutaway of typical "MFQ" fixed displacement motor.

From Hydura — A Simple Compact Design

Fewer components and use of modern technology result in a compact high horsepower low inertia motor at low initial cost plus low maintenance cost. These axial piston type motors are designed with optimum balance of hydraulic forces for long bearing life. They allow high continuous ratings so you can upgrade your machine's performance. Like matching Hydura Pumps, the cartridge construction of the rotating group simplifies field servicing, replacement parts ordering and stocking. Many parts are common to both the Hydura pump and motor (of the same size).

From Hydura — A Variety

These bi-directional (reversible) axial piston motors are available in four sizes, both as fixed or variable displacement motors. The same handwheel (HN), pintle/lever (MN), two position hydraulic (RU), three position hydraulic (RR), electronic solenoid (VU) and electronic servo (VV) controls used on Hydura pumps can be applied to variable displacement motors.

"Any-Speed"

Not just speed in steps, but speed steplessly adjustable from 100 rpm to maximum in either direction as commanded. Hydura low inertia motors respond to command quickly and smoothly to improve performance of your machines.

Low Inertia = Quick Reversing

You can slow down, stop or reverse Hydura motors rapidly and smoothly because the inertia of rotating parts is very low. When used with Hydura Hydrostatic Pumps, overhauling loads are automatically absorbed.

Quick Braking

Limited internal slip, even when braking high inertia connected loads, means the pump has positive control of the braking. Fast emergency hydrodynamic braking, metered hydrodynamic braking or regenerative braking can be accomplished by proper selection of pump and control. (See Hydura Bulletin H-6)

Flexible, Easy Mounting

You can mount Hydura motors in any position, connect up to two pressure lines, one drain line and you're ready to go. Type "MFQ" and "MVQ" motors are furnished with standard SAE mounting flanges.

Totally Enclosed to Operate in Hazardous Locations

The motor operating mechanisms are totally enclosed in a fluid filled case. There are no openings to atmosphere where foreign matter can enter. Motors are sealed against humid atmospheres, even washdowns with high pressure hoses. Hydura motors are used in hazardous locations.

Long Service Life

All working parts are fully enclosed. Fluid used as power medium automatically pressure and flood lubricates operating mechanisms.

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HYDURA™ PRODUCTS
The Oilgear Company
2304 South 51st Street, Milwaukee, WI USA 53219
Phone: (414) 327-1700

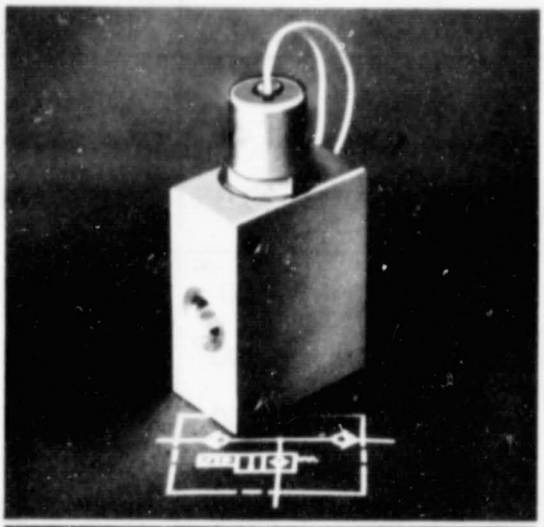
Specifications

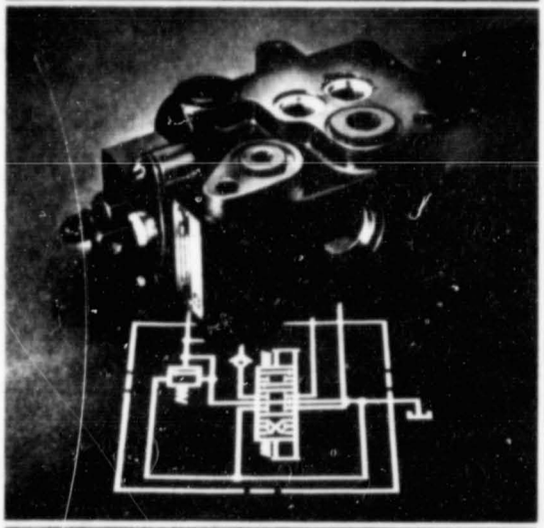
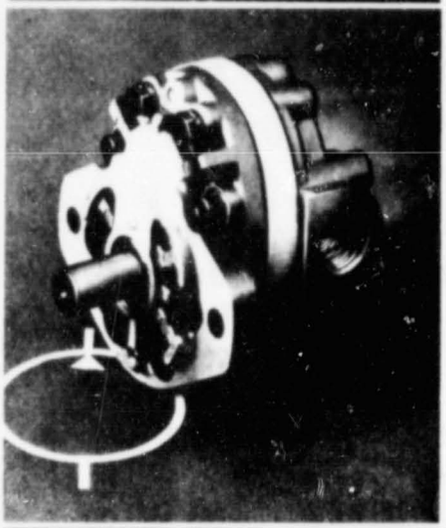
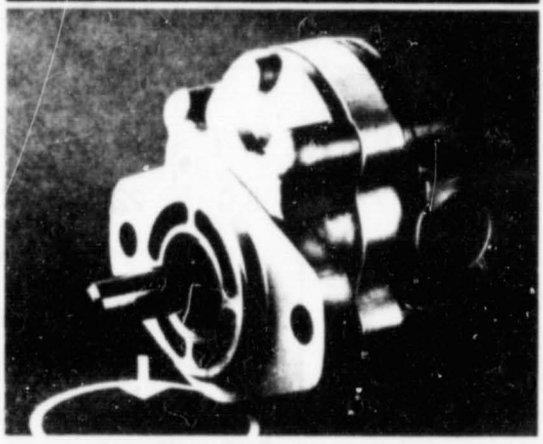
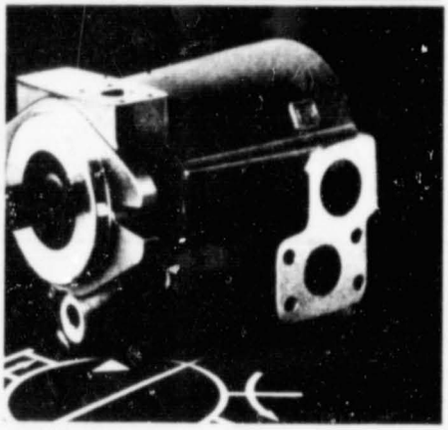
MOTOR SIZE		06	10	15	20
DISPLACEMENT, fixed or maximum for variable units	cipr	0.85	1.44	2.5	2.82
	lpm	13,9	23,6	33,6	46,2
SPEED*, minimum	rpm	100	100	100	100
rated (at full displacement)	rpm	1800	1800	1800	1800
maximum†	rpm	3000	3000	3000	3000
PRESSURE, continuous	psi	3000	2000	3500	2500
	bar	207	138	242	173
maximum	psi	3500	2500	4000	3000
	bar	242	173	276	207
BREAK-AWAY PRESSURE, at no load	psi	250	250	250	250
	bar	17,2	17,2	17,2	17,2
TORQUE, at rated pressure and maximum displacement	lb.in	350	375	1030	960
	Nm	39,6	42,4	116,4	108,5
HORSEPOWER OUTPUT, at rated speed, pressure and max. displacement	hp	10.1	10.7	30.0	27.5
	kw	7,5	8,0	22,4	20,5
INERTIA	lbs.ft^2	0.029	0.029	0.130	0.130
	kg m^2	0,0012	0,0012	0,0055	0,0055
WEIGHT — "MFQ" motors	lbs	25	25	42	42
	kg	11,4	11,4	19,1	19,1

*Consult Hydura Products for service at higher speeds.
†Not to be exceeded by MVQ motors operating at reduced displacement.

Parker
Fluidpower

Mobile Hydraulic Components



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ORIGINAL PAGE IS
OF POOR QUALITY

Gear Pumps

Parker pressure loaded gear pumps are designed to maintain high efficiency and long life throughout a full range of operating conditions. All Parker gear products are manufactured with precision ground and lapped gear assemblies enclosed in high strength die cast aluminum covers and center sections. Parker gear pumps and motors provide a compact, lightweight solution to continuous or intermittent service demands.

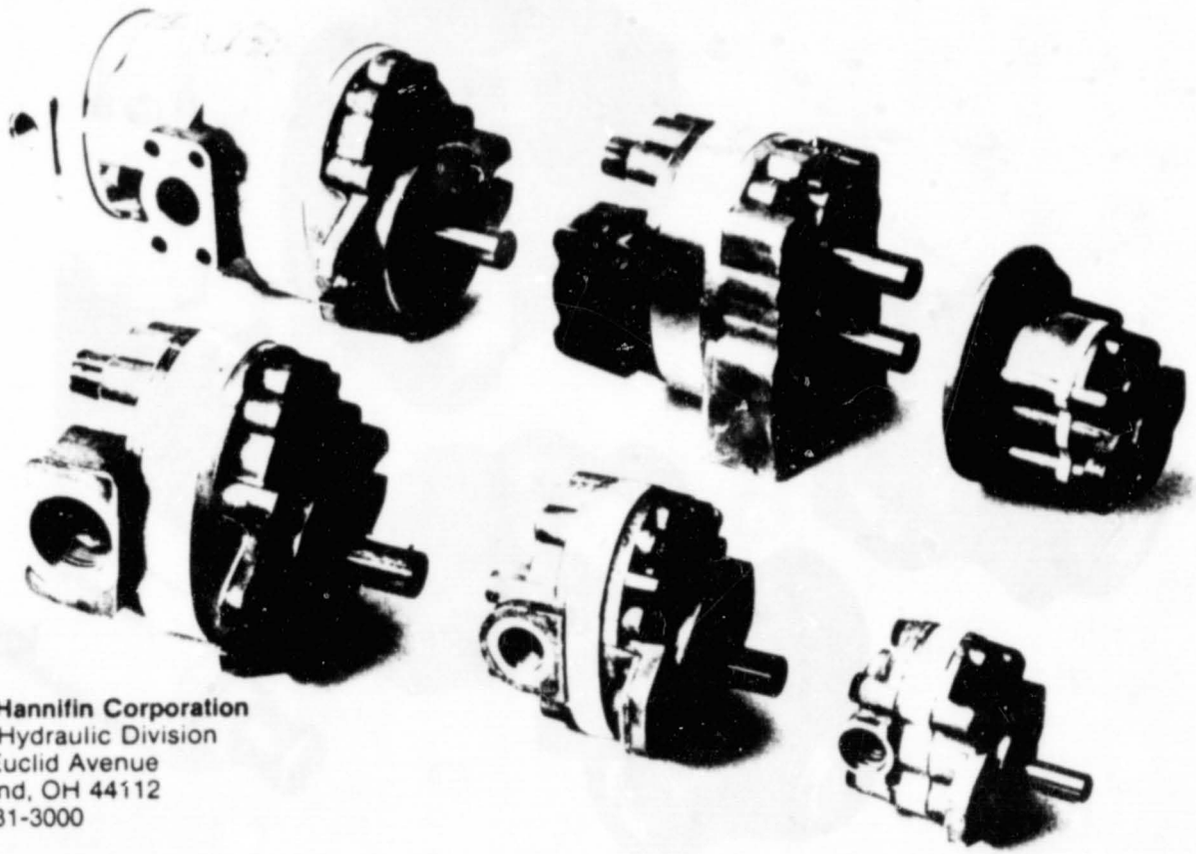
SINGLE PUMPS

Series	Delivery (g.p.m. @ 1200 r.p.m./100 p.s.i.)	Displacement ($in.^3$/rev.)	Maximum Speed (r.p.m.)	Maximum Pressure (p.s.i.)
D	0.58 - 3.28	0.111 - 0.630	4000	2500
H	3.14 - 9.60	0.606 - 1.85	4000	2500
M	7.17 - 17.52	1.38 - 3.38	3000	3000

DOUBLE PUMPS

Model Series	Displacement ($in.^3$/rev.)		Delivery (g.p.m. @ 1200 r.p.m./100 p.s.i.)		Maximum Speed* (r.p.m.)	Maximum Pressure* (p.s.i.)
	1st Stage	2nd Stage	1st Stage	2nd Stage		
MD	1.38 - 3.38	0.111 - 0.630	7.2 - 17.5	0.6 - 3.3	3600	2500
MH	1.38 - 3.38	0.606 - 1.850	7.2 - 17.5	3.1 - 9.6	3600	2500
HD	0.606 - 1.85	0.111 - 0.630	3.1 - 9.6	0.6 - 3.3	3600	2500

* Maximum speed and pressure may vary within each model series



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Auxiliary Valves

Pressure and flow control valves in a variety of types and configurations are readily available to solve your auxiliary valve requirements. Select direct acting or pilot operated relief valves, priority type flow dividers, check valves, selector valves or two- or three-way two position solenoid valves in a wide range of pressure and/or flow ratings. Receive rugged valves designed for long trouble-free service under the most demanding operating conditions. Rely upon Parker application assistance in selecting the best valve for your requirements . . . Parker manufacturing expertise and quality control to assure consistent, dependable performance.

Model	Description	Rating
VPRD3B	Direct acting relief	Adjustment range 500-4000 p.s.i. Flows to 6 g.p.m.
VPRP5B	Pilot operated relief	Adjustment range 500-3000 p.s.i. Flows to 30 g.p.m.
VFDY4B	Priority flow divider	Maximum input flow 30 g.p.m. Increment priority flow range 1 to 10 g.p.m. Maximum operating pressure 2500 p.s.i.
VCPD	Pilot operated inline, load-lok check valve	Rated flow 8 g.p.m. Maximum loop ΔP 180 p.s.i. @ 8 g.p.m.
VNUP7B	Normally closed pilot operated two-way solenoid valve	Recommended operating pressure 50-3000 p.s.i. Flows to 5 g.p.m.
VNUP7C	Normally closed pilot operated two-way solenoid cartridge	Recommended operating pressure 50-3000 p.s.i. Flows to 5 g.p.m.

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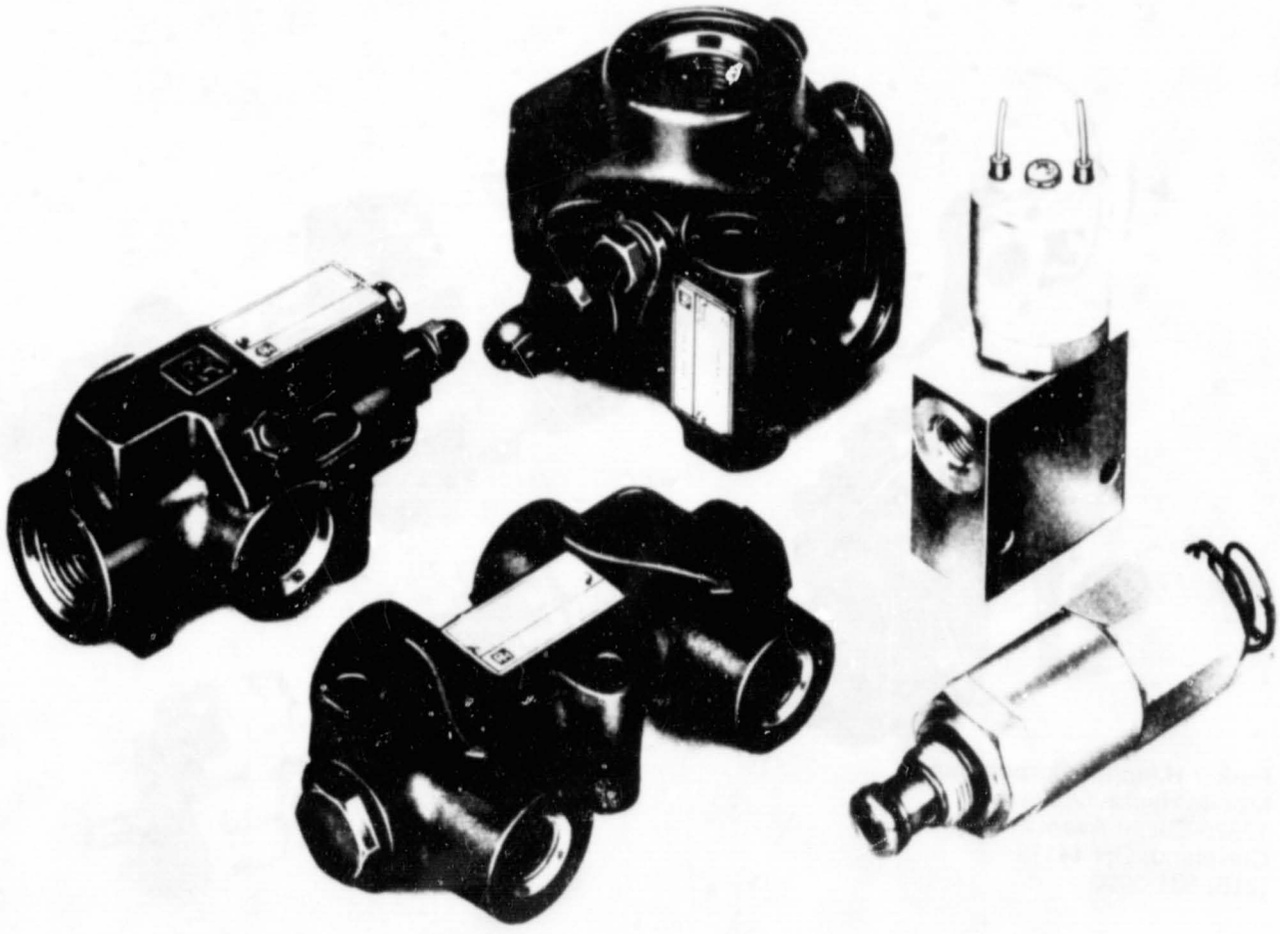

Hydra-Flex Valves

Controlling hydraulic system flow and pressure in modern day mobile and industrial equipment demands flexibility . . . the kind of flexibility that provides practical economical solutions for hydraulic control valve applications. Hydra-Flex block valves incorporate Parker's proven control valve cartridge assemblies into hydraulic integrated circuits, custom designed to meet specific needs. Block valves consist of single or multiple function component cartridges which can be block-mounted individually or in combination to perform multiple functions. Hydra-Flex block valves provide flexibility in design that:

- Reduces total hydraulic system cost.
- Saves time and cost of installation and plumbing.
- Increases reliability and reduces leakage.
- Saves space and weight.
- Simplifies maintenance and valve replacement.

Hydra-Flex provides the hydraulic flexibility to meet the challenge of controlling flow and pressure with standard off-the-shelf components, or with block valves custom designed and manufactured to your specifications.

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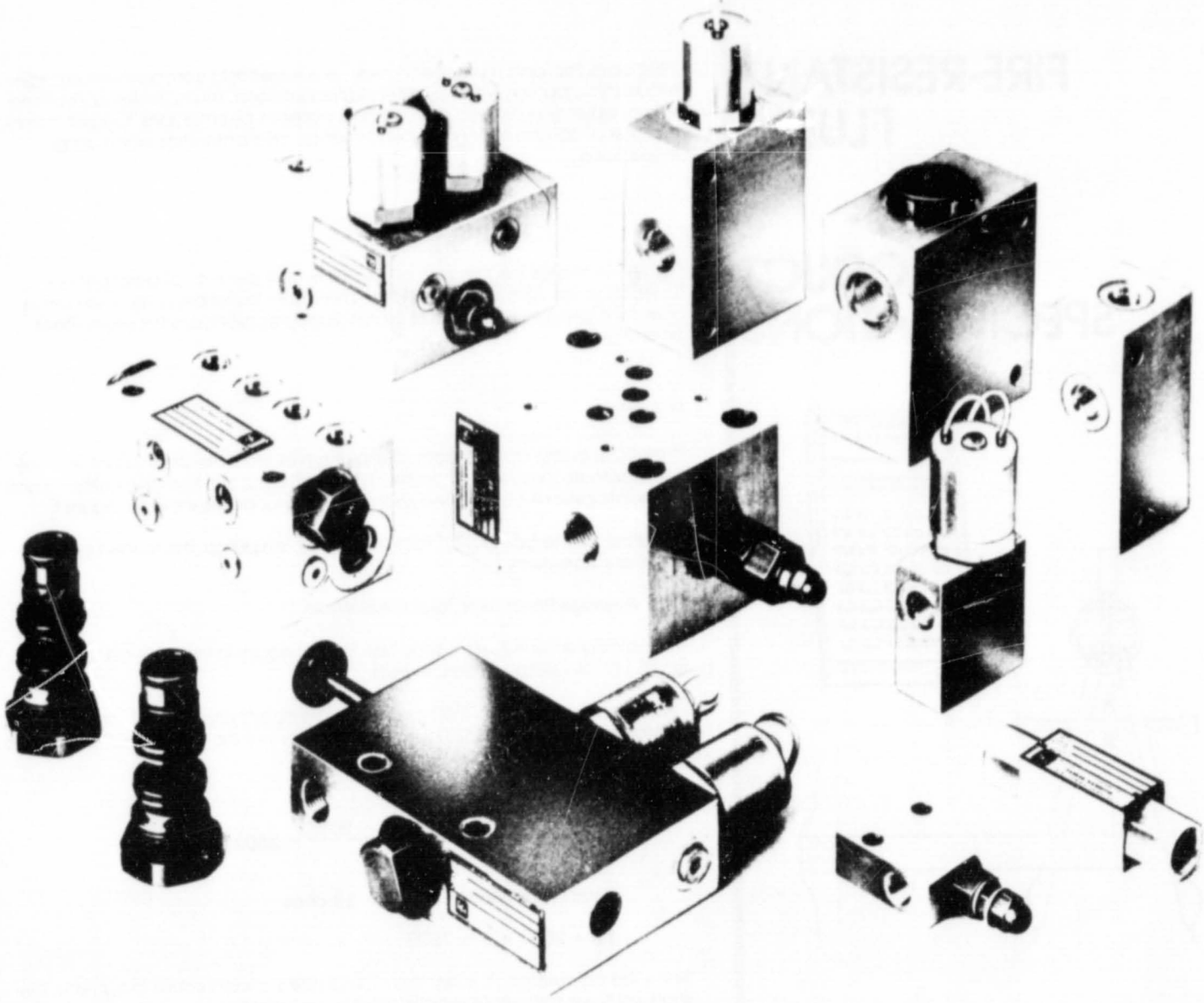


ANNOUNCING PERMCO'S NEWEST PATENTED FEATURE – BIRODIVERTERS

1500 FROST ROAD
P.O. BOX 68
STREETSBORO, OHIO 44240 U.S.A.
TELEPHONE (216) 626-2601

You can now have the increased efficiency, higher working pressures and increased operating life of the diverter plate in birotational pumps, motors and flow dividers with Permco's newest invention...the patented BiRo Diverter Plate.

FLOW DIVIDERS

Flow dividers are available in all series. Please contact Permco's factory engineering department for details.

MULTIPLE UNITS

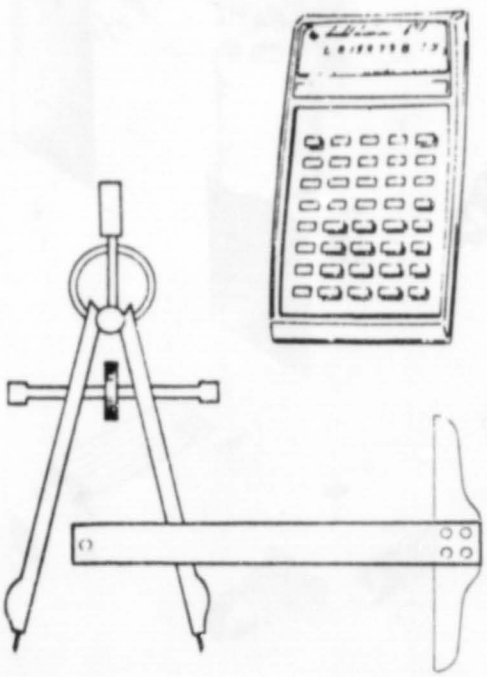
Multiple pump and motor units are available in each series and in every size shown on the enclosed performance curves.

FIRE-RESISTANT FLUIDS

Permco pump and motor performance is superior to competitive cast iron, rebuildable pumps when diverter plates are used. This includes phosphate esters, water glycols (hydrolubes) and water-in-oil emulsions. Consult Permco for seal compatibility and performance characteristics when using these fluids.

PRODUCT SPECIFICATIONS

Figure 1 illustrates the theoretical displacement per inch of gear per rev for each series. Also, illustrated is the maximum outlet pressure when using diverter plates instead of thrust plates. Pressures given are for intermittent operation.



PL Factor

In multiple pump applications, the strength of the drive shaft will determine the maximum torque that can be delivered to the unit from the prime mover. This relationship is designated as the "PL" factor and is shown in figure 1.

To calculate the actual "PL" factor of any given pump, the following equation should be used.

PL = Average Pressure × Total Gear Width

This calculated number must be less than or equal to the stated figures in figure 1 or life rating will be lowered.

Example: A two section 7500 series pump is constructed with 2" and 1" gears, operating at 3000 and 2000 p.s.i. respectively. Will the pump shaft be able to carry the necessary torque?

Solution: Employing the Equation

$$\text{Average Pressure} = \frac{3000 + 2000}{2} = 2500 \text{ p.s.i.}$$

Total Gear Width = 2 + 1 = 3 inches

PL = 2500 × 3 = 7500

Since the calculated PL is less than 12000 (the stated number in figure 1), the shaft will have sufficient strength to carry the torque.

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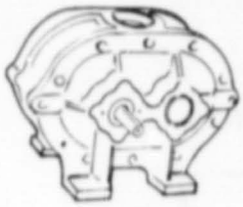
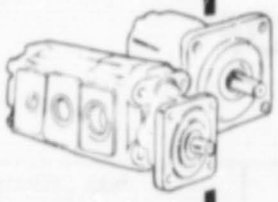
PERMCO PUMPS AND MOTORS

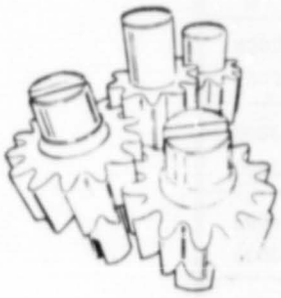
Precision manufacturing and solid engineering experience are the keys to Permco's long standing reputation for quality and durability.

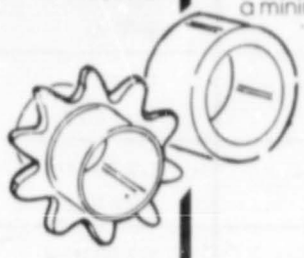
Here are just a few of the techniques and innovations that make Permco pumps a better buy than competitive models.





GEARS





Gears for Permco pumps are cut in our own plant to extremely close tolerances. Gear width tolerances are held to 0.0003" with backlash held to a minimum of 0.003" to 0.006". To prevent leakage caused by the common "crowning" effect, Permco "shapes" gears rather than hobbing and shaving them. This gives a true involute profile for the full length of each gear tooth, assuring maximum volumetric efficiency. All this extra care means more efficiency in operation, no headaches with hand matched gear sets and longer operating time without rebuilding.

HOUSINGS

Permco uses a special iron alloy for shaft covers, gear housings, bearing carriers and port end cover castings. The added strength and bearing quality due to this extra care in metallurgy assures more hours of trouble free running for your pump or motor.

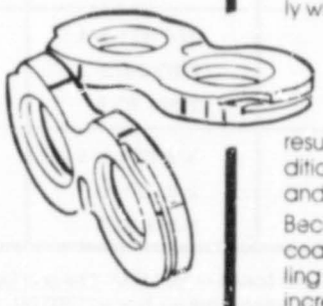
CONVENTIONAL THRUST PLATES

In pumps and motors ordered with conventional thrust plates you get the added protection of a higher density bronze alloy. The better wearing characteristics of this alloy assure more hours of pump or motor service without the need for costly rebuilding and replacement of thrust plates.

PERMCO'S PATENTED DIVERTER PLATE OPTION

Permco's revolutionary new diverter plate gives you increased working pressures of up to 4,000 p.s.i. It increases "B-10" bearing life up to 5 times, gives running speeds up to 3,600 R.P.M. This is how it works. In other gear type hydraulic pumps, pressure at the outlet side pushes internal moving parts towards the inlet. Gears flex, cutting into the housing. Bearings may overload and break down. Shafts and hubs can wear quickly. Gears wear unevenly. Constant rebuilding and downtime erode profits.

Permco's patented diverter plates reduce pump destroying wear by diverting hydraulic pressure through specially machined channels to key areas on the inlet side of the pump. This fluid pressure acts as a counter force to push gears back towards a centered position. This allows them to function properly while reducing bearing loads. Bearings function properly with up to five times longer service under rated pressures. Wear to hubs, gears and housings is also significantly reduced. These same diverter plate channels also help to reduce the harmful effect of cavitation.





With high vacuum inlet conditions gears do not "fill" completely; the result is cavitation when the pump is subjected to high vacuum inlet conditions. Permco's diverter plate channels flow to these "partially" filled teeth and displaces cavitation from the diverter plate's surface.

Because these plates are not pressure loaded they tend to retain the Teflon coating far better than conventional plates. This aids the pump in the handling of fire resistant fluids. The re-centering force of Permco diverter plates increases proportionally with increased working pressures. On-the-job experiences and in-plant testing indicate that working pressures of 4,000 p.s.i. or speeds up to 3,600 R.P.M. are now possible without unusual wear, depending upon gear width.

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PERFORMANCE CHART OF FACTORY BUILT UNITS

figure 1

SERIES	DISP. IN 3/IN PER REV.	PL FACTOR (MULT UNIT)	MAX OPERATING* PRESSURE RATING GEAR WIDTH	PSI
1200	2.522	6,000	1/4 TO 1-1/2	2000
			2 TO 3	2000
1500	1.453	7,000	1/4 TO 1	3000
			1-1/4 TO 2	2500
3000	2.38	8,000	1/2 TO 1-1/4	4000
			1-1/2 TO 2	3500
3100 (DOWELED)	2.38	8,000	1/2 TO 1-1/4	4000
			1-1/2 TO 2	3500
			2-1/4 TO 2-1/2	3000
2500	2.573	9,000	1/2 TO 1-1/4	4000
			1-1/2 TO 2	3500
			2-1/4 TO 2-1/2	3000
5000	2.573	14,000	1/2 TO 1-1/4	4000
			1-1/2 TO 2	3500
			2-1/4 TO 2-1/2	3000
5100 (DOWELED)	2.573	14,000	1/2 TO 1-1/4	4000
			1-1/2 TO 2	3500
			2-1/4 TO 2-1/2	3000
3700	3.067	11,000	1/2 TO 1-1/4	4000
			1-1/2 TO 2-1/4	3500
			2-1/2 TO 3	3000
7500	4.044	12,000	3/4 TO 1-3/4	4000
			2 TO 2-1/2	3500
			2-3/4 TO 3	3000
7600 (DOWELED)	4.044	12,000	3/4 TO 1-3/4	4000
			2 TO 2-1/2	3500
			2-3/4 TO 3	3000

*Pressure Rating is For Intermittent Operation (10% duty cycle) for a Pump Speed of 1000 RPM. Size and Type of Porting Will Affect Actual Pressure Maximums. Consult Factory For Applications When Pressures Exceed 2500 psi.

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FLUID RECOMMENDATIONS

Use premium quality hydraulic fluid with a viscosity range 150-300 SUS (32-65 CST) at 100°F (38°C). Normal operating viscosity range is between 80-1000 SUS. (16-220 CST) Maximum start up viscosity should not exceed 4000 SUS. Oil should have maximum anti-wear properties, rust and oxidation inhibitors.

SIDE LOADS

When a side or overhung load is imposed on the drive shaft of a pump or motor, an outboard bearing must be used (3000, 5000, 7500 series). Double outboard bearings are recommended for 2500 and 3700 series in these applications.

FILTRATION (MANDATORY)

For maximum pump life, the system should be protected from contamination at a level not to exceed 250 particles greater than 10 micrometres per millilitre of fluid. A 25 micrometre return line filter with a B10 rating of at least 2.2 should provide this level of purity. A 149 micrometre suction strainer is also suggested for added pump protection.

SHAFT ALIGNMENT

Unit shaft alignment must be within 0.007 inches total indicator reading using a standard motor coupling. Follow coupling manufacturer's installation instructions to prevent end thrust on shaft. Turn pump shaft to assure freedom of rotation. Pump and motor must be on a rigid base.

INLET CONDITIONS

Not to exceed 10 in. Hg at 1200 R.P.M., 7 in. Hg at 1800 R.P.M., or a positive pressure greater than 20 p.s.i.

MOUNTING RESTRICTIONS

Mounting position is non-restrictive.

SPEEDS

Typical operating speeds are between 400-2200 R.P.M. Consult factory should these speeds be exceeded.

TEMPERATURE

Under normal conditions of continuous operation, fluid temperature should not exceed 150°F (65°C). In no instance should the temperature exceed 185°F (85°C.)

A HYDROSTATIC TRANSMISSION SYSTEM TO MATCH YOUR SPECIFIC DESIGN REQUIREMENTS

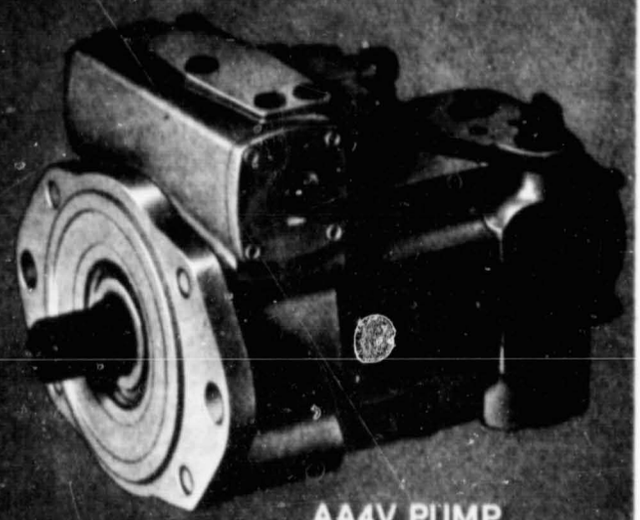
Worldwide Proven REXROTH HST Systems

A Unique HST Pump

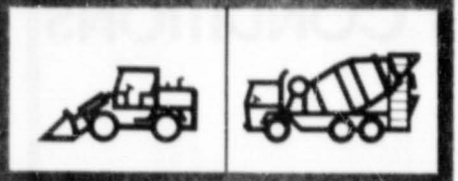
Presenting the state-of-the-art for mobile hydrostatic transmission design...the Rexroth AA4V Pump.

This HST Pump is a swashplate design, variable displacement, overcenter, axial piston unit which incorporates an integral charge pump, a charge pressure relief valve, and two make-up check valves. Also included are two system pressure relief valves. The AA4V utilizes a spherical control plate design which has the advantages of low peripheral speed, self centering of the cylinder block and high volumetric efficiency.

Also featured is a wide range of control variations; high power-to-weight ratio; heavy duty service capability; compact size; SAE mounting configuration; and, optional through-drive for auxiliary pumps.



AA4V PUMP



Rated Pressure 5000 psi Maximum 5800 psi	AA4V Variable Displacement Pump 5 sizes	A2F Fixed Displacement Motor 20 sizes	A6V Variable Displacement Motor 9 sizes
Maximum Displacements (in.³/rev.)	2.43 to 7.63	0.61 to 61.0	1.71 to 28.56
Maximum Speeds (rpm)	3700 to 2600	6000 to 1600	6250 to 2500
Maximum Flows (gpm)	39 to 85	15.8 to 422	35 to 235
Maximum Power (at 5800 psi) (HP)	132 to 290	53 to 1428	118 to 795
Maximum Torque (at maximum displacement and 5800 psi) (lbs-ft)	187 to 586	46 to 4692	131 to 2197

THE REXROTH CORPORATION
MOBILE HYDRAULICS DIVISION
Old Mansfield Road
Wooster, Ohio 44691
Tel: 216/262-2010

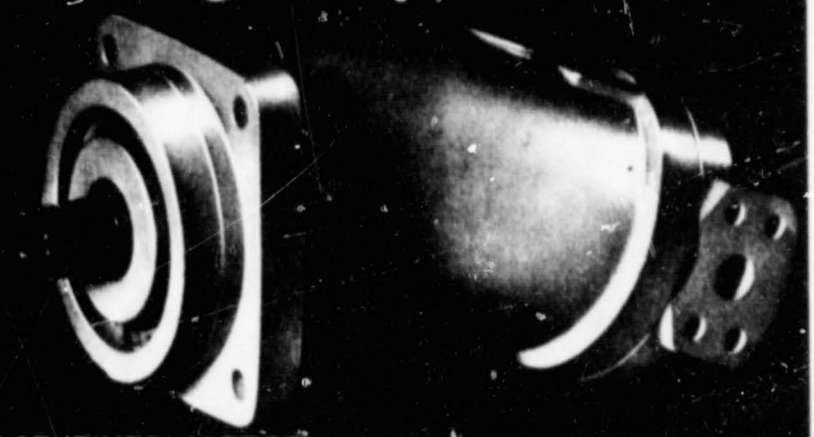
REXROTH HST Motors Are System Matched to Your Mobile Design Requirements

The A2F fixed displacement axial piston motors feature the bent axis design. This design provides high starting torque characteristics and high operating speeds. Large shaft bearings allow the motors to absorb substantial axial and radial forces. As with the AA4V pump, the A2F fixed displacement motors offer the benefits of the spherical control plate design.

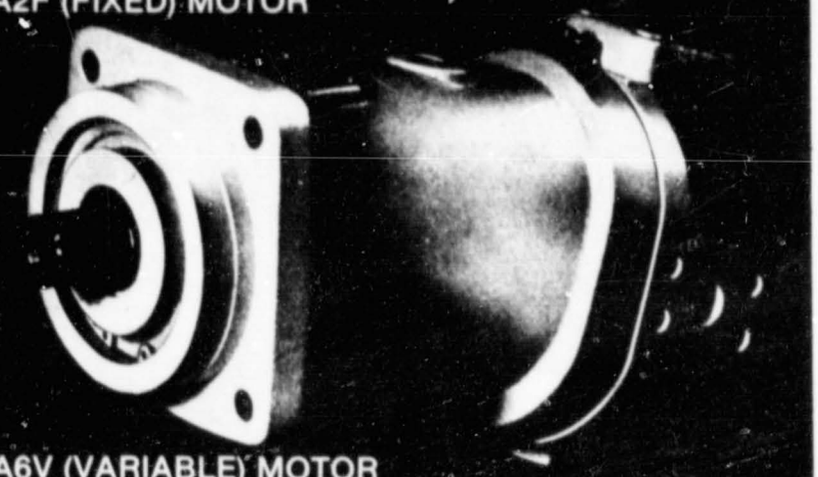
The Rexroth A6V incorporates the proven A2F cylinder block with its advantages of high starting torque and volumetric efficiency. The stroking action is to one side of center only, hence its size and weight is less than most variable displacement motors currently available.

The motor displacement may be altered while driving under full load, and actuation of the motor control allows the cylinder block to swivel between 25° and 7° to give a displacement (speed) ratio of 3.47:1. Five control variations for manual or automatic operation are available with the A6V motor for use in Rexroth mobile hydrostatic transmissions.

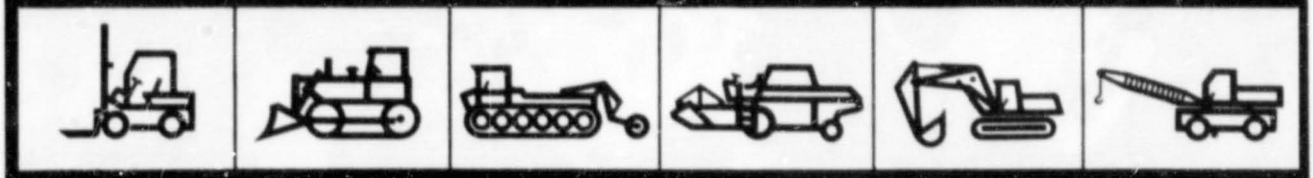
Match your mobile design requirements with Rexroth Hydrostatic Transmission Systems...you'll like the performance.



A2F (FIXED) MOTOR



A6V (VARIABLE) MOTOR



For immediate information, call 216/262-2010. Or, write The Rexroth Corporation, MOBILE HYDRAULICS DIVISION, Hydrostatic Systems Group, Wooster, Ohio 44691

REXROTH

WORLDWIDE HYDRAULICS

MOBILE HYDRAULICS DIVISION

1700 Old Mansfield Road, Wooster, Ohio 44691

Telephone: 216/262-2010

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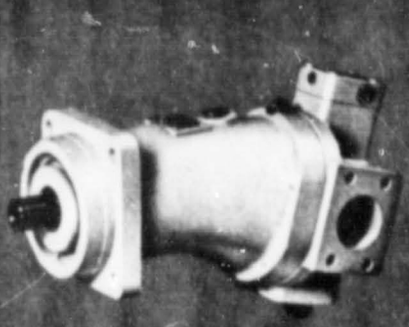
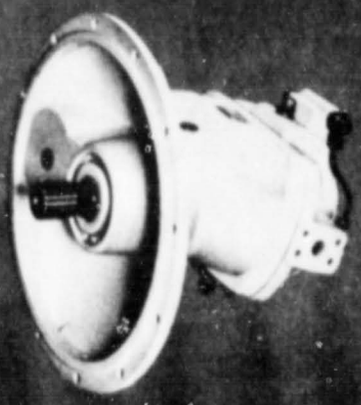
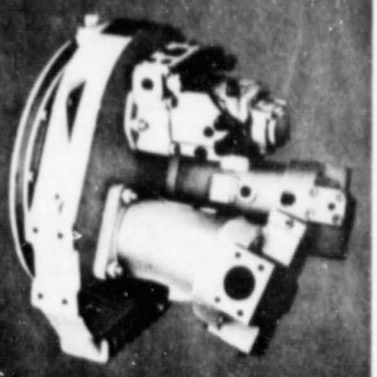
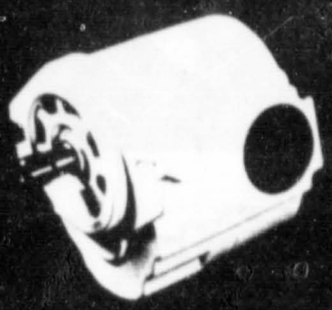
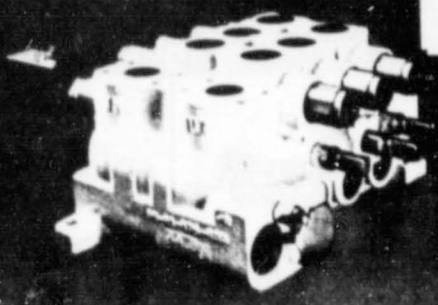
REXROTH HST System Components: Your Application Advantage

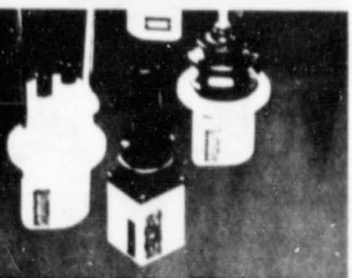












THE REXROTH CORPORATION
MOBILE HYDRAULICS DIVISION
Old Mansfield Road
Wooster, Ohio 44691
Tel: 216/262-2010

REMOTE CONTROLS

The Rexroth line of joystick lever and paddle operated remote control units, offer fine control and ease of operation for hydrostatic systems.

They are maintenance free and available for hydraulic pilot or electric remote operation. The control characteristics of these units are matched to all Rexroth pumps, motors and valves, thereby simplifying your system design and component selection.

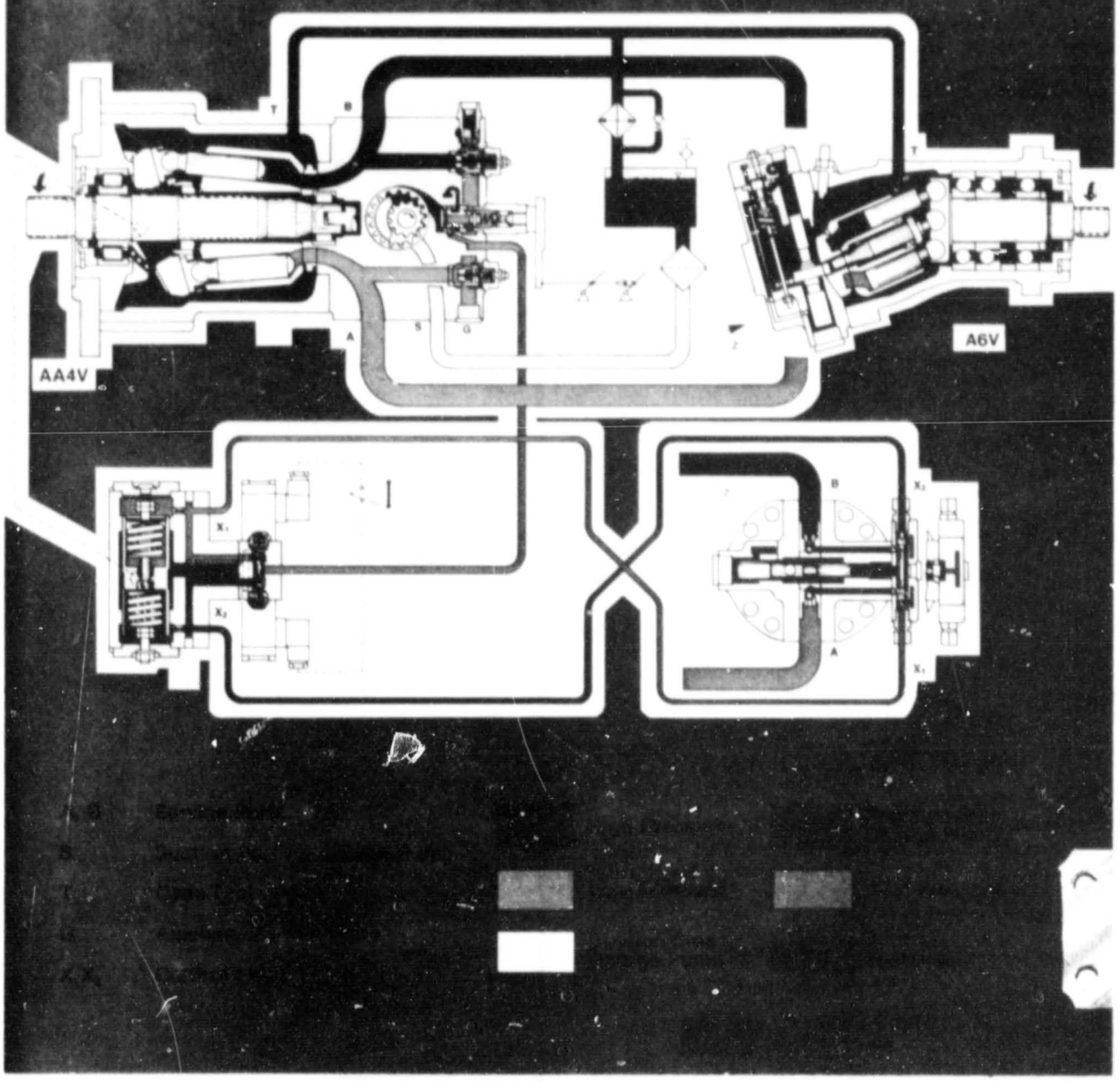
REXROTH: High Efficiency Mobile HST

The Rexroth hydrostatic drive uses the combination of a swashplate design, axial piston variable displacement pump; and, bent axis design, axial piston variable displacement motor.

The AA4V swashplate design pump is compact, lightweight and provides rapid response to control inputs. The compact size and low weights are distinct advantages when mounting several pumps in confined areas around the engine flywheel gear box.

The A6V bent axis, variable displacement motor also provides high performance from a compact and lightweight, yet extremely rugged unit. The 2.47:1 displacement ratio provides high speed capability without sacrificing torque and, therefore, traction effort.

Common controls in both the AA4V and the A6V permit ease of synchronization of pump and motor functions.



THE REXROTH CORPORATION
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Wooster, Ohio 44691
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SPERRY VICKERS
NORTH AMERICAN GROUP, TROY, MI. 48084 TEL: 313-280-2321

Features and Benefits

Low Maintenance, High Productivity

Simple, rugged construction provides an extremely reliable pump design. The replaceable wafer-type valve plate incorporates the pump's timing and provides the stationary surface on which the cylinder block rotates. Low cylinder block stresses result from its strong, massive hub and heavy walls. The rigid, ductile iron yoke is a one-piece design which eliminates pintle connection wear and provides maximum stiffness. Large, anti-friction pintle bearings support the yoke, complementing its strength and its reliability. The rugged drive shaft is designed for minimum deflection at its highest loads. This maintains optimum alignment and lubrication of the bearings, thus providing long bearing life. Bearing life is further enhanced by using large, high strength, tapered roller bearings.

Fewer, stronger parts greatly reduce the potential for component failure and offer a large margin of inherent overall strength. Individual pump components are sized for maximum rigidity, strength and service life. These fewer, rugged parts offer a more durable, reliable pump which will result in lower maintenance costs and increased productivity.

Case Pressure Protection

Although a case drain line is required to limit the steady-state case pressure to 5 psi, an integral relief valve limits the pump case transient pressures to 10 psi higher than the inlet pressure. Flow from this valve is returned directly to the pump inlet.

High Efficiency

E Series pumps handle today's higher speeds and pressures with high efficiency. Typical is 96% volumetric and 83% overall. These pumps meet the critical demands of increased vehicle performance where it counts . . . *in the field.*

Variety of Controls

Pressure compensator and load-sensing controls maximize functional usefulness while minimizing energy consumption, heat load and prime-mover size. These controls respond effectively to the demand for matching the flow needs of the load. This increases system efficiency by reducing wasted power and increasing productivity.

General Description

Pumps

Sperry Vickers' improved E Series piston pumps are inline, variable displacement units, available in two sizes with a selection of optional controls for maximum operational flexibility. They are efficient, reliable pumps, designed specifically for today's hardworking mobile equipment.

Motors and Transmission Pumps

E Series piston products also include fixed and variable displacement motors and hydrostatic transmission pumps. Consult bulletin MB-198A or your local Sperry Vickers representative.

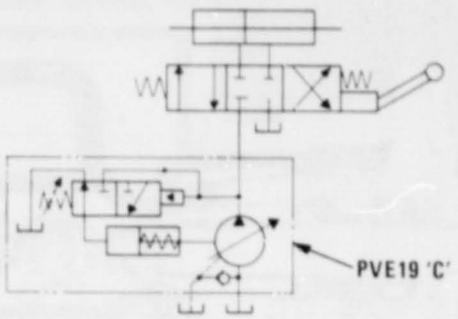
Pump-to-Pump Combinations

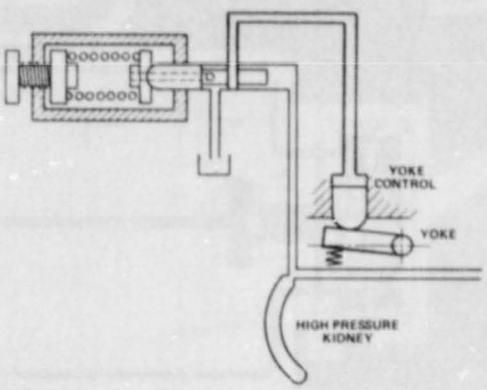
Combinations of E Series piston pumps and fixed displacement gear or vane pumps provide lower installed costs (e.g. one mounting pad) and energy savings from more efficient power utilization (ability to vary the higher combined flow affords greater delivery/demand flexibility). Sperry Vickers can provide a complete package for such tandem configurations. Consult your local Sperry Vickers representative.

Pump Controls

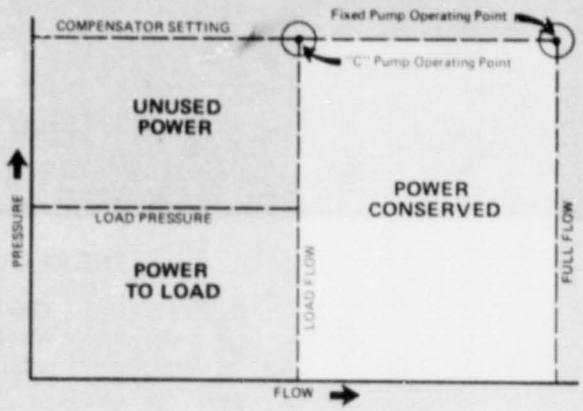
Pressure Compensator Control (C)

This control automatically varies pump displacement to provide, at a constant pressure, only that flow necessary to satisfy the load demand. Displacement starts to reduce at approximately 100 psi below the compensator setting. Control response is sufficiently fast to preclude the need for a pressure relief valve in most systems.



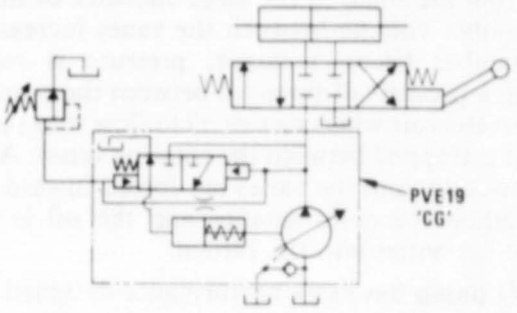


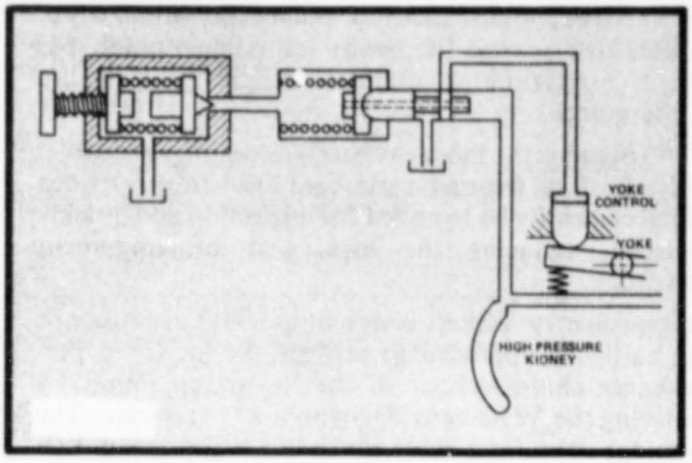
The pressure compensator is the simplest of the pressure limiting controls. Performance characteristics, compared to the same size fixed displacement pump, are shown below.



Remote Adjustment Compensator Control (CG)

This control allows the vehicle operator to change the compensator setting through the use of a remotely located relief valve. This control has the same performance characteristics as the "C" type compensator. It is not available as a remote CV- or CVP- type control.

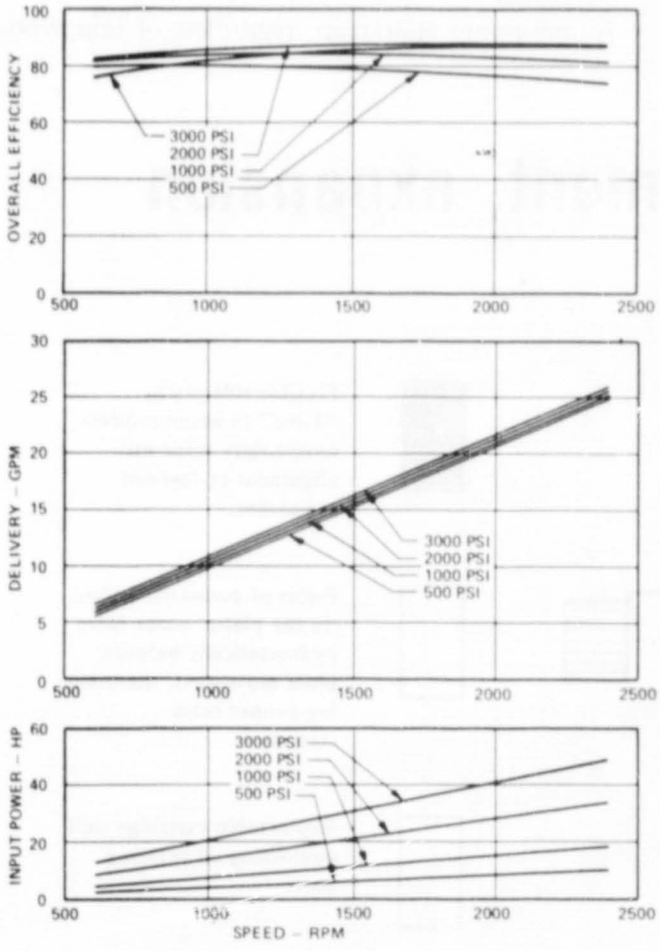




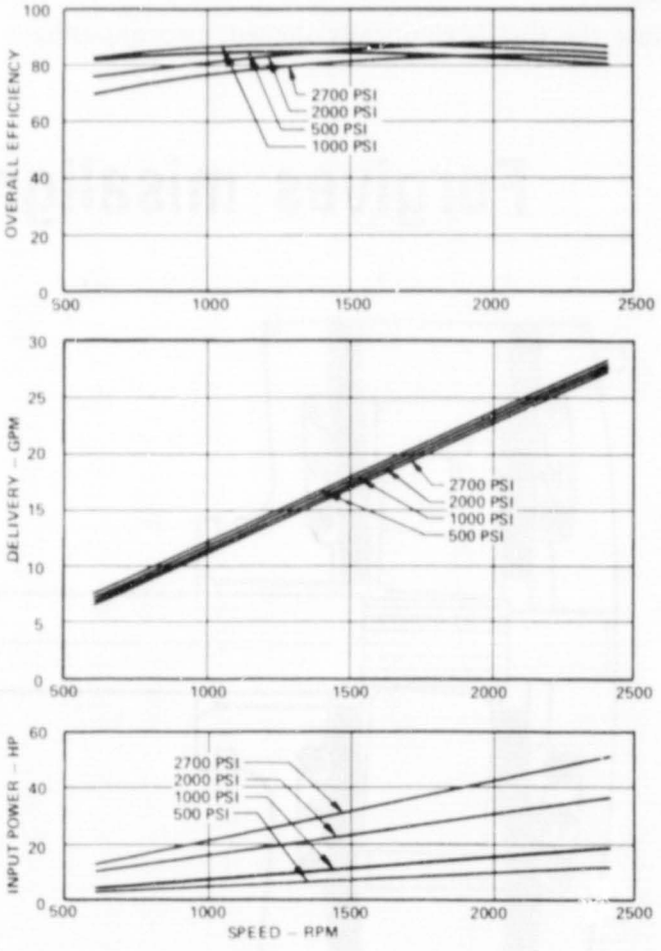
Performance Data

Oil Type: SAE 10W; Oil Temp: 180°F; Inlet Pressure: 0 PSI; Theo. Disp: PVE19 = 2.50 CIR - PVE21 = 2.75 CIR

PVE19



PVE21



SPERRY VICKERS

NORTH AMERICAN GROUP, TROY, MI 48084 TEL: 313-280-2321

VQ vane pumps

are versatile, high efficiency pumps providing long, trouble-free service life, with self-compensation for wear to maintain high volumetric efficiency for the life of the pump.

A VQ pump is the most-easily serviced pump available, with all of its wearing parts contained in a cartridge which can easily be removed for inspection and quickly replaced, reducing the high cost of equipment downtime.

Present Sperry Vickers heavy duty VHO vane pumps can easily be upgraded to provide the increased performance characteristics of the VQ pump simply by replacing the VHO cartridge with a VQ cartridge. The cartridge contains a rotor, intra-type vanes, ring, two flex plates and two support plates. In operation, the pump rotor is driven by a splined shaft coupled to a power source. As rotor speed builds up, centrifugal force moves the vanes outward where they follow the cam-shaped contour of the ring. System pressure applied behind the vanes and inserts presses them against the elliptical contour of the ring, to maintain sealing.

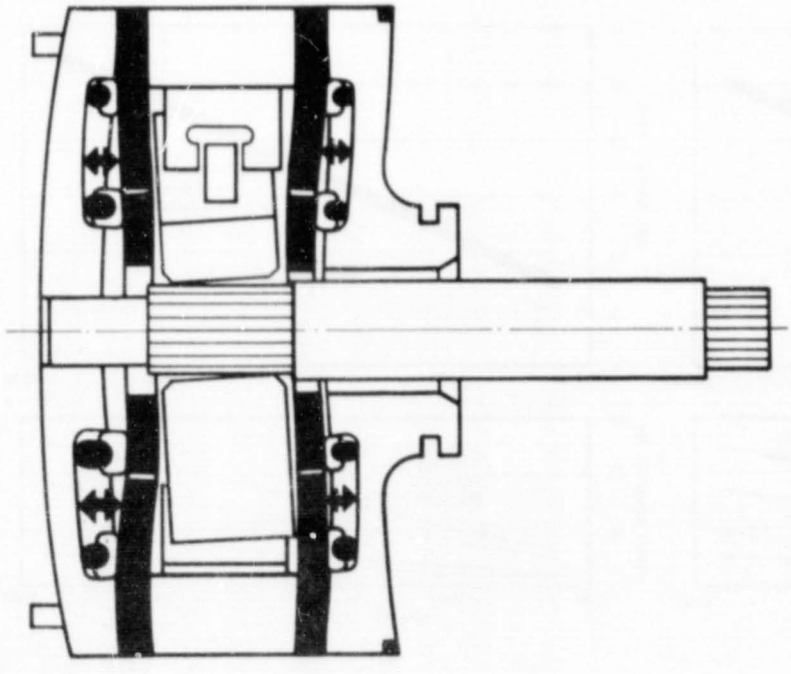
Because the ring is elliptically shaped, two opposing pumping chambers are formed which cancel out radial loads on the shaft bearing, resulting in extraordinarily long bearing life.

As the rotor rotates and the vanes move radially outward from the small to the large diameter of the ring, the chamber volume between the vanes increases. As the chamber becomes larger, pressure is reduced, creating a pressure differential between the pump inlet and the reservoir which causes oil to flow into the inlet. Here, it is trapped between the rotating vanes. As rotation continues and the vanes are forced inward again, the chamber becomes smaller and the oil is forced through an outlet into the system.

The VQ pump has extra performance designed in.
The VQ flexible-plate design provides a number of significant performance advantages:

- Most pumps have heavy, rigid side plates which cannot "give" to accommodate thermal expansion of the rotor. By contrast, the flexible side plates of the VQ pump are designed to flex outward to compensate for thermal expansion of the rotor during operation.
- In any pump at startup, regardless of temperature,

Forgives misalignment, expansion



Flexible side plates "Give" to accommodate momentary rotor misalignment or thermal expansion.

Pools of pressurized fluid on the plates' outer faces hydrostatically balance plate movement, maintaining proper rotor clearance.

Replaceable cartridge unit containing all rotating parts.

HEATER, VEHICULAR

(CODE **HT**)

HARRISON RADIATOR DIVISION
GENERAL MOTORS CORPORATION
LOCKPORT, NEW YORK 14094

Harrison Radiator Division, General Motors Corporation
200 Upper Mountain Road
Lockport, New York 14094
Phone: (716) 439-2011

Harrison offers a wide variety of vehicular heat transfer devices including air conditioners, heaters and various heat exchangers. Currently these units are available for prototype, production and service applications.

HUNTER



HEATERS

DIESEL

SPECIFICATIONS Complying with DOT Regulations	Model DH-22 Series 20,000 BTU/hr Input	Model GH-21 Series 20,000 BTU/hr. Input	Model PH-20 Series 20,000 BTU/hr. Input
TEMPERATURE CONTROL	Built-in Airstream Thermostat *(See "Accessories" For Remote Temperature Control Thermostat)*	Built-in Airstream Thermostat *(See "Accessories" For Remote Temperature Control Thermostat)*	Built-in Airstream Thermostat *(See "Accessories" For Remote Temperature Control Thermostat)*
SAFETY CONTROL	100% Shutoff	100% Shutoff	100% Shutoff
POWER REQUIRED*	12 volt DC 7 amp. Average	12 volt DC 7 amp. Average	12 volt DC 5 amp. Average
AIR DELIVERY	120 (high)/100 (low) cfm at 0" H_2O Back Pressure	120 (high)/100 (low) cfm at 0" H_2O Back Pressure	100 cfm at 0" H_2O Back Pressure
INTEGRATED SAFETY CONTROL	Overheat Cutout Switch and "Tip-Over" - Mercury Switch	Overheat Cutout Switch and "Tip-Over" - Mercury Switch	Overheat Cutout Switch and "Tip-Over" - Mercury Switch
INDICATOR LIGHT	Tell-Tale Type	Tell-Tale Type	Tell-Tale Type
TYPE FUEL PUMP REQUIRED	Electric - 12 Volt DC	Electric - 12 Volt DC	(Pressure Regulator)
VENTING	To Exterior	To Exterior	To Exterior
COMBUSTION CHAMBER	Stainless Steel	Stainless Steel	Stainless Steel
DIMENSIONS	Height: 6¾ Inches	Width: 11¼ Inches	Depth: 16 Inches
WEIGHT SHIPPING	30 pounds	30 pounds	30 pounds
FUEL CONSUMPTION	8½ Hrs./Gal. Average	6¼ Hrs./Gal Average	1 Hr./Lb. Average
TYPE FUEL	No. 1-2 or Arctic Diesel	Unleaded or Low Lead Gasoline (Regular Grade)	Propane Vapor
SHIPPED COMPLETE WITH	• Mounting Hardware • 90° Exhaust Elbow & 9" Nipple • Exhaust Insulator Collar • Installation Manual	• Mounting Hardware • 90° Exhaust Elbow and 9" Nipple • Exhaust Insulator Collar • Installation Manual	• Mounting Hardware • 90° Exhaust Elbow and 9" Nipple • Exhaust Insulator Collar • Pressure Regulator with Excess Flow Valve • Installation Manual

All Hunter Heaters feature forced air delivery and all Heaters operate independently of the vehicle engine.

**Other Voltages Available on Special Order*

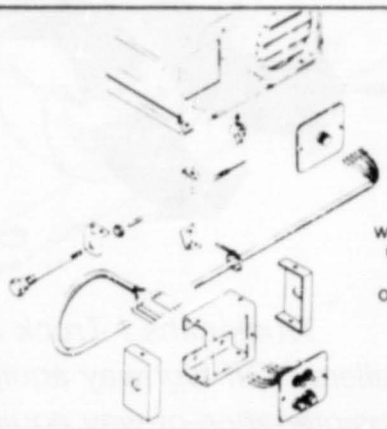
HUNTER HEATER ACCESSORIES:

- **Remote Control Assembly Kit** (shown at right).
- **Thermostat**: Heater automatically maintains "Comfort" temperature setting once heater is manually put into operation. U.L. Listed.
- **12 or 24 Volt Fuel Pump**: DOT Regulations Prohibit Gravity Feed of Liquid Fuels.
- **Auxiliary Fuel Tanks**: Heavy Duty, quality construction available in 5 gallon sizes — (LP Tanks not supplied).
- **Defroster Adapter Assembly**: Fits all Hunter Heaters. Uses 2½" I.D. Convoluted Hose not supplied.

All Hunter Heaters have been tested for exhaust pollutants while operating at the proper fuel adjustment as per instructions contained in "Operating Instructions for Hunter Heaters."

Test results indicate the following:
CO (Carbon Monoxide) — Negligible
SO_2 (Sulphur Dioxide) — Only trace amounts.

Device used for testing for CO: Carbon Monoxide Tester made by Mine Safety Appliances Co.



REMOTE CONTROL HOOKUP KIT

For Diesel, Gasoline or Propane Heaters
For instant heat control within arm's reach, Remote Control Kit makes it easy to have the full benefits of Hunter "Comfort Zone" heating. Kit with 6-foot length cable is simple to connect.

HUNTER MANUFACTURING COMPANY 30525 AURORA RD., CLEVELAND, OHIO 44139 • Phone: 216/248-6111

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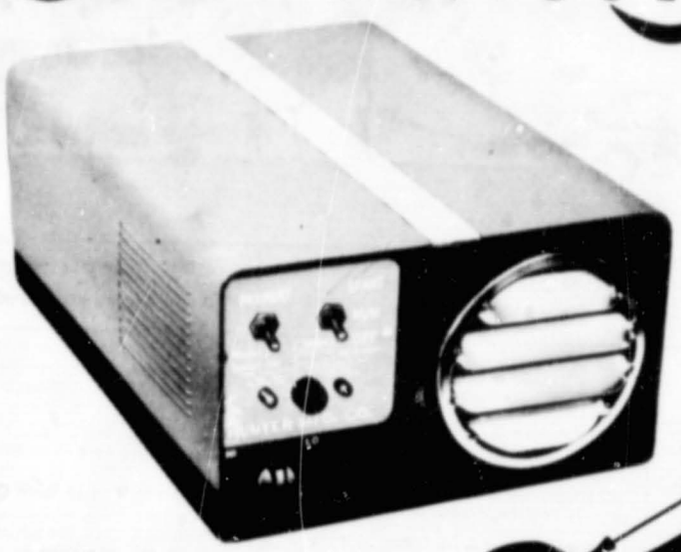
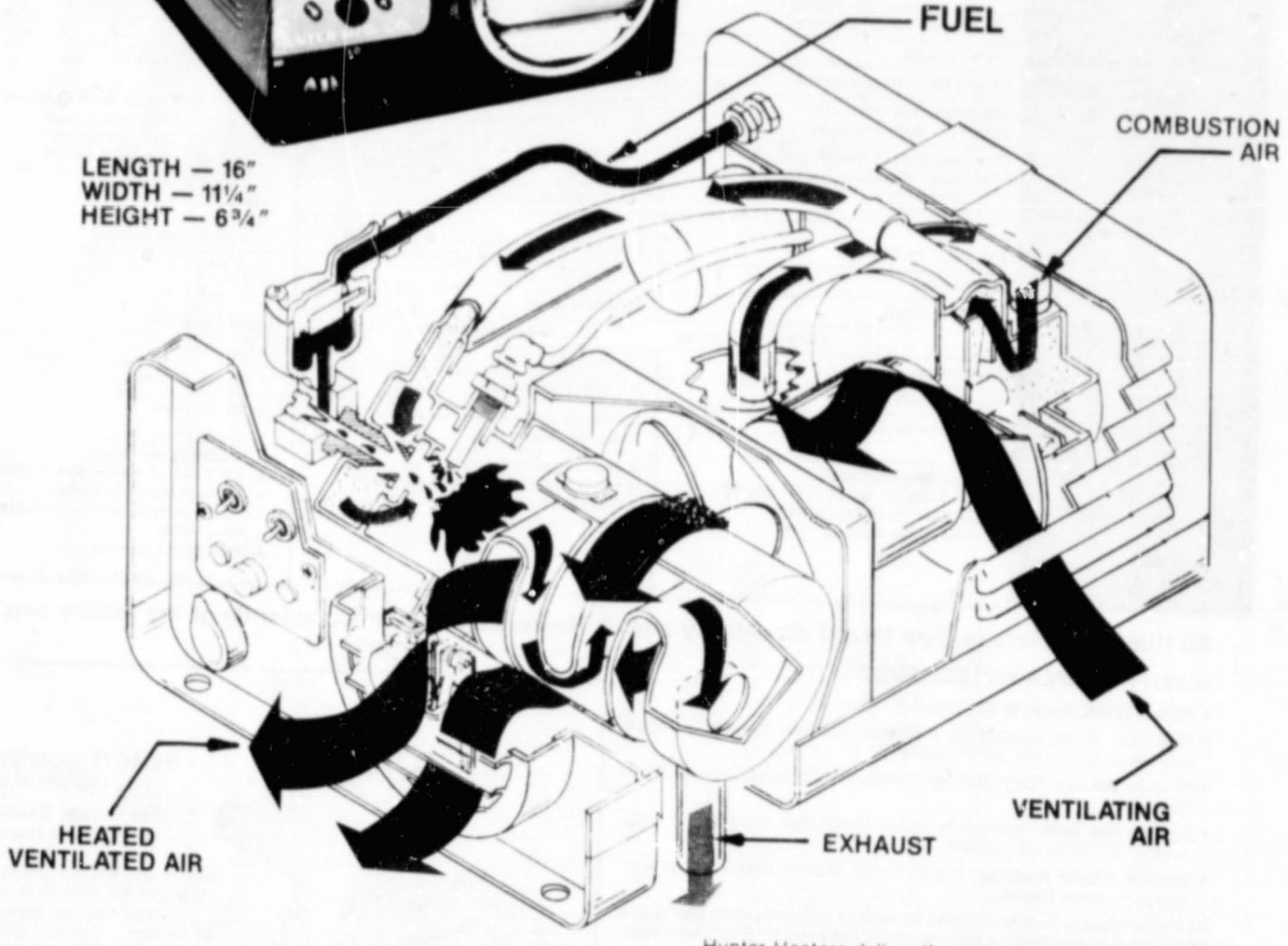
HUNTER *FalconAire*® HEATERS



DIESEL
GASOLINE
PROPANE

LENGTH — 16"
WIDTH — 11¼"
HEIGHT — 6¾"



Truck cabs / Truck bodies / Truck trailers / Off-highway equipment / Railroad maintenance-of-way equipment / Mobile field shops and offices / Electric vehicles

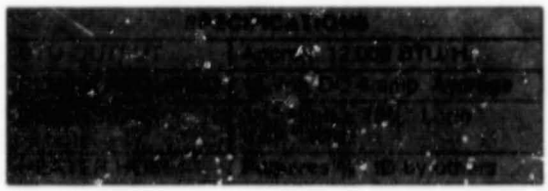
Hunter Heaters deliver the greatest amount of heat with the least amount of fuel in the least amount of space. Hunter's experience and modern engineering techniques combine a controlled amount of fuel with the correct amount of combustion air and ignition of the atomized fuel to produce an optimum burn inside a stainless steel heat exchanger. The fresh air or ventilating blower quietly blows air over the heat exchanger extracting the maximum amount of heat from the exchanger surface before the burned fuel is exhausted to the outside. Whenever — wherever, you need heat, Hunter Heaters are the reliable choice.

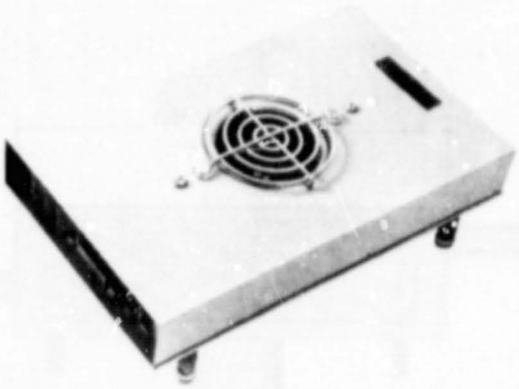
For all types of "On" and "Off" Highway Vehicles
UNIVERSAL HOT WATER HEATER Model HW-125

Compact size and efficiency allow the use of this heater in many places: underseat in cars and trucks; vans and van bodies; construction and farm equipment cabs; pick-up campers and shells.

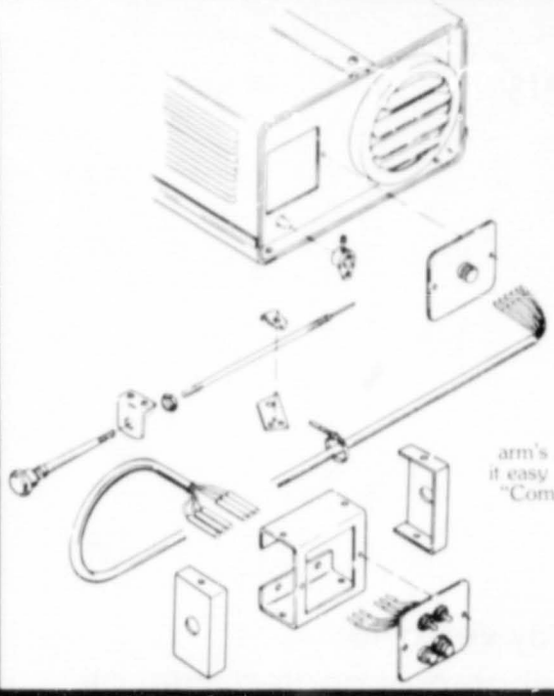
Versatility is added with the removable spacer plate allowing the heater height to be set to one of two heights, 2-3/4" or 3-1/2" high.

Heater can be mounted on floor, wall or ceiling, and the air discharge may be to the sides or up and down.





HEATER ACCESSORIES



REMOTE CONTROL HOOKUP KIT

For Diesel, Gasoline or Propane Heaters

For instant heat control within arm's reach, Remote Control Kit makes it easy to have the full benefits of Hunter "Comfort Zone" heating. Kit with 6-foot length cable is simple to connect.



5 GALLON CAPACITY FUEL TANK

Rugged, dependable fuel tank, complete with mounting brackets, safety cap, welded seams — 18 gauge, terne plate, leak tested — meets D.O.T., FHWA Regulations

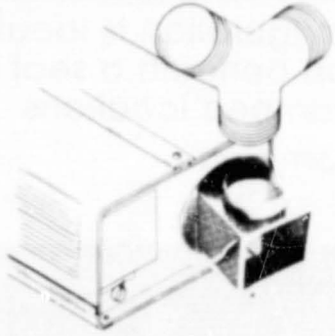
AVAILABLE FROM:



ELECTRIC GASOLINE FUEL PUMP 12 or 24 VOLT AVAILABLE

- Dependable Operation as low as -50°F.
- Constant Pressure
- No Flooding
- Easy to Install
- Built-In Fuel Filter
- Terminals are Oil and Water-Proof
- U.L. Listed.

NOTE: DOT Regulations do not permit gravity-feed fuel operation.



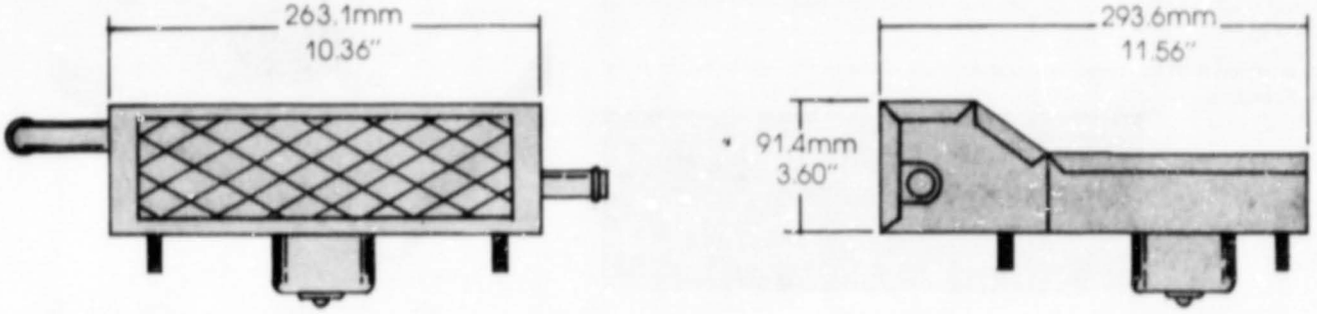
HEATER/DEFROSTER ADAPTER ASSEMBLY

Fits all models of Hunter Heaters. Designed for manual control of heat deflector. Furnished in Red baked enamel. Opening takes 2-1/2" i.d. convoluted hose.

HUNTER MANUFACTURING COMPANY 30525 AURORA RD., CLEVELAND, OHIO 44139 • Phone: 216/248-6111 •

Heater

DIMENSIONS



SPECIFICATIONS

BTU's Per Hour: 17,280 BTU at 100° temperature rise.

Weight: 8 lbs. dry.

Air Flow: 150 C.F.M.

Motor: 1/25 H.P., 12V DC. Also available 24V DC.

Current Draw: 6 amp single speed sealed motor.

FEATURES

- Low Profile
- Easily Installed
- Configuration is ideal for installation beneath a seat or other cramped locations
- Compact
- Highly Versatile
- Fabricated of coated steel all welded construction.
- Core position may be reversed for opposite side installation.

ORDERING INFORMATION

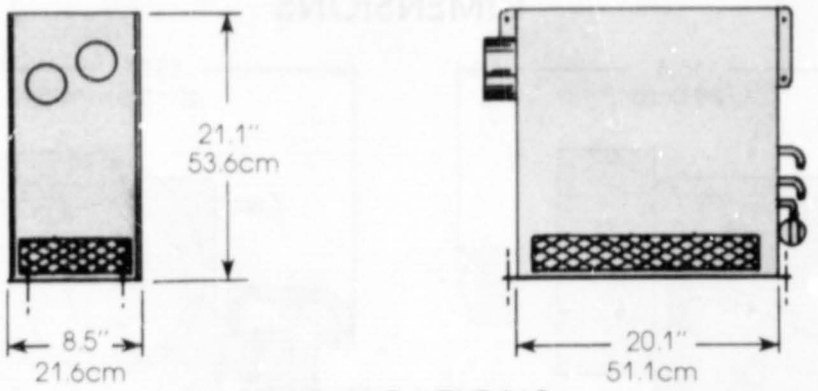
ORDER BY MODEL NUMBER **R-8014-0** (12 VOLT) OR R-8014-0-24 (24 VOLT)
FOR DETAILED ORDERING INFORMATION SEE TECHNICAL SALES BULLETIN
KIT INCLUDES WIRE, TWO SPEED HEATER SWITCH, IN-LINE FUSE AND
ELECTRICAL CONNECTOR.

Note: Not recommended for installation on diesel powered vehicles.

RED DOT CORPORATION 495 Andover Park East Seattle, WA 98188 (206) 575-3840

Heater- Air Conditioner

DIMENSIONS



SPECIFICATIONS

BTU's Per Hour: 44,500 (Heating) 31,000 (Cooling)

Air Flow: 400 CFM

Weight: 55 lbs. dry

Motor(s): Two, 12 VDC, Three Speeds

Current Draw: 32 Amps

Controls: Adjustable Thermostat

Note: BTU Based On 100° F Temperature Rise (Heating) And 36° F Refrigerant Temperature With 80° F Wet Bulb Entering Air (Cooling).

FEATURES:

- High Capacity
- Designed For "Hidden" Installation
- Heavy Duty Welded Construction
- Variety Of Applications
- "O"-Ring Air Conditioner Fittings
- Threaded Fasteners

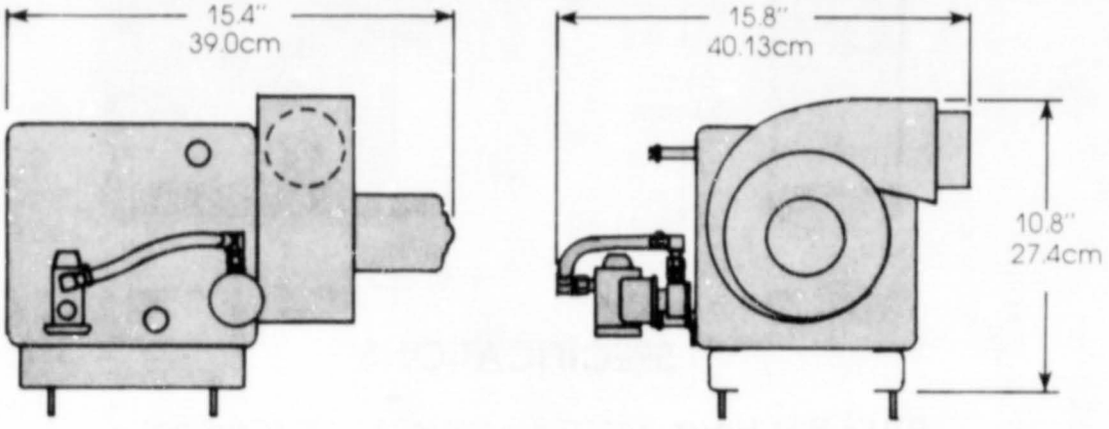
ORDERING INFORMATION

ORDER BY MODEL NUMBER **R-8912-2** (12 VDC). ADD -24 TO MODEL DESIGNATION FOR 24 VDC.
FOR DETAILED ORDERING INFORMATION SEE TECHNICAL SALES BULLETIN 3-2B.

RED DOT CORPORATION
495 Andover Park East Seattle, WA 98188 (206) 575-3840

All Purpose Heater — Air Conditioner

DIMENSIONS



SPECIFICATIONS

BTU's Per Hour: 13,000 (Heating) 10,000 (Cooling)

Air Flow: 120 CFM

Weight: 24 lbs. dry

Motor(s): One, 12 VDC, Single Speed

Current Draw: 6 Amps

Controls: Adjustable Thermostat NOTE – Thermostat NOT included with Unit. (See Parts Catalogue)

Note: BTU Based On 100° F Temperature Rise (Heating) And 36° F Refrigerant Temperature With 80° F Wet Bulb Entering Air (Cooling).

FEATURES:

- Equipped With "O"-Ring Air Conditioner Fittings
- Heavy Duty Welded Construction
- Versatile Installation
- "Squirrel Cage" Type Blower Wheel
- Simplified Construction For Ease Of Maintenance
- Convenient Mounting Brackets

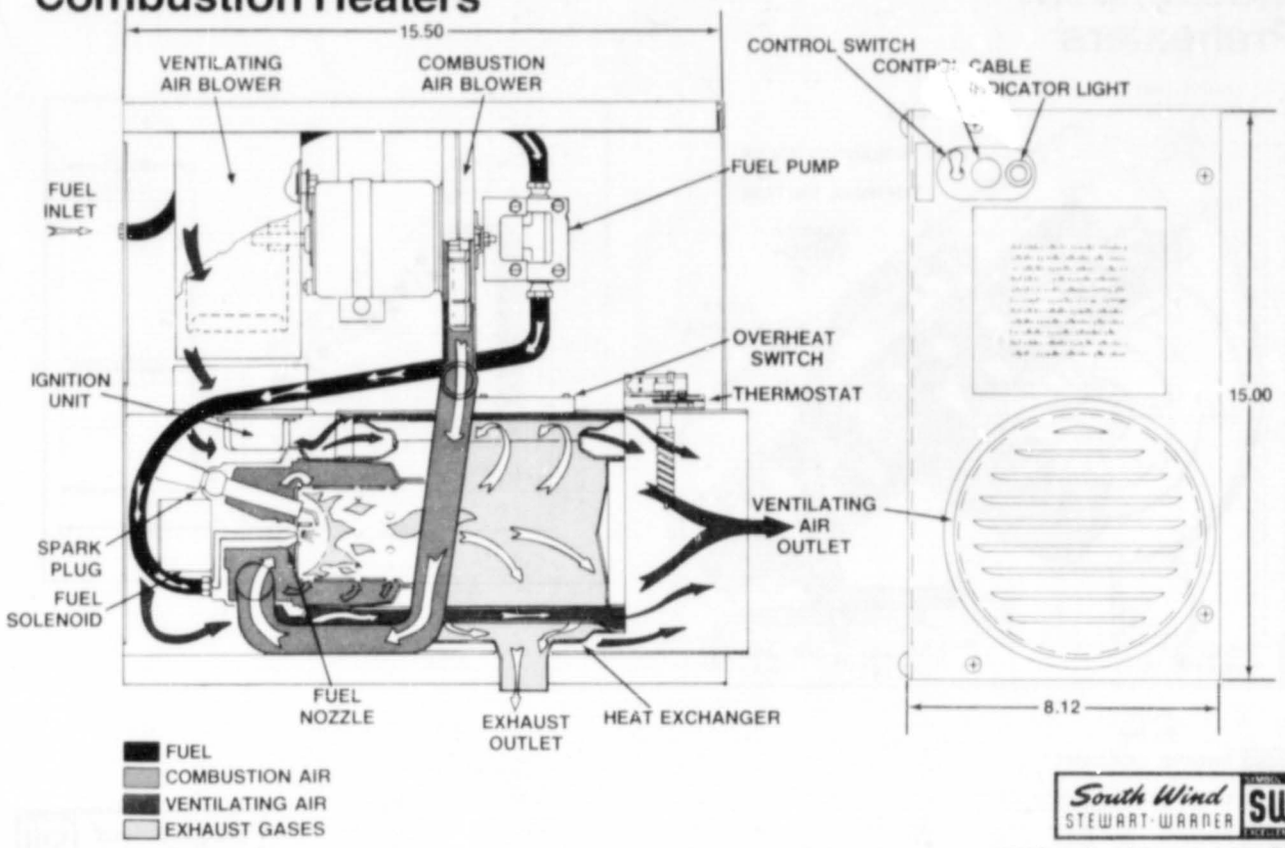
ORDERING INFORMATION

ORDER BY MODEL NUMBER **R-3911A** (12 VDC). ADD -24 TO MODEL DESIGNATION FOR 24 VDC.
FOR DETAILED ORDERING INFORMATION SEE TECHNICAL SALES BULLETIN 3-4B.

RED DOT CORPORATION 495 Andover Park East Seattle, WA 98188 (206) 575-3840

STEWART-WARNER CORPORATION
SYMBOL OF EXCELLENCE SW
South Wind Division
1514 DROVER ST. • INDIANAPOLIS, IN 46221 • 317/267-1613

Independent Combustion Heaters



South Wind STEWART-WARNER SW
1514 Drover Street, Indianapolis, Indiana 46221

The SOUTH WIND 2 is a compact combustion air heater complete with its own fuel pump. It's all that's required to heat almost any electric vehicle. The heater is always ready to deliver heat in a matter of seconds at the flip of a switch. A thermostat maintains the selected temperature at the desired level so that as much or as little of the heater's 18,000 BTU output may be used for any specific application. The powerful fresh air blow delivers enough air to meet defroster velocity quickly.

DESCRIPTION

The SOUTH WIND 2 is an independent, solid state, fuel-burning combustion heater. Air provided by a combustion blower is pumped into the burner assembly. Fuel is atomized by a nozzle in this assembly and the resultant fuel/air mixture is ignited by a spark plug. The hot gases then flow through a stainless steel heat exchanger and are exhausted to the outside. A separate fresh air blower pumps air over the heat exchanger. The air is then directed to the area to be heated.

INSTALLATION

The SOUTH WIND 2 may be easily installed either vertically or horizontally. Units as shipped are for horizontal mounting, but the vertical operation can be easily achieved by simply repositioning the safety upset switch in the heater.

The 5/16-inch bolts provided with the unit will meet most mounting needs, or the unit can be removed from the case to allow installation flexibility. A wide variety of installation situations may be encountered, and to provide maximum flexibility the following parts are available as accessories:

PART NUMBER	ACCESSORY
G486794-2	90 degree fresh air outlet adapter
G484325-2	45 degree fresh air outlet adapter
736411-2	50-inch long, 4-inch diameter flexible duct
484371	Duct clamp for above
735905-3	Exhaust pipe, flexible 30-inch long
G738313-7	Remote control kit with 7-foot cable
G738313-11	Remote control kit with 11-foot cable
G738127	Fuel tank (1.6 U.S. gallon capacity)

The outlet adapters and associated duct and clamps allow the air to be ducted to any desired location. The remote control kits will provide maximum convenience of heater operation.

SPECIFICATIONS

Model No.	10603DH
Heat Output	18,000 BTU/Hr.
Nominal Fuel Rate	.36 Gallon/Hour
Current	7.5 Amperes
Voltage	12V
Outlet Temp. Range	110-220° F.
Air Rate	100 CFM
Minimum Wire Size Required	14
Approx. Shipping Weight	33 Lbs.

SOUTH WIND COMBUSTION HEATER RESEARCH

During 1981, South Wind Division, Stewart-Warner Corporation, will introduce a new liquid-fuel-burning combustion heater. This compact, high-output heater will offer more installation flexibility for electric and hybrid vehicles.

Independent Preheaters

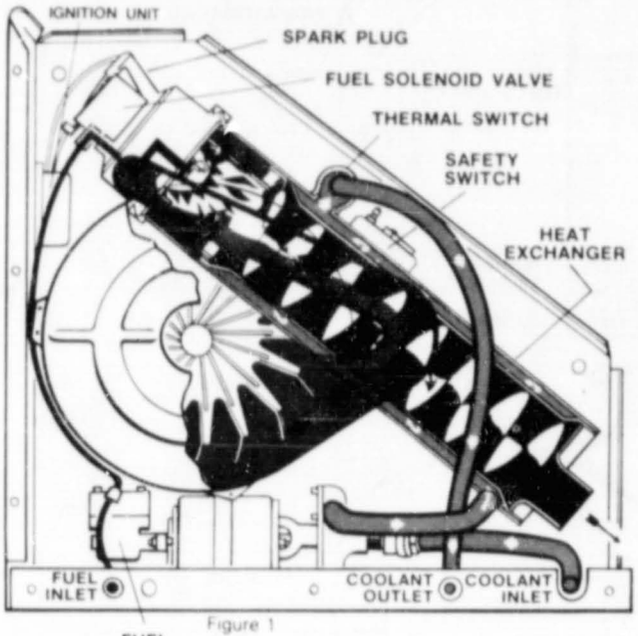
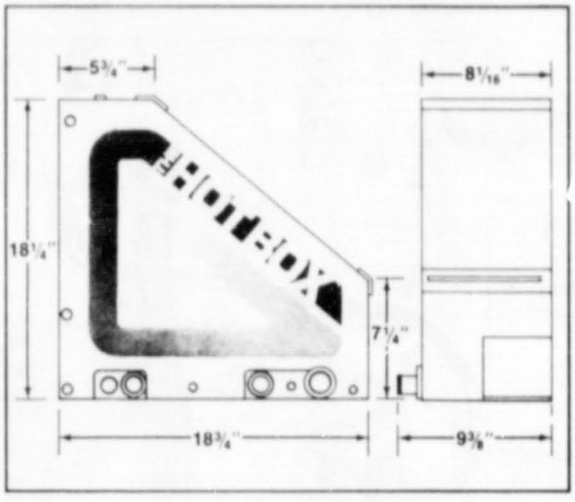


Figure 1



ENGINE COOLANT
COMBUSTION AIR
FUEL
HOT COMBUSTION GASES

South Wind STEWART-WARNER SW

1514 Drover Street, Indianapolis, Indiana 46221

Operation

THE HOT BOX is a sealed, self-contained, fuel-burning combustion heater with its own fuel pump, coolant pump and solid state ignition. THE HOT BOX is connected to the electrical system and coolant reservoir of the vehicle.

In THE HOT BOX's burner assembly, fuel is mixed with air brought in by a combustion air blower. This mixture is ignited in a manner similar to that in a car's ignition system, and the resulting hot gases circulated through a spiral baffle in the heat exchanger. The double-walled water jacket type heat exchanger absorbs the heat into the coolant which is then circulated. With a heating capacity of 40,000 BTU/Hr., THE HOT BOX rapidly achieves and maintains a coolant temperature of between 140 and 160° F. When this temperature is attained, the thermostat automatically cycles the burner on and off to maintain the proper level. Should the heat exchanger temperature rise above the predetermined level, a safety switch shuts down the heater operation.

INSTALLATION

THE HOT BOX can be easily installed in any suitable location or removed from the box for maximum installation flexibility. However, installation below the coolant level and as close as possible to the coolant reservoir is recommended.

SPECIFICATIONS

Model No.	8303-C
Heat Output	40,000 BTU/Hr.
Fuel	Gasoline
Maximum Fuel Rate	.06 Lbs./Min.
Current	10.5 Amperes
Voltage	12V
Thermostat Range	140-160° F
Coolant Pump Capacity	2 GPM
Minimum Wire Size Required	14
Approx. Shipping Weight	52 Lbs.

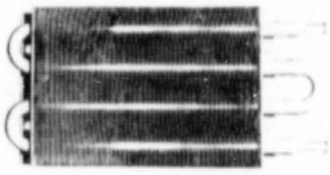
HEAT EXCHANGERS

AIR-TO-AIR, LIQUID-TO-AIR

(CODE **HX**)

CHAM – CAL ENGINEERING CO.
P.O. Box 972
Garden Grove, CA 92641
Tel: 213-594-8604

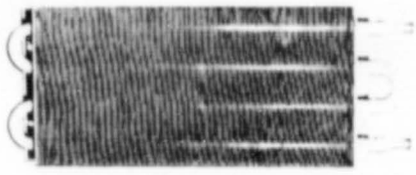
THE NEW LINE of CHAM-CAL transmission coolers



414
9500#



214
6000#



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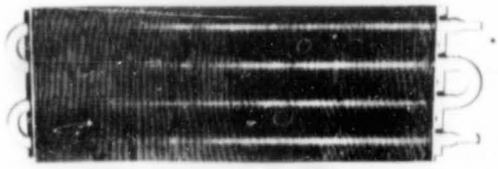
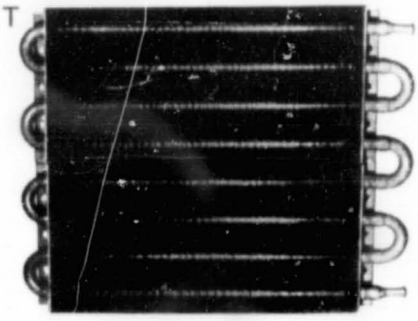
12000#



PARTS KIT



422
16,000#



818
18,000#

OVERHEATED TRANSMISSIONS FAIL PREMATURELY:

Original equipment transmission coolers are barely adequate for light duty driving. Any heavy load on your vehicle (pulling a boat or trailer–R V motor homes and campers–just driving fast in hot weather even though not pulling a trailer) will overheat the transmission fluid. This causes oxidation, acids and tars and ruined oil seals, all of which means an expensive transmission rebuild.

CHAM-CAL TRANSMISSION INSURANCE:

Your transmission oil is good for 100,000 miles at 175°–50,000 at 200°–only 7000 miles at 250°. Your new car or truck probably has a thermostat which keeps the radiator water over 200°. How can you cool transmission oil to a safe level with 210° water? You cant! However, a properly sized CHAM-CAL cooler will insure the life of your transmission by keeping the oil at a safe operating level.

OTHER BENEFITS FROM A CHAM-CAL COOLER:

You have increased cooling for your engine because the excess heat of the transmission fluid is no longer added to your radiator water. A major city police department found it necessary to change transmission oil every 9000 miles before they equipped their autos with heavy duty transmission coolers. You can recover the cost of the cooler from reduced changes of transmission fluid. Of course, the biggest benefits are increased transmission life, and prevention of a frustrating and costly road breakdown far from help.

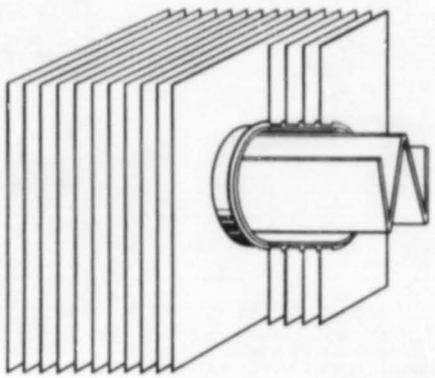
CHAM-CAL G.V.W. RATINGS ARE SAFE:

Compare our cooler size per G.V.W. rating with other brands. Be wary of coolers that are physically smaller with the same G.V.W. rating. There are some coolers being marketed which are grossly over-rated.

CHAM – CAL ENGINEERING CO.

P.O. Box 972
Garden Grove, CA 92641
Tel: 213-594-8604

"W" FIN HEAT CONDUCTOR INSIDE ALL TUBES INCREASES PERFORMANCE BY 40%.



YET, IT DOES NOT RESTRICT NOR PLUG OIL FLOW THROUGH LARGE OIL TUBE PASSAGEWAYS.

The hard tempered aluminum "W" fin is pressed into the tubes by hydraulic powered pistons to force a super tight contact from the heat conductor to the wall of the tube. This "W" fin extracts heat from throughout the column of oil and transfers the heat into the tube and outer fin assembly to be carried away in the air stream. Round tube coolers that do NOT have a bonded internal heat conductor are much less efficient since the oil film on the inner wall of the tube tends to insulate the center of the oil flow column from being cooled.

Copper tubes (which give maximum heat-transfer) are hydrostatically expanded at 1800 PSI into full-collar aluminum fins. The fins are impervious to vibration and will never loosen, giving maximum cooling performance for the life of the vehicle.

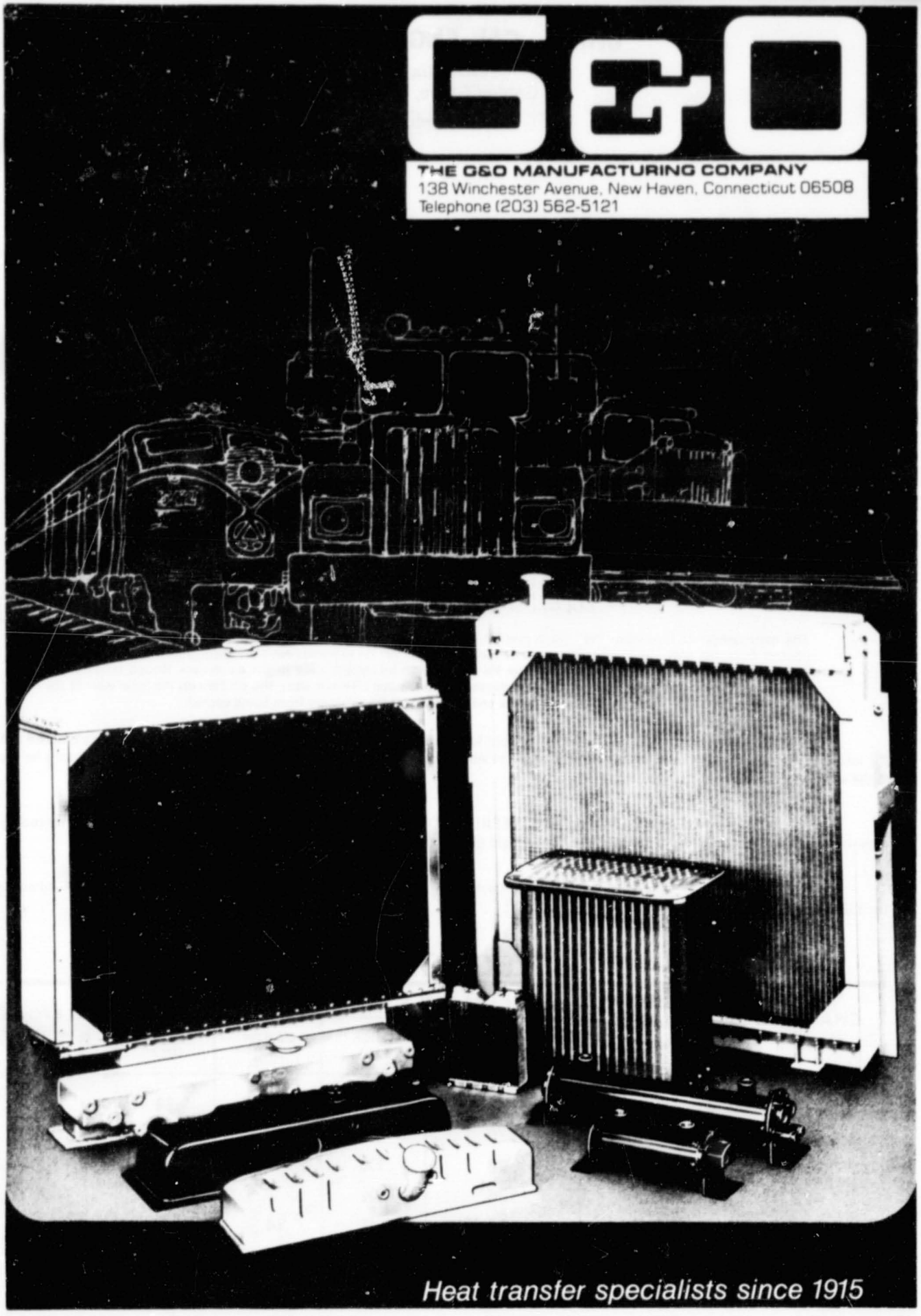
CHAM-CAL ENGINEERING COMPANY has developed this cooler design especially for oil cooling. All manufacturing processes are done in our own plant under rigid quality control standards.

16 gauge galvanized steel mounting straps–100% stainless steel hose clamps– BUNA-N lined hose good for 300° F. oil temperature.

SELECTION CHART

CHAM-CAL MODEL	G.V.W. RATING (LBS.) REPLACEMENT INSTALLATION	DIMENSIONAL DATA				HEAT EXCHANGE BTUH *
		FACE AREA (Finned Area · Sq. In.)	THICK (IN.)	WIDTH (IN.)	LENGTH (IN.)	
214	6000	35	1½	3½	14	5500
414	9500	70	1½	7	14	10,000
418	12,000	98	1½	7	18	13,200
422	16,000	126	1½	7	22	16,400
818	18,000	196	1½	14	18	24,000

* BTUH CAPACITY BASED ON LAB CONDITIONS AS FOLLOWS: 2500-FPM AIR VELOCITY . . . 2-GPM TRANSMISSION OIL . . . 100° AIR TO OIL TEMPERATURE DIFFERENTIAL.



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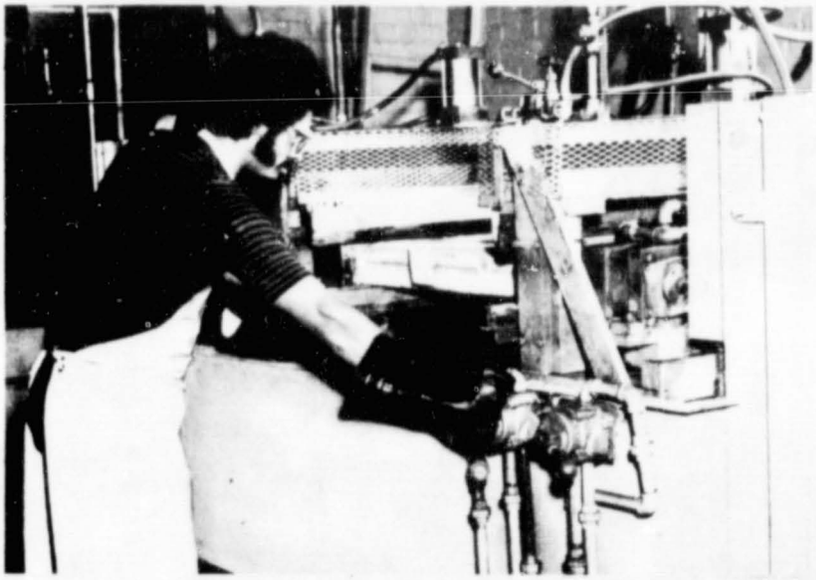
OF POOR QUALITY

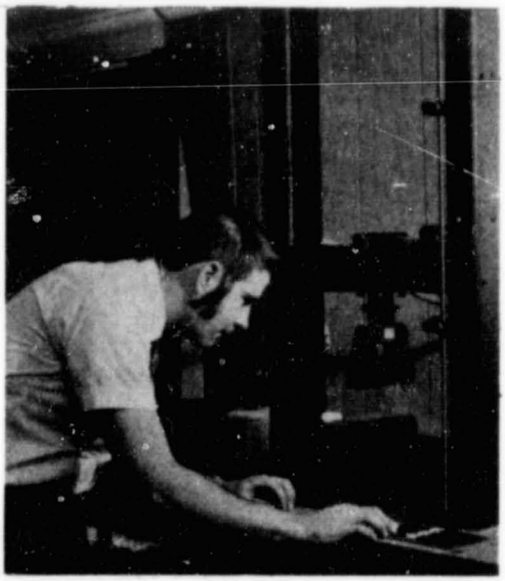
THE G&O MANUFACTURING COMPANY
138 Winchester Avenue, New Haven, Connecticut 06508
Telephone (203) 562-5121

Since 1915: Radiators and heat exchangers have been the specialty of the G & O Corp. (now a division of The Allen Group) ever since its founding in 1915. As far back as World War I, our equipment was used in heavy-duty military vehicles, aircraft, and commercial trucks. Automobiles, too—the Stanley Steamer, for example. Today we supply radiators and heat exchangers to many of the world's leading manufacturers of trucks, construction equipment, compressors, and locomotives.

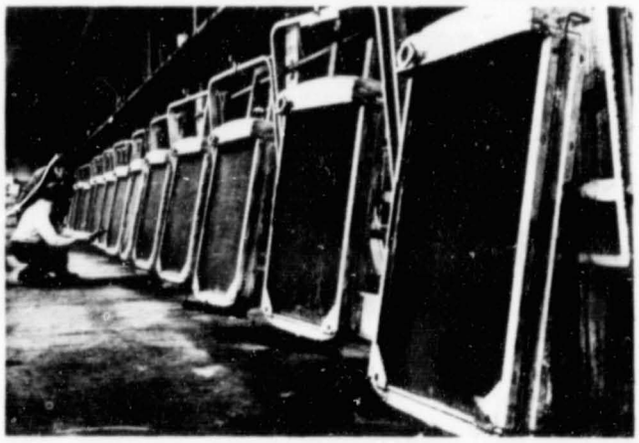
Engineered Products—from Concept to Completion: Every O.E.M. radiator or heat exchanger we build for you will be engineered to meet your specifications by engineers with years of experience in this highly specialized field. Their extensive experience with all types of heat transfer problems often results in substantial savings to our customers, through design efficiencies.

Computerized Design Data; Complete Pre-Testing: Our own computer facilities provide design computations to determine the required core type, sizes, and fin configurations. Prototypes are built and tested in our laboratories, which include computer controlled wind tunnels to test heat transfer rates, pressure cycle testing equipment to determine life expectancy, de-aeration, and drawdown testing devices, as well as standard laboratory equipment.









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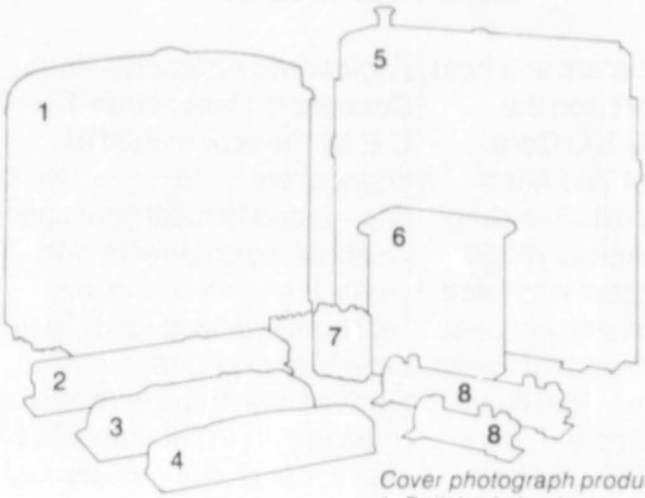
OF POOR QUALITY

THE G&O MANUFACTURING COMPANY
138 Winchester Avenue, New Haven, Connecticut 06508
Telephone (203) 562-5121

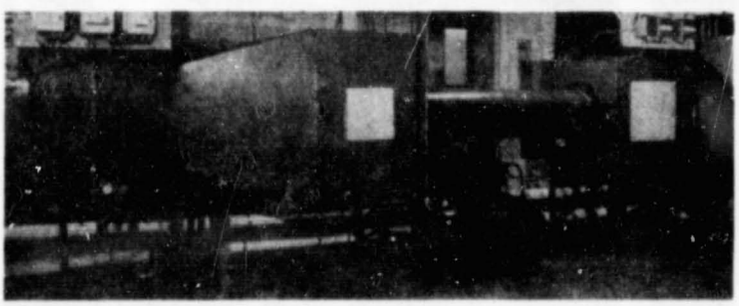
100% Quality Control: Every G & O product is thoroughly tested by a hydrostatic or air-under-water test for leakage, for dimensional accuracy, and for appearance. Our Quality Control Department has the last word: If the product is not 100% satisfactory, it is not shipped. Among other process certifications, we have the following: NAVSHIPS-250-634-6, Class P-3b (Brazing); MIL-T-5021 (Welding); and MIL-T-704D, Paint.



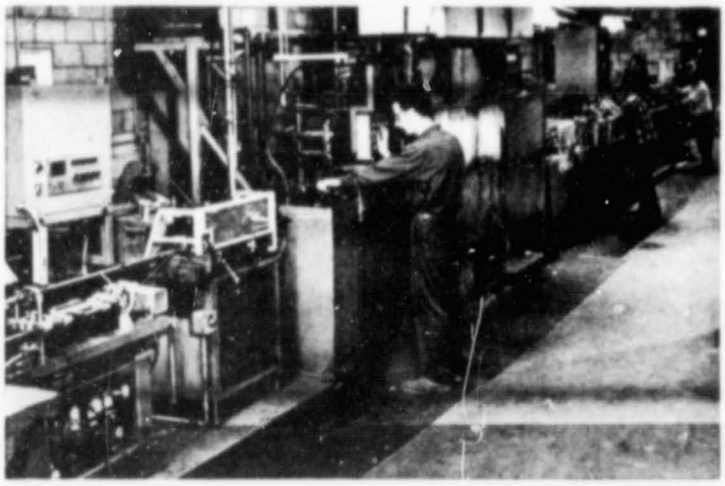
Cover photograph product identification
1 Polished aluminum radiator
2 Lightweight cast aluminum top tank
3 Drawn steel top tank
4 Drawn brass top tank
5 Fabricated steel radiator
6 Diesel engine intercooler
7 Vehicle heater core
8 Porobond shell and tube heat exchangers











Welded Tubing
Butt welded tubing is recognized as being significantly superior to soldered lock-seam tubing, since it is both stronger and lighter. The smooth seam of butt welded tubing fits snugly on all sides to the fin, thereby delivering superior heat transfer performance. G & O has its own butt weld tubing mill, giving us complete control over quality and production. *We are the only radiator manufacturer with in-plant butt weld tubing capability.*

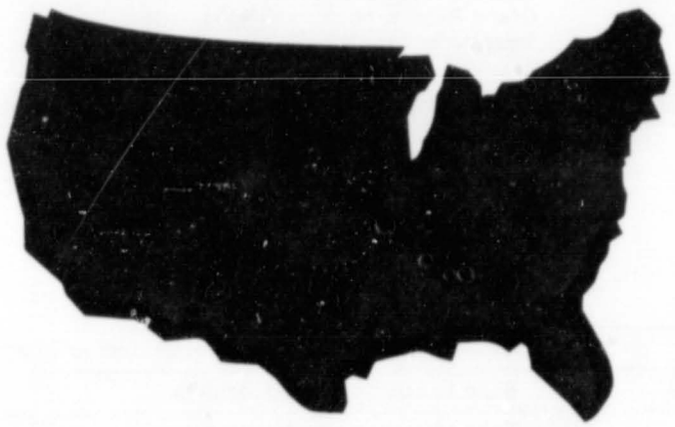
Prompt Field Engineering Service: All our field representatives are experienced heat transfer engineers who work closely with our customers and our resident engineering staff. Strategically located in the major industrial regions of the country, they are available to you for assistance in design and field consultation.

PRODUCT CAPABILITIES

Engine-cooling Radiators for trucks, tractors, locomotives, construction and industrial equipment, busses, compressors, and engine generator sets.

Shell and tube heat exchangers for custom designed heat exchangers.

Heater Core and Tank Assemblies for trucks, tractors, locomotives, construction and industrial equipment.



G & O FACTORIES ARE STRATEGICALLY LOCATED IN ALL MAJOR INDUSTRIAL AREAS OF THE COUNTRY.

New Haven, Connecticut
Wallingford, Connecticut
Chicago, Illinois
Peru, Illinois
Jackson, Mississippi
Hayward, California

G & O CORP.

A Division of ALLEN

138 Winchester Avenue / New Haven, Connecticut 06508 / Telephone (203) 562-5121

Gulf + Western
Manufacturing Company

Electric Vehicle Components

Bohn Heat Transfer Division

1625 East Voorhees Street
Danville, Illinois 61832
Telephone: 217/446-3710

Heat Exchangers	Air to air, liquid to air and liquid to liquid designs. Custom manufacture.

Michigan Plating & Stamping Division

1860 Alpine Avenue, N.W.
Grand Rapids, Michigan 49504
Telephone: 616/363-4847

Fuel Tanks	Supplier to automotive industry of terneplate stamped and welded tanks.

Automotive Marketing and Engineering Center

Detroit Sales and Engineering Office
24114 Research Drive
Farmington Hills, Michigan 48024
Telephone: 313/478-8140

Relays	Miniaturized 12VDC to control circuits to 20 amperes.
Solenoids	Build to customer requirements.
Switches	Build to customer requirements.
Transducers	Current, Position, Pressure, Speed, Temperature, Torque, Voltage - Build to customer requirements
Voltage Regulators	12VDC Solid State

Collyer Insulated Wire Division

100 Higginson Ave.
Lincoln, RI 02865
Telephone: 401/723-7800

Apparatus Cables	**Single conductor, Type A.I.A.** IPCEA S-28-357, NEMA WC-1; Underwriters' Lab. Sizes #4 AWG and larger. Asb. covered, 300V and 600V.
Appliance Wires	**Single conductor** Collyer P-400 THHN/THWN PVC/NYLON in those sizes which are 19W uncompressed. U.L. Listed Rate AWM 105°C Dry and 80°C in oil.
Control Cables	**Single and multi conductor** THERMOPLASTIC: Collyer C-141 — PZR — PE/NYLON condrs. PVC Jacket 600V, 1000V, 75°C. Collyer C-140 — PVC insulated and jacketed 600V. Collyer C-143 — PE/PVC conductors, PVC jacket 600V, 1000V. Collyer C-153 — PE/NYLON, PZR 90°C, PVC jacket 600V, 1000V. Collyer C-154 — THHN/THWN conductors Type T.C. U.L. Listed.

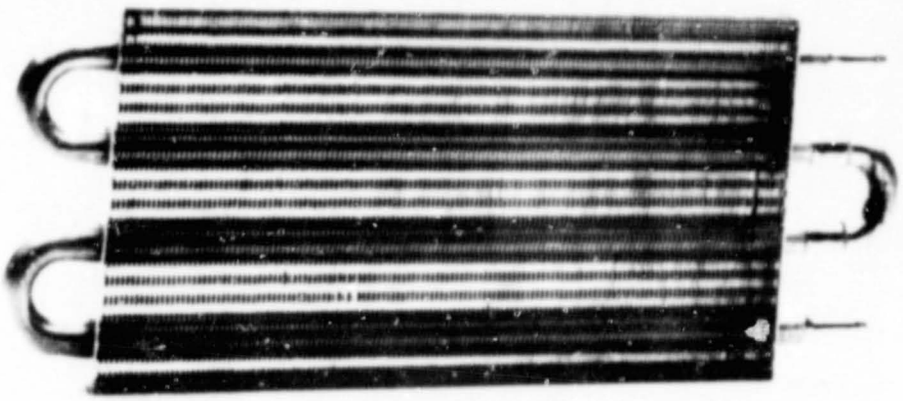
HARRISON RADIATOR DIVISION
GENERAL MOTORS CORPORATION
LOCKPORT, NEW YORK 14094

Harrison Radiator Division, General Motors Corporation
200 Upper Mountain Road
Lockport, New York 14094
Phone: (716) 439-2011

Harrison offers a wide variety of vehicular heat transfer devices including air conditioners, heaters and various heat exchangers. Currently these units are available for prototype, production and service applications.

HEAT EXCHANGERS

TRANSMISSION COOLERS



Principle of operation:

An oil-to-air transmission cooler utilizes the coolest available medium, air, for extracting heat from transmission fluid. The cooler the cooling meduim, the more heat it can extract. Air is about 70°F, engine coolant about 200°.

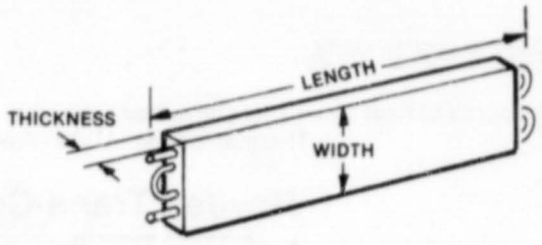
Keeping transmission fluid cool inhibits formation of heavy oxides and acids. These can damage hardware by corrosion and by weakening the ability of the oil to do its job. Transmission fluid is a double duty fluid - transmitting power in the torque converter and lubricating the parts. It is a compromise between these two demands and so especially in need of protection from the degrading effects of heat. In fact every 20° increase in temperature accelerates that degredation by 100%.

Oil circulates in a continuous loop from the pan through the oil pump, through the cooler, through the filter to the engine. In the cooler, an exclusive inner swirling action of the oil is created by uniquely designed inner-swirl fins. As the hot oil flows through the swirl fins, hundreds of tiny "swirlpools" swirl clockwise and then counter-clockwise at precisely tooled spiral grooved openings. This 360° swirling action assures double heat extraction by the double turn exposure of hot oil to the cold air side of the cooler.

HAYDEN INC.
1531 Pomona Road, Corona, California 91720
(714) 735-4900 Outside CA (800) 854-4757

HEAT EXCHANGERS

DIMENSIONS



TRANSMISSION OIL COOLERS

SWIRL-COOL SPACE SAVER	SWIRL-COOL 1½" THICK	ULTRA-COOL ¾" ECONOMY	GVW RATING TRANS. ONLY	DIMENSIONS		
				THICK	WIDTH	LENGTH O.A.
1010		401	10,000	¾	5	12-3/4
	1334		10,000	1½	4	12
1011		402	12,000	¾	5	14-3/8
	1359		12,000	1½	4	15
1012		403	15,000	¾	5	18-3/8
	1315		15,000	1½	8	12-1/8
1013		404	17,500	¾	7½	16-3/8
	1301		17,500	1½	8	15-1/8
1014		405	21,000	¾	10	16-3/8
	1305		21,000	1½	8	18-1/8
	1306		24,000	1½	12	15-1/8

*GVW Ratings: For Heavy Duty, Use Swirl-Cool . . . For Standard Duty, Use Ultra-Cool.

WEIGHT

Transmission coolers can vary in weight from 1/2 - 5 pounds depending on size and efficiency.

RATING

A transmission cooler is evaluated by the heat, in BTU/HR (British Thermal Units per Hour) it removes. Shrinking available room near the radiator is making size an important factor in rating a cooler.

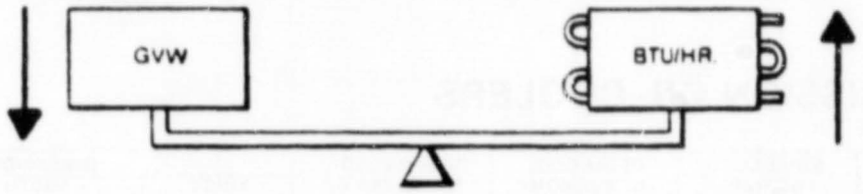
HAYDEN INC.
1531 Pomona Road, Corona, California 91720
(714) 735-4900 Outside CA (800) 854-4757

HEAT EXCHANGERS

PERFORMANCE DATA

The source of heat in an automatic transmission is the torque converter. The measurement of heat is BTU (British Thermal Units). GVW (Weight) puts BTU's (Heat) into your transmission.

Hayden Trans-Coolers Take BTU's (Heat) Out.



BTU/HR RATINGS PER HAYDEN STANDARD TEST (1.7 GPM @ 100°F ITD @ 2500 FPM) RELATE TO GVW RATINGS. THE HAYDEN COOLER WE SPECIFY WILL TAKE OUT THE NECESSARY BTU'S TO MEET THE STANDARD TEST AND WILL COOL YOUR OIL FROM 20°F TO 60°F.

REMEMBER — a 20° drop in oil temperature doubles oil and equipment life.

	GVW		BTU/HR (APPROX)
If your	8,000	You need to take out this	5,740
GVW load	10,000	many BTU/HR of additional	7,484
on a 100° day	13,000	heat for heavy duty stress	10,223
is:	15,500	driving.	12,600
	18,000		15,052

The most frequent mechanical failure on a car is the transmission . . . protect it.

OPERATING INSTRUCTIONS

N/A

ENGINE OIL COOLERS

Principles of operation:

Oil naturally forms a thick boundary layer against a cool surface, like a heat exchange tube, and that boundary layer can insulate the main body of hot oil from the cool tube surface. In order to be effective an oil cooler must mix the oil to prevent that insulating boundary layer from forming.

Oil circulates in a continuous loop from the pan through the oil pump, through the cooler, through the filter to the engine. In the cooler, an exclusive inner swirling action of the oil is created by uniquely designed inner-swirl fins. As the hot oil flows through the swirl fins, hundreds of tiny "swirlpools" swirl clockwise and then counter-clockwise at precisely tooled spiral grooved openings. This 360° swirling action assures double heat extraction by the double turn exposure of hot oil to the cold air side of the cooler.

HAYDEN INC.
1531 Pomona Road, Corona, California 91720
(714) 735-4900 Outside CA (800) 854-4757

HEAT EXCHANGERS

Engine oil is required to operate in a hostile environment in smaller high-revving engines where it has to absorb heat and emissions. Taking heat out of the oil helps protect it and increase its effectiveness and lifespan. In doing so the parts it is lubricating are better protected as well. The amount of protection can be gauged by the fact that it is doubled with each 20° worth of heat removed from the oil!.

DIMENSIONS

HAYDEN SWIRL-COOL FULL FLOW ENGINE OIL COOLERS — Heavy Duty & Performance Grade				
2400	K2400	1½ x 6 x 18	205/225*	Ford-Chrysler-GM
2401	K2401	1½ x 8 x 21	205/225*	Performance — Steel Brd. Hose
2402	K2402	1½ x 6 x 18	258	Chev w/Cartridge Filter
2403	K2403	1½ x 8 x 21	258	Performance — Steel Brd. Hose
— —	K2404	— —	—	Use 2400
— —	K2405	— —	—	Use 2401
2406	K2406	1½ x 6 x 18	211	Chev w/Spin-On Filter
2408	K2408	1½ x 4 x 15	211	Chev 4 Cyl. w/Spin-On Filter
2409	K2409	1½ x 4 x 15	205	Datsun-Toyota-Compacts
2410	K2410	1½ x 6 x 15 Spec.	166	Volkswagen Bug
— —	K2411	— —	—	Use 450
2460	K2460	1½ x 4 x 15	221 — Remote	Honda Civic
2461	K2461	1½ x 4 x 15	242/243*	Metric-Imports-Compacts
HAYDEN ULTRA-COOL FULL FLOW ENGINE OIL COOLERS — ECONOMY				
450	New	1 x 7½ x 12 Spec.	166	Volkswagen Bug
451	New	3/4 x 7½ x 16½	205/225*	Ford-Chrysler-GM
452	New	3/4 x 7½ x 16½	258	Chev w/Cartridge Filter
454	New	3/4 x 7½ x 16½	211	Chev w/Spin-On Filter
455	New	3/4 x 5 x 14½	205	Datsun-Toyota-Compacts
456	New	3/4 x 5 x 14½	242/243*	Metric-Imports-Compacts

WEIGHT

Engine oil coolers can vary in weight from 1 - 10 lb depending on size and efficiency.

RATING

An engine oil cooler is evaluated by the heat, in BTU/HR (British Thermal Units per Hour) it removes. Shrinking available room near the radiatior is making size an important factor in rating a cooler.

PERFORMANCE DATA

An engine oil cooler should be able to remove 8,000 - 30,000 BTU/HR depending on engine size, operating RPM and load.

OPERATING INSTRUCTIONS

N/A

HAYDEN INC.
1531 Pomona Road, Corona, California 91720
(714) 735-4900 Outside CA (800) 854-4757

Modine liquid-to-air coolers • time-proved design

MODINE

MODINE MANUFACTURING COMPANY
1500 DE KOVEN AVENUE,
RACINE, WISCONSIN 53401
PHONE: 414/633-2411

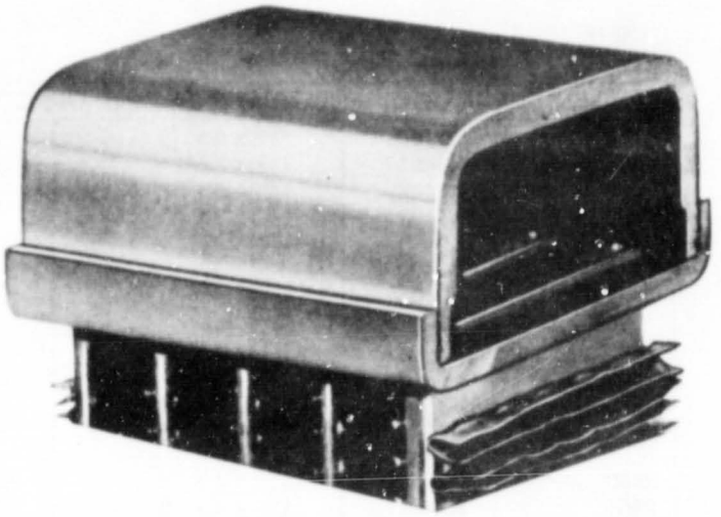
why air cooling?

Air cooling has several inherent advantages over water cooling. For example, where feed water supplies are unreliable, scarce, or inconvenient to provide, cooling with air is favored. And when engine jacket water temperatures are too high, air cooling will consistently maintain desired heat dissipation rates. Air cooling also eliminates the need for anti-freeze solutions.

Modine liquid-to-air coolers incorporate advanced heat-transfer design innovation

Nearly 25 years ago, Modine research engineers applied the salt-bath brazing process for bonding aluminum. Still very much in use today, this process, which Modine calls "ALBRAZE," causes aluminum alloys to merge or flow across voids to fuse individual parts into a one-piece integral structure.

Modine liquid-to-air coolers are produced by means of the ALBRAZE process. As a result, they are highly resistant to mechanical stress and because the bond between fins and tubes is metallurgical, Modine liquid-to-air coolers retain their high heat-transfer efficiency during their entire lifetime.



smaller size — lighter weight two very important benefits

Modine's special ruffled air-fin configuration exposes a greater area of secondary heat-transfer surface to cooling air. Extruded aluminum tubes have internal fins that turbulate the oil to increase its contact with the tube surfaces. Result? The rate of heat transfer is accelerated.

Due to the high heat-transfer efficiency of the fin and tube design, Modine all-aluminum coolers match the performance of conventional coolers up to 50% larger in physical size. Consequently, designers are permitted the option of reducing the overall sizes of their equipment or providing more cooling within the same space occupied by other coolers. Weight, too, is significantly reduced — by up to 25% less weight than other coolers of comparable cooling capacities. Advantages afforded by Modine's lighter weight cooler are the elimination of special cooler mounting supports, easier installation on the assembly line, and reduced transportation costs.

corrosion-resistant for long life

Since aluminum does not adversely react to oils, "oil varnishing" caused by deoxidation is avoided. Galvanic action which can shorten cooler life is often caused by the use of dissimilar metals in the cooler coils. The Modine core, however, is fabricated entirely of a single metal — corrosion-resistant, long-life aluminum.

anti-clog core design for easy maintenance

Costly downtime associated with cleaning closely spaced finned cores of ordinary coolers can be drastically reduced or eliminated by using Modine oil coolers. The extremely high heat-transfer efficiency of the Modine fin permits wider spacing to provide free pass-through of most airborne dust and debris.

built to rigid quality-control specification

Quality control over materials used in Modine oil coolers receives high priority. Samples from shipments of metals and finished parts are checked and verified against rigid specification standards. At Modine, final product quality is considered to be as much the result of extreme care in material selection as it is dependent upon modern manufacturing techniques and processes employed to produce the product.

wide range of sizes • unitized construction

MODINE

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RACINE, WISCONSIN 53401
PHONE: 414/633-2411

ALBRAZE® bonding process forms one-piece unitized structure for durable strength

When joined together by the ALBRAZE® bonding process, individual fins and tubes form a one-piece integral unit possessing great physical strength and resistance to mechanical stress. Extruded aluminum tubes and tanks impart further resistance of the cooler to stress, vibration, and shock.



high-efficiency fin design reduces cooler size

A ruffled serpentine fin developed by Modine, is the result of extensive research, development, and testing. Its ruffled surface causes the air to turbulate and scrub the fin surfaces as it passes over them picking up more heat in its movement through the core. Result? A more efficient heat transfer surface which contributes to a substantial overall reduction in cooler size. Furthermore, because spacing between fins is generous, most airborne matter passes through the core instead of collecting on the fins to impede air passage.

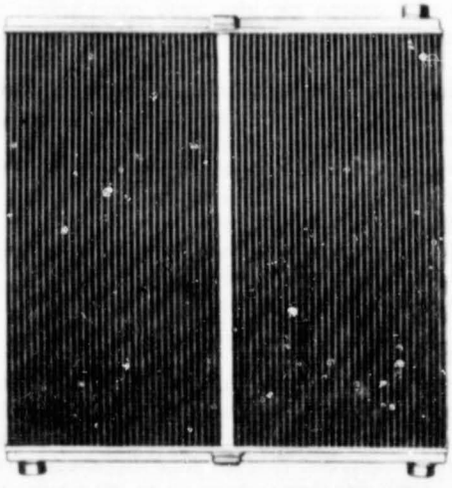


tube turbulators increase heat-transfer rate

Acting as turbulators that break up the laminar flow of oil through the tubes, perforated crimped internal tube fins provide additional surface to increase the rate of heat transfer through the tube to external fin surfaces. The turbulator fins also break up the oil film on the inner walls of the tubes to increase transfer of heat from oil to tubes to fins.

12 good reasons for considering Modine liquid-to-air coolers

- all-brazed construction
- 19 sizes for selection flexibility
- 2 core thicknesses (1-1/16" and 2-1/4")
- anti-clog core design
- core face areas from .4 to 32 sq. ft.
- corrosion-resistant
- extruded tubes for strength
- lightweight
- compact size
- for pressures up to 150 psi
- installation flexibility
- accurately performance-rated



the benefits of water cooling with Modine B.T. Units

the advantages of water cooling

Water cooling offers several distinct and important advantages over other methods of cooling.

For example, water-cooled heat exchangers are generally more compact in size. Their smaller size is a significant advantage where space is one of the determining factors in the selection of a unit. Another feature which often permits their application where space limitations exist is that they may be installed in a location remote from the equipment they are to cool.

Water-cooled heat exchangers offer lower initial investment as they can be installed more easily and economically than other cooling systems. Since they do not require electric power to operate fans or pumps, lower operating cost is another benefit of their use. Furthermore, little if any horsepower demand is made on the equipment which is cooled by the heat exchanger.

Since a water-cooled system does not utilize a fan—as required by most air cooling systems—the advantage of a quiet operation is realized. This is particularly important with stationary equipment applications.

the benefits of Modine B.T. Units

Utilizing water as the coolant, Modine B.T. Units are compact, high-performance shell-and-tube heat exchangers of heavy-duty construction providing dependable and economical operation. Designed to produce a maximum heat-transfer rate for given oil-flow conditions, they make a significant contribution to the operating efficiency of various machinery systems by properly satisfying their oil-cooling requirements.

The fixed tube-sheet design of Modine B.T. Units consists of a bundle of straight tubes rolled into tube sheets. This type of design permits easy mechanical cleaning of tube passages should it become necessary.

For flexibility of selection and application, Modine B.T. Units are available in a range of 20 model sizes of varying cooling capacities and performance. These models are arranged into three distinct groups classified by a common diametral dimension: the 2½" (250 series), 3½" (350 series), and 5" (500 series) diameter models. The 3½" and 5" diameter models are available in either single-pass or two-pass arrangements. The 2½" is available only as a single-pass arrangement.

compact size saves space
The unique design of the Modine B.T. Unit, with its extended oil-side surface, exposes a greater area of heat-transfer surface to the oil resulting in an accelerated rate of heat transfer. Due to this increased efficiency, the size of the Modine unit is up to 40 percent smaller than conventional shell-and-tube heat exchangers. Therefore, designers have the choice of reducing the overall size of their equipment or providing more cooling within the same space occupied by other coolers.

MODINE

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RACINE, WISCONSIN 53401
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equalized thermal resistance for increased efficiency
Modine's efficient use of extended surface results in an equal balance of thermal resistance on shell-and-tube sides for highest heat-transfer efficiency. This thermal balance is attempted by others through conventional cooler design which utilizes additional tubes and results in inefficient thermal usage of the additional tube material.

low water flow saves operating costs
Since considerably fewer tubes are utilized in the construction of Modine B.T. Units to effect a given heat-transfer rate, water-flow requirements are approximately 50% less than for other coolers of this type. The result is a significant saving in utility-sourced water or in cooling-system cost.

dependable, time-proven design
The Modine finned-tube bundle design utilized in the B.T. Unit has been in use since 1960. Millions of hours of actual field service experience have demonstrated the efficiency and dependability of these units in various machinery cooling systems.

This highly reliable design, plus the rigid quality control exerted over materials used in production, play important roles in maintaining customer confidence and satisfaction in the performance of Modine B.T. Units.

pre-engineered components reduce lead time
The models in the cooler line are assembled from pre-engineered components in inventory to shorten lead time between order receipt and shipment.

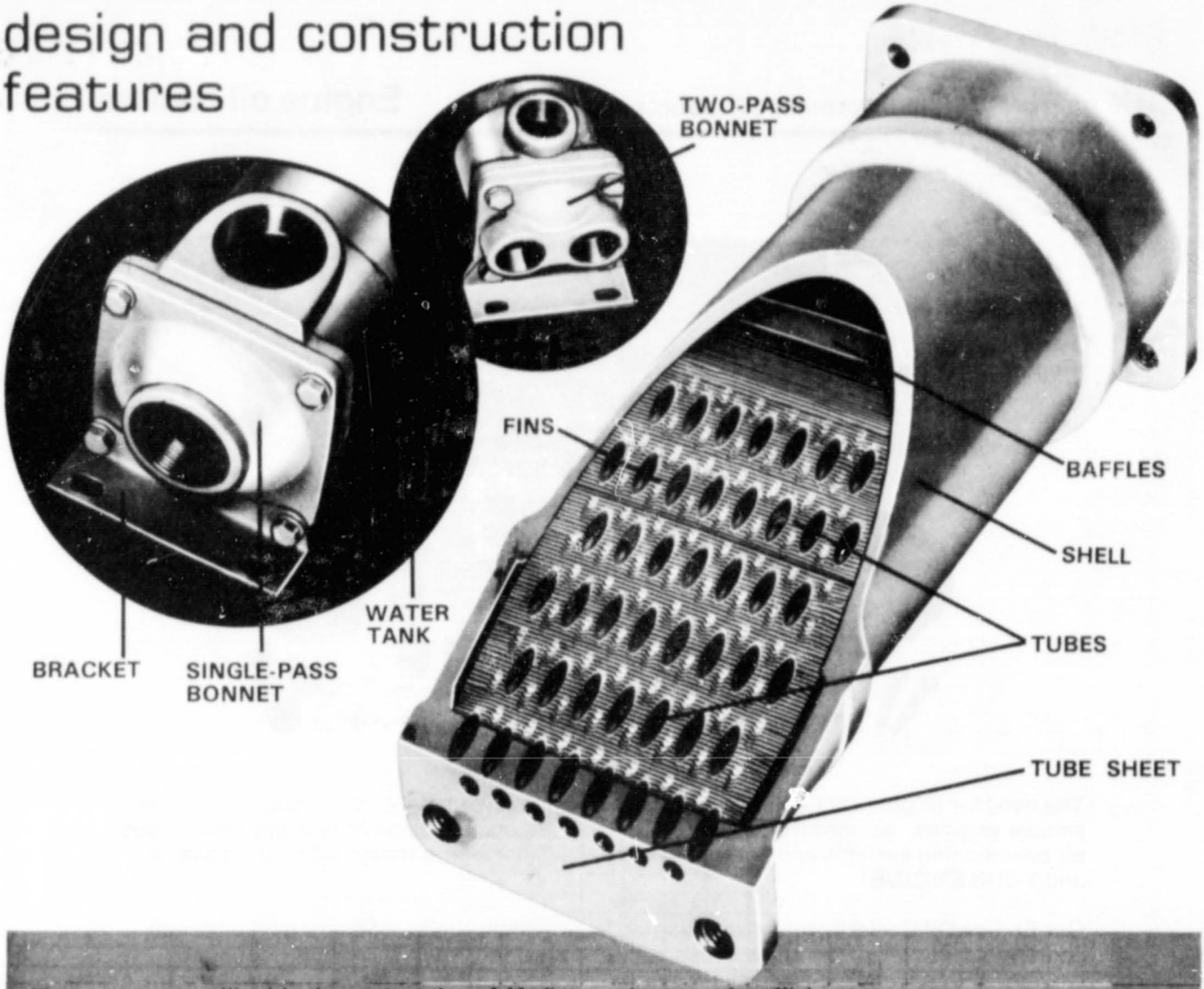
higher pressure ratings
Maximum constant operating shell-side pressures are significantly higher than those which can be safely handled by most standard tube bundles. Since applications vary in operating pressures it is suggested Modine engineers be contacted if 500 psi pressure is exceeded on the 2½-and 3½-inch models, and if 400 psi pressure is exceeded on the 5-inch models.

Modine B.T. Units are accurately tested and rated by experienced technicians under carefully controlled and universally accepted testing procedures.

construction materials selected for long trouble-free life
Cast iron tube sheets and water tanks, copper tubes, steel shell and oil baffles, and aluminum oil fins are selected for optimum performance and efficiency for long-term durability, reliability of service, and minimal maintenance.

typical B.T. Unit applications
Transmission, hydraulic, and engine lube-oil systems are typical examples in which the Modine B.T. Units are recommended for application. In such systems as recommended, the Modine units are designed to satisfy specific requirements such as: providing increased heat-transfer capacity for cooling oil, withstanding high continuous operating pressures, and accommodating space limitations as a result of compact model dimensions. Modine B.T. Units, due to their quiet low-cost operation are especially suitable for application on stationary air compressors and on various hydrostatic systems.

design and construction features



The components utilized in the construction of Modine B.T. Unit shell-and-tube heat exchangers are briefly described here.

A. Tubes Made of copper, tubes are positioned and mechanically bonded into the tube sheet in a staggered triangular pattern for optimization of heat transfer.

B. Tube sheet Made of a heavy-duty, high-strength alloy casting, the tube sheet is capable of withstanding stresses caused by variations in operating pressures on both the shell and tube sides. Tubes and tube sheets are joined by a durable, roll-formed mechanical bond that reduces potential tube and sheet failure.

C. Baffles Die-formed steel for a correct fit between tubes. The oil baffles, in addition to providing support for the tube bundle, are designed to force shell-side fluid to follow a direction that will achieve maximum heat-transfer efficiency.

D. Water tank Bolted-on bonnet type with a rounded, contoured shape designed for uniform distribution of fluid to tubes. Reduces turbulence to a minimum. Single-pass and two-pass bonnets are used.

E. End Hub and tube sheet (B.) casting form a one-piece unitized component that is precision-welded to shell.

F. Bracket Heavy-gauge steel bracket is adjustable for installing unit in various positions.

G. Shell Seamless drawn tubing of high-tensile steel, built to withstand continuous high operating pressures.

H. Fins Extended aluminum oil fins are mechanically bonded to tubes by tube expansion. The draw-formed collar design of the fins maximizes their contact with tubes.

MODINE

MODINE MANUFACTURING COMPANY
1500 DE KOVEN AVENUE,
RACINE, WISCONSIN 53401
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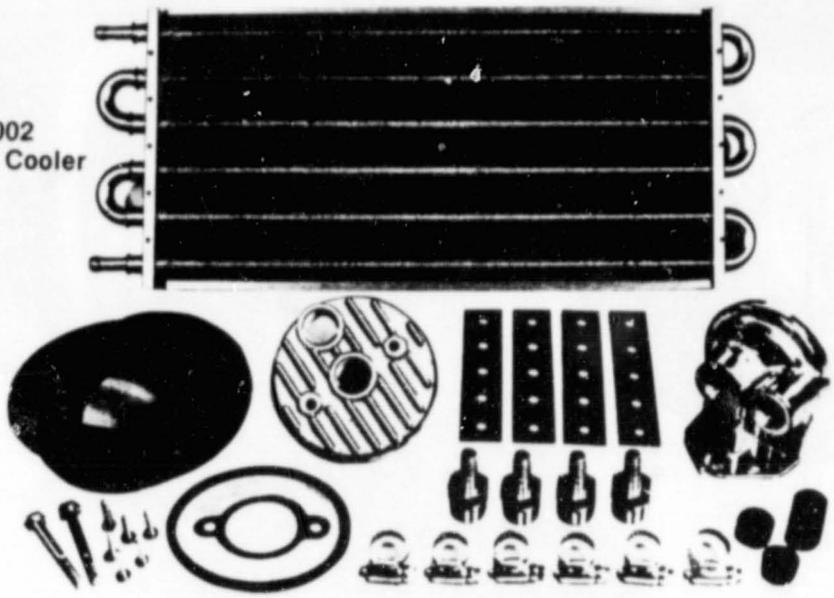
Engine oil coolers

Part No. 2002
Engine Oil Cooler



The need for Engine Oil Coolers is greater today than ever before. With greater loads on smaller engines, reduced frontal area, smaller radiators, emission control systems, added air conditioning systems and power accessories all damaging todays lubricating systems and YOUR ENGINE!

Our Engine Oil Coolers protect your engine by providing cooler lubricating oil under all operating conditions. Greatly extends oil life. Pays for itself through less frequent oil changes and reduced maintenance costs.

Designed with ½" copper tubing which is expanded into a 360° collared aluminum fin using aerospace refrigeration design. This assures a 100% heat transfer from the outside diameter of the tube to the finned surface. This Engine Oil Cooler effectively combats the excess heat created by performance driving and heavy duty uses, either in competition or normal street and highway driving.

All Engine Oil Coolers are complete with instructions, installation kit, hose and fittings.

T.P.P. Cooling Industries

Automotive Cooling Accessories

830 N. Lake St., Burbank, Ca. 91502

(213) 845-1583 (213) 849-5003

Young TYPE MOC MOBILE OIL COOLERS

The complete line of Air Cooled MOC Oil Coolers has been developed by the Young Radiator Company as a result of over 49 years experience in the design and manufacture of heat transfer equipment. Young MOC Coolers provide the simplest solution to complex cooling problems associated with stationary or mobile applications. Mounted in front of or in the rear of an engine cooling radiator, these coolers make an effective dual use of the vehicle's existing air stream, cooling hydraulic transmissions, torque converters, fluid power systems, lube oil, fluid couplings, hydrostatic drives or power steering. Remotely mounted, MOC Coolers may be used with any external air flow system for cooling process fluids.

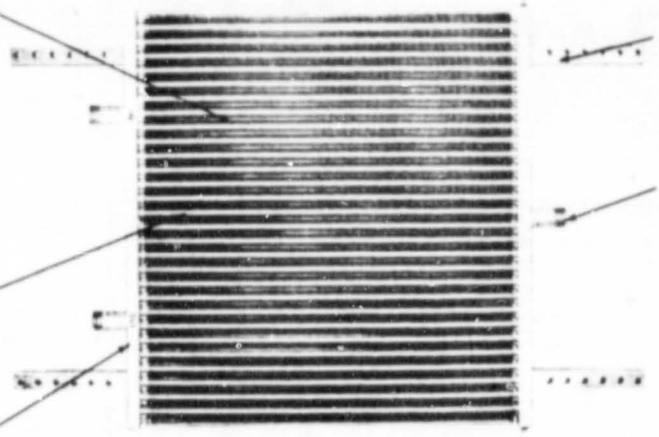
The Young MOC Cooler line is complete with eight standard sizes, each of which may be piped at installation in one or two pass oil flow arrangements meeting specific application requirements. This provides an efficient, low cost oil cooling system with minimum oil pressure drop and low air flow resistance. Young MOC Coolers have a performance range to 100 gpm oil flow and heat transfer capacities from 5,000 to 350,000 Btu per hour. They operate efficiently at pressures to 300 psi based on a safety factor of 450 psi test pressure. Maximum operating temperature is 400 F. All standard MOC Coolers are available for immediate delivery from stock.

SUPERIOR CONSTRUCTION FEATURES

Core—Heat Transfer surface consists of round steel tubes, capable of withstanding repeated pressure shocks, aluminum alloy fins and welded tubular steel manifolds. A permanent bond is obtained between fins and tubes by mechanically expanding the tubes into specially formed fin collars providing double-walled continuous metal heat transfer surfaces.

Turbulators—Exclusive patented Young Turbulators inserted in each tube improve heat transfer more than 100% by eliminating laminar oil flow.

Manifolds—Electric welded heavy gauge tubular steel manifolds have drain-vent connections and plugs.



Mounting Brackets—Four, steel "U" section outrigger brackets with multiple mounting holes allow various optional mounting positions.

Connections—Inlet and outlet oil connections with male dryseal threads allow efficient fluid flow with minimum pressure drop. Coolers designed for service either as one or two pass oil flow; selection of proper connections made by customer choice on installation.

Finish—Gray, semi-gloss enamel.

Fig. 1

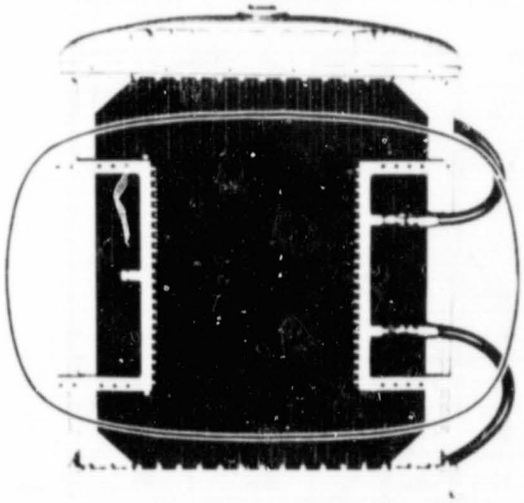
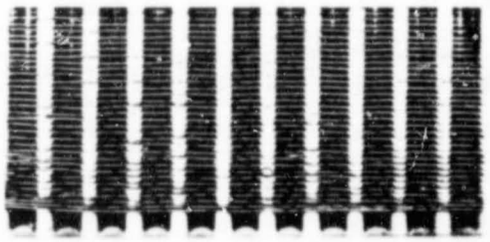


Fig. 2 Model MOC-4 Air Cooled Oil Cooler mounted in front of a Young Cast Tank Radiator. The MOC unit acts as an auxiliary oil cooler with this large diesel engine cooler.

OPERATING PRESSURE	300 psi
OPERATING TEMPERATURE	400 F



TUBE TO HEADER CONSTRUCTION

Fig. 3 Unique Young plane-red, high temperature, induction fusion bonding method insures permanent bond and positive joining of tubes to manifolds, eliminating leaks and providing maximum heat transfer.

YOUNG RADIATOR COMPANY

2825 Four Mile Road ● Racine, Wisconsin 53404

(Tel. 414-639-1010)

Young TYPE MOC MOBILE OIL COOLERS

DIMENSIONAL DATA

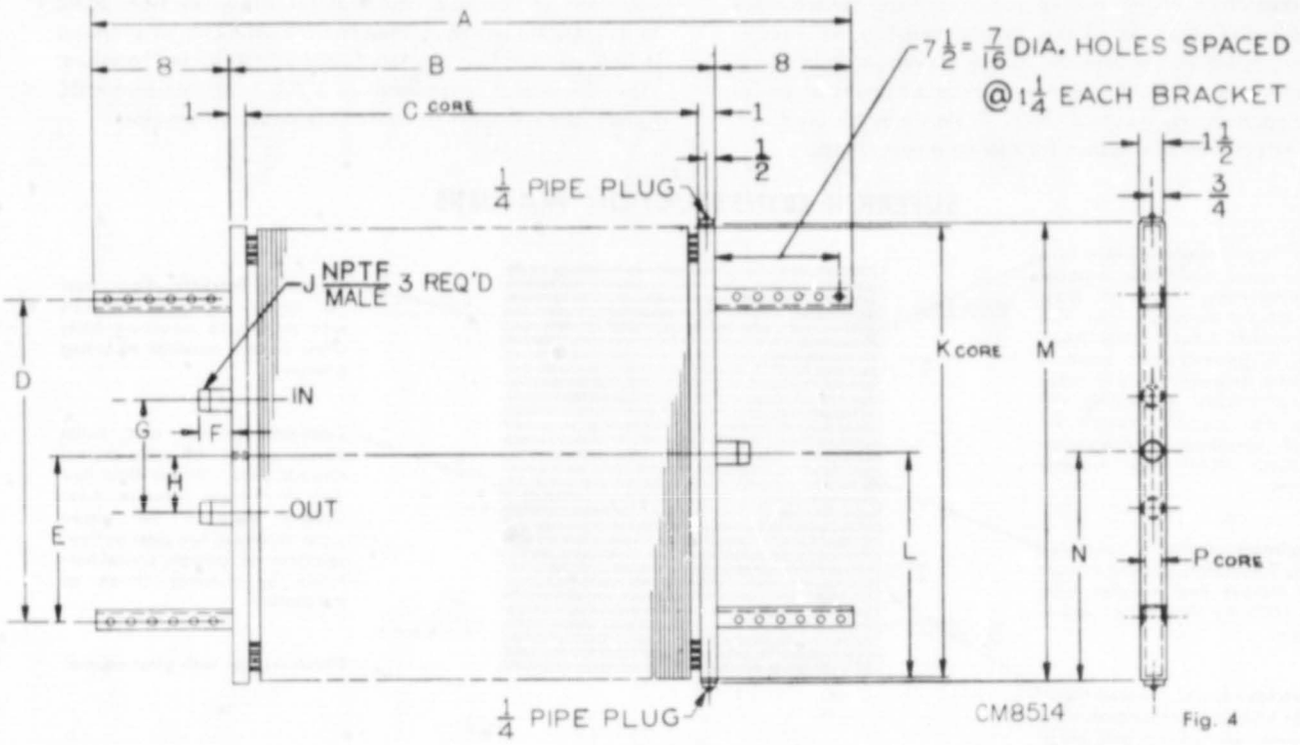


Fig. 4

TABLE 9	DIMENSIONAL DATA															
MODEL	A	B	C	D	E	F	G	H	J	K	L	M	N	P	FACE AREA sq ft	WEIGHT lb
*MOC-1	33	17	15	7½	3¾	1½	3	1½	½	8	4	8½	4¼	13/16	.83	8.6
*MOC-2	33	17	15	15½	7¾	1¾	9	4½	¾	16	8	16½	8¼	13/16	1.7	13.2
MOC-3	33	17	15	15½	7¾	1¾	9	4½	¾	16	8	16½	8¼	1⅜	1.7	16.4
*MOC-4	38	22	20	21½	10¾	1¾	11	5½	¾	22	11	22½	11¼	13/16	3.1	18.8
MOC-5	38	22	20	21½	10¾	1¾	11	5½	¾	22	11	22½	11¼	1⅜	3.1	25.6
MOC-6	45	29	27	23	11½	2½	14½	7¼	1	29	14½	29½	14¾	1⅜	5.4	39.3
MOC-7	47½	31½	29½	23	11½	2½	16	8	1	32	16	32½	16¼	1⅜	6.6	45.5
MOC-8	50	34	32	29	14½	2½	22	11	1	44	22	44½	22¼	1⅜	9.8	65.2

* Non Stock Models

YOUNG RADIATOR COMPANY

2825 Four Mile Road ● Racine, Wisconsin 53404

(Tel. 414-639-1010)

INTERLOCK DEVICES

MECHANICAL, ELECTRICAL

(CODE **ID**)

QD DeENERGIZE TO OPEN MODEL

QUICK DISCONNECT INSTRUCTIONS

PRODUCT LINE 216 CAT.NO. 415-420

One Quick Disconnect (DeEnergize to Open-350 Amp) and two contacts.
NOTE: Optional installation kits are ordered separately.

PROPERTY	CHARACTERISTICS
Rating	350 Amps Continuous at 72 VDC Max.*
Load Breaking	2500 Amps at 72 VDC, 100 Cycles-Emergency only.*
Coil Operation	Continuous duty, 11 Watts at 20°C
Min. Coil VDC	75% of normal rating. 12 standard
Coil Amps VDC	12 18 24 36 48 72
AMPS	.87 .52 .42 .26 .22 .15
Mechanical Life	10,000 Cycles minimum *With 300 MCM contacts and cable.

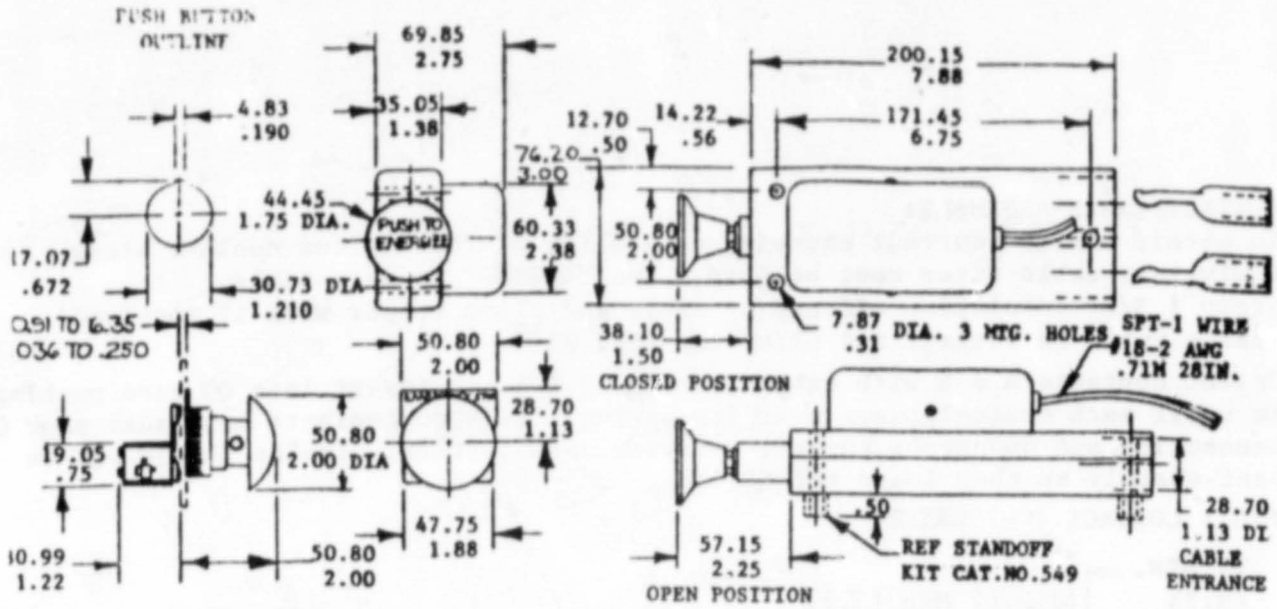
APPLICATION:
This model QD is intended for electric vehicles where it is desired to energize the QD separately from the vehicle itself. For example, the QD electro mechanical latch may be energized by a common 12V battery while the QD contacts control the vehicle drive motors at a higher voltage.

OPERATION:
Battery Connect/Disconnect: D.C. power cables with contact terminations inserted into the QD are connected when the QD plunger is manually engaged. An electro mechanical latch or trigger holds the plunger and cable connection. By using a normally closed push button switch, the QD provides a means of quickly disconnecting the battery power from the electric vehicle by releasing the latch, disengaging the plunger and contacts.

OPERATION INSTRUCTIONS (See Fig. 1)
TO CONNECT BATTERY & TURN VEHICLE ON: With Aux. Battery connected, push QD plunger in until it latches and connects the main battery. Then turn vehicle key on.
FOR EMERGENCY BATTERY DISCONNECT: Actuate push button switch and QD plunger will release to disconnect battery.
FOR NORMAL VEHICLE SHUTDOWN: Turn key off, QD plunger will remain engaged with main battery connected. The push-button switch may be actuated to disconnect the battery. NOTE: The QD is intended for emergency disconnect use only. Repeated making and breaking under load will result in premature pitting of contacts.

MF-79

Anderson Power Products Inc. / 145 NEWTON ST / BOSTON, MA. 02135 / TEL: 787-5880



INSTALLATION:

MOUNTING: The QD may be mounted in any position and orientation convenient to the operator as near to the vehicle connector half as possible. Approximately 304.8mm (12") space from QD cable entrance to the nearest obstruction should be allowed for use of QD contact extraction tool. The QD is mounted with (3) 6.35mm (.25") screws located as shown on the outline. The optional Standoff Kit (Cat.No.549) can be used to provide 12.7mm (.5") spacing from mounting surface for QD plunger knob clearance if required. Mount Pushbutton Switch (Cat.No.509) on vehicle dash conveniently within reach of operator. See outline for mounting hole dimensions.

WIRING:

WARNING: Disconnect the battery from the truck during installation.

Connect the QD contacts A & B to the negative or positive side of the battery directly after the battery connector (Anderson SB or SBX connector is recommended). Contacts A & B may be inserted into either side of the QD but orientation of the contacts for proper engagement must be maintained. See Fig. 2 & 4.

Connect the QD lead #1 to the pushbutton switch.

Connect the pushbutton switch lead (PB) & lead #2 using #18 AWG. standed insulated wire suitable for truck environment, as shown to aux. battery.

FIG. 1 SCHEMATIC CIRCUIT DIAGRAM

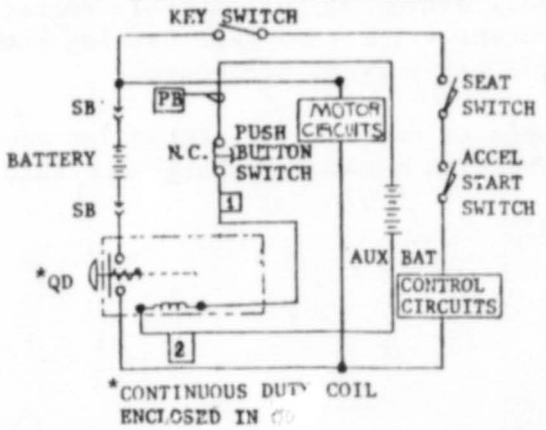
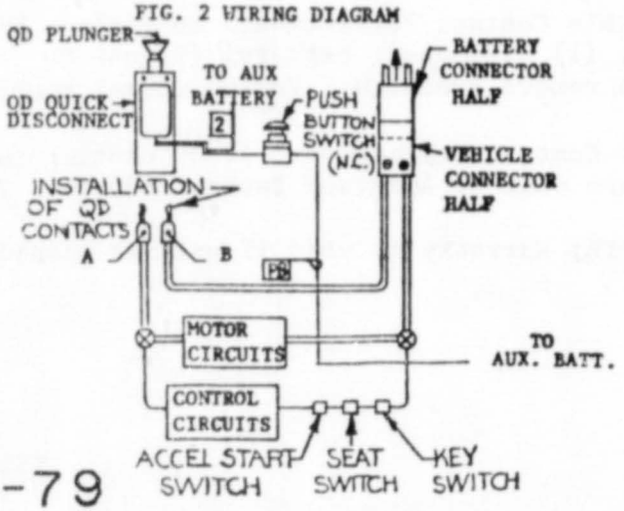


FIG. 2 WIRING DIAGRAM



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CONTACT/CABLE ASSEMBLY:
To obtain maximum current carrying capability of the various contact sizes, equivalent cable sizes must be used. See "RATING" in data table.
Strip 1 3/8" insulation off end of cable and clean copper wire if required.
Insert cable in contact and crimp per fig. #3.

Orient contacts A & B with cable per fig. 2 & 4 and insert into QD case pushing in until each contact snaps over its spring. Twisted contacts may cause poor QD connection and downgrade current carrying capabilities. Cables should not be bent sharply as they leave the QD case.

FIG.3 CONTACT VC-7 CRIMP

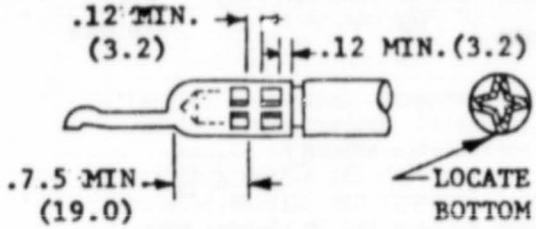
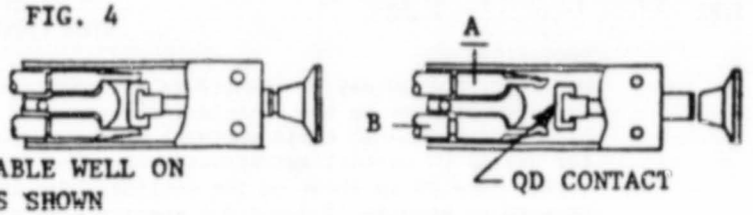


FIG. 4



CONTACT MAINTENANCE:
Inspection: Under normal QD operating conditions, (not making or breaking under load), cable contacts A and B (see fig. 2) and QD contacts (see fig. 4) should be inspected by observing contacts through clear case half every few months and each time QD breaks the excessive battery current associated with a faulty motor circuit. Observe surfaces where contacts A and B actually wipe against QD contact with the plunger engaged.

Cable Contact Replacement: To replace badly pitted or burned cable contacts A and B, (1) disconnect battery, (2) use QD contact extraction tool Catalog Number 599 to remove contacts. Follow normal routine replacement procedure.

QD Contact Replacement: If QD contact surfaces have become pitted or scored return unit to Anderson Power Products. There is a nominal charge for this service.

NOTE: Warranty is void if unit is opened.

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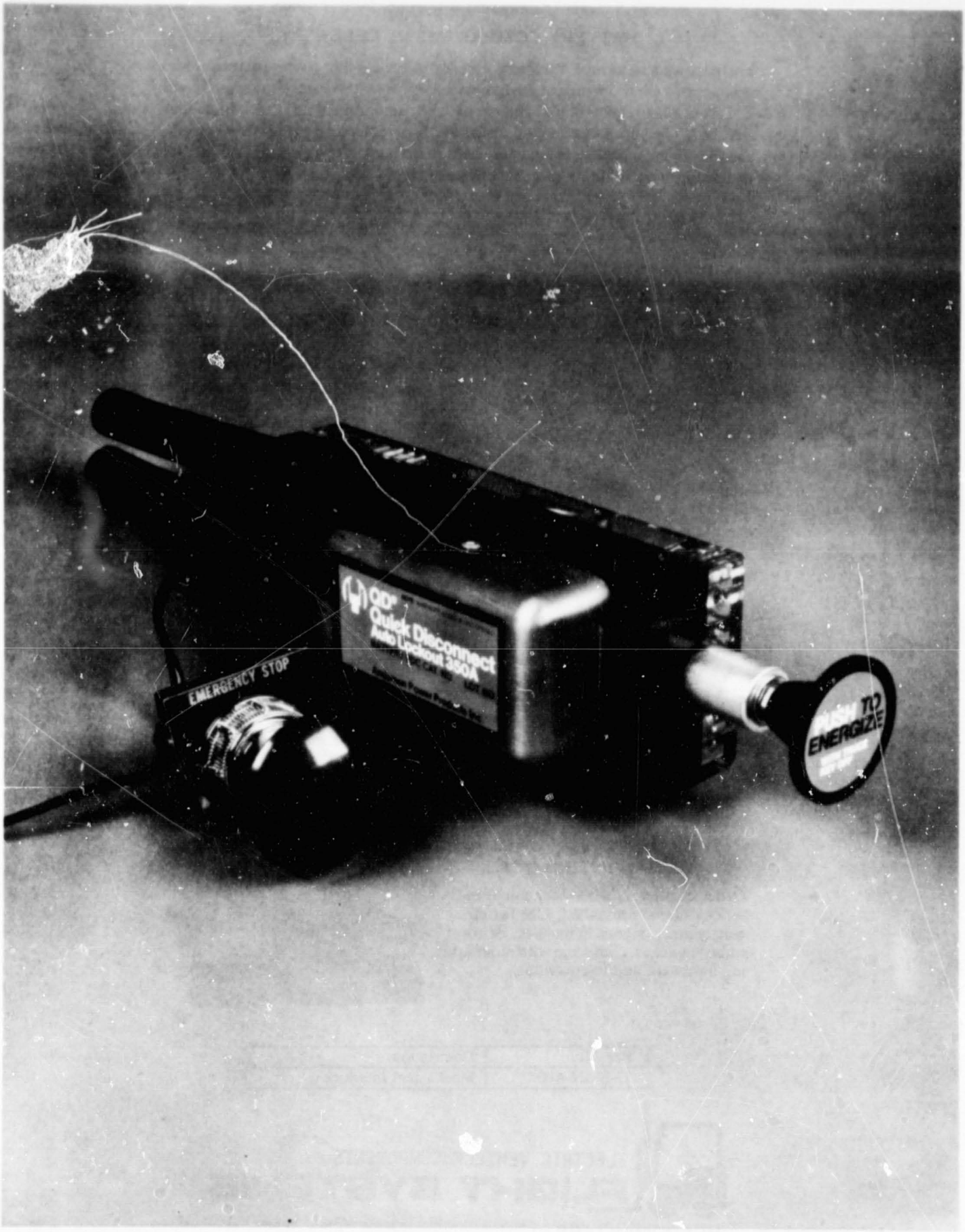

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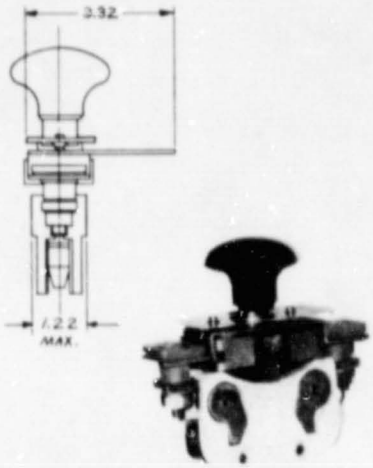
C-7

BATTERY COMPARTMENT RELEASE

For easy access to an EV battery compartment use this power release. This product will allow opening of the battery compartment without getting out of an EV. Touch the release button and the battery compartment lid is automatically released. The button is mounted inside the glove compartment for extra safety and the release mechanism attaches easily to the battery compartment. Can also be used as a trunk lid or hatchback release.

Part No.	Description
14-071-850	Battery Compartment Release



BATTERY DISCONNECT SWITCH

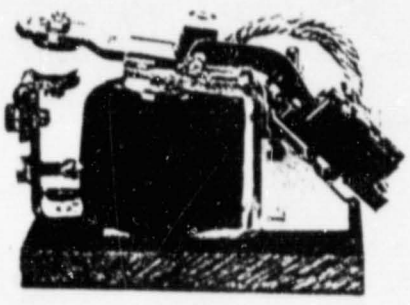
Enhance the operational safety of your vehicle ! Designed for use as an emergency disconnect of the battery circuit on battery-powered vehicles. This single pole switch carries a continous load current rating of 250 amps. This switch is especially designed for rugged, long life under severe operating conditions. The battery circuit is normally closed when the red actuator is in the extended position. It can immediately be interrupted by pushing the actuator into its recessed position. The heavy-duty switching elements are provided with blowout magnets. An arc-suppression chamber is available as an option.

Part No	Description
14-S135-290	Battery Disconnect Switch
14-S135-291	Arc-Suppressor

ACCESSORIES FOR 200 AMP AND 300 AMP CONTACTORS

ADD AN INTERLOCK

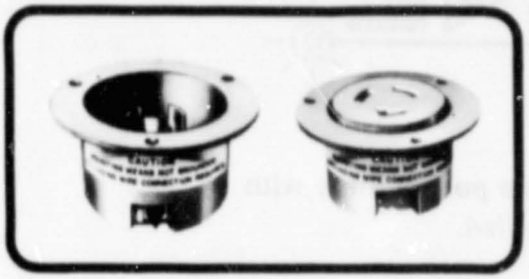
Order contactors with mechanical interlock already installed. Use for circuit control, status indicators, or for safety switches. Complete with mounting hardware and microswitch.



Part No.	Description
33-3MN-410	Mechanical Interlock

ELECTRIC VEHICLE COMPONENTS
FLIGHT SYSTEMS
HEADQUARTERS
P.O. BOX 25, MECHANICSBURG, PA 17055
PHONE (717) 697-0333

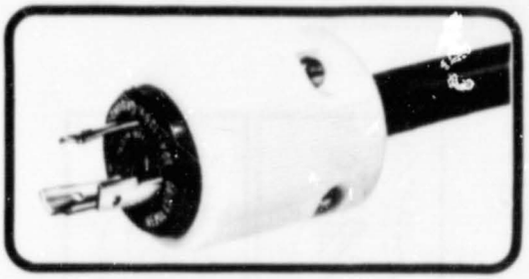
Interlock Devices, Electrical



No. 71630-FI

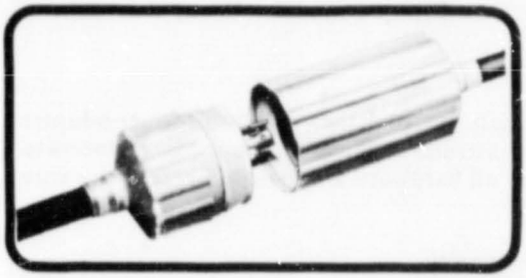
Complete line of 15, 20 and 30 amp locking inlets and outlets in all NEMA ratings, with dead-front construction.

Completely insulated with bodies and flanged casings molded of high-impact plastic and featuring "dead fronts".



No. 70520-P

Complete line of 20 and 30 amp nylon locking plugs and connectors, available in all ratings, with fast. single-screw wiring and two-screw body assembly.



Available with color-coded neoprene boots that provide weather-tight protection. Each boot has an adjustable sleeve that allows you to fit the boot tightly over the wire.

Call on Leviton's Custom Design Capability Team for personal attention to your requirements.

Whatever you need—be it a consultation with the engineering-wise Marketing Manager of our Appliance Products Division, or a full-scale meeting between your staff and ours, including the Chief Engineer of our Design Capability Team—you'll find that the session is more like a think-tank experience than the usual cut-and-drie "what-do-we-have-that-we-can-sell-you?" Not that we don't have a vast product line to show you. We do. We offer a complete line of wiring devices, power supply cords, wire and specialty cable, which is what we mean by "Total Capability from a Single Source".

Phone us at 212-229-4040, ext. 532. Or write Mr. Lou Vlismas, Marketing Manager, Leviton, 59-25 Little Neck Parkway, Little Neck, N.Y. 11362.

LEVITON

Affiliates:

AMERICAN INSULATED WIRE • PACIFIC ELECTRICORD

GM-277/J80

OMNIFAC'S

SAFELINE™

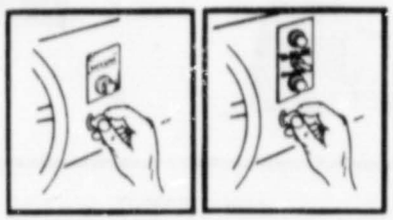
connection alarm

This device protects the boater or RV owner from pulling away with his shore power cord still connected.

What it does. Safeline connection alarm monitors both the 12 volt ignition system and the 120 volt shore power system. Starting the engine with the outside cord still engaged causes the Safeline unit to give warning.

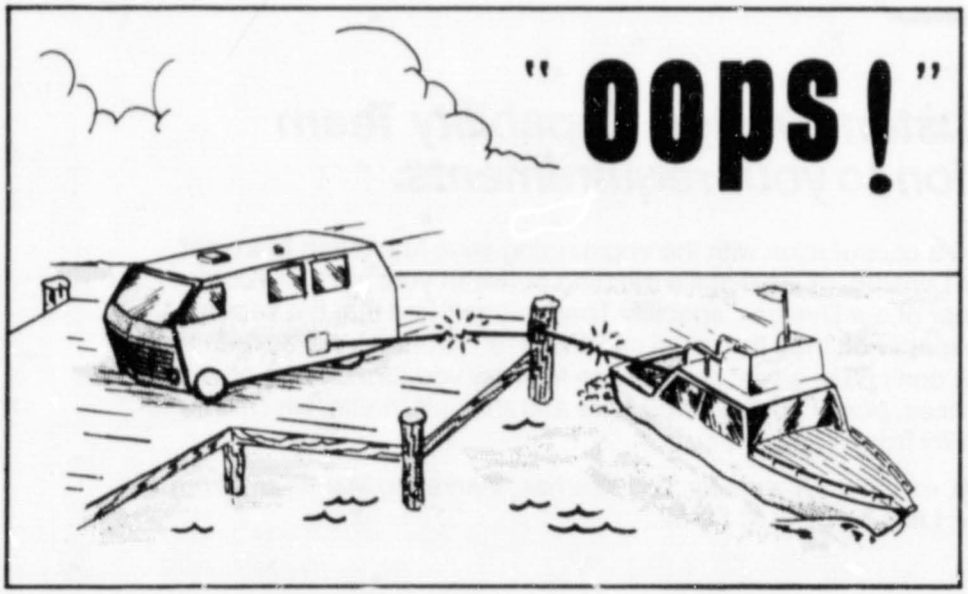
Models. For self-propelled vehicles (boats and motorhomes) there are two model groups. Group 1 models have a flashing red light on the instrument panel. Group 2 models have a red light and a switchable buzzer. When the group number is combined with "K" (1K or 2K), that model is for use on outfits that do not have their own 120 volt generator. When the number is combined with "L" (1L or 2L), that model is for use on outfits that do have a generator.

For non self-propelled vehicles (travel trailers, 5th wheelers, truck campers), Model 5 is the choice.



Group 1 models Group 2 models

Installation. The latest evolution in the Safeline series is the simplest of all to install. Just plug the small transformer-adapter into any on-board 120 volt receptacle and run a wire forward to the lamp on the instrument panel. The lamp also connects to an ignition switched terminal for its 12 volt source. Simple instructions and all hardware are included except the wire between adapter and lamp.



Design. This new Safeline design is a miniaturization of earlier models. Cost, weight, and installation time are all reduced, but neat appearance on the instrument panel is preserved.

SAFELINE™
connection alarm

If you're plugging in without it, your turn is coming.

Innovative Instrumentation by

OMNIFAC CORPORATION
1700 EAST WHIPP ROAD
DAYTON, OHIO 45440
(513) 434-8400

INSTRUMENTATION

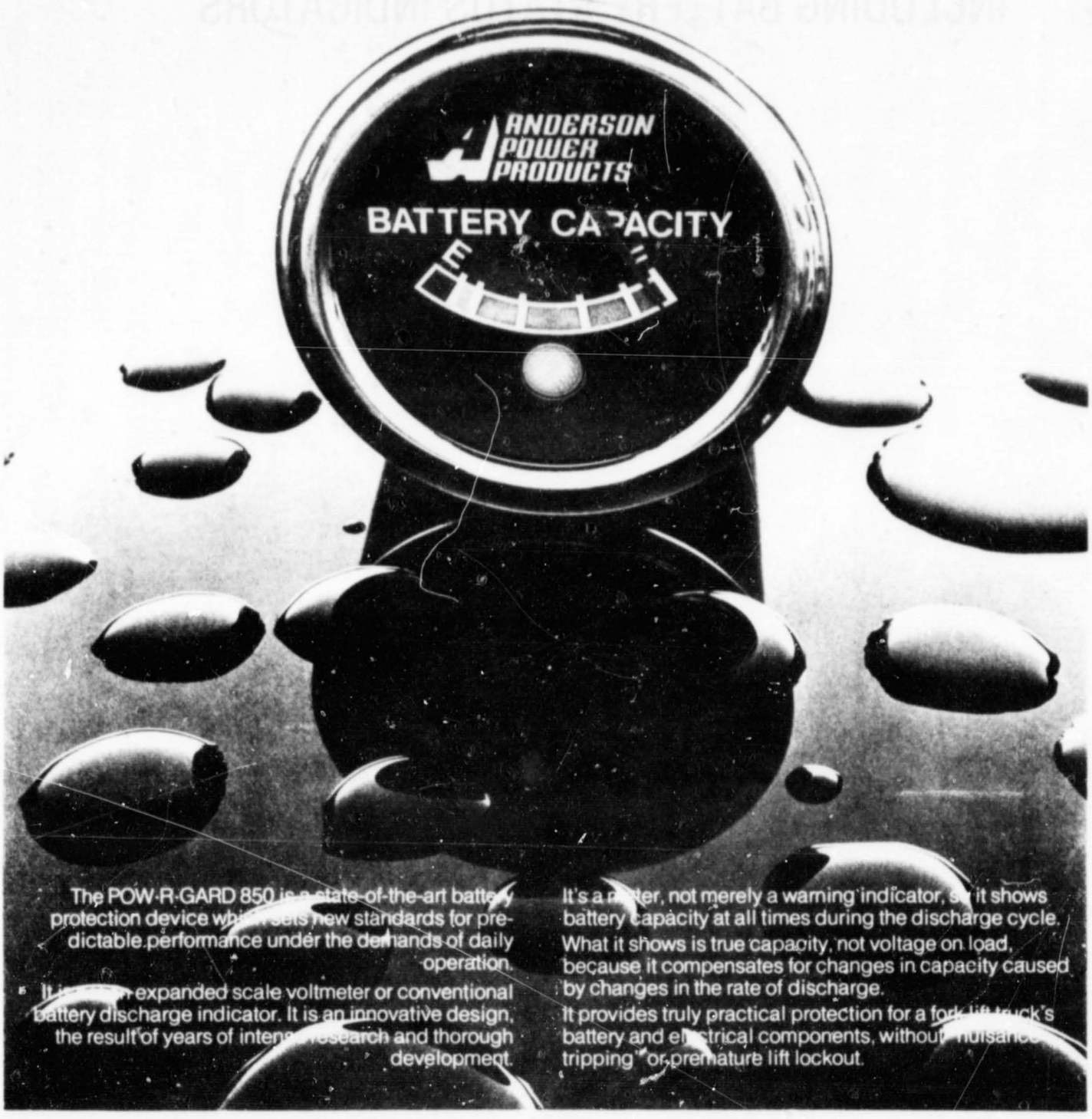
INCLUDING BATTERY STATUS INDICATORS

(CODE **IN**)

Anderson Power Products

Pow-r-gard® 850 battery capacity meter

Anderson Power Products Inc. / 145 NEWTON ST / BOSTON, MA. 02135 / TEL: 787-5880



The POW-R-GARD 850 is a state-of-the-art battery protection device which sets new standards for predictable performance under the demands of daily operation.

It is not an expanded scale voltmeter or conventional battery discharge indicator. It is an innovative design, the result of years of intensive research and thorough development.

It's a meter, not merely a warning indicator, so it shows battery capacity at all times during the discharge cycle.

What it shows is true capacity, not voltage on load, because it compensates for changes in capacity caused by changes in the rate of discharge.

It provides truly practical protection for a fork lift truck's battery and electrical components, without nuisance tripping or premature lift lockout.

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Pow·r·gard® 850 . . . The Practical Battery Capacity Meter

NOW AVAILABLE IN 12 VOLT FORM

OPERATING FEATURES

METER always shows proportionate level of charge so operator can judge when to bring truck in.

METER LIGHT signals beginning of use of reserve.

RESERVE available is capacity, not time, so operator isn't under needless pressure.

LIFT locks out where battery manufacturers specify, so operator doesn't ignore the need to recharge.

METER INDICATES undercharged replacement battery so operator always knows what capacity he has to work with.

DATA TABLE

Accuracy:	Correlates with Specific Gravity throughout range.
Adjustments:	Factory calibrated.
Warning Light:	Self-testing.
Warning Period:	Variable with discharge rate.
Recharge Point:	As generally recommended by battery manufacturers.
Reserve Capacity:	8% at warning point.
Reset Protection:	Unplugging will not reset.
Polarity Protection:	Misinstallation will not damage.
Meter Housing:	Steel, splashproof, and dustproof.
Recommended Leads:	18 AWG heavy-duty insulated.
Power Requirements:	Standard – 0.2 amps, Economy – 0.1 amps.

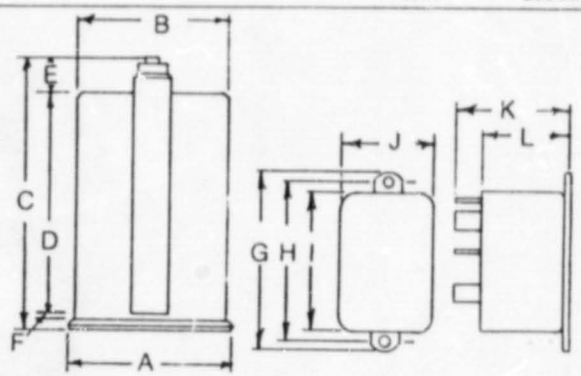
INSTALLATION INFORMATION

Wire following installation Instructions.

1. From meter ± terminals to battery ± terminals.
2. From relay #1 terminal to meter "S" terminal.
3. From relay #2 & #4 terminals to lift contactor coil.
4. From relay #3 terminal to convenient vehicle + terminal.

ORDERING INFORMATION

MODEL	DESCRIPTION	BATTERY VOLTAGE	CATALOG NUMBER
Protector Series	Meter, warning light & lift lockout relay	24	853G1
		36/48	853G2
		72/80	853G3
	Meter and warning light only	24	851G1
		36/48	851G2
		72/80	851G3
Monitor Series	Meter only	24	852G2
		36/48	852G4
		72/80	852G5
Lift Lock-out Relay	Relay only	24	889G1
		36/48	889G2
		72/80	889G2



DIMENSIONS

METER	A	B	C	D	E	F
Millimeters	57.15	52.32	95.25	79.25	11.68	3.30
Inches	2.25	2.06	3.75	3.12	.46	.13
RELAY	G	H	I	J	K	L
Millimeters	60.96	54.61	47.24	31.75	39.62	29.46
Inches	2.40	2.15	1.86	1.25	1.56	1.16

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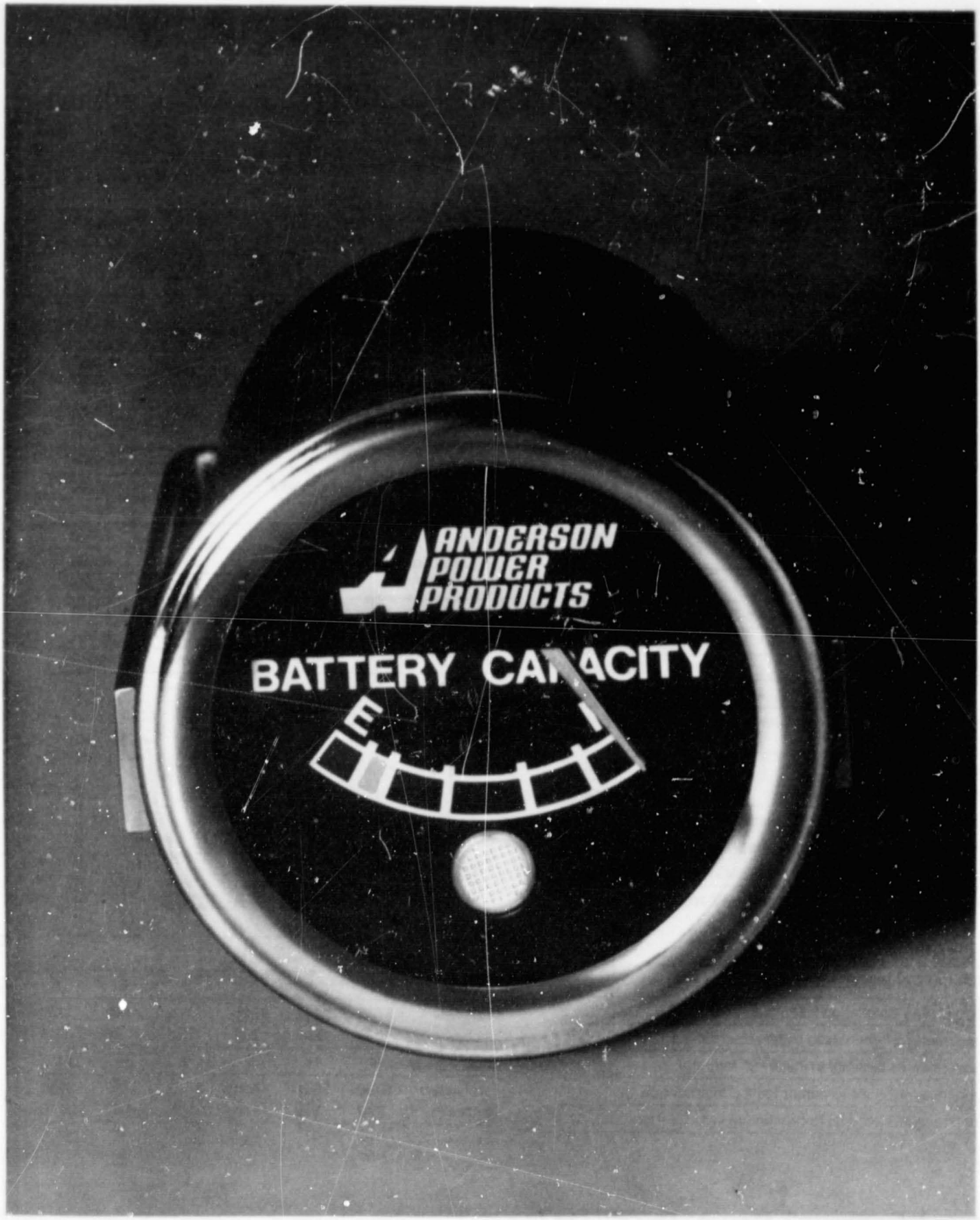
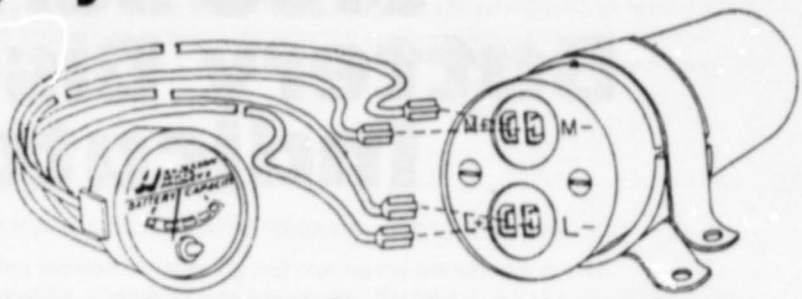

ANDERSON
POWER
PRODUCTS
BATTERY CAPACITY
E

Pow-r-gard® 850 Remote Mounting System

NEW!

Product Data Sheet

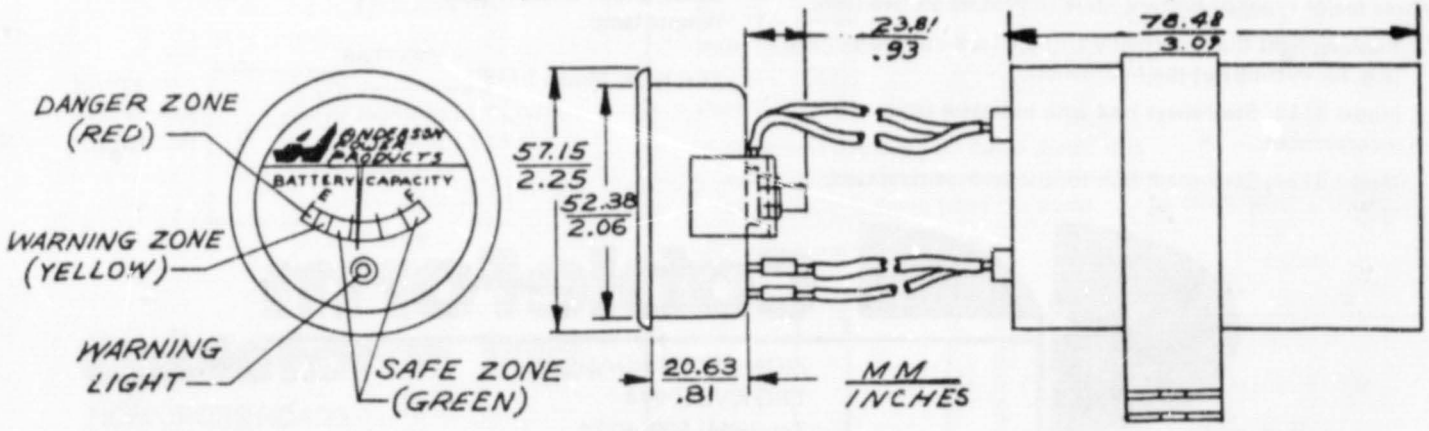


PURPOSE: A Pow-R-Gard meter with separately packaged electronics to facilitate installation where space restrictions make normal mounting difficult.

FUNCTION:
- Permits optimum positioning of both meter and electronics pack.
- Makes replacement of damaged meters easier and more economical.
- Eliminates need in underground mines to mount meter in a permissible enclosure (subject to specific approval).

OPERATION: On connection to a battery, the meter self-tests as the pointer swings from "F" to "E" and back up to indicate the battery state of charge. When the battery reaches 72% discharge, the indicator needle passes into the yellow zone and the red warning light on "Protector" models illuminates to alert the operator of the need to recharge. When the battery reaches 80% discharge, the indicator needle passes into the red danger zone and the optional lift lockout relay prevents further battery discharge by disabling the lift pump motor.

INSTALLATION: Mount meter on truck instrument panel in a cutout of 2-1/6 to 2-1/8 inch diameter using the "U" mounting bracket and nuts provided. Mount electronics pack with a #10 screw. Connect units with convenient 36" preterminated wires as furnished, or use any alternative length of #18 AWG or larger heavy duty insulated wire. Follow standard Pow-R-Gard Installation Instructions for electrical connections to vehicles. The meter is protected from damage due to polarity reversal by improper installation. No adjustments are required.



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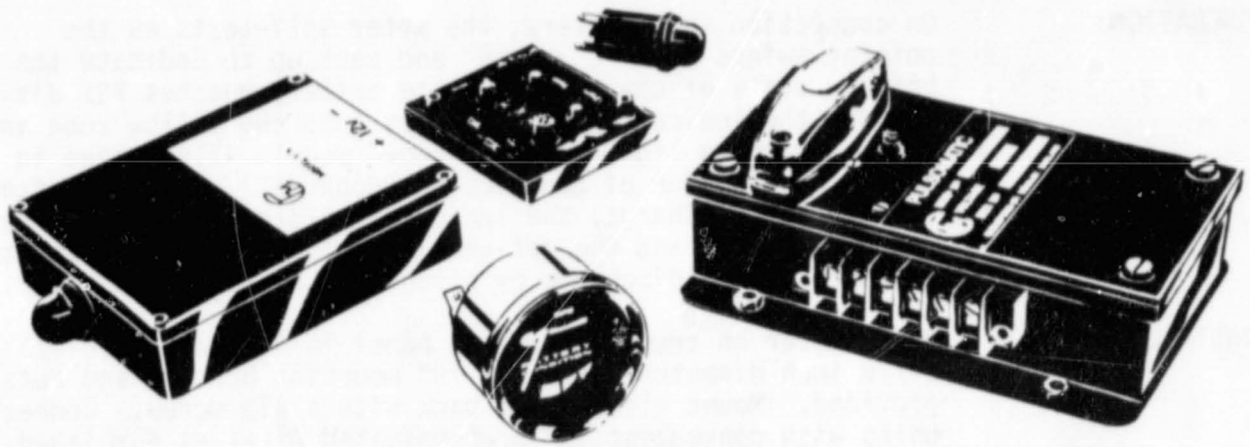
5100 series Battery Discharge Indicators



The Cableform Range of Visual Battery Discharge Indicators provides a simple and economical means of checking the battery state.

Three major types of Battery State Indicators are available.

* Flashing light (light normally OFF) + lock-out protection (e.g. for cutting out the hydraulics).

  Model 5114: Steel-sheet box with indicator lamp incorporated.

  Model 5124: Steel-sheet box for use with remote lamp.

* Flashing light: (light normally ON)
  Model 5111: Steel-sheet box with indicator lamp incorporated.

  Model 5121: Encapsulated printed circuit card for use with remote lamp.

* Dial type: Model 5118

Cableform

ZION CROSS ROADS
TROY, Va 22974
Tel: (804) 589-8224

5100 Series Battery Discharge Indicators

Models 5114 and 5124

Operation

The lamp is normally off. The unit monitors the battery voltage. When the voltage goes below the safe discharge level the lamp will flash at approximately 1 cycle per second. A timing circuit begins to time the required delay and then switches the lock-out relay. The contacts of the relay may be used as an interlock to cut out a function, for example, the hydraulic pump contactor on a lift truck.

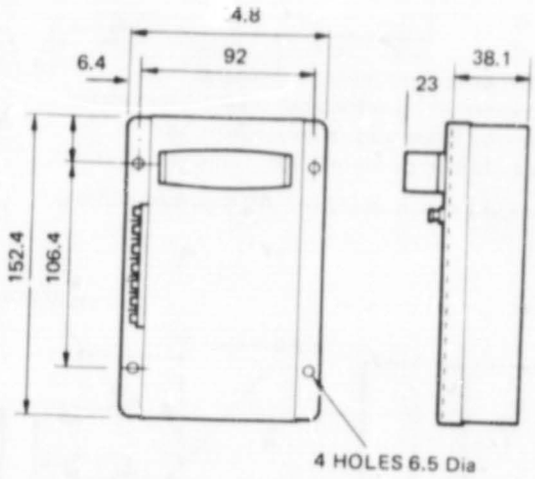
Features

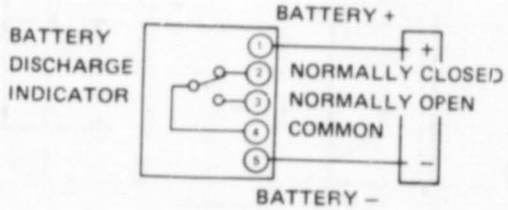
* FIVE WATT not to be ignored flashing light to indicate low battery voltage.
* TRANSIENT LOCKOUT To prevent false operation due to switching pump motors or starting on ramps.
* MEMORY CIRCUIT To prevent the operator resetting the unit by opening and closing the battery connector. A circuit ensures that the battery must be disconnected for at least 30 seconds to reset the unit.
* PROTECTION CIRCUIT
  (a) The unit cannot be damaged by reverse battery connection.
  (b) The lockout relay contacts are completely isolated from the electronics.
* POWER ECONOMY The unit consumes only 0.050 amps when monitoring a charged battery.
* SIMPLICITY Only four wires connect.
* FLEXIBLE APPLICATION The lockout relay has change over contacts. The normally open contacts are therefore available for additional circuits.

Installation DIMENSIONS IN MILLIMETRES

Model. 5114

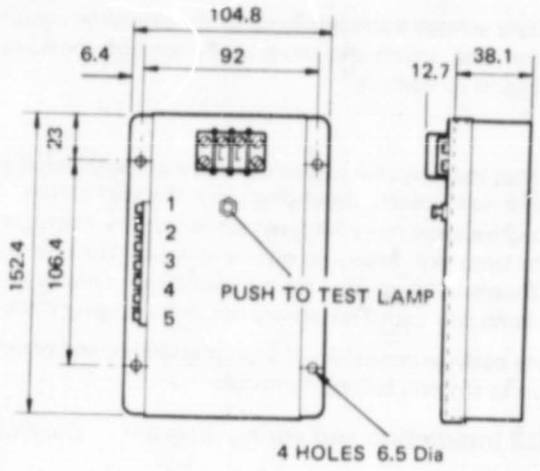
Complete with indicator lamp.

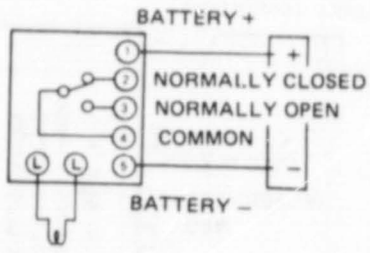




Model. 5124

(For use with remote lamp)

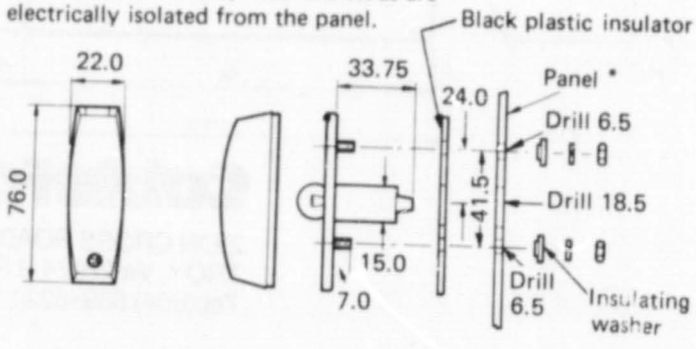




Remote Lamp

Part No. 13650
Item 1 Up to 80 volts.
Part No. 13650
Item 2 from 84 to 140 volts.

* If lamp is mounted on metal panel, it is essential that the lamp case and studs are electrically isolated from the panel.



Cableform Inc.
ZION CROSS ROADS
TROY, Va 22974 U.S.A.
Tel:(804) 589-8224

5100 series battery discharge indicators

Performance Specification

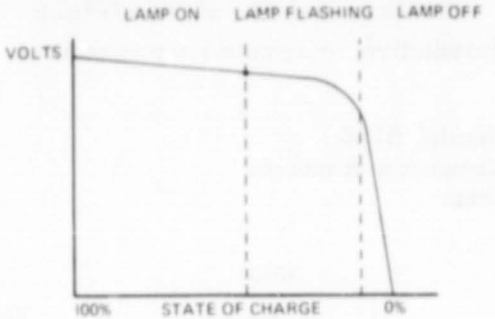
Temperature range	-40°C to +50°C.
Humidity	95% RH.
Relay contacts	electrically isolated single pole changeover
Contact rating	500 VA - maximum 3 amps.
Number of operations	In excess of 10,000,000.
Lock-cut level	1.7 volts per cell.
Time delay from initial flashing to relay lock-out	3 minutes.
Time delay from the fall in voltage to the initiation of the lamp flashing	20 seconds.

Ordering Information (for model 5114 and 5124)

Unit complete with lamp assembly model No 5114 please specify voltage.
Unit for use with, but not including a remote lamp Model No 5124, please specify voltage, example 5124 (72volts).
Lamp and holder for use with Model 5124 Pt No 13650-1 for systems up to 80 volts.
Spare bulb for use up to 80 volts (12 volts 5 watt) Pt No 13844-1
Lamp and holder for use with Model 5124 from 84 to 140 volts Pt No 13650-2
Spare bulb for use above 84 volts (24 volts 3 watt) Pt No 13844-2

For use with the following system: Voltages 24,36,48,60,72-80,84,96,108,112 and 140.

Model 5111 and 5121



Operation

As the battery voltage decreases towards the discharge condition, the indicator lamp, which also serves as the ignition or power-on indicator begins to flash.

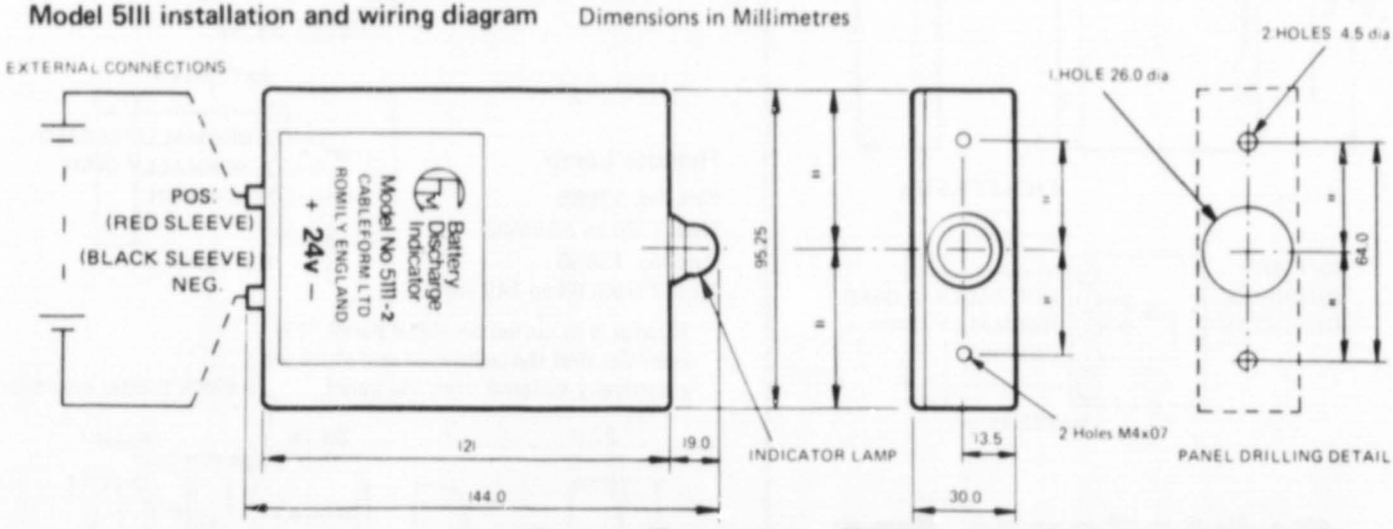
The level that the indicator begins to flash may be selected as 1.35 or 1.75 volt per cell, depending upon the application.

The flashing becomes more frequent as the battery continues to discharge. If the driver continues to discharge the battery the lamp will finally go out completely. The unit will not respond to momentary overload but during a temporary heavy discharge, such as using the hydraulic pump motor or operating whilst heavily laden up a steep gradient, the indicator lamp will flash. The battery requires charging if the lamp flashes during off-load or normal light running conditions.

A complete package consisting of a lamp assembly and control module mounted in a case is available. All that is required is connection to the two battery terminals.

Model 5111 installation and wiring diagram

Dimensions in Millimetres



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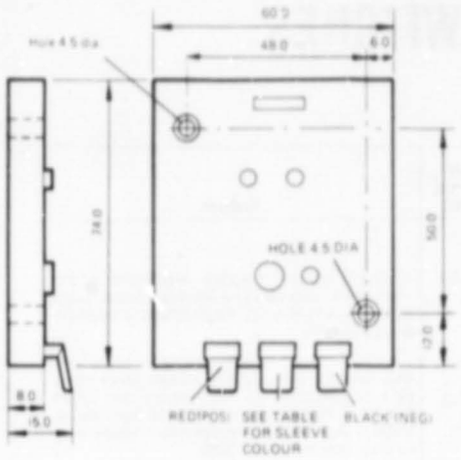
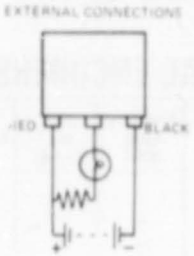
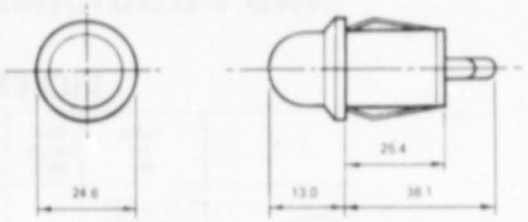
ZION CROSS ROADS
TROY, Va 22974 U.S.A.
Tel:(804) 589-8224

Alternatively the module and, if required a lamp assembly can be supplied separately. Please note that at 12 volts, a 12 volt lamp should be used. At 24 volts and above, a 24 volts lamp is required. Above 24 volts an external dropper resistor must be inserted in series with the lamp as shown on the wiring diagram. The value of the dropper resistor will depend on the lamp used. The maximum permitted watts are 2.2 at 12 volts and 2.8 at 24 volts and above.





LAMP HOLDER 12657



PANEL HOLE CUTOUT – 19,25 dia
USED ON PANELS – 3,2 max.thickness
0,8 min.thickness
BULB TYPE – M.E.S.

Cableform Inc.
ZION CROSS ROADS
TROY,Va 22974
Tel. (804) 589-8224

MODEL NO.	SLEEVE COLOUR	VOLT
5121-1-X	BLUE	12
5121-2-X	WHITE	24
5121-3-X	BROWN	36
5121-4-X	YELLOW	48
5121-5-X	VIOLET	60
5121-6-X	GREEN	72/80

Ordering information

Module and lamp assembly mounted in case 5111

Module only 5121

Voltage available:
12, 24, 36, 48, 60, 72-80
Please specify
1, 2, 3, 4, 5, 6

Operation level

1.35 volts per cell please specify - 1
1.75 volts per cell please specify - 2
example 5121 – 3 – 2

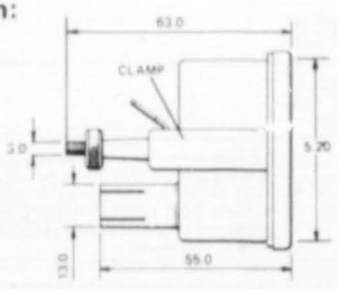
Module only | 36 volt operation | 1.75 volts per cell operating level

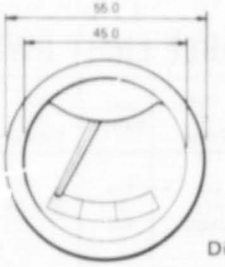
Spares Lamp Holder - 12657, Lamp 12 volts - 12658, Lamp 24 volts - (for use with 24 volt system and above) - 12659
Dropper resistors - for use with the 2.8 watt 24 volt lamp - (this is already fitted on 5111 units), 36 volts system Pt. No. 13192-25, 48 volts system Pt. No. 13192-29, 60 volts system Pt. No. 13192-31, 72-80 volts system Pt. No. 13192-32

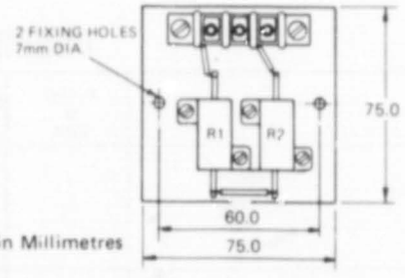
Model 5118 Dial Type: Panel mounted indicator with coloured sector display.
The moving coil is heavily damped to eliminate response to transients and protect against mechanical shock.

This Standard Indicator is readily adapted to any system voltage ranging from 18V to 144V by means of an externally mounted Resistor Assembly.

Installation:







Dimensions in Millimetres

Connection:
The connections to the Indicator and to the Resistor Assembly are by 6.35 mm faston type terminals. The resistors must be connected in series with the Indicator.

Ordering Information:
When ordering Model 5118 also order the appropriate Resistor Assembly as stated in the table below:

Battery Voltage	18V	24V	36V	48V	60V	72V	84V	96V	108V	120V	132V	144V
Resistor Assembly Part No. 14788	–1	–2	–3	–4	–5	–6	–7	–8	–9	–10	–11	–12

Example: For 48V operation order Resistor Assembly 14788–4

TRUMP-ROSS OPTICAL SHAFT ENCODERS AND PROGRAMMABLE LIMIT SWITCHES

INCREMENTAL ENCODERS

	Pulses Per Rev.	Input Voltage (VDC)	Output Formats	Frequency Range (KHZ)	Shaft Dia. (Inches)	Outline Dimensions (Inches)	Features
Tru-Rota Instrumentation Encoder 	10 to 1270 Single and dual channel 1271 to 2500 single channel only	5 to 15	TTL, HTL, CMOS, sine wave	0 to 50	1/4	2.3 DIA. x 1½ L	Compact, general purpose, instrument grade, incremental encoder. Low starting torque. Single or double-ended shaft. English/Metric combinations available.
LC-23 Low Cost Encoder 	30 to 1270	5 to 15	TTL, CMOS, line driver	0 to 50	1/4	2.3 DIA. x 1.6 L	Ultra low cost, self-contained encoder which meets OEM requirements for high quality and offers features of more expensive units. LED light source, single or dual channel complementary square wave outputs. Optional marker pulse.
Tru-Mite Industrial Encoder 	200 to 5000	5 to 15	TTL, HTL, CMOS, sine wave, line driver	0 to 100	3/8	2½ DIA. x 2½ L	High performance, industrial duty, incremental encoder with ⅜" diameter shaft and sealed bearings. Cast aluminum housing with flange or servo mount. Side or end-mounted MS connector. LED light source. English/Metric combinations available.
Tru-Tac Industrial Encoder 	10 to 600	5 to 24	TTL, HTL, CMOS, line drivers	0 to 30	3/8	3L x 3¼W x 3¼H	Economical, industrial duty, incremental encoder with double-ended ⅜" diameter shaft and sealed bearings. Foot or face mounting and MS connector. LED light source.
Trim-Step Modular Encoder 	50 to 250	5	TTL, HTL, CMOS, sine wave	0 to 25	N/A	2¼ DIA. x 1⅛ L	Rugged, modular, incremental encoder designed to be integrally mounted on a stepper or servo motor. Consists of a cylindrical slotted rotor and concentric stator. High shaft end play tolerance (.020"). Easy to install.
Kit-Coder Modular Encoder 	200 to 1000	5	TTL, sine wave	0 to 50	N/A	2.1 DIA. x ¾ L	Low cost, modular, incremental encoder designed to be integrally mounted on a servo motor. Consists of an optically encoded disc on an aluminum hub and an LED light source/phototransistor/amplifier module. Small size and low inertia. Easy to install.

ABSOLUTE ENCODERS

	Resolution (Single Turn)	Input Voltage (VDC)	Output Codes	Output Formats	Frequency Range (KHZ)	Shaft Dia. (Inches)	Outline Dimensions (Inches)	Features
Model LR 	9 Bit	5 to 24	BCD, gray, natural binary	TTL, HTL, CMOS	0 to 50	⅜ or ⅝	5L x 3⅛W x 3⅛H	Industrial duty, absolute encoder. Heavy duty cast aluminum housing with ⅜" or ⅝" diameter shaft, and sealed bearings. Foot or face mounting and MS connector. LED light source. Non-ambiguous output.

PROGRAMMABLE LIMIT SWITCHES

	Number of Cams	Resolution (degrees)	Type of Output	Input Voltage	Shaft Dia. (Inches)	Outline Dim. (Inches)	Features
Digi-Cam 	1 to 12	1	TTL, HTL, CMOS	5 to 24 VDC	⅜ or ⅝	5L x 3⅛W x 3⅛H	Dedicated solid state, electronic cam switch. Internal semiconductor memory can be factory programmed for up to 12 individual cam on/off profiles with 1° minimum dwell for 360° of shaft rotation. Same rugged mechanical construction and I/O voltages as LR Absolute Encoder.
Electronic Cam System 	1 to 8 expandable to 24	1	Relay or Solid State	24, 115 or 230 VAC	Encoder ⅜ or ⅝ Programmer N/A	Encoder 5L x 3½W x 3¼H Programmer 13W x 5½H x 6D	Replaces mechanical cam switches. Consists of LR Absolute Encoder and an electronic programmer. Never requires readjustment. Thumbwheels permit adjusting up to 8 on/off set points with 1° minimum dwell while shaft is rotating. Relay or solid-state outputs. Digital display indicates shaft position. Absolute encoder remembers shaft position even with power off.

Trump-Ross Encoders are manufactured by

Datametrics Inc.
340 Fordham Road, Wilmington, Mass. 01887
Tel: (617) 658-5410

datametrics

General Specifications

MODEL 4015 AND 4012 AMMETERS

CASE

Thick high temperature engineering plastic is standard. Available in translucent plastic for waterproof lighted gauges. Heavy zinc coated steel case also available. Cases can be supplied with panel locating key.

DIAL

2" nominal diameter, 1-1/8" long scale. Aluminum dial plate. Numerals and graduations are bold and legible; can be read to 5 feet and monitored to 10 feet. White on black markings standard. Special zones or color combinations available to order.

DIAL RANGE

Model 4015: 5-0-5 through 100-0-100 amperes. Expanded scales, as 20-0-10, supplied to order. Model 4012: 0-20 through 0-100 amperes. See standard dial ranges below. Special ranges supplied to order.

POINTER

Corrosion proof. White is standard. Black, Fire Orange fluorescent and other colors supplied to order.

CRYSTAL

Glass is standard. Tempered glass and high temperature plastic available to order.

BEZEL

430 polished stainless steel is standard. 302 stainless steel, chromium plated and painted bezels available.

MOUNTING

Supplied with plastic mounting clamp for panel mounting. Insulated steel mounting clamp available. 2" push-on speed nut mounting available. Wide flange style also available.

TERMINALS

10-32 brass studs, 1-1/16" long, standard. Other sizes available.

ACCURACY

10% of full scale is standard. Higher accuracy at specific calibrated points can be supplied to order.

RESPONSE

Silicone dampened to overcome vibration and minimize response to high transients in the system (such as regulator contact chatter). Time constant of dampening can be set for specific requirements.

MOVEMENT

Magnepivot pointer movement with solid Alnico pointer magnet. Pointer is calibrated against soft iron keeper, which is not affected by external electrical fields or high overcurrent.

REPEATABILITY

Calibration is permanent.

MILITARY SPECIFICATION

Can surpass all tests of AMMETER SPEC MIL-A-3427.

OVERCURRENT

100 amperes continuous for ranges up to 60-0-60 amperes; 200 amperes for ranges up to 100-0-100 amperes.

TEMPERATURE EXPOSURE

Not damaged by —65° to 230° F. for complete assembly.

VIBRATION

Will operate under 2 g's vibration intensity, up to 100 cps sted to 10 g's.

SHOCK

Tested to 100 g's.

ADVERSE ENVIRONMENT

Fully weatherproof; sealed against rain, ice, sand and dust. Will not leak in 12 feet depth of water (5 PSI).

STANDARD MODEL AMMETERS USUALLY IN STOCK FOR IMMEDIATE DELIVERY

MODEL 4015 — CENTER ZERO, CHARGE AND DISCHARGE							
RANGE	10-0-10	15-0-15	20-0-20	30-0-30	50-0-50	60-0-60	60-0-60
POINTER COLOR	WHITE	WHITE	WHITE	WHITE	WHITE	WHITE	Red Fluorescent
CASE	OPAQUE	OPAQUE	OPAQUE	OPAQUE	OPAQUE	OPAQUE	Translucent for Night Lighting
MODEL 4012 — LEFT ZERO							
RANGE	0-30	0-60					
POINTER COLOR	WHITE	WHITE					
CASE	OPAQUE	OPAQUE					

TO ORDER standard ammeters specify: 1. Range 2. Pointer Color 3. Standard opaque case or translucent case for night lighting.

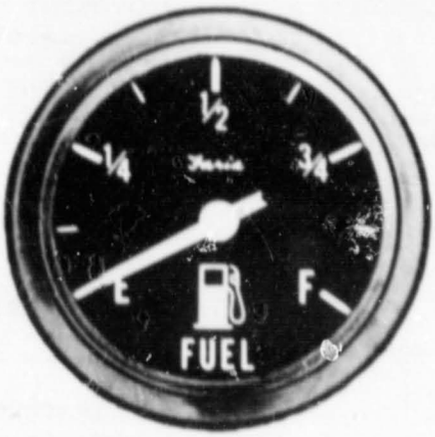
Send us your request for quotes on special ammeters. We supply all major American and Canadian tractor, truck, generator, marine engine and off-the-road equipment manufacturers with their special requirements.

Ammeters per PATENT #2,867,768 formerly manufactured by Rochester Gage Corporation and American-Standard Controls Division are now produced and supplied solely by the Thomas G. Faria Corporation. (Faria Corporation purchased tooling, manufacturing and patent rights in June, 1967.)

THOMAS G. FARIA CORP. FARIA LANE UNCASVILLE, CONN. 06382 U.S.A. PHONE 203-848-9271

NEW Faria

250° FULL SWEEP ELECTRIC GAUGES



THE MOST ACCURATE ELECTRIC GAUGE AVAILABLE FOR TEMPERATURE, OIL PRESSURE AND FUEL.

Faria 250° electric gauges contain the same 2% accuracy patented 250° movement used in Faria original equipment tachometers. Movement is damped and completely free of stickiness or hysteresis. Zener solid state voltage regulation keeps reading accurate despite variations in battery voltage.

Sealed watertight in a 2-1/6 diameter translucent plastic case, gauge is guaranteed to withstand 5 psi or 12 feet depth of water. Dial can be lighted through sides or with a plug in lamp socket in back of case. Interchanges with standard SAE gauges.

All standard ranges of temperature, oil pressure and fuel level are available to match any sender unit. Also supplied as a voltmeter and ammeter.

3", 4" and very large 5" electric gauges can be supplied on special order.

Phone or write for quotes and delivery information.

THOMAS G. FARIA CORP. **Uncasville, Conn. 06382**

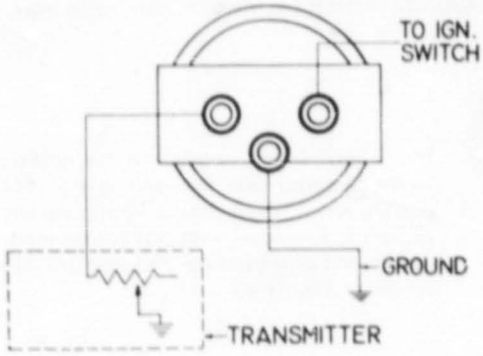
PHONE: (203) 848-9271

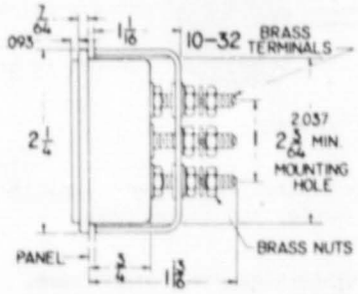
IN-12

NEW Faria



MAGNETCORE ELECTRIC GAUGES





GAUGES ALSO AVAILABLE IN 2-1/16" CASE DIA

Faria Magnetcore gauges are similar to air-core or bi-torque gauges in that the pointer magnet is centered in the driving coil. However the magnetcore movement has only 1 large coil and uses solid state voltage regulation.

The pointer magnet is centered in and surrounded by a single large coil in a configuration that permits a maximum number of turns. The resulting high torque combined with a magnepivot bearing system provides a strong smooth friction free pointer action.

In the magnepivot system a strong Ceramic permanent magnet, carried by the pointer on a conical pivot bearing, provides sensitive, smooth pointer action and steadies the pointer against shock and vibration. The pointer assembly is silicone dampened to reduce pointer flutter from transients in the electrical circuit, or external vibration. Calibration is permanent.

Unlike most competitive gauges pointer returns to zero when turned off.

Magnetcore gauges are quick responding and are not affected by temperature or mounting position. There is no warm-up time or delayed action as found in bimetal type electrical receivers and the FARIA gauge does not produce radio interference as is the case with bimetal systems.

Available for 6, 12 or 24 volt systems, either positive or negative ground, in styles for clamp, front flange or back of panel mounting. Many bezel styles available. Gauge also supplied as a voltmeter and ammeter.

In addition to stock gauges all ranges of temp, oil press and fuel gauges are available to match any sender unit.

Standard sealed gauges supplied in zinc plated steel cases or translucent plastic are guaranteed waterproof and will withstand 5 psi or 12 feet water depth.

Lighted gauges supplied in translucent plastic for side lighting or with rear hole for plug in light sockets.

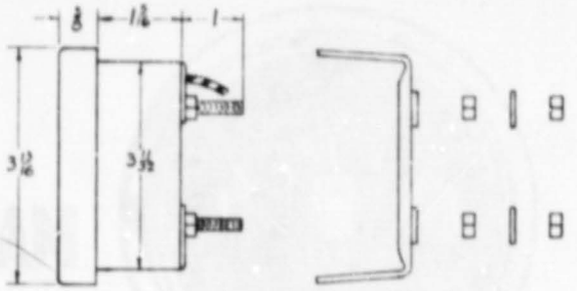
PHONE OR WRITE FOR QUOTES AND DELIVERY INFORMATION. MODERN ASSEMBLY LINE METHODS AND SPECIAL AUTOMATIC EQUIPMENT ENABLE HIGH VOLUME PRODUCTION AND REASONABLE PRICES.

THOMAS G. FARIA CORP. Uncasville, Conn. 06382

PHONE 203-848-9271

Faria TACHOMETER SPECIFICATIONS

DIMENSIONS: Meets SAE dimensions for mechanical tachometer. Fits standard panels and 3⅜" to 3½" diameter mounting holes.



BEZEL: Chromium plated brass or stainless steel. Double strength curved glass window.

DIAL: Lighted with standard min bayonet base lamp plugged in rear of case. Daylight flourescent red (fire orange) pointer.

WATERPROOFNESS: Hermetically sealed, guaranteed to withstand 5 PSI or 11 feet depth of water. Guaranteed for outside open weather use.

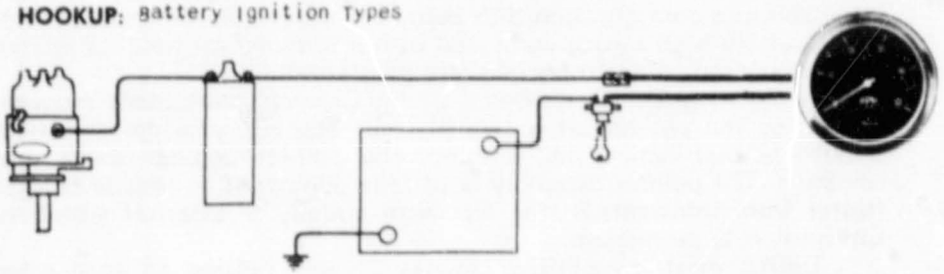
SHOCK: Guaranteed to withstand 50G shock. Tested to 110G shock.

VIBRATION: Guaranteed to withstand .030" excursion at 30 CPS, tested to 60 CPS. Withstands shock and vibration encountered in Roce car, racing boat, tractor and military equipment.

ACCURACY: 2% of full scale. Factory calibrated to match engine cylinders for greatest accuracy.

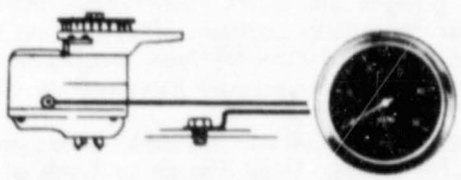
RADIO INTERFERENCE: Does not connect to distributor and therefore does not produce radio interference. Meets military radio interference specifications MIL-I-11683 and MIL-S-10379A.

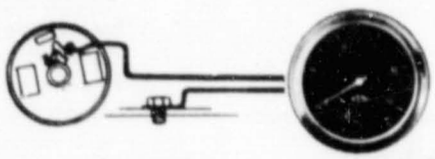
HOOKUP: Battery Ignition Types



The 2 tach leads connect to the ignition switch in series with the ignition coil. No need to run wires to engine. Works equally well on 6, 12 and 24 volts positive or negative ground also transistorized ignitions. No sender unit required.

HOOKUP: Magneto Ignition Types





One tach lead connects to magneto primary. The other lead connect to ground.

STOCK RANGES: 0-1500, 0-2500, 0-4000, 0-5000, 0-6000, 0-8000, and 0-12000 RPM.

ORDERING INFORMATION: For battery ignition, specify number of cylinders and RPM range. For magneto ignition, specify range, number of cylinders, whether 2 cycle or 4 cycle, and engine make.

Tachometers can be supplied with bezels to match other gauges or with dials containing users brand name. Your inquiries are solicited.

24 volt and magneto ignition tachometers for government and military applications are regularly supplied meeting radio interference specs MIL-I-11683 and MIL-S-10379A.

Standard tachometers are carried in stock in many ranges.
Sample tachometers for trial purposes will be sent upon request.

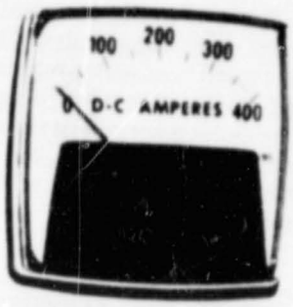
FULL 2-YEAR FACTORY GUARANTEE **MADE 100% IN U.S.A. OF 100% U.S. PARTS**

Manufactured under Faria patents 3005155, 3233175 and patents pending.

THOMAS G. FARIA CORPORATION
UNCASVILLE, CONNECTICUT 06382 • PHONE 203: 848-9271

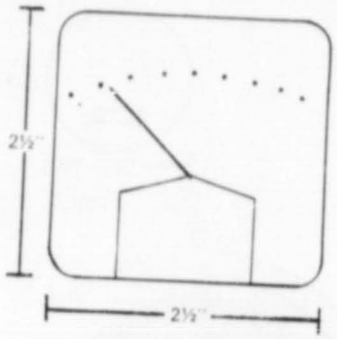
DC AMMETER

Monitor the current load through the DC motor with this heavy duty ammeter. Observing the amperage drawn by the motor provides information on the operating state of the motor. During normal driving, the meter should indicate the rated full load amperage for the installed motor. When starting or climbing hills, amperage may double for short periods. Continued operation at high amperage indicates a problem and may result in damage.



Our ammeter comes complete with a shunt to allow measurement of up to 400 amps DC.

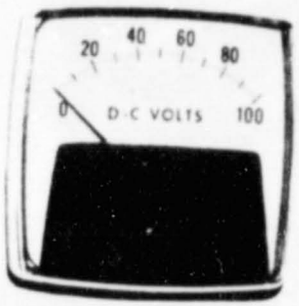
72-900-800 400 Amp DC Ammeter



72 VOLT DC VOLTMETER

Use this rugged DC voltmeter for an electric fuel gauge on any system up to 72 volts. Full scale deflection at 100 volts DC. For a 72 volt system, "full" will be indicated by a reading of approximately 83 volts and "empty" will be indicated by a reading of 62 volts.

70-959-800 72 Volt DC Voltmeter



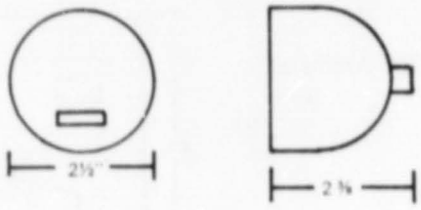
ELECTRIC VEHICLE COMPONENTS
FLIGHT SYSTEMS
HEADQUARTERS
P.O. BOX 25, MECHANICSBURG, PA 17055
PHONE (717) 697-0333

HOUR METER

Electric vehicle service is measured in elapsed time rather than miles. This five digit elapsed time meter registers hours and tenths. Wiring is simple because the meter is not polarity sensitive. Supplied with "U" bracket for dash panel mounting. Choice of two voltage ranges. Lighted



Part No.	Description	Volts
70-77650-600	DC Hour Meter	8-50V
70-77613-600	DC Hour Meter	50-130V





ELECTRIC FUEL GAUGE

The key indicator of EV status is the charge level of the batteries. The range from "full" to "empty" is 2.3 to 1.7 volts per cell. Color shading calls attention to battery status.
Comes supplied with "U" bracket for dash panel mounting. Lighted

Part No.	Description	Volts
70-8332-600	Electric Fuel Gauge	24
70-8333-600	Electric Fuel Gauge	36
70-8334-600	Electric Fuel Gauge	48

ELECTRIC VEHICLE COMPONENTS
FLIGHT SYSTEMS
HEADQUARTERS
P.O. BOX 25, MECHANICSBURG, PA 17055
PHONE (717) 697-0333

Protect your electric vehicle battery with the latest electronic technology

- Reliability proven by over 2 years of Field testing
- Field Analyzer available
- 1 year warranty



- One unit covers 12-72V in 6V increments
- Optional Audible Alarm
- Increases battery life up to 50%

Protects against:
- Motor Damage
- Battery Overheating
- Control Failure
- Contact Burning

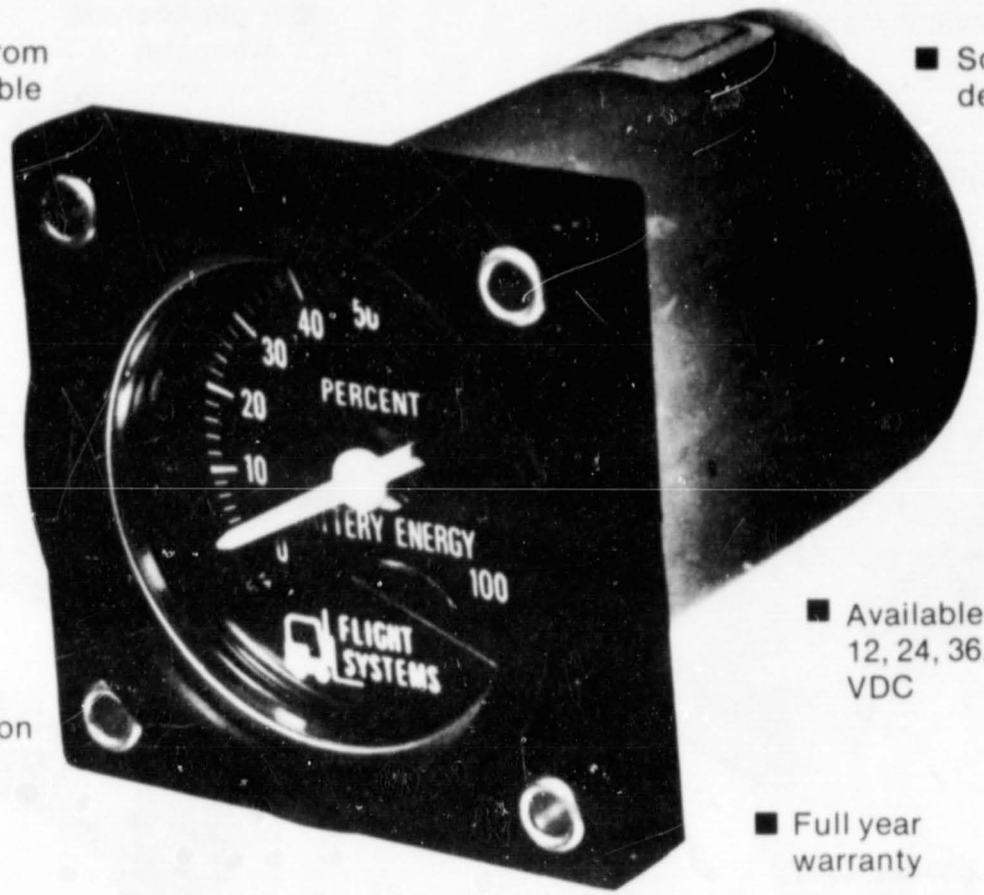
- 6 foot wiring harness included (12 foot optional)
- All solid state design
- Reduces Electric Consumption for charging

ELECTRIC VEHICLE COMPONENTS
FLIGHT SYSTEMS

HEADQUARTERS
P.O. BOX 25, MECHANICSBURG, PA 17055
PHONE (717) 697-0333

Protect your electric vehicle investment with the "FUEL GAUGE"

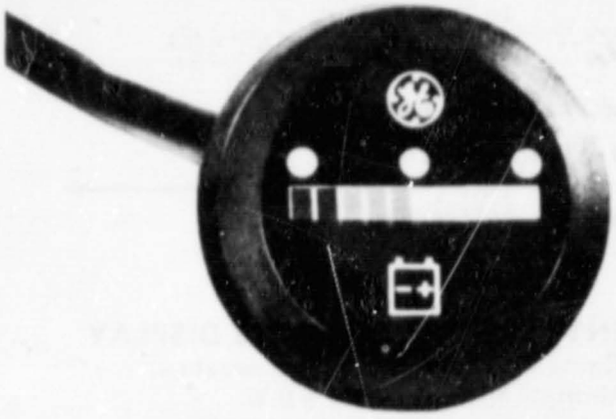
- Exact readings from 0 to 100% of usable battery energy
- Fast, easy 2 wire installation
- Low cost, one piece construction



- Solid state design
- Available in 12, 24, 36, 48 and 72 VDC
- Full year warranty

FLIGHT SYSTEMS MODEL 214A BATTERY ENERGY GAUGE

ELECTRIC VEHICLE COMPONENTS
FLIGHT SYSTEMS
HEADQUARTERS
P.O. BOX 25, MECHANICSBURG, PA 17055
PHONE (717) 697-0333

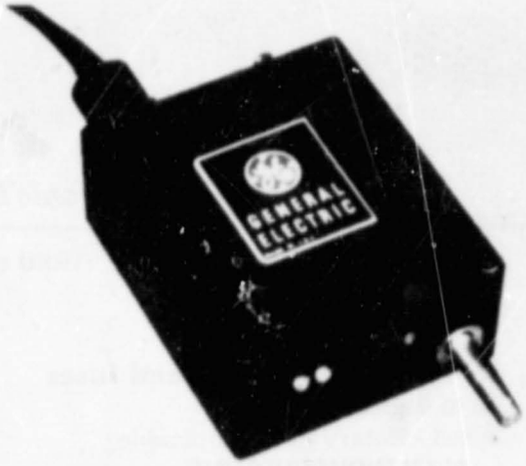


Battery Condition Indicator

The Battery Condition Indicator displays battery condition very clearly and accurately, and maximizes battery life by protecting the battery from the damaging effects of deep discharge.

This microprocessor device actually *measures* energy consumed and displays battery condition on an eight-position LED readout with green, amber, and red zones. If the battery discharges to the red zone condition, the indicator begins flashing and several minutes later, it will render the truck inoperable by disconnecting the hydraulic pump motor (forward contactor disconnect is optional).

The device cannot be fooled by disconnecting the battery or by temporarily connecting a charged battery.



Accelerator Switch

Solid state electronics provide at least 100 times longer life for this new accelerator, and eliminates the potentiometer.

- Only one principal moving part
- Small size
- Rugged, gasketed enclosure
- Short stroke assures positive shaft return
- Reliable solid-state by-pass switch

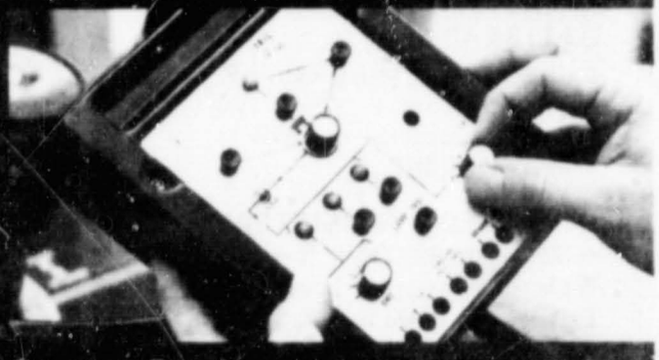
GENERAL ELECTRIC

INDUSTRIAL CONTROL DEPARTMENT

P.O.Box 8106, Charlottesville, VA 22906

TEL: 804-973-1851

You get... outstanding backup and support



System Analyzer for easy troubleshooting

Using the EV-1 Analyzer, one service person can check out the control and all vital truck electrical components in less than 10 minutes. With the flick of a switch, the analyzer can test a key switch, seat switch, brake switch, accelerator switch, directional selector switch, capacitor, SCRs, diodes, thermal protector, motor and wiring.

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electronic instrumentation & data systems

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Wide to very narrow spectral range.
Target sizes down to 0.020" dia.
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Raster scan video graphics generators.
Multiple displays. Color & B-W
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0-1 Mega bps, FD & HD, sync & async
Dial-up & dedicated line, Short Hauls
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☐ **TEST EQUIPMENT, electronic**
Signal generators, Spectrum analyzers,
Deviation meters, White noise test sets, etc.
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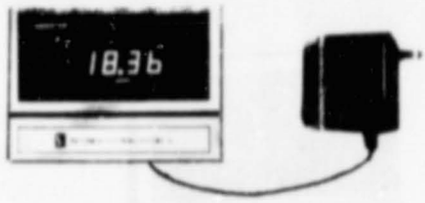

DC AMMETER

Measure DC current from .01mA on up to 2,000 amperes! These meters are delivered complete and ready to go . . . they even include external current shunts where needed.

Excellent for monitoring DC motor loading, electroplating operations, battery performance, and much more.

INPUTS: Power: 120 VAC (with transformer supplied), 0.2A, 60Hz. **SIGNAL:** IDA-7843 thru 7848 inserted in series with signal line, produce 100mV drop. Other models require external shunt (included) which produces 1mV drop per display count. Protected to 300% continuous overload. Meter isolated by power xmfr; potential from signal input to meter power input 600V max. Potential from signal to meter panel = 300V max.

OUTPUTS: None.

MANUAL CONTROLS: Gain: adjusts full scale calibration (factory-set). **Decimal Select:** switch selects decimal position. **Polarity:** switch selectable. **Noise Filter:** four switch positions for slow-fast response. **Signal Input Switch:** disables signal input.

DISPLAY: 3½ digits (1999 counts), polarity, decimal point. Overrange (over 1999 counts) indicated by 1---.

ACCURACY: Greater than ± 0.05% of reading ± 1 count. No zero drift (auto-zero circuit). Temp. stability = (.005%FS ± .005%R)/°C.

MODEL	RANGE
IDA-7843	± 1.999 µA
IDA-7844	± 19.99 µA
IDA-7845	± 199.9 µA
IDA-7846	± 1.999 mA
IDA-7847	± 19.99 mA
IDA-7848	± 199.9 mA
IDA-7849*	± 1.999 A
IDA-7850*	± 19.99 A
IDA-7851*	± 1999.9 A
IDA-7852*	± 1999 A

* Price includes external current shunt. IDA-7843 thru 7848 include built-in shunt.

AC AMMETER

This is **the** selection of instruments for measuring AC current. Our low-range models are super-accurate and very economical. The mid-range models cover the most commonly encountered currents.

The major innovation: our IDA-7835! This instrument will work with **any** current transformer with a 5-ampere secondary. Special internal controls and built-in calibration standard allow the user to adjust this meter in the field to match his transformer.

INPUTS: Power: 120 VAC (with transformer supplied), 0.2A, 60Hz. **Signal:** IDA-7828 and 7829 inserted in series, produce 200mV drop; 30Hz to 5kHz. IDA-7830 to 7834 require external current-to-voltage transformer (included), 0-10VAC output. IDA-7835 requires external current transformer with 5A output (not included).

OUTPUTS: None.

MANUAL CONTROLS: Gain: adjusts full-scale calibration (factory-set). IDA-7830 thru 7835 has coarse and fine adjustment. **Calibrate:** IDA-7830 thru 7835 reference internal standard for field calibration to any 5A transformer. **Decimal Select:** jumper selects decimal position.

DISPLAY: 3½ digits (1999 counts), decimal point. Overrange (over 1999 counts) indicated by flashing display.

ACCURACY: Greater than ± 0.05% of reading ± 1 count. Models IDA-7830 to 7835 limited by current transformer ratio error (repeatable, typ. 1% to 2% max.). Temp. stability = (.005%FS ± .005%R)/°C.

MODEL #	RANGE
IDA-7828	19.99mA
IDA-7829	199.9mA
IDA-7830*	1.999A
IDA-7831*	19.99A
IDA-7833*	50.0A
IDA-7834* †	100.0A
IDA-7835†	200 to 2000 counts

* Price includes external transformers required.

† Requires external current transformer with 5-ampere secondary (not included).

TRUE RMS AMMETER

With this meter, the true current going to a device can be measured. Modern day motor controllers, variable speed drives, energy conservers, etc. produce weird waveforms. Consequently, the normal averaging-type ammeter will not give a proper reading. By using the Slimline TRMS (true root-mean-square) Ammeter, you'll know the true current.

INPUTS: Power: 120 VAC (with transformer supplied), 0.2A, 60Hz. **Signal:** Differential: greater than 100KΩ impedance. CMR: greater than 100dB with 1000Ω imbalance. NMR: greater than 60dB at 60Hz. Meter isolated by power transformer. Common Mode Voltage (meter power in to signal) 600V max. Potential from signal to panel: 300V.

OUTPUTS: None.

MANUAL CONTROLS: Gain: adjusts full scale calibration (factory-set). **Decimal Point:** switch selects decimal position. **Polarity:** switch selectable. **Zero Trim:** factory-set. **Self Test:** switch selectable. **Signal Input Switch:** disables signal input. **AC Only or DC & AC:** switch selectable.

DISPLAY: 3½ digits (1999 counts), decimal point, polarity. Overrange indicated by 1---.

ACCURACY: Total mode conversion for all waveforms; AC component ≥8Hz but ≤50KHz, the accuracy will be better than ± .25% of the reading ± 1 count @ 25°C. No zero drift (auto-zero). **Temperature Stability:** .01% F.S. ± .005% R/°C. **Crest Factor Error:** 0 to 2 = above accuracy. 2 to 3 ≤ -0.1% R plus above. 3 to 6 ≤ -1% R plus above. **Very Low Frequency AC Component Error:** 10Hz ≤ 0.1% R. 6Hz ≤ -1% R. **±3dB Bandwidth:** All models 50KHz. (±) Bandpass and linearity of current to voltage and current to current transformer if used.

MODEL #	RANGE
ITA-7870	19.99 mA
ITA-7871	199.9 mA
ITA-7872	1.999 A
ITA-7873	19.99 A
ITA-7874	199.9 A

Price includes external transformers required.

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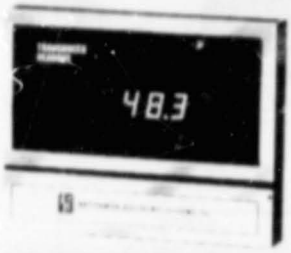





DC VOLTMETER

More rugged and reliable than the run-of-the mill digital panel meter. These instruments will hold their calibration and perform reliably for years.

Ideal for general purpose measuring in the laboratory or factory. An ideal instrument for OEM test instruments and systems.

INPUTS: Power: 120 VAC (with transformer supplied).
Signal:
single-ended, 100kΩ impedance. CMR>100dB at 60Hz with 1kΩ unbalance. NMR>60dB at 60Hz. Protected to ±300V. Meter isolated by power transformer; com. mode voltage (meter power input to signal) 600V max. Potential from signal com. to meter panel 300V max.

OUTPUTS: None.

MANUAL CONTROLS: Gain: adjusts full scale calibration (factory-set). **Decimal Select:** jumper selects decimal position. **Polarity Disable:** jumper turns off polarity sign

DISPLAY: 3½ digits (1999 counts), automatic polarity, decimal point. Overrange indicated by flashing display.

ACCURACY: Greater than ±0.05% of reading ±1 count at 25°C ±2°C. No zero drift (auto-zero circuit). Temp. stability = (.005%FS ±.005%R)/°C.

MODEL #	RANGE
IDV-7802	±199.9mV
IDV-7803	±1.999V
IDV-7804	±19.99V
IDV-7805	±199.9V

OPTION
#61 + 12 VDC operation

AC VOLTMETER

An excellent power monitor! The only instrument that is this easy to install and this accurate and reliable . . . at a good price, too.

Suited for power monitor panels, test sets, laboratory research, and many other uses.

INPUTS: Power: 120 VAC (with transformer supplied).
Signal:
differential input >100kΩ impedance, 30Hz to 5KHz. CMR>100dB at 60Hz with 1kΩ unbalance. NMR>60dB at 60Hz. Protected to ±600V peak. Meter isolated by power transformer; com. mode voltage (meter power input to signal) 600V max. Potential from signal to meter panel 300V max.

OUTPUTS: None.

MANUAL CONTROLS: Gain: adjusts full scale calibration (factory-set). **Decimal Select:** jumper selects decimal position.

DISPLAY: 3½ digits (1999 counts), decimal point. Overrange indicated by flashing display.

ACCURACY: Greater than ±0.05% of reading ±1 count at 25°C. No zero drift (auto-zero circuit). Temperature stability = (.005%FS ±.005%R)/°C.

MODEL #	RANGE
IDV-7812	199.9mV
IDV-7813	1.999V
IDV-7814	19.99V
IDV-7815	199.9V

OPTION
#61 + 12 VDC operation

OHMMETER

An accurate, easy-to-install digital ohmmeter, complete and ready to use . . . this is the only one available that we know of! The precision internal current source and stable measuring circuitry insure consistent accuracy. Use either 2-wire or 4-wire technique.

Measure resistance of motor windings, coils . . . quality control for resistors and thin or thick-film circuits.

INPUTS: Power: 120 VAC (with transformer supplied).
Measure:
2 or 4-wire technique. Constant current generated internally.

OUTPUTS: None.

MANUAL CONTROLS: Gain: adjusts full scale reading (factory-set). **Zero:** adjusts zero offset (factory-set).

DISPLAY: 3½ digits (1999 counts), decimal point. Overrange indicated by flashing display.

ACCURACY: Greater than ±0.1% of reading ±1 count at 25°C ±2°C. Temp. stability (.01%FS ±.01%R) per °C.

MODEL #	RANGE
IDH-7838	19.99Ω
IDH-7839	199.9Ω
IDH-7840	1999Ω
IDH-7841	19.99kΩ
IDH-7842	199.9kΩ

OPTION
#61 + 12 VDC operation

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ELECTRICAL





3-3/4 DIGIT OHMMETER

Same great features as the 3½ Digit Ohmmeter such as auto-zero & 4-wire hookup PLUS buffered and latched BCD outputs, and more than 50% greater range. Measure a wider range of resistances with a single instrument while maintaining superb resolution.

Measure motor winding resistance for factory check-out . . . quality control for resistors, coils, switches and contacts . . . measure resistance of electrolytes and other conductive fluids.

INPUTS:

Power: +5 VDC @ 500 mA and ±12 VDC @ 40 mA.

Measure: 2-wire or 4-wire technique.

Current: internally generated constant current.

Sample Rate: 5 readings/sec, other rates available.

Response Time: 0.1 to 5 sec, depending on model, others possible.

Hold: logic "0" inhibits updating of BCD outputs and display.

Trigger: logic "1" allows one update of BCD data and display (must be in hold condition).

Decimal Point Select: jumper allows selection of any decimal point position.

Test: logic "0" or closure to gnd. displays all "8's".

OUTPUTS:

Data: buffered latched BCD, updated 5 times/sec.

Data Ready: normally high, goes low during conversion & updating of BCD outputs.

Inverted Data Ready: complement of data ready.

Overrange: logic "1" when full scale reading exceeded.

DISPLAY:

Data: standard LED display.

Overrange: Blinking display indicates full scale reading is exceeded.

ADJUSTMENTS:

F.S., Zero (used only in 2 wire mode).

ACCURACY:

Greater than ±0.1% of reading ±1 count @ 25°C ±2°C.

TEMPERATURE STABILITY:

(.01% F.S. ± .01% R)/°C.

MODELS:

Model #	Readout	I thru Rx
DH 1937	3.100 Ω	10 mA
DH 1938	31.00 Ω	10 mA
DH 1939	310.0 Ω	1 mA
DH 1940	3100 Ω	1 mA
DH 1941	31.00 kΩ	100 µA
DH 1942	310.0 kΩ	10 µA
DH 1943	3.100 MΩ	5 µA

OPTIONS & ACCESSORIES:

Uses Connector #48 23 50
Cable #15 50 (per foot)

#50 ±12 VDC P.S. built-in

3-3/4 DIGIT VOLTMETER

Boasts the same features and superb quality as the 3½ Digit Voltmeter plus extended range, buffered BCD outputs and latches; when the latches are activated, the display and the outputs hold.

This meter gives you nearly the performance of 4½ digit instruments but at a much lower cost.

This unit has filled the gap for applications requiring an extended range such as high voltage systems, production line testers, automatic check out equipment, etc.

INPUTS:

Power: +5 VDC @ 500 mA and ±12 VDC @ 30 mA.

Signal:

Noise Rejection: CMR = 100 dB, NMR = 60 dB.

Input Resistance: (typ), DC units > 10 MΩ; AC units = 100 kΩ.

Overvoltage Protection: (typ), DC units ±300 V; AC units ±600 V peak.

Sample Rate: 5 readings/sec, other rates available.

Response Time: 0.1 sec typ, others possible.

Frequency Range (AC units): 30 Hz to 5 kHz.

Bias Current: typ. less than 10 picoamps.

Hold: logic "0" = bits updating of BCD outputs and display.

Trigger: logic "1" = lows one update of BCD data and display (must be in hold condition).

Decimal Point Select: jumper allows selection of any decimal point position.

Test: logic "0" or closure to gnd. displays all "8's".

OUTPUTS:

Data: buffered latched BCD, updated 5 times/sec.

Polarity: logic "1" = positive; logic "0" = negative.

Data Ready: normally high, goes low during conversion and updating of BCD outputs.

Inverted Data Ready: complement of data ready.

Overrange: logic "1" when full scale reading exceeded.

DISPLAY:

Data: standard LED display, with polarity indication on DC units.

Overrange: Blinking display indicates full scale reading is exceeded.

ADJUSTMENTS:

F.S.

ACCURACY:

Greater than ±0.05% of reading ±1 count @ 25°C ±2°C.

TEMPERATURE STABILITY:

(.005% F.S. ± .005% R)/°C.

MODELS:

Model #	Readout	Type
DV 1901	±31.00 mV	DC
DV 1902	±310.0 mV	DC
DV 1903	±3.100 V	DC
DV 1904	±31.00 V	DC
DV 1905	±310.0 V	DC
DV 1911	31.00 mV	AC
DV 1912	310.0 mV	AC
DV 1913	3.100 V	AC
DV 1914	31.00 V	AC
DV 1915	240.0 V	AC

For higher voltages dividers & transformers consult factory.

OPTIONS & ACCESSORIES:

Uses Connector #48 23 50
Cable #15 50 (per foot)

#50 ±12 VDC P.S. built-in

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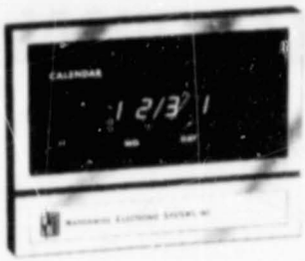
TIME





CLOCK / TIMER

Measure real or elapsed time. Synchronized to 60 Hz or optional 50 Hz line frequency for long-term stability. Complete range of formats to cover all applications in both 12 and 24 hour models.

Ideal for computer time entry, system clocks, automatic controllers, console readouts, master clock systems, and much more. With the ASCII Bustle, they make great computer peripherals and master drivers for two-wire clock systems.

INPUTS:

Power: 5 VDC @ 780 mA max. (6 digit models).

Time Base: 3.5 to 20 VAC rms 60 Hz (50 Hz optional) full sine or square wave or rectified half wave; 10K ohms impedance.

Hold: logic "0" or contact closure to gnd. to hold; logic "1" or open to run; inputs are reversed when Start/Stop switch is pressed.

Reset: logic "0" or contact closure to gnd., resets to all zeros.

OUTPUTS:

Data: Full parallel BCD.

24 Hour Decode: 12 hour models: logic "0" = AM, logic "1" = PM. 24 hour models: 1 μS logic "1" pulse at end of day.

Data Ready: normally high, goes low for 2 μsec when BCD outputs are updating.

Inverted Data Ready: complement of data ready.

MANUAL CONTROLS:

Start/Stop; Reset; Set hours, minutes and seconds (or applicable display digits).

DISPLAY:

Time: standard LED display; includes LED decimal points and colons where required.

AM/PM: LED indicators (12 hour models only).

Running: Models DC1410, 11, 12, 14, 15, 16 include blinking decimal point to indicate running condition.

ACCURACY:

Depends on sync signal; power line typically ± .003% within a 24 hour period, 0% long term.

MODELS:

Model #	Readout	Resets to
DC 1400	12:59:59	1:00
DC 1401	12:59.99	1:00
DC 1409	12 59.9	1:00
DC 1410	12:59	1:00
DC 1402	12.999	1:00
DC 1411	12.99	1:00
DC 1412	12.9	1:00
DC 1403	23:59:59	0
DC 1404	23:59.99	0
DC 1413	23 59.9	0
DC 1414	23:59	0
DC 1405	23.999	0
DC 1415	23.99	0
DC 1416	23.9	0

OPTIONS & ACCESSORIES:

Uses Connector #48-23-34
Cable #15-34 (per foot)
#15 50 Hz time base

CALENDAR

Perfect companion for a Digital Clock . . . keep the date in either month/day or day-of-year format. The month/day model automatically allows for the different days in each month; the day-of-year model displays the total number of days elapsed during the year. Both with automatic leap year.

Great for automatic logging systems, computer standby clocks, observatories, control consoles, and much more.

INPUTS:

Power: 5 VDC @ 700 mA.

24 Hour Decode: one cycle per day, updates on transition from logic "1" to logic "0"; min. pulse width ≥ 1 μs.

Blanking: logic "0" or contact closure to gnd. to blank display.

Reset: logic "0" or contact closure to ground, resets to all zeros.

OUTPUTS:

Data: Full parallel BCD.

Data Ready: normally high, goes low for 2 μsec during update of BCD outputs.

Inverted Data Ready: complement of data ready.

MANUAL CONTROLS:

Reset; Date set; Leap year set.

DISPLAY:

Date: standard LED display.

Leap Year: decimal point indicates leap year is set.

MODELS:

Model #	Readout
CA 1626	Month/Day
CA 1627	Day of Year

OPTIONS & ACCESSORIES:

Uses Connector #48-23-34
Cable #15-34 (per foot)

OSI

SPECIALISTS IN MEASUREMENT MONITORING, AND CONTROL OF CURRENT, POWER AND ENERGY

ENERGY MONITORING INSTRUMENTS

The O.S.I. Watt-hour and Amp-hour Meters provide a convenient and highly accurate way to characterize, monitor and control critical manufacturing processes where product quality and cost are related to electrical energy output.

These solid-state units utilize low loss transducers and are especially suited for watt-hour or amp-hour totalization, power or current monitoring and observation of waveforms in applications where SCR chopped, or other non-sinusoidal waveforms are involved.

In addition to the display of totalized watt-hours or amp-hours since last reset, these units provide a panel meter indication of average watts or amps.

Many models are available for electric vehicle, solar electric system, and commercial building power applications.

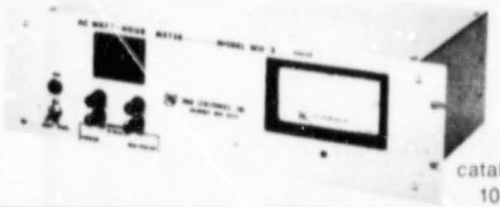
FEATURES

0 to 10 volt output proportional to watts or amps.
Pulse output for watt or amp-hours.
4½" Meter, 6 digit counter.
±0.5% f.s. accuracy.
Convenient Rack Mount—5¼" high.
Complete—Ready for customer installation.
For complete specifications, contact O.S.I.

OPTIONS

BCD Output
Split Transducers
Balance Control
Electronic Counters
Instrumental Enclosure
Digital Panel Meter

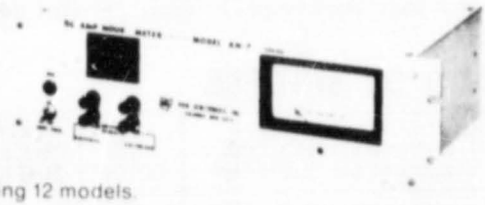
A.C. WATT-HOUR METERS



Request catalog listing 102 models.

SINGLE PHASE 60 Hz MODELS				
MODEL	INPUT VOLTS	INPUT CURRENT AMPERES	METER FULL SCALE WATTS	W-H PER COUNT
WH3-1	120	5	600	1
WH3-2	240	5	1.2K	1
WH3-31	120	100	12K	10

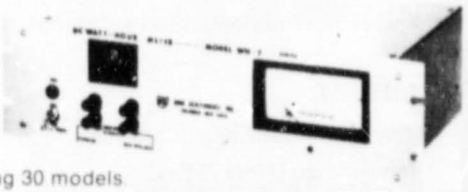
D. C. AMPERE-HOUR METERS



Request catalog listing 12 models.

MODEL	INPUT CURRENT AMPERES	METER FULL SCALE CURRENT	AH PER COUNT
AH7-5	5	5	001
AH7-100	100	100	01
AH7-1K	1K	1K	1

D.C. WATT-HOUR METERS



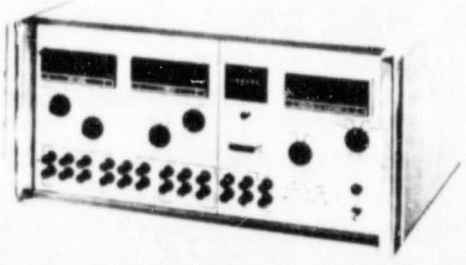
Request catalog listing 30 models.

MODEL	INPUT VOLTS	INPUT CURRENT AMPERES	METER FULL SCALE WATTS	W-H PER COUNT
WH7-1	120	5	600	1
WH7-2	240	5	1.2K	1
WH7-3	480	5	2.5K	1
WH7-46	120	2000	250K	100

POWER TEST PANEL

The Model PTP-948 is a custom designed panel to operate on a single phase, 3 phase 3 wire, or 3 phase 4 wire. The display includes voltage and current on each phase, total kilowatts and an electromechanical counter to display watt-hours.

OSI will custom design equipment for a.c., d.c., and variable frequency applications. Readouts interface features are supplied as required.



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1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212

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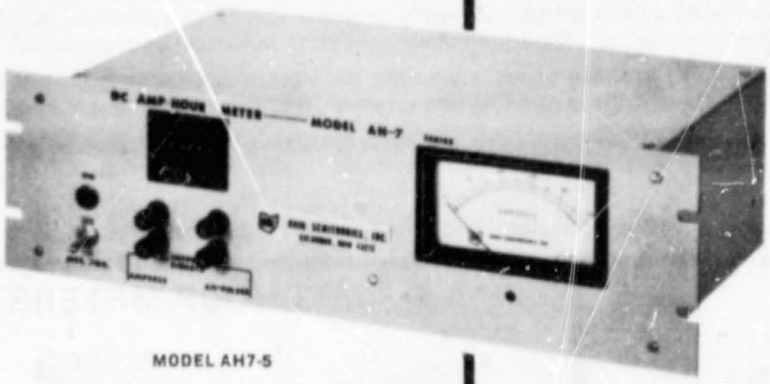
AND CONTROL OF CURRENT, POWER AND ENERGY

OSI



MODEL AH7-5

DC AMPERE-HOUR METER

MEASURES AND DISPLAYS AMPERES AND AMPERE-HOURS

AH7 SERIES

SPECIFICATIONS:

INPUT

Overload (Continuous)
2 X Rating (5-50 Ampere)
10 X Rating (100A-10KA)

DC Insertion Loss
<.01V × I (5-50 Amp)
Zero (100A-10KA)

Isolation: 1.5KV (5-50 Amperes)
5KV (100A-10KA)

Instrument Power: 115VAC, ±15%, 50/60Hz

Response: (Transient) 50 microsecond

OUTPUT

Response Time: 250 milliseconds

Temperature Effect (0 to 40°C):
±0.1% F.S. ±1% of reading

Ammeter: 4½" panel meter

Ampere Hour Counter: 6 digit push button reset

Electrical Output: 8V d.c. FS (Amps)
4V Pulse (Amp-hour)

Accuracy & Linearity
±0.5%FS (5A-2KA)
±1.0%FS (5KA-10KA)
Meter 1.5%FS
Electrical Output
±0.5%FS (5A-2KA)
±1.0%FS (5KA-10KA)

Zero Drift (max.): ±0.1%FS of rated Ampere Hour per Hour

Instrument Case Size: 19" x 5¼" x 11" WHD

External Transducer: See Table at right

Instrument Panel Color: Gray

DESCRIPTION:

The O.S.I. AH series Ampere-Hour Meters provide a convenient and highly accurate way to monitor and control manufacturing and experimental processes. The unique zero dc insertion loss and split-core features on the 100 ampere to 10,000 ampere models increase the applicational possibilities.

The solid-state units utilize Hall-effect transducers and are especially suited for current monitoring of various current wave shapes which may be found riding on dc signals.

In addition to the display of totalized amp-hours since last reset, the unit provides a panel meter indication of the average instantaneous current in amperes and an isolated electrical output signal proportional to instantaneous current. The bipolar models indicate charge and discharge on normal and reverse ampere hours on separate 6 digit counters.

STANDARD DC MODELS

MODEL NUMBER AH7-	INPUT CURRENT AMPERES	METER FULL SCALE CURRENT	A-H PER COUNT	*EXTERNAL TRANSDUCER DIMENSIONS
5	5	5	.001	—
10	10	10	.001	—
25	25	25	.01	
50	50	50	.01	—
100	100	100	.01	C
200	200	200	.1	D
400	400	400	.1	D
600	600	600	.1	E
1K	1K	1K	.1	E
2K	2K	2K	1	E
5K	5K	5K	1	G
10K	10K	10K	1	H

* 100 AMPERES AND ABOVE, 1 EXTERNAL TRANSDUCER IS SUPPLIED.
See Page 11 for external transducer dimensions.

NOTE 1: Models listed above are unipolar. For bi-polar units add a dash 2 after the model number.

NOTE 2: For split core option add S after model number. For example, a 100 ampere unit with split core would be listed as AH7-100S.

PHONE 614/486-9561
1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212

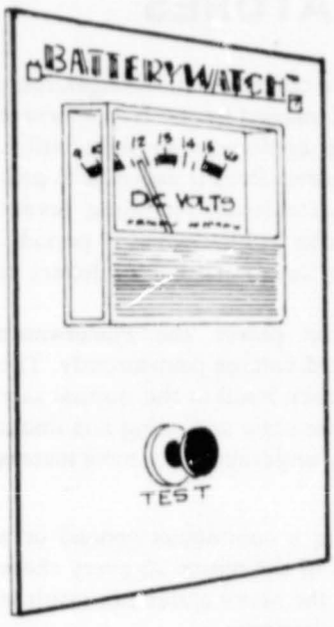
OHIO SEMITRONICS, INC. 7

OMNIFAC'S

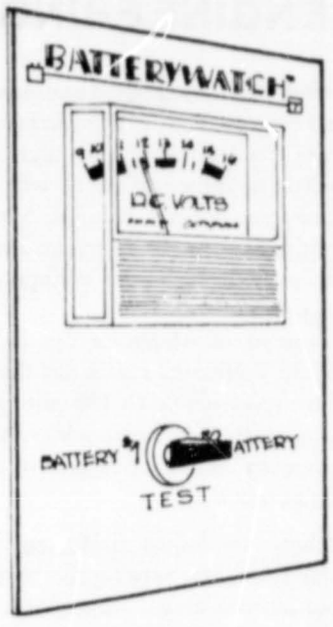
BATTERYWATCH™

battery monitor

This smart looking, wall-mounted unit tells at a glance the condition of on-board batteries.



Model BW-1
for 12 volt single
battery monitoring



Model BW-2
for 12 volt dual
battery monitoring

Models available for more batteries and other voltages.

ENGINEERING FEATURES

In boats and RVs, battery power is an energy source that must be relied on. Instrument systems, emergency lighting, and vital mechanical equipment depend on it. A deficient battery is always an inconvenience, and in some cases a source of real danger. The provision of a low cost yet highly reliable battery condition monitor is yet another tool that the RV or boat captain uses to insure the fitness of his vehicle.

The Batterywatch condition meter uses a sophisticated D'Arsonval movement to achieve its high degree of accuracy. The dial is calibrated in D.C. volts for quantitative evaluation and is also color coded with red, yellow, and green bands for instant interpretation by the user.

DESIGN FEATURES

Models. Model BW-1 monitors a single 12 V. battery system; Model BW-2 monitors two separate 12 V. battery systems; Model BW-3 monitors three 12 V. battery systems. (Models are available for more batteries and other voltages; consult Omnifac.) All units have an energy saving switch-on feature that activates the monitor only when desired.

Installation. The Batterywatch panel flush-mounts on any wall or instrument surface with the screws provided. Hookup is made by connecting the unit to the battery with two wires.

Size. The panel is 3-1/2" wide by 5-1/4" high. Depth behind panel is 1-1/2". Size of the mounting hole is 2-3/4" wide by 4-1/8" high.

Styling. Omnifac's traditional emphasis on styling shows in the crisp Batterywatch appearance. Designed as a twin to Powerwatch A.C. monitor, the Batterywatch monitor highlights any mounting area, either by itself or side-by-side with Powerwatch.

BATTERYWATCH™
battery monitor

Innovative Instrumentation by
OMNIFAC CORPORATION
1700 EAST WHIPP ROAD
DAYTON, OHIO 45440
(513) 434-8400

The instrument to rely on
when you're relying on battery power.

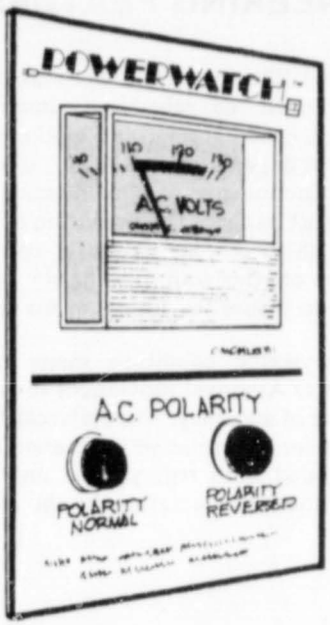
OMNIFAC'S

POWERWATCH™

A.C. monitor

In one compact unit boaters and RV owners can keep track of the two big parameters of A.C. electrical power: Voltage and Polarity.

ENGINEERING FEATURES



Voltage Section. Such motorized equipment as air conditioners, refrigerators, sweepers and hair blowers can be irreversibly damaged by the hypercurrent resulting from low voltage. And such resistive appliances as light bulbs, toasters, electric heaters and ovens will have shorter lives if exposed to prolonged higher-than-normal voltage. Voltage fluctuations, including severe drops, are not uncommon at marinas and RV parks in high demand periods. The ability to monitor on-board voltage can thus save hundreds of dollars in equipment repairs.

Whether you're on shore power or generator power, the Powerwatch Expanded Scale Voltmeter reads out the on-board voltage continuously. The meter is calibrated from 90 to 130 volts with a green band in the normal safe region. By eliminating the bottom 90 volts from the scale and using non-linear sensing, the meter achieves a degree of accuracy unparalleled in most meters costing twice as much.

Polarity Section. On-board appliances requiring a continuous ground or a constant polarity chassis rely on the correctness of the wiring in every shore power connection you make. Improper wiring in the shore outlet can result in equipment failure and physical danger to your passengers.

The Powerwatch polarity/ground monitor shows when polarity is reversed or ground is improper in the A.C. wiring. Unlike conventional three-lamp systems that require a chart to read, the unique Powerwatch two-lamp (green and red) indicator tells the polarity/ground condition at a glance.

DESIGN FEATURES

Installation. The Powerwatch panel flush-mounts on any wall or instrument surface with the screws provided. Hookup is made by connecting a standard 120 V. 2-wire with-ground cable with the connectors provided. All connections are enclosed within the rear housing.

Size. The panel is 3-1/2" wide by 5-1/4" high. Depth behind panel is 1-3/4". Size of mounting hole is 3-1/8" wide by 4-3/8" high.

Styling. As with all Omnifac instrumentation, attractive styling was a design requirement from the beginning. Powerwatch A.C. monitor is an eye-catching complement to any mounting area.

Cost. Perhaps the best news about Powerwatch is its surprisingly modest price. It demonstrates that professional quality equipment, properly planned, need not always be expensive.

POWERWATCH™

A.C. monitor

If you've got 120 volts on board, you need it.

TWO MODELS

Model 1P - continuous reading unit

Model 2P - with push-to-test button that reads only when pressed.

Innovative Instrumentation by
OMNIFAC CORPORATION
1700 EAST WHIPP ROAD
DAYTON, OHIO 45440
(513) 434-8400

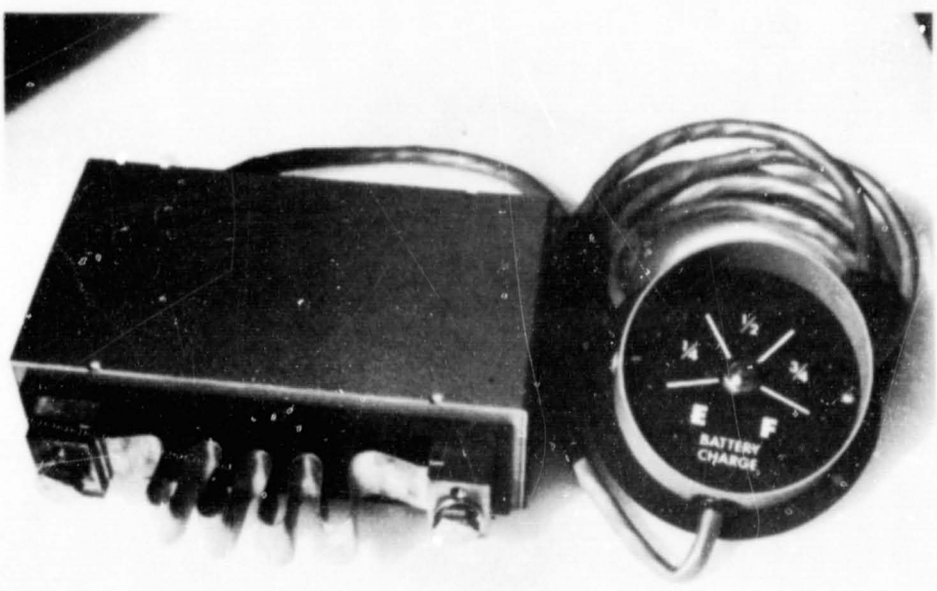
Penta Engineering Co.

design - manufacturing - distribution

615 W. Covina Blvd.
San Dimas, CA 91773
(714) 599-6085

DIGITAL ELECTRIC FUEL GAUGE

The new Penta Digital Electric Fuel Gauge continuously measures and computes both the quantity of electric charge put into the battery system when charging and the amount removed when the equipment is operating. The integrating circuitry of the electronic memory retains the charge status for instant display on the digital LED gauge. The display is accurate at all times whether the equipment is charging, running or stopped. Compensation is provided for battery charge-discharge efficiency and the calibration can be adjusted for a wide range of battery amp-hour capacities, allowing for continued accuracy as battery capacity diminishes with age.



Penta Engineering Co.

design - manufacturing - distribution

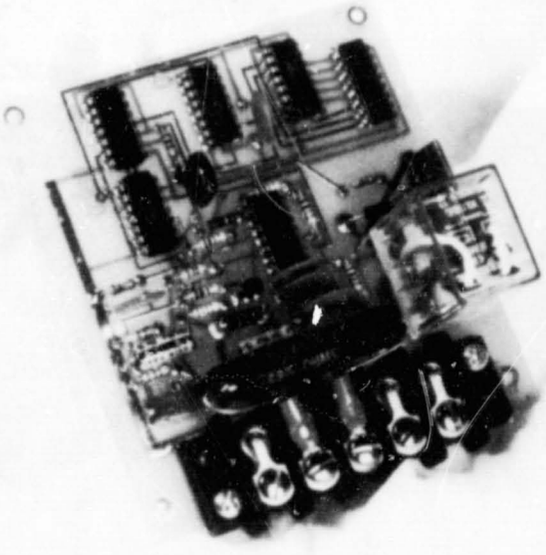
615 W. Covina Blvd.
San Dimas, CA 91773
(714) 599-6085

BATTERY OVERCHARGE PROTECTION

BY

PENTA'S "CHARGE GUARD"

The Penta "Charge Guard" is designed to completely prevent the possibility of battery overcharge or undercharge by continuously monitoring the rate of change of battery voltage during charge. At 100% charge, the voltage stops increasing, at which point, the cutout circuit functions automatically to interrupt the charging current. Recharging is automatically prevented until either the battery has been used or until the battery voltage has dropped to the point where charge is needed. Even older batteries are kept in a constant state of readiness without being damaged by overcharging and without the frequent necessity of adding water. Industrial use to date has shown that the Charge Guard will increase battery life by a very significant amount.

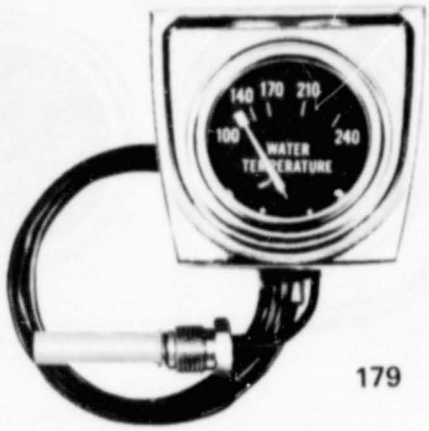


RITE AUTOTRONICS CORP. 3485 S. LA CIENEGA BLVD., LOS ANGELES, CALIFORNIA 90016 TEL: 213-836-7900

GAUGES



178



179

deluxe mechanical

WATER TEMPERATURE GAUGES

SPECIFICATIONS – Rugged Bourdon tube mechanism • Calibrated 100-240° range • 2" diameter case • Universal application • Needs no battery • 6 Foot Capillary tube with adapters.



360

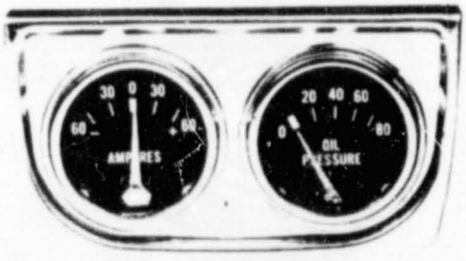


362

deluxe

AMMETERS 60-0-60

SPECIFICATIONS • Calibrated 60-0-60 charge-discharge rating • Heavy duty • Sealed against dust and moisture • Pointer is silicone dampened to insure accurate readings under severe vibration • Has adjustable zero • For 6 and 12 volt systems • Universal application • 2" diameter case.



839

deluxe duals

AMMETER/OIL 60-0-60

METRIC ADAPTERS AVAILABLE

SPECIFICATIONS • Pointers are dampened to insure accurate readings under severe vibration • Sealed against dust and moisture • 2" diameter case • Heavy duty construction • Universal application • For 6 and 12 volt systems • Has adjustable zero • Easy to follow instructions.

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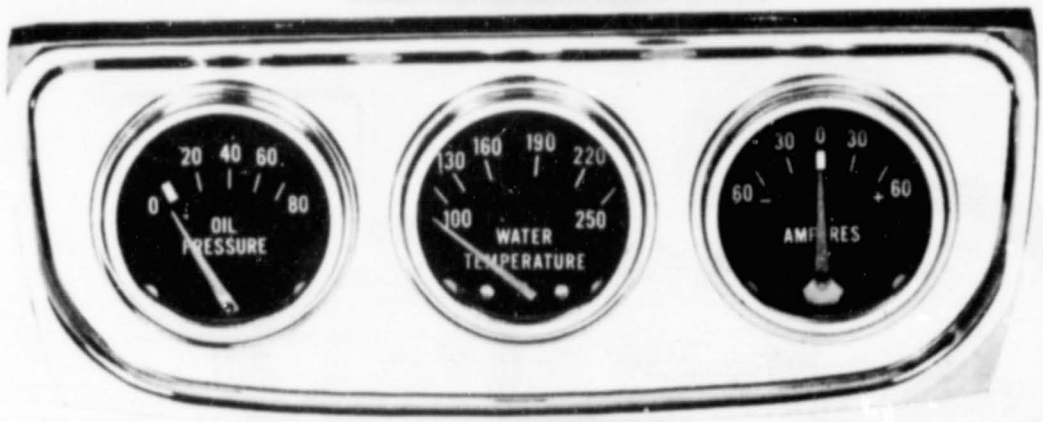
GAUGES



858

METRIC ADAPTERS AVAILABLE

deluxe trio

ELECTRONIC OIL/ WATER TEMP./AMP 60-0-60

SPECIFICATIONS • Water temperature gauge calibrated from 100° to 250°F. range • 0-80 lb. oil pressure gauge • 60-0-60 Ammeter • Water temperature gauge includes sending unit • Ammeter has adjustable zero • Pointers are silicone dampened to eliminate flutter and bounce • 2" diameter case • Sealed against dust and moisture • Heavy duty construction • Universal application • For 12 volt, negative ground electrical systems • Easy-to-follow installation instructions



280



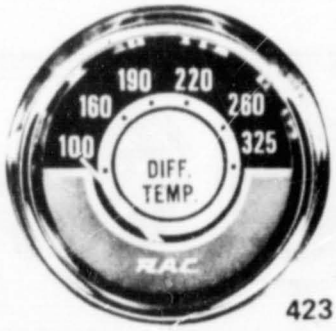
283

METRIC ADAPTERS AVAILABLE

custom mechanical

OIL PRESSURE GAUGES

SPECIFICATIONS • Custom styling • 0-80 lbs. • 2" diameter case • Heavy duty • Sealed against dust and moisture • Dampened against vibration • Universal application • 1/8" PT connector.



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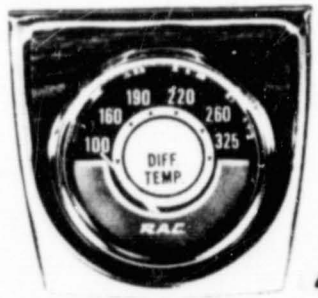


425

METRIC ADAPTERS AVAILABLE

(SPECIAL ORDER)

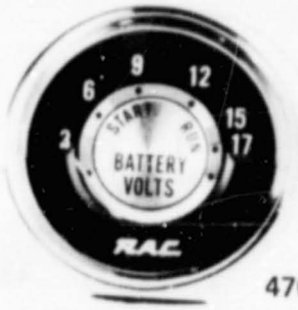
custom electronic

DIFFERENTIAL TEMPERATURE GAUGES

SPECIFICATIONS • Custom styled • 100°-325°F. range • Can be mounted near or far from temperature source • Electronically operated • For 12 volt negative ground electrical system installations • Supplied with temperature sender and adapters • 2" diameter case.

RITE AUTOTRONICS CORP. 3485 S. LA CIENEGA BLVD., LOS ANGELES, CALIFORNIA 90016
TEL: 213-836-7900

GAUGES



470



472

(SPECIAL ORDER)

custom electronic

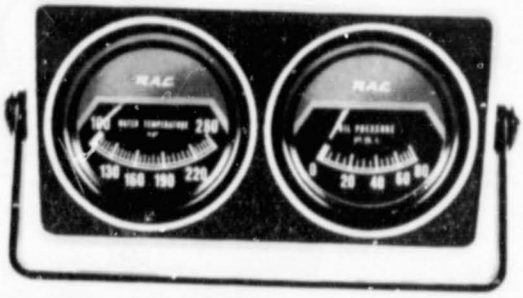
BATTERY CONDITION INDICATOR

SPECIFICATIONS • Custom styled • Calibrated 3-17 volt range • 2" diameter case • Single hole mounting • For 6 and 12 volt electrical systems • Positive-Negative grounds.

METRIC ADAPTERS AVAILABLE

continental 500

DUAL WATER/OIL – 0-80 lb. Oil Pressure Gauge and 100-260° Water Temperature Gauge • For 12V negative ground systems • Molded Black Leatherette panel with bright chrome • Gauges are hooded and deep set to reduce reflections • Cradle mounted • Fully enclosed backplate • All connecting and mounting hardware, illumination kit and installation instructions • Patented • Pack: 6 to a carton, carton weight: 10 lbs.



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METRIC ADAPTERS AVAILABLE

continental 500

TRIO AMP/OIL/WATER – 0-80 lb. Oil Pressure Gauge, 60-0-60 Ammeter, 100-260° Water Temperature Gauge • For 12V negative ground systems • Molded Black Leatherette panel with bright chrome • Gauges are hooded and deep set to reduce reflections • Cradle mounted • Fully enclosed backplate • All connecting and mounting hardware, illumination kit and installation instructions • Patented • Pack: 4 to a carton, carton weight: 7 lbs.

904



RAC

RITE AUTOTRONICS CORP. 3485 S. LA CIENEGA BLVD., LOS ANGELES, CALIFORNIA 90016 TEL: 213-836-7900

GAUGES



430

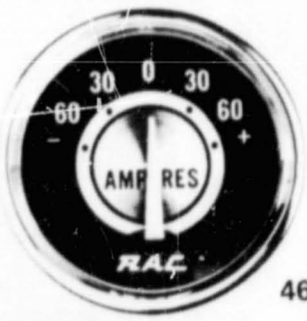


433

custom electronic

AMMETERS 30-0-30

SPECIFICATIONS • Custom styled • Calibrated 30-0-30 charge-discharge rating • Heavy duty • Sealed against dust and moisture • Pointer is silicone dampened to insure accurate readings under severe vibration • Has adjustable zero • For 6 and 12 volt systems • Universal application • 2" diameter case.



460



463

custom electronic

AMMETERS 60-0-60

SPECIFICATIONS • Custom styled • Calibrated 60-0-60 charge-discharge rating • Heavy duty • Sealed against dust and moisture • Pointer is silicone dampened to insure accurate readings under severe vibration • Has adjustable zero • For 6 and 12 volt systems • Universal application • 2" diameter case.



60-0-60 AMMETER – 958

30-0-30 AMMETER – 967

custom trio gauges

OIL/AMP/WATER

SPECIFICATIONS • Custom styled • Water temperature gauge calibrated from 100° to 250°F. range • 0-80 lb. oil pressure gauge • 60-0-60 or 30-0-30 Ammeter • Water temperature gauge includes sending unit • Ammeter has adjustable zero • Pointers are silicone dampened to eliminate flutter and bounce • 2" diameter case • Sealed against dust and moisture • Heavy duty construction • Universal application • For 12 volt electrical systems • Easy-to-follow installation instructions.

Teleflex INCORPORATED
industrial

Electrical systems:
1816 57th Street, Sarasota, Florida 33580
Telephone (813) 355-7721

Mechanical systems:
640 North Lewis Road, Limerick, Pennsylvania 19468
Telephone (215) 495-7011

Instrumentation for off-highway and over-the-road vehicles and equipment

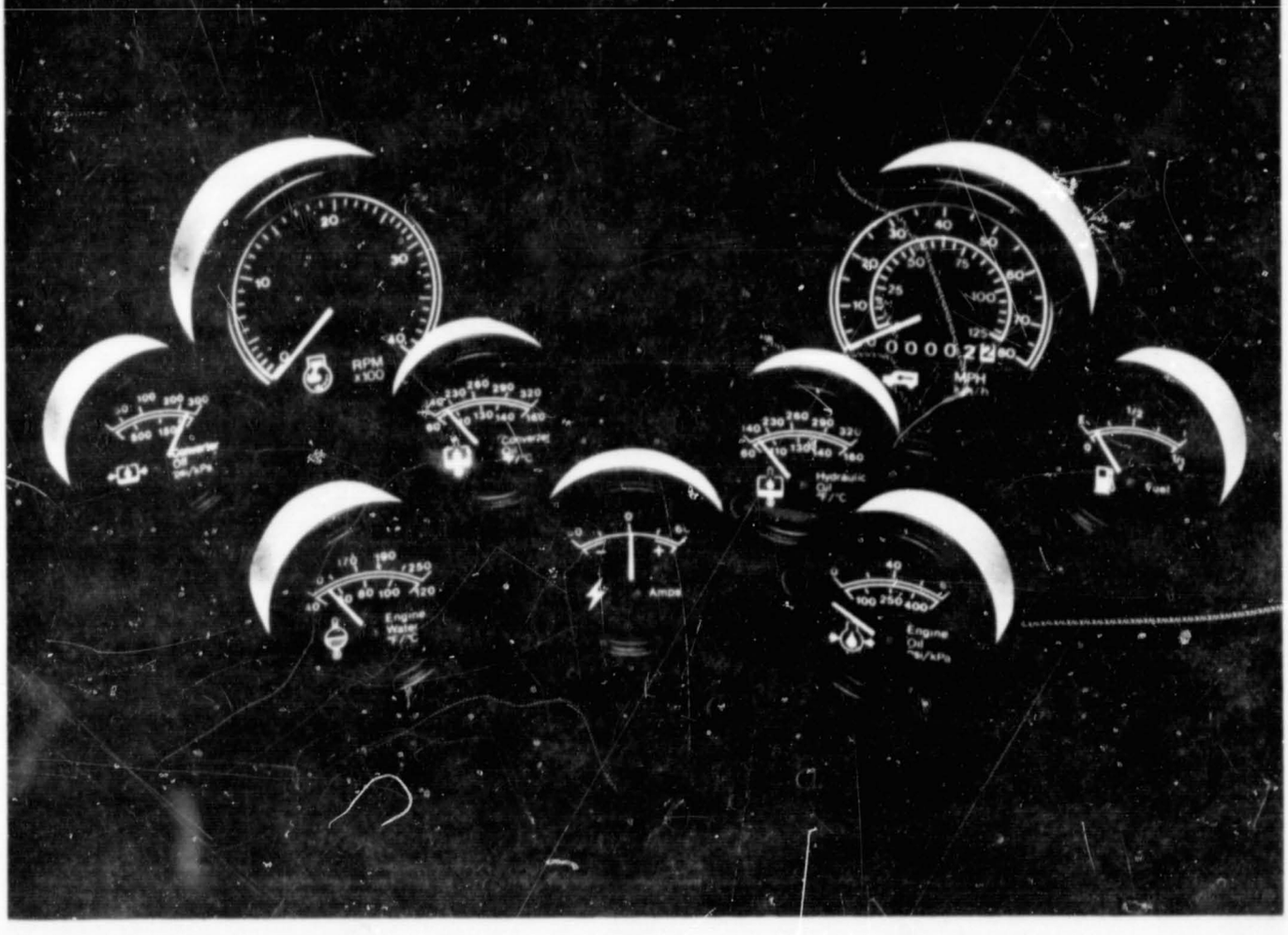
Catalog Number 1/A

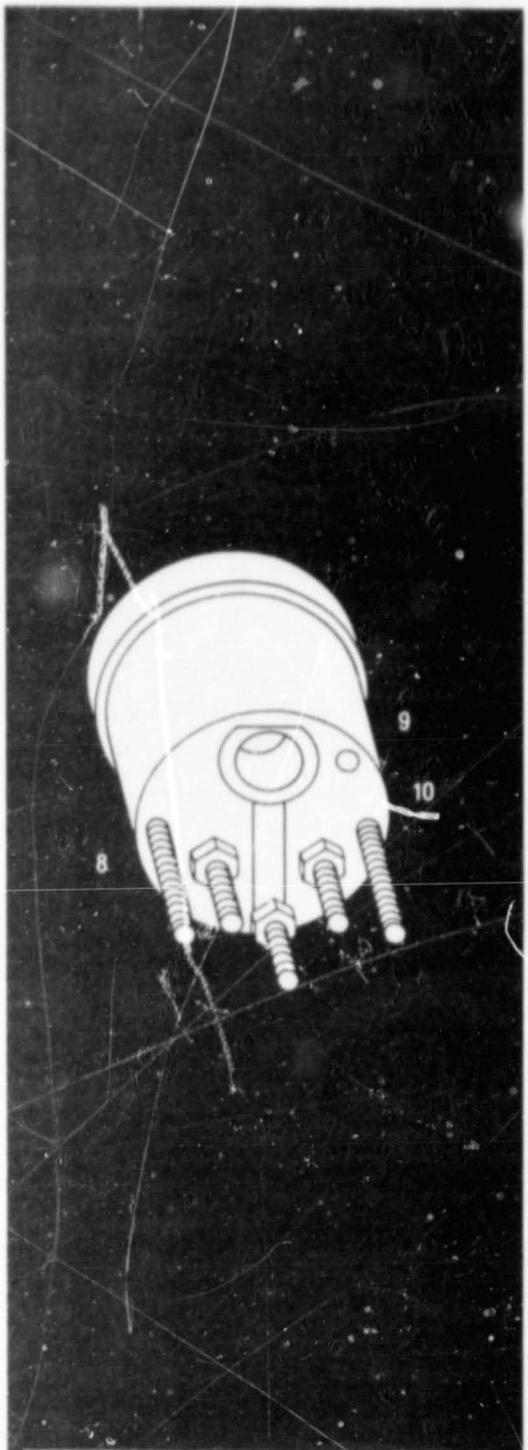
Gauges

Sending Units

Accessories

Wiring Harnesses and Custom Panels





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TELEFLEX GAUGE OPERATING PRINCIPLES

Electrical Instruments
The operation of all electrical gauges is based on the Vector magnetic movement principle. A rotating armature responds to changes in the magnetic field caused by varying currents passing through two or more perpendicular coils, generating a corresponding movement change in the gauge pointer. The Vector movement is built to withstand shock and vibration and is temperature and voltage compensated.

The operation of hourmeters is based on precision, solid-state, integrated circuitry, which is activated only when vehicle power is on. A resistance-capacitance (RC) network controls the timing and triggers a solenoid that indexes the counter wheel every 36 seconds, with an accuracy of ±1%. The circuitry is voltage spike and reverse polarity protected.

Mechanical Instruments
All Teleflex mechanical gauges operate on the basis of a Bourdon tube movement. A formed tube flexes and straightens in proportion to external pressure sources, causing a corresponding change in the gauge pointer.

Mechanical speedometers operate on a magnetic speed cup principle. A rotating magnet causes a speed cup with attached pointer to move at an angle proportional to vehicle speed.

COMMON TELEFLEX GAUGE SPECIFICATIONS

CONSTRUCTION:
- **Housings:** Celanese 1310-2 nylon
- **Bezels:** Chromed corrosion free metal, standard; black paint, optional
- **Lens:** Clear glass
- **Dial Faces:** Flat black with white & amber silk screened calibrations and symbols; white-tipped pointers
- **Connection Hardware:** Threaded #8-32 brass stud-type terminals with brass nuts/washers
- **Mounting Hardware:** Aluminum or steel, rear take-up, U-clamp style brackets
- **Optional Illumination:** Provisions made for optional ⅝" push-in sockets accepting SAE* A-1 type miniature bayonet lamps
- **Operating Movements:**
  - **Electrical:** Vector meter movements for all gauges except solid-state hourmeter
  - **Mechanical:** Bourdon tube mechanisms
- **Moisture Protection:** Gasket sealed lens to prevent front of gauge moisture entry

ENVIRONMENTAL SPECIFICATIONS
(where applicable all testing performed in accordance with SAE* J197)

ACCURACY:
- **Tachometers:** ±3% of F.S. reading at 75°F (24°C)
- **Hourmeter:** ±1% of reading at 75°F (24°C)
- **Speedometer:** Meets requirements of FMVSS** No. 127
- **Vector Gauges:** Varies with gauge type and use; contact factory for individual specification data sheets

Operating Temperature Range: −25° to +185°F (−40° to 85.5°C) with ±2% F.S. reading change, maximum, from 75°F (24°C) indication

Shock Withstand: Remains within initial accuracy specification up to 50 G's, half sine 9-13 milliseconds duration, 25 shocks of equal magnitude in each of three axes

Vibration Withstand: Remains within initial accuracy specification at .060" double amplitude vibration from 10-80-10 Hz for one minute periods over two hours in each of three axes (six hours total)

Humidity: Remains within initial accuracy specification in 95% relative humidity at 100°F (37.8°C) for 48 hours

Salt Spray: Conforms to ASTM† 117 after 48 hours

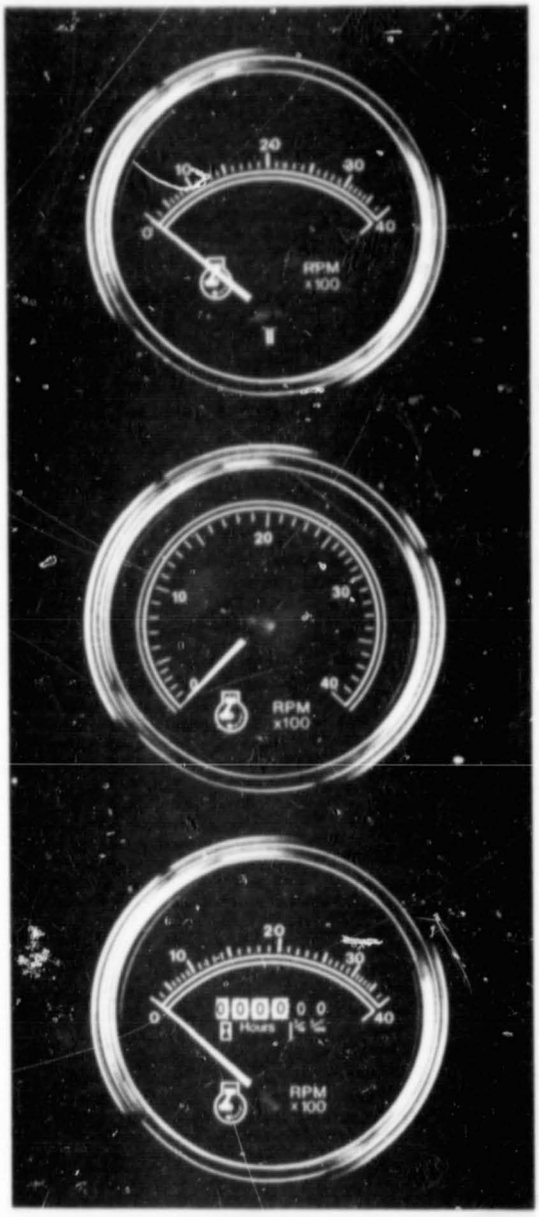
Overvoltage: Withstands a maximum of 17 volts dc applied to the +14 terminal with no damage

Reverse Polarity Protection: Standard on all gauges

Voltage Variance: Accuracy remains within ±2% of initial reading at 14.5 volts dc when voltage is varied 12 to 16 volts

*Society of Automotive Engineers
**Federal Motor Vehicle Safety Standard
†American Society for Testing and Materials

Gauges



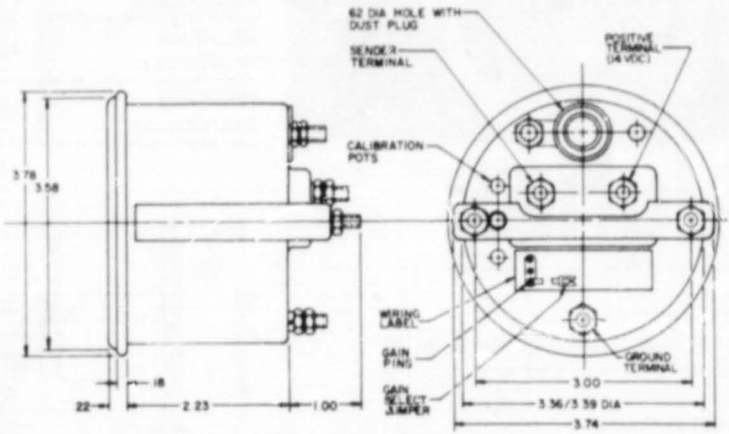
TACHOMETERS
Vector Movement

SWEEP	SCALE RANGE	BEZEL STYLE	SENDER	PART NUMBER
100° movement	0-6000	Step/Black	Std. Ign	1137275
	0-6000	Step/Chrome	Std. Ign	1137171
	0-4000	Step/Black	Alternator	1137078
	0-4000	Step/Chrome	Alternator	1136978
	0-4000	Step/Black	Signa-Flex	9151874
	0-4000	Step/Chrome	Signa-Flex	9151771

SWEEP	SCALE RANGE	BEZEL STYLE	SENDER	PART NUMBER
270° movement	0-6000	Step/Black	Std. Ign	1136272
	0-6000	Step/Chrome	Std. Ign	1136179
	0-4000	Step/Black	Signa-Flex	1136075
	0-4000	Step/Chrome	Signa-Flex	1135975
	0-4000	Step/Black	Alternator	1135871
	0-4000	Step/Chrome	Alternator	1135778

TACHOMETER/HOURMETER
Vector Movement

SWEEP	SCALE RANGE	BEZEL STYLE	SENDER	PART NUMBER
100° movement	0-4000	Step/Black	Signa-Flex	1136874
	0-4000	Step/Chrome	Signa-Flex	1136771
	0-6000	Step/Black	Std. Ign	1136677
	0-6000	Step/Chrome	Std. Ign	1136573
	0-4000	Step/Black	Alternator	1136470
	0-4000	Step/Chrome	Alternator	1136376



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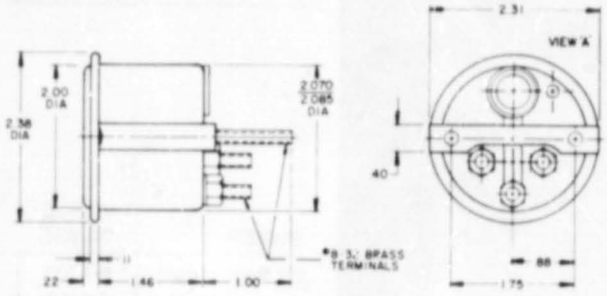
Gauges



AMMETERS
Vector Movement

SCALE	BEZEL STYLE	PART NUMBER
40-40	Step-Black	9154478
40-40	Step/Chrome	9154177
60-60	Step/Black	9154571
60-60	Step/Chrome	9154271
100-100	Step/Black	9154575
100-100	Step/Chrome	9154374

NOTE: 100 ammeter requires .0015Ω shunt part number Stewart Warner 407616-U-10

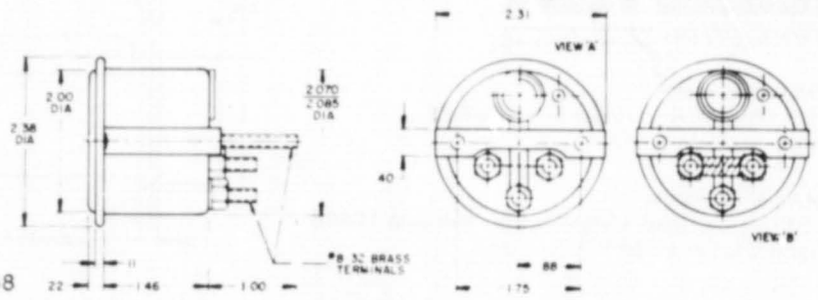


VOLTMETERS
Vector Movement

SCALE	BEZEL STYLE	PART NUMBER
12 volts	Step/Black	9154073
12 volts	Step/Chrome	9153973
24 volts	Step/Black	9173074
24 volts	Step/Chrome	9173178

FUEL LEVEL
Vector Movement

BEZEL STYLE	SENDER PART NUMBER	SENDER TYPE	GAUGE PART NUMBER
Step/Black Step/Chrome	1501775	Stewart Warner	9152078 9151978
Step/Black Step/Chrome	N/A	AC	9160977 9160872
Step/Black Step/Chrome	1507170	Introl	9161171 9161077



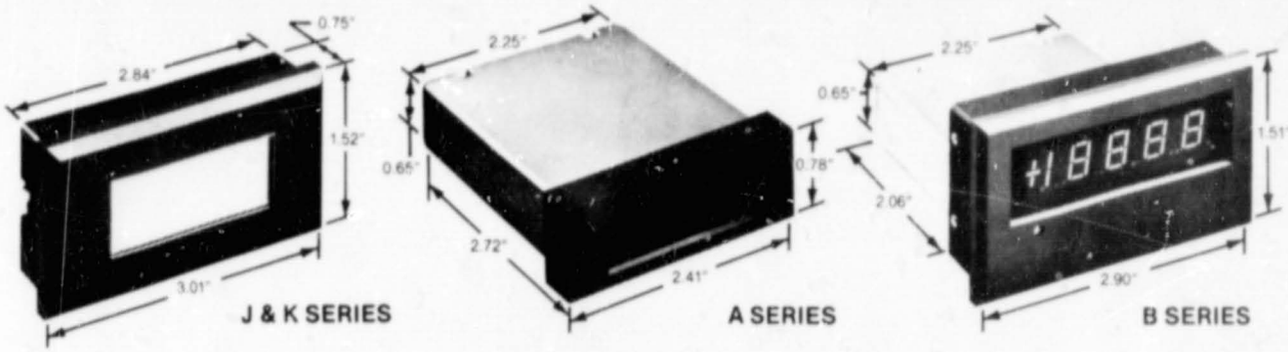
Teleflex INCORPORATED
industrial

Electrical systems:
1816 57th Street, Sarasota, Florida 33580
Telephone (813) 355-7721

Mechanical systems:
640 North Lewis Road, Limerick, Pennsylvania 19468
Telephone (215) 495-7011

velonex

IMPAC™ DIGITAL PANEL METERS



IMPAC miniature LCD and LED meters feature high reliability, compact size (smallest available), automatic zero, and quick, easy installation. The miniature LCD series features extremely low power consumption (max. 50mW) and large (½") display. The IMPAC LED series offers high resolution measurement (from 10μV) in thirty-two models—3, 3½, 4, and 4½ digits, all with BCD outputs as a standard feature. For militarized and severe environmental applications, ruggedized and extended temperature versions of the LED models are available. Most models are immediately available from stock; Velonex can also design models for your OEM specifications.

FEATURES

All Velonex DPM's

☐ Bipolar—auto polarity ☐ Automatic zero set each conversion ☐ Overrange indication ☐ Shielded construction ☐ Proven reliability ☐ Fully burned in & tested ☐ 100VAC, 115VAC, 230 VAC, 50 to 400 Hz and 28VDC input power adapters available

Ruggedized Models

☐ Available for wide temperature, humidity, shock and vibration environments

SPECIFICATIONS

Series	31A & 31B 3 digit LED	36A & 36B 3½ digit LED	37J & 37K 3½ digit LCD	41A & 41B 4 digit LED	46A & 46B 4½ digit LED	Range
Analog Input	± 99.9mV	± 199.9mV	± 199.9mV	± 99.99mV	± 199.99mV	– 1
Full Scale Ranges	± 999.9mV	± 1.999V	± 1.999V	± 999.9mV	± 1.9999V	– 2
(including 100%	± 99.9V	± 19.99V	± 19.99V	± 9.999V	± 19.999V	– 3
overrange)	± 99.9V	± 199.9V	± 199.9V	± 99.99V	± 199.99V	– 4
Accuracy	± 0.1%rdg ± 0.1%FS	± 0.1%rdg ± 0.05%FS	± 0.05%rdg ± 0.05%FS	± 0.05%rdg ± 0.02%FS	± 0.05%rdg ± 0.01%FS	
Sample Rate	7/second	5/second	2.5/second	7/second	5/second	
Input Impedance	37 Series 1000 Megohms on – 1 and – 2 range; 10 Megohms on – 3 range; and 9 Megohms on – 4 range Others 1000 Megohms on – 1 range, 100 Kilohms on – 2 range, 1 Megohm on – 3 and – 4 ranges					
Noise Rejection Common Mode Rejection 1kΩimbalance	100 dB	100 dB	80 dB	100 dB	100 dB	
Normal Mode Rejection	40 dB at 60Hz	40 dB at 60Hz	50 dB at 50, 60 and 400Hz	40 dB at 60Hz	40 dB at 60Hz	
BCD Output	STD	STD	No	STD	STD	
Digital Display	7 segment digit, polarity, and decimal point Height: "A" series 0.2 inches, "B" series 0.33 inches, "J" and "K" series 0.5 inches					
Power Requirements						
Voltage	+ 4.8 to + 6.0 VDC (+ 7.0 VDC maximum without damage)					
Current @ 5VDC (typ.)	180 mA	195 mA	*	210 mA	225 mA	
	Current requirements shown are with all digit segments, + sign and decimal lit. Current requirement in "Display Blank" mode 110 mA					
	*37J 4 mA maximum @ 9V (battery powered)					
	*37K 10 mA maximum @ 5V (logic powered) 150 mA with backlight option "W"					
Temperature Coefficient	100 ppm/0°C					
Temperature Range	Wide temperature range options available on both LCD and LED					

OTHER VELONEX PRODUCTS

High Power Pulse Generators
Up to 180kW, 30kV, 750A. Rise times as low as 7 nS and pulse widths up to 10 mS are available. Burst, programming and other features are also available.

Transient Generators
For system testing in full compliance with IEEE Std 472-1974 and ANSI C37.90a-1974. Decaying sine wave outputs with initial crests to 3.3kV.

Miniature DC-DC Converters
Outputs available to 20kV designed to withstand aerospace environments.

For complete information and applications assistance, contact VELONEX, 560 Robert Avenue, Santa Clara, California 95050 (408) 727-7370 TWX 910-338-0114

velonex

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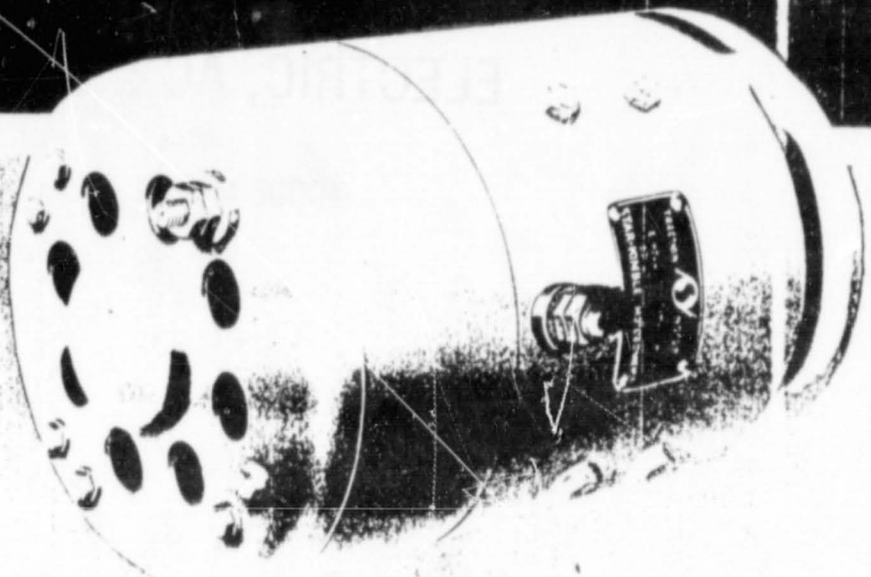
MOTORS, TRACTION,

ELECTRIC, AC & DC

(CODE **MT**)

DC ELECTRIC VEHICLE MOTOR



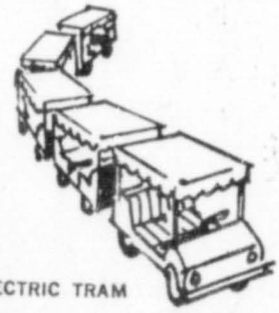
BUILT AS RUGGED AND WELL DESIGNED AS THE VEHICLES THEY POWER

FIDELITY ELECTRIC

FIDELITY ELECTRIC CO., INC.

Motors, Generators & Electrical Machinery

332 N. ARCH ST. LANCASTER, PENNA.



ELECTRIC TRAM



ELECTRIC BUS



ELECTRIC AUTOMOBILE



ELECTRIC TRUCK

MT-2

ORIGINAL PAGE IS
OF POOR QUALITY

FIDELITY ELECTRIC

Air pollution is probably the #1 menace to the health and well being of the human race. Companies like Fidelity of Lancaster are taking an active part to solve our pollution problem by encouraging the use of battery powered electric venicles, such as electric garden tractors, utility trucks, industrial fork lift trucks, golf carts, and other types of short range vehicles.

Fidelity, one of the oldest manufacturers of electric rotating equipment in the United States (since 1895) contributes to today's war on pollution by offering a vehicle drive motor that is rugged, powerful, and by its use will make battery powered electric vehicles more versatile, more powerful, and more in demand — providing every advantage of a gasoline or diesel powered machine with none of the disadvantages of noise or of adding to the pollutants in the air we breathe. Fidelity Vehicle Drive Motor • Rugged • Powerful (1 Hp to 20 Hp) • Quiet • Low Battery Drain • Components Meet UL Requirements • Compact in Design • Thorough Environmental Projection • Economical.

BRUSHES. Metal-graphite material for low contact drop and high capacity. Two unusually large, insulated, flexible heavy-copper shunts imbedded in each brush with tightly-packed metallic cement. Neutral locations, fixed at factory, need not be readjusted when new armature is installed or motor reassembled.



BRUSH HOLDERS. Reaction type. Inclined at an angle to commutator-face for stable commutation and uniform motor performance when reversing under heavy loads. Brushes are held in a fixed position — always against back of holder, without rock or bounce when armature rotation is changed. Impossible to adjust spring tension incorrectly. No danger of damage to holder or seizure of brush during overloads. Even after commutator has been turned down, brush holders can be reset to correct spacing above commutator. Insulation is glass-reinforced plastic-Class 155.



WIRE FOR ARMATURE AND FIELD. Two oppositely-wound layers of glass tightly bonded to the wire by organic or silicone varnish. Good abrasion resistance during winding — long thermal endurance in service. Class 155 insulation is standard. Class 180 readily available.

COILS FOR ARMATURE AND FIELD. Produced with glass-asbestos-glass layer insulation which has an organic binder for Class 155 or silicone for Class 180. Glass tape is used on field coils.

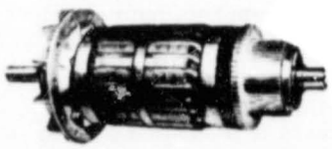
ARMATURE CONSTRUCTION. No wedges are used to hold conductors in the slots. Instead, the coils are tightly banded with special glass fiber materials which are bound into a solid mass by epoxy resins. Banding is not only more reliable but this construction allows more contact of the conductors with the ventilating air. Armature coil end turns are held down by the bands on an insulated steel support ring, which prevents coil movement and produces a symmetrical, well-balanced assembly. The support ring also holds the lamination stack square with the shaft and carries the ventilating fan.

CONDUCTORS. Not taped — and not over-insulated. The neatly-formed coil ends are spaced apart to provide a natural fan effect and to expose a larger amount of heat-dissipating surface.

SHAFTS. Made of heat-treated carbon or special alloy steels. Can be replaced without disturbing armature windings or harming coils. Shaft extensions can be straight, tapered, or splined.

COMMUTATORS. Made of 25-30 oz./ton silver-bearing copper. Silver increases hardness and provides greater resistance to heat-softening. Fidelity commutators are not easily ruined by stalls or by long, heavy hauls. They have adequate wear-depth for long life. They can be changed without destroying armature windings. Hubs are of the ring-nut type; they can be tightened if necessary and dismantled when bars need attention. Only high-grade NEMA No. 3 mica is used.

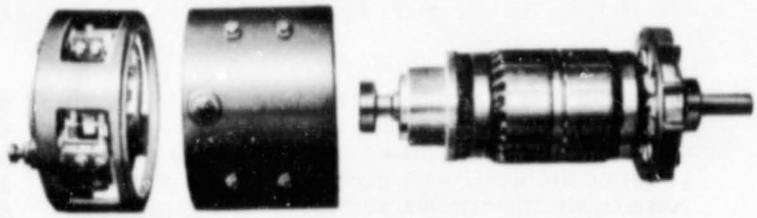
FAN. Internal fans are cast of a high-strength aluminum alloy and designed for maximum efficient air flow in either direction.



COMMUTATION. Perfect commutation" is essential for long, satisfactory motor life and is attained only through careful design and by liberal use of the right materials. The Fidelity type of commutation is achieved through use of a large number of commutator bars, open armature slots, non-magnetic bands, large brush areas, cor-

FIDELITY ELECTRIC CO., INC.
Motors, Generators & Electrical Machinery
332 N. ARCH ST. LANCASTER, PENNA.

RUGGED AND STRONG ELECTRIC MOTORS



An electric truck depends upon the strength and power of its motor for its operation. No motor can be stronger than the sum of its parts. That is why we place before you (here) a complete and detailed explanation of the elements which make Fidelity electric vehicle and lift motors preferred above all others wherever reliability, performance-security and long-life are demanded.

Fidelity motors are ruggedly constructed — you can see that by looking at them. But far more important, they are skillfully designed, close-tolerance machined, and carefully assembled in all parts, whether you see them or not.

The finest materials are used in their manufacture (even where you might never know the difference) — only because so many companies have come to realize that the Fidelity name on a motor is automatic assurance that it is the best you can buy.

You'll learn a lot by reading our illustrated construction story below. You will save a lot — of time, trouble, expense, and replacement costs — by making certain that your electric vehicles have Fidelity motors.

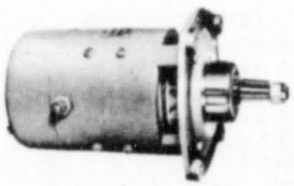
rect brush compounds and single-turn armature coils. Trucks equipped with Fidelity vehicle motors normally can be stalled with no sparking under the brushes.

TERMINALS. Standard motors have two series-field terminal studs in the frame and two armature terminals extending axially from the face of the bracket at the commutator-end. Simple in construction, easily disassembled, not difficult to replace if damaged.

BEARINGS. Extra-wide cartridge type — sealed so they need no greasing and are well protected when the armature is removed. They are equipped with a permanent supply of correct high-temperature lubricant. Can be regreased if desired.

VENTILATION. Air is drawn in around the commutator-end bearings and exhausted radially through openings at the drive end. This causes all air to pass over commutator and brushes as well as over the armature and through the field coils.

NON-VENTILATED. Fidelity non-ventilated motors are spark-enclosed to meet ITA specifications and Underwriters' dust-tight requirements. They are cooled either by natural air-convection over inner surfaces or by a fan located outside the motor but enclosed in a shroud.

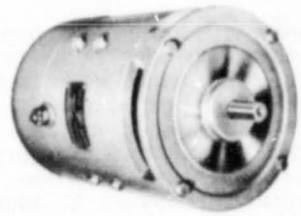


BRACKETS. The cast end brackets have ventilation and access openings. Fidelity is fussy — the outside diameter of the commutator-end brackets is machined . . . to improve appearance and to provide a good fit for the cover.

COVERS. One-piece type surrounding the commutator-end bracket with a very snug fit. No ventilation openings in these neat covers. They are so tight that no gaskets are needed to meet spark-enclosed specifications.

POLES. Pole pieces are assembled from mild steel laminations to reduce pole-face losses. Rivets hold the laminations together and two or more large screws secure this assembly to the frame.

FRAMES. Made of seamless cold-rolled steel tubing for 5.5" to 9.5" diameter units; rolled plate for larger frames. Abundantly thick to provide high torque per ampere — and great mechanical strength.



MOUNTINGS. Your choice of five: **Type** H (hub) has machined bracket for locating motor in a gear housing and holding it there with only four screws. **Type** C (face) or **Type** D (flange) conform to the standard NEMA dimensions for general-purpose motors. H, C, or D mountings can also be supplied with **Type** F (foot) which is a conventional foot mounting with four holes. **Type** S (saddle) is not standardized but made to suit each specific need. In addition, special mounting arrangements or brackets can very readily be provided.

ASSEMBLY AND DISASSEMBLY. Fidelity Electric Truck motors have almost the same mechanical simplicity as squirrel cage ac motors. All internal connections between frame and brush holders usually have been eliminated; the armature and either end bracket can be removed by taking out only four screws. There are no inside bearing caps, washers, or spacers. There are no "press fits" to impede disassembly and reassembly.

FIDELITY ELECTRIC

FIDELITY ELECTRIC CO., INC.

Motors, Generators & Electrical Machinery

332 N. ARCH ST. LANCASTER, PENNA.

APPLICATION AND DESIGN FLEXIBILITY

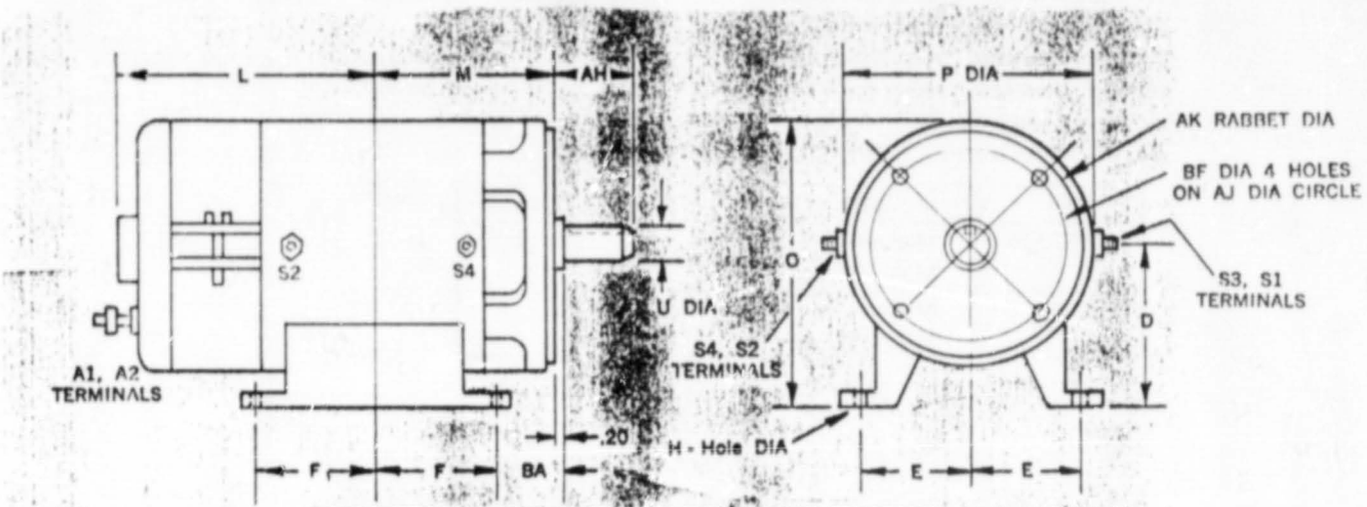
Fidelity's line of electric vehicle motors covers a wide range of frame sizes and horsepower ratings which is divided into logical and convenient increments, permitting a high degree of standardization, and design flexibility. More importantly, it permits Fidelity to custom tailor motors to closely fit any application.

Special motors with special mechanical configurations such as; custom mounting brackets, machined frames, custom shaft extensions, and special enclosures, and special electrical modifications can be assembled, followed by production units with far less delay.

ENGINEERING SERVICE READILY AVAILABLE

Fidelity's experienced engineering department is always happy to assist customers in analyzing the power requirements for vehicles and designing a drive system to meet those requirements.

Fidelity's engineering service extends from design discussion, through the design of a prototype to the final production design stages and then to providing assistance in installation if desired.



DIMENSIONS ARE TYPICAL AND FOR TYPE C FACE MOUNTING WITH FEET. OTHER STANDARD MOUNTINGS ARE AVAILABLE.

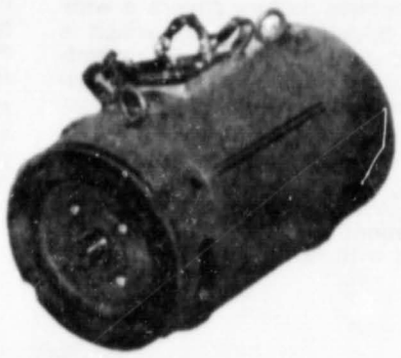
FRAME	HP*	D +.000 −.030	E	F	H HOLE	L	M	O	P DIA	U +.000 −.001	AH	AJ	AK +.000 −.003	BA	BF HOLE
V42	1.0			2.00		6.27	4.45								
V43	1.5	4.12	3.00	2.50	.406	6.77	4.95	7.62	7.00	.750	2.40	5.875	4.500	2.45	3/8-16
V44	2.0			3.00		7.27	5.45								
V53	3.0			2.50		7.20	5.85								
V54	4.0	4.50	3.75	3.00	.406	7.70	6.35	8.56	8.10	1.125	2.45	5.875	4.500	3.55	3/8-16
V55	5.0			3.75		8.45	7.10								
V63	6.0			3.00		9.25	6.65								
V64	7.5	5.25	4.25	3.50	.406	9.75	7.15	10.00	9.50	1.250	3.20	7.250	8.500	3.85	1/2-13
V66	10.0			4.25		10.50	7.90								
V74	15.0			3.25		10.50	7.50								
V75	17.5	6.25	5.00	4.00	.531	11.25	8.25	11.95	11.40	1.750	3.95	7.250	8.500	4.45	1/2-13
V77	20.0			4.75		12.00	9.00								

* Horsepower ratings are approximate and for continuous duty, self-ventilated, 1800 r/min.

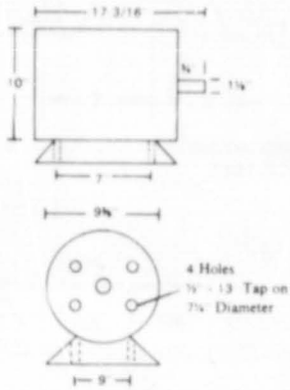
FIDELITY ELECTRIC
COMPANY INC.
332 NORTH ARCH STREET
LANCASTER, PENN. 17603
717-397-8231

MEDIUM POWER MOTOR

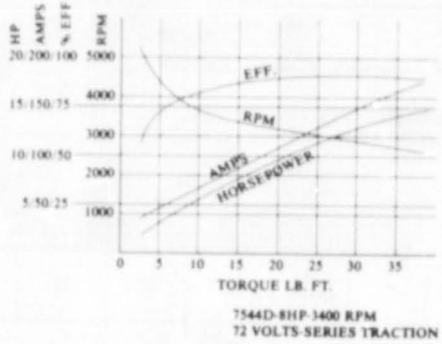
This is our most popular rating. This 96 volt series wound traction motor produces 10.5 HP at 4200 rpm. The approximate full load current rating is 100 amps. The motor is also designed to operate effectively and produce 8 HP at 3400 rpm in a 72 volt system. For protection from contamination, the motor is in a totally enclosed non-ventilated frame with a continuous duty rating of 1 hour. The motor uses a patented cast field design utilizing the superior heat dissipating qualities of aluminum and a continuous ring laminated field. Available in either NEMA 'C' flange or standard base mount configuration. Allow 8-10 weeks for delivery.



Part No	Description		Ship Wt.
40-75B-520	Medium Power Base Mount Motor		160 lbs.
40-75F-520	Medium Power Flange Mount Motor		155 lbs.



Dimensions are approximate



"Typical Performance Curve"

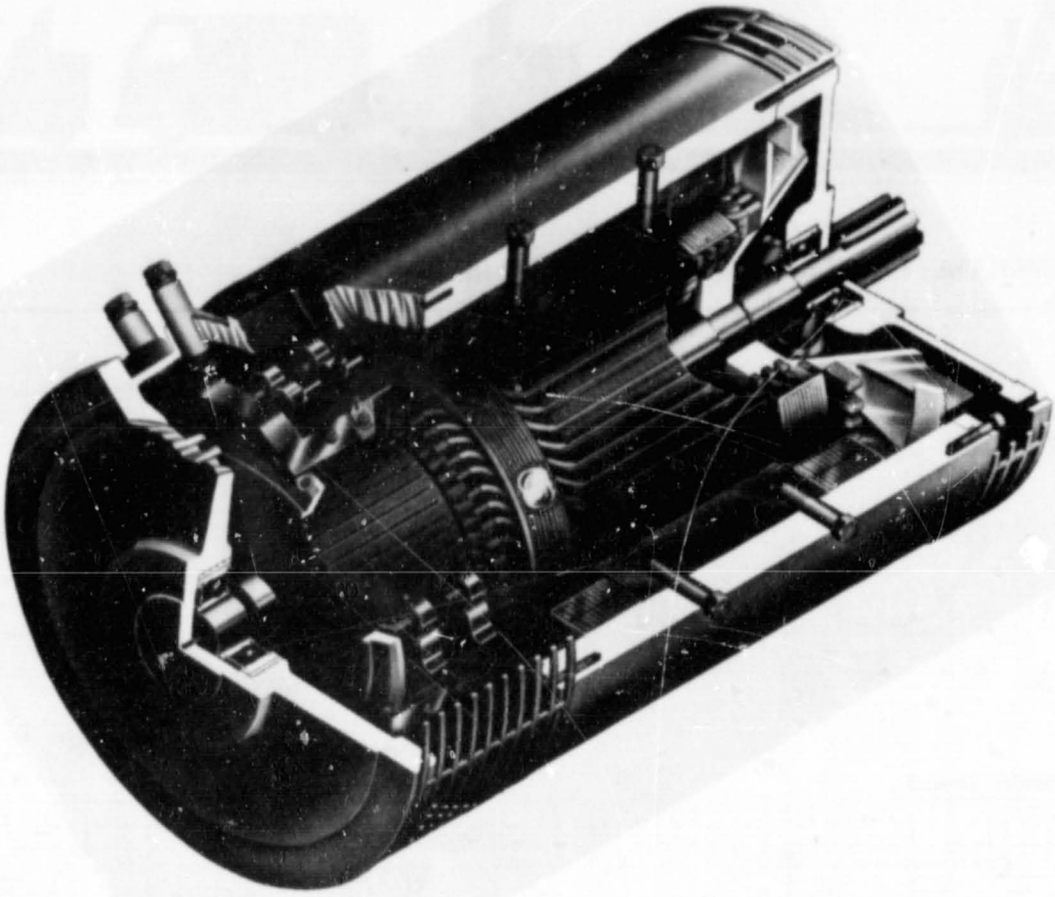
Part No.	Description	Ship Wt.
40-29-130-520	Brushes (8 per motor req'd.)	1 lb.
40-29-784-520	Commutator	10 lbs.
40-29-129-520	Rocker Arm (less brushes & spring)	5 lbs.
40-12105-520	Brush springs	1 lb.

*These custom ordered motors qualify for our initial deposit order plan. Use the special order form to use this plan.

ELECTRIC VEHICLE COMPONENTS
FLIGHT SYSTEMS
HEADQUARTERS
P.O. BOX 25, MECHANICSBURG, PA 17055
PHONE (717) 697-0333

Electric Vehicle Motors

FOR MATERIALS HANDLING, TRUCK, PASSENGER CAR, AND DELIVERY VAN APPLICATIONS



DIRECT-CURRENT INTEGRAL-HORSEPOWER MOTORS

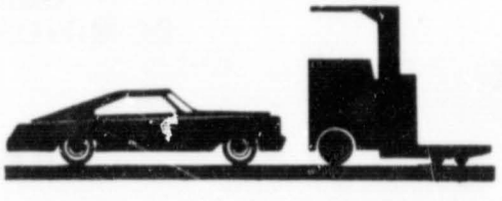
Type BT

Class F Insulation

24 to 192 Volts

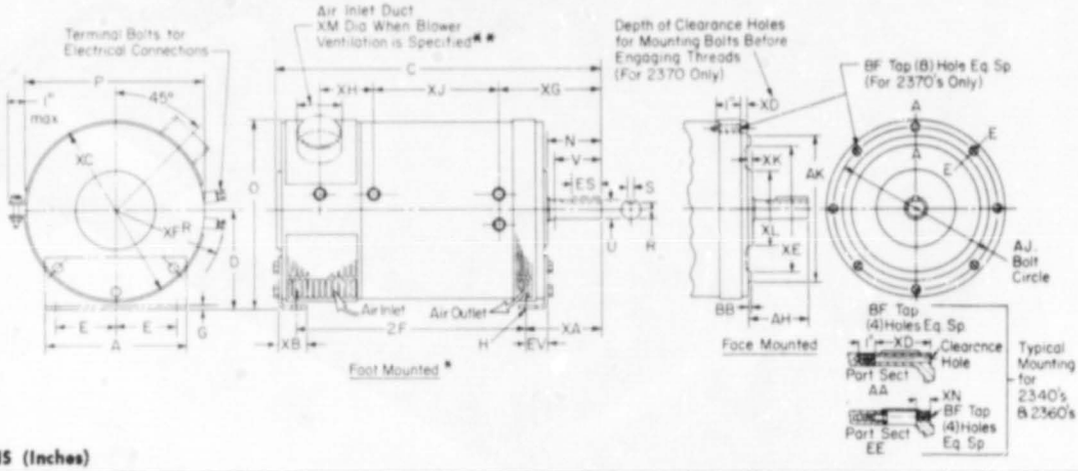
The use of electrically powered vehicles has expanded significantly in the areas of material handling and personal transportation. Industry and the general public have placed increased emphasis on lower maintenance and operating costs, longer motor life, and freedom from the pollution of internal combustion engines.

General Electric has kept pace with the growing demand for electric vehicles through its ability to supply the proper motor to meet new application requirements. Vehicle builders benefit from General Electric's longstanding experience in the design and manufacture of motors for a wide range of applications.





DIMENSIONS: Open or Separately Ventilated Motors



DIMENSIONS (Inches)

FRAME SIZE	APPROX NET WT (N LB	A	C	D	E	2F	G	H	N	O	P	R	S	U †	V ‡	AH	AJ	AK	BB	BF TAP	ES	EV	XA	XB	XC	XD	XE	XF	XG	XH	XJ	XK	XL	XM	XN
2346	150	6.75	18.50	5.18	2.88	13.12	.18	.44	2.31	9.81	9.00	.986 .971	.25	1.125	2.00	3.06	8.38	7.500 7.497	.12	.3125-24 UNF	1.50	1.12	4.00	1.75	9.25	1.88	6.00	6.00	5.56	3.00	7.12	.62	4.25	3.00	.31
2348	180		20.00			14.62																									8.62				
2364	230	8.50	20.00	6.12	3.50	15.12	.18	.44	2.81	11.94	11.28	1.201 1.186	.31	1.375	2.50	2.81	10.68	9.750 9.747	.18	.375-24 UNF	1.88	.88	3.50	1.50	11.62	2.31	8.38	7.00	5.75	2.88	8.50	–	4.50	3.50	.44
2366	255		21.31			16.44																									9.81				
2368	290		23.00			18.12																									11.50				
2374	407		24.56			18.25																									10.88				
2376	445	10.00	26.06	7.50	4.25	19.75	.38	.53	3.31	14.25	13.25	1.476 1.401	.38	1.625	3.00	3.50	12.38	10.750 10.745	.18	.500-20 UNF	2.38	1.50	4.75	2.25	13.50	.81	9.18	7.88	7.62	3.00	12.38	1.6	5.00	5.00	–
2378	495		28.06			21.75																									14.38				

* Feet are bolted on type.
Machine can be furnished with or without feet. When feet are specified, they can be turned inward or outward.

** For blower ventilation bottom half cover is solid.
For open fan-cooled ventilation screen covers top and bottom half will be furnished.

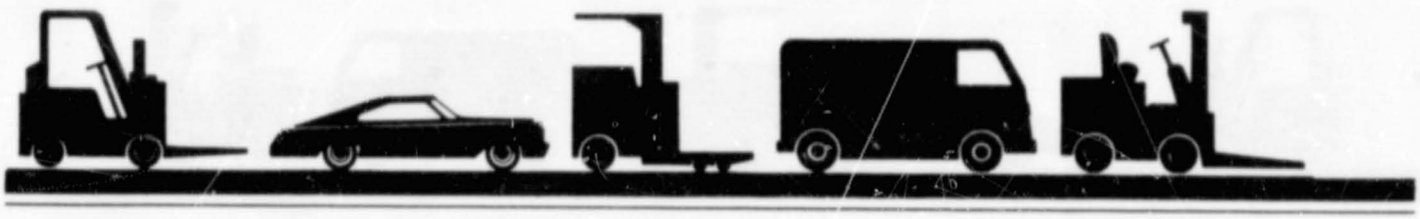
† Shaft diameters 1.375 inches and smaller shall come within the limits of +0.0000, -0.0005.
Diameter 1.625 inches +0.000, -0.001.

Mounting face will be square and rabbet diameter concentric with shaft within 0.004 inch indicator reading. Shaft runout will not exceed 0.002 inch indicator reading.

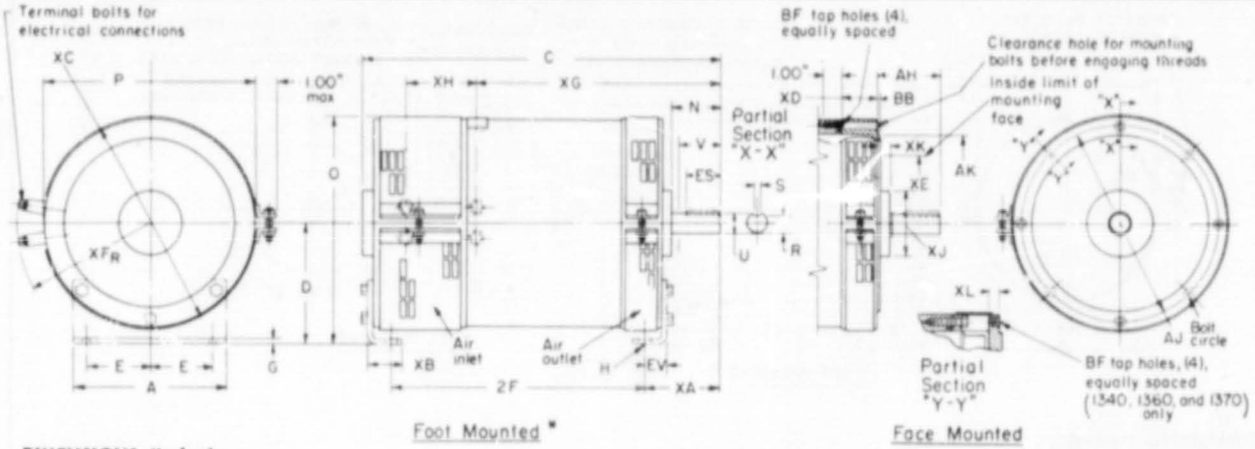
‡ "V" represents length or straight part of shaft.

GENERAL ELECTRIC COMPANY
DC MOTOR AND GENERATOR DEPARTMENT
ERIE, PA. 16531

GENERAL ELECTRIC



DIMENSIONS: Open Motors



DIMENSIONS (Inches)

FRAME SIZE	APPROX NET WT IN LB	A	C	D	E	2F	G	H	N	O	P	R	S	U †	V ‡	AH	AJ	AK	BB	BF TAP	ES	EV	XA	XB	XC	XD	XE	XF	XG	XH	XJ	XK	XL
1322	72		14.75			9.94																							11.88				
1324	87	6.00	15.88	4.25	2.50	11.06		4.06		7.96	7.31					2.62	6.62	5.750 5.747	12	3125 24 UNF		1.03	3.46	1.68	7.38	1.62	4.00	4.62	13.00	1.00	2.50	31	–
1326	95		17.00			12.19			2.31			.986 .971	.25	1.125	2.00						1.50								14.12				
1341	95		14.25			11.00																							10.44				
1343	118		17.25			12.00																							11.44				
1344	153	6.75	18.50	5.18	2.88	13.25												7.500 7.497											12.68	3.00	4.25	.75	31
1346	178		19.81			14.56	.18			9.81	9.00					3.06	8.38		12			1.12	4.00	1.75	9.25	1.88	6.00	6.00	14.00				
1362	210		17.75			12.93																							12.00				
1364	245	8.50	19.88	6.12	3.50	14.06		44	2.81	11.94	11.38	1.201 1.186	.31	1.375	2.50	2.75	10.68	9.750 9.747		375-24 UNF	1.88	.88	3.44	1.50	11.62	2.31	9.00	7.00	13.12	2.88	4.50	–	.44
1366	275		20.38			15.56																							14.62				
1368	344		22.38			17.56				12.00	11.50														11.75				16.62				
1372	347		12.06			15.62													18										15.68				
1314	385	10.00	23.12	7.50	4.25	17.00	.38	53	3.31	14.25	13.25	1.416 1.401	.38	1.622	3.00	3.44	12.38	10.750 10.747		500-20 UNF	2.38	1.50	4.56	2.25	13.50	3.00	10.00	7.88	16.82	3.38	5.00	–	50
1376	436		24.62			18.50																							18.31				
1378	505		26.62			20.50																							19.81				

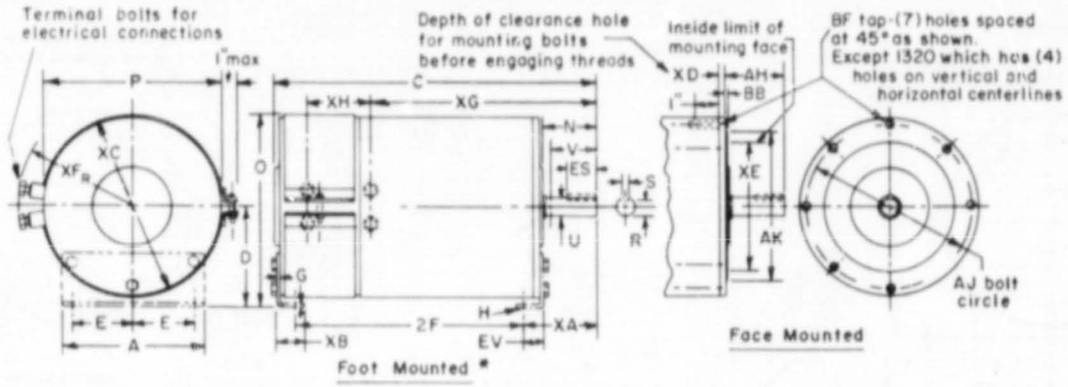
*Feet are bolted-on type. Machine can be furnished with or without feet. When feet are specified, they can be turned inward or outward.

†Shaft diameters 1.375 inches and smaller shall come within the limits of +0.0000, -0.005. Diameter 1.625 inches +0.000, -0.001. Mounting face will be square and rabbet diameter concentric with shaft within 0.004-inch indicator reading. Shaft runout will not exceed 0.002-inch indicator reading.

‡"V" represents length of straight part of shaft.



DIMENSIONS: Totally Enclosed Motors



DIMENSIONS (Inches)

FRAME SIZE	APPROX NET WT IN LB	A	C	D	E	2F	G	H	N	O	P	R	S	U †	V ‡	AH	AJ	AK	BB	BF TAP	ES	EV	XA	XB	XC	XD	XE	XF	XG	XH
1322	68		13.12			8.18																							9.75	
1324	83	6.00	14.25	4.25	2.50	9.31		40		7.96	7.31	.986 .971	.25	1.125	2.00	2.88	6.62	5.750 5.747	.09	3125-24 UNF	1.50	1.03	3.72	1.68	7.38	.25	4.50	4.62	10.88	1.00
1326	90		15.38			10.44			2.31																				12.00	
1341	87		14.25			9.56																							8.44	
1343	110		15.25			10.56				9.81	9.00					2.53	8.38	7.500 7.497	.12			1.12	3.09	1.75	9.25	.38	6.50	6.00	9.44	
1344	145	6.75	16.50	5.18	2.88	11.81	.18																						10.68	3.00
1346	170		17.81			13.12																							12.00	
1362	200		16.62			11.31		.44																					10.88	
1364	235		17.75			12.44			2.81	11.94	11.38	1.201 1.186													11.62				12.00	
1366	265	8.50	19.25	6.1...	3.50	13.94							.31	1.38	2.50	3.50	10.68	9.750 9.747	.18	375 24 UNF	1.88	8a	3.94	1.30		.44	8.75	7.00	13.50	2.88
1368	334		21.25			15.94				12.00	11.50														11.75				15.50	
1372	332		19.75			13.31																							17.88	
1374	370		20.88			14.68																							19.00	
1376	421	10.00	22.38	7.50	4.25	16.18	.38	.53	3.31	14.25	13.25	1.416 1.401	.38	1.62	3.00	3.50	12.38	10.750 10.745		50 20 UNF	2.38	1.50	4.88	2.25	13.50	.81	9.18	7.88	20.50	3.31
1378	490		24.38			18.18																							22.50	

* Feet are bolted on type. Machine can be furnished with or without feet. When feet are specified they can be turned inward or outward.

† Shaft diameters 1.375 inches or smaller shall come within the limits of +0.0000, -0.0005. Diameter 1.625 inches +0.000, -0.001. Mounting face will be square and rabbet diameter concentric with shaft within 0.004 inch indicator reading. Shaft runout will not exceed 0.002-inch indicator reading.

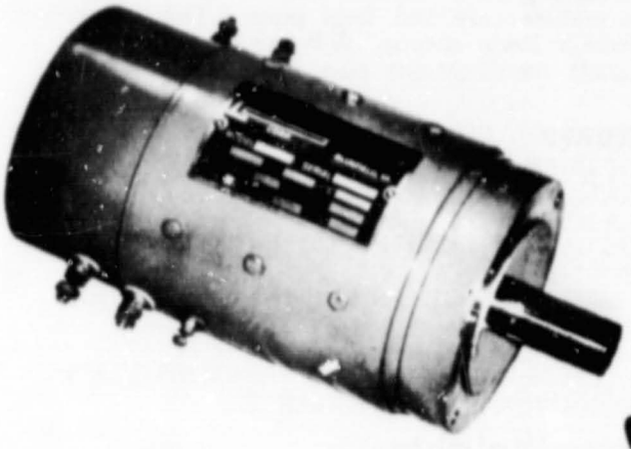
‡ "V" represents length of straight part of shaft.

LAWNEL CORP

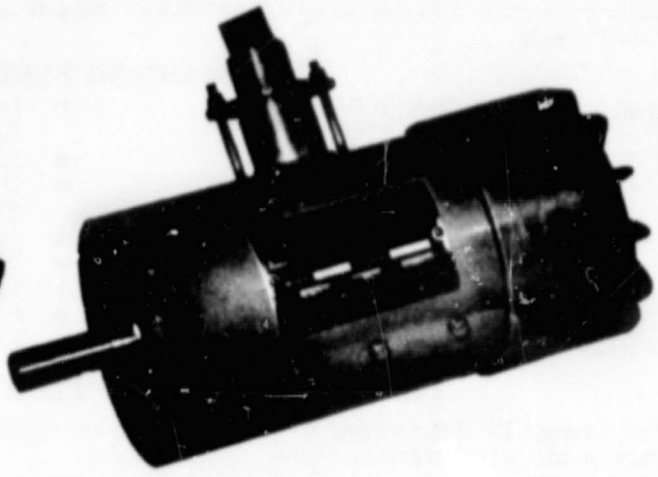
D-C MOTORS

For Electric Vehicles

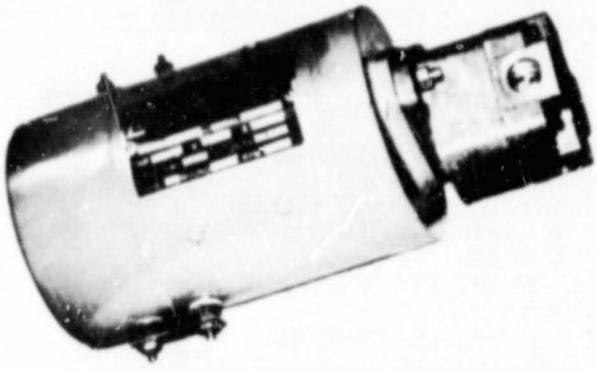
12 to 120 Volts



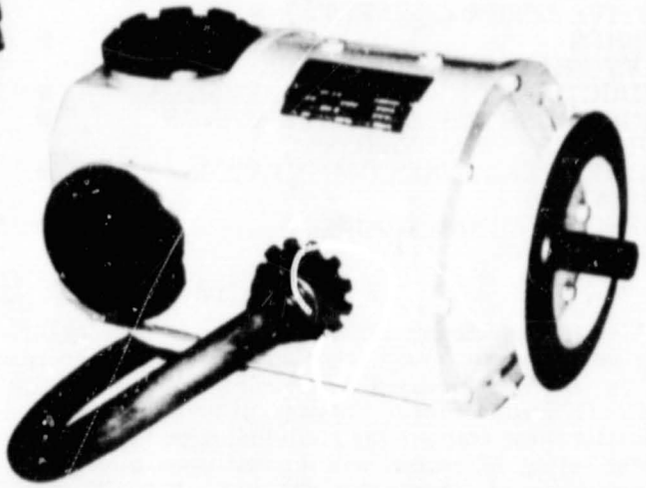
MODEL 7L6-16C
48 VOLT, 4.5 HP



MODEL 7K6-16S
36 VOLT, 3.5 HP
TYPE "EX" CONSTRUCTION



HYDRAULIC POWER PACKAGE
MODEL 6L4-14C-6
24 VOLT, 5.5 GPM
AT 1500 PSI



MODEL 13K5-14S
48 VOLT, 9 HP
TYPE "EX" CONSTRUCTION

LAWNEL CORP., P.O. BOX 206, BLUEFIELD, VA 24605, TEL: 703-326-1171

Lawnel Corporation is dedicated to battery powered electric vehicles. Having personnel with years of experience in the design and manufacture of DC motors, the company made the logical decision to produce motors for its own vehicles. We now build motors for other Original Equipment Manufacturers as well as for the Lawnel line of rider lift trucks and motorized hand trucks. Applications for the motors have ranged from industrial trucks, to highway vehicles, to mining equipment. Our experience in the design of both electric vehicles and motors provides the exceptional opportunity to purchase a quality motor from a company that truly understands your requirements.

The High Performance Light Weights

Lawnel 6⅝" and 7" frame diameter motors exhibit a high horsepower to weight ratio. Weight is minimized by using high strength cast aluminum end shields, and designing for maximum overall efficiency. A huge 1⅜" diameter alloy steel armature shaft turning in oversized, sealed ball bearings, provides the capacity to safely increase the length of the armature core and field poles. This allows higher operating voltages, greater HP output, and higher torque at lower speeds. A bonus achieved from the large armature shaft and bearings is a variety of output shaft modifications plus extra capacity for overhung shaft loads.

OUTSTANDING FEATURES

- 12 TO 48 VOLTS OPERATION
- HIGH HP TO WEIGHT RATIO
- SEALED BALL BEARINGS
- LARGE BRUSH INSPECTION OPENINGS
- DUPONT "NOMEX" SLOT LINERS
- CLASS "F" INSULATION
- TWO APPLICATIONS OF CLASS "F" VARNISH
- LARGE, HIGH CURRENT CAPACITY BRUSHES
- HIGH SILICON STEEL ARMATURE LAMINATIONS
- LAMINATED POLES
- HIGH TEMPERATURE COMMUTATOR CONNECTIONS
- POLYESTER GLASS BANDED ARMATURE
- WIDE CHOICE OF OUTPUT SHAFT MODIFICATIONS
- UL TYPE "EX" (U. S. B. M. "PERMISSIBLE") CONSTRUCTION AVAILABLE

The Heavy Duty Heavy Weights

The Lawnel 13" frame diameter motors were designed for "around the clock" operation. These large motors, made with precision, offer the following:

OUTSTANDING FEATURES

- 36 TO 120 VOLTS OPERATION
- CAST STEEL END SHIELDS
- BRUSHES ARE ADJUSTABE FOR NEUTRAL
- INTERPOLES ARE USED FOR 72 VOLTS AND OVER
- POSITIVE SCREW CONNECTIONS TO BRUSHES
- HEAVY BRASS BRUSHHOLDERS CONDUCT HEAT AWAY FROM BRUSHES
- LARGE BRUSH INSPECTION OPENINGS
- HIGH RISER COMMUTATOR
- HIGH TEMPERATURE COMMUTATOR CONNECTIONS
- BRAZED INTERNAL WIRING CONNECTIONS
- CLASS "F" INSULATION
- DUPONT "NOMEX" SLOTLINERS
- ARMATURE COILS INDIVIDUALLY WRAPPED IN GLASS TAPE
- SEALED BALL BEARINGS
- ARMATURE BANDED WITH POLYESTER GLASS TAPE
- HIGH SILICON STEEL ARMATURE LAMINATIONS
- LAMINATED FIELD POLES
- TWO APPLICATIONS OF CLASS "F" VARNISH
- "DUST TIGHT" CONSTRUCTION STANDARD
- OPTIONAL UL TYPE "EX" (U. S. B. M. "PERMISSIBLE") CONSTRUCTION

The Space Saver

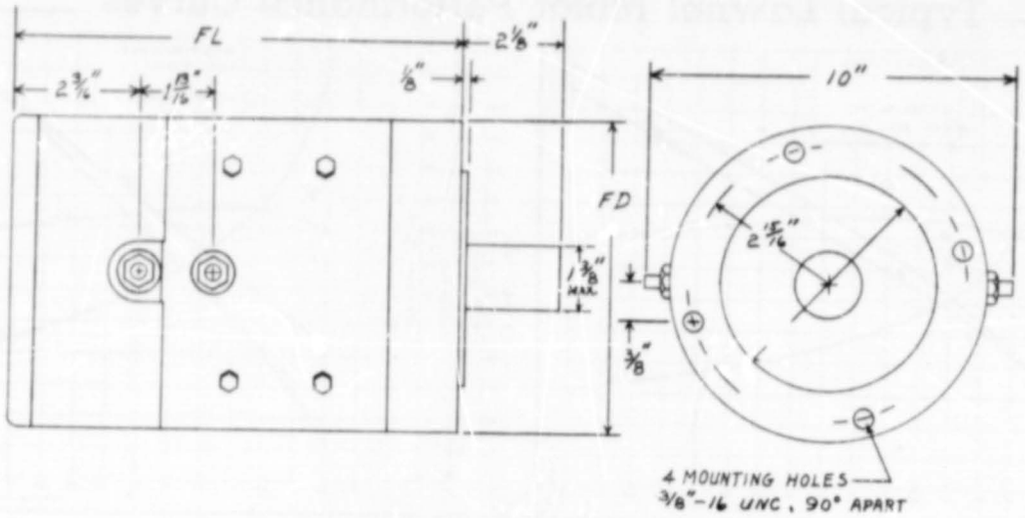
Electric vehicle manufacturers are constantly striving to reduce the size of their product without sacrficing performance. Inches become precious when placing the larger components in accessible positions. This fact was soon realized during the development of our own line of vehicles, and led to the design of a Hydraulic Power Package utilizing our 6⅝" and 7" frame diameter motors. All Lawnel motors having these frame sizes including type "EX" construction are available for hydraulic pump drives. Horsepower rating, of course, will depend upon duty cycle in this application. Our pre-engineered power package consisting of a Lawnel motor and a Borg Warner S15 series hydraulic pump is only ½" longer than the combined body lengths of the pump and motor. The pumps are rated at 3,000 PSI. Six pump models give displacements from 0.43 to 1.20 cu. in. per revolution.

Power Package specifications are not listed due to the variety of combinations possible. An example, however, would be the Model 6L5-14C, 24 volt motor, and an S15-6 pump. Overall length of the unit is 15¼". Rating is 7 GPM at 1500 PSI for a 20% duty cycle. GPM at 100 PSI is 9.5.

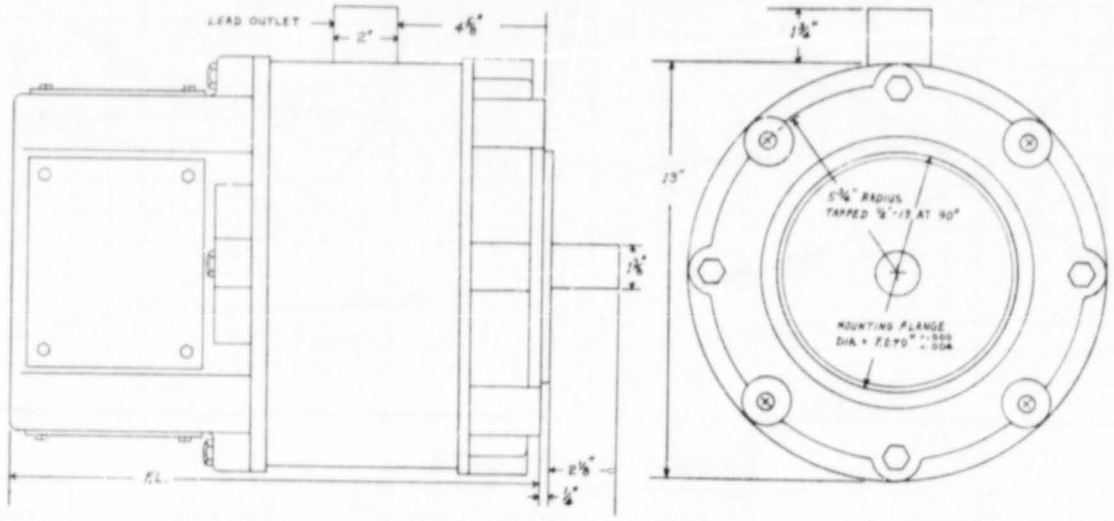
OUTSTANDING FEATURES

- 12 TO 48 VOLTS OPERATION
- PRE-ENGINEERED
- EXTREMELY COMPACT
- LOW NOISE LEVEL
- WIDE CHOICE OF MODELS
- OPTIONAL MOUNTINGS
- UL TYPE "EX" (U. S. B. M. "PERMISSIBLE") CONSTRUCTION AVAILABLE

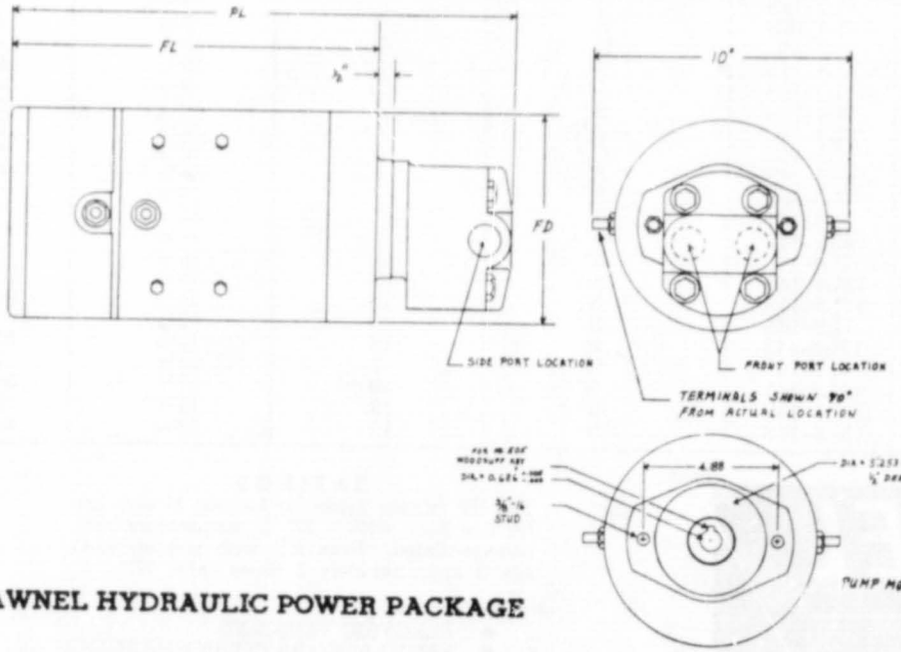
LAWNEL CORP., P.O. BOX 206, BLUEFIELD, VA 24605, TEL: 703-326-1171



LAWNEL 6⅛" AND 7" FRAME DIAMETER MOTORS



LAWNEL 13" FRAME DIAMETER MOTORS



LAWNEL HYDRAULIC POWER PACKAGE

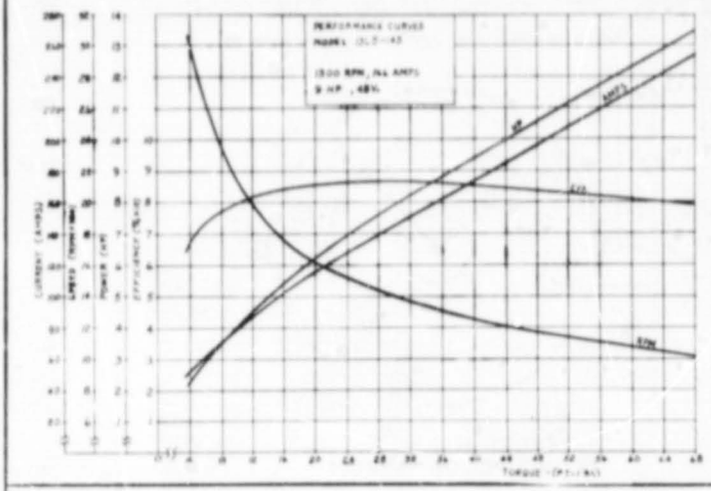
DIMENSIONS

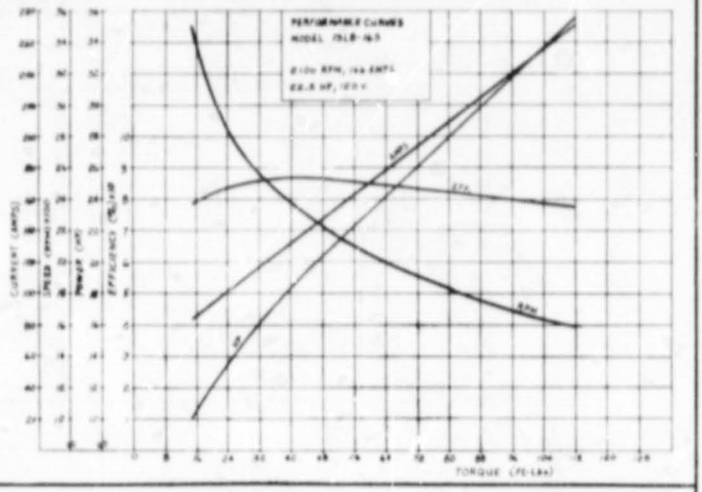
Type "Ex" Construction 6⅛" - 7" FRAME DIAMETER MOTORS - Maximum-frame-diameter (F.D.) is 7⅛" for all motors. The frame length (F.L.) is increased 1½".

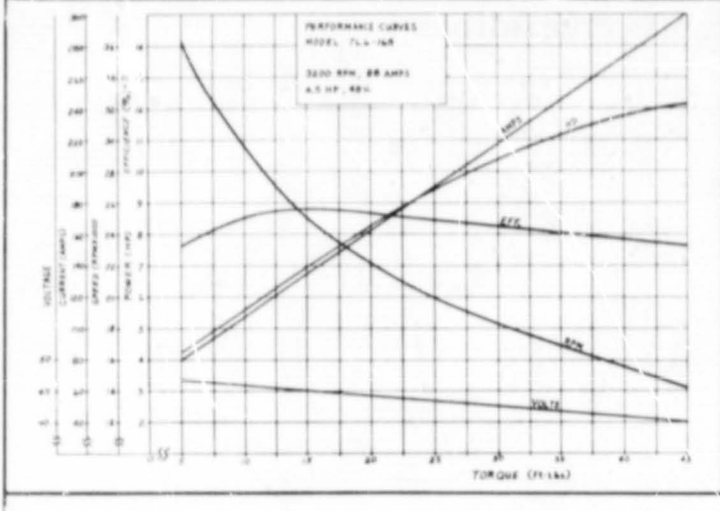
13" FRAME DIAMETER MOTORS - The frame length (F.L.) is increased 1⅝". Consult factory for mounting information.

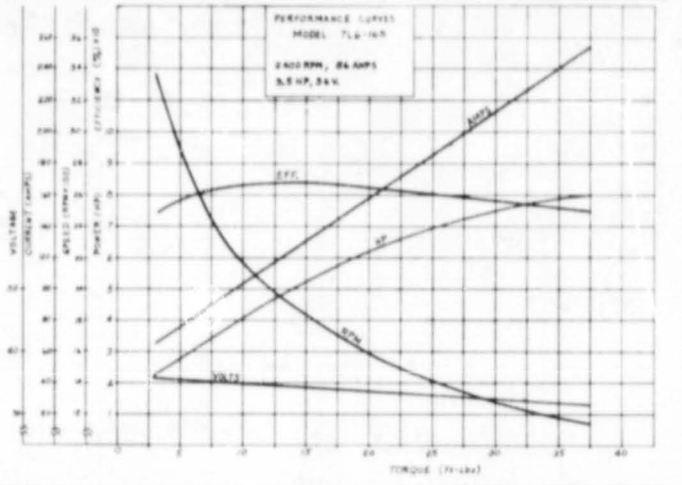
LAWNEL CORP., P.O. BOX 206, BLUEFIELD, VA 24605, TEL: 703-326-1171

Typical Lawnel Motor Performance Curves









LAWNEL MOTOR DATA

HP	VOLTS	RATED AMPS	RATED SPEED (RPM)	MODEL NO.	FIELD WINDING S = SERIES C = COMPOUND	FRAME DIAMETER "F. D." (inches)	FRAME LENGTH "F. L." (inches)	APPROX. WEIGHT (LBS.)
1	12	82	1900	6L3-14S	S	6 3/8	9 1/2	43
1	12	82	1600	7L3-16S	S	7	9 1/2	48
1.25	12	87	2000	7L3-16C	C	7	9 1/2	48
2.25	24	80	3000	6L4-14S	S	6 3/8	10 1/2	51
2.25	24	80	3300	7L3-16S	S	7	9 1/2	48
2.25	24	80	2500	7L4-16S	S	7	10 1/2	57
2.25	24	87	2450	6L4-14C	C	6 3/8	10 1/2	51
2.25	24	90	2700	7L3-16C	C	7	9 1/2	48
3.5	36	86	2900	6L6-14S	S	6 3/8	12 1/2	67
3.5	36	86	2900	7L5-16S	S	7	11 1/2	66
3.5	36	86	2400	7L6-16S	S	7	12 1/2	75
3.5	36	95	2900	6L5-14C	C	6 3/8	11 1/2	59
3.5	36	96	3000	7L4-16C	C	7	10 1/2	57
7	36	172	1200	13L4-14S	S	13	15 3/8	335
7	36	172	940	13L5-14S	S	13	16 3/8	865
4.5	48	88	3200	7L6-16S	S	7	12 1/2	75
9	48	166	1300	13L5-14S	S	13	16 3/8	365
4.5	48	94	2850	7L6-16C	C	7	12 1/2	75
13.5	72	166	1625	13L6-145	S	13	17 3/8	395
18	96	166	1625	13L8-14S	S	13	19 3/8	425
22.5	120	166	2100	13L8-16S	S	13	19 3/8	425

LAWNEL CORP
P. O. Box 206 Bluefield, Virginia 24605
703-326-1171

RATINGS

The HP ratings listed for Lawnel Motors are for one hour with a 70° C temperature rise, non-ventilated. Peak HP with sloping voltage is approximately 3 times rated HP.

Manfuacturers of

- ELECTRIC VEHICLES
- REGULATED BATTERY CHARGERS
- D.C. ELECTRIC MOTORS

Leroy-Somer, Inc.
16 Passaic Avenue
Fairfield, New Jersey 07006
Phone: (201) 227-9277

TRACTION AND AC AND DC ELECTRIC MOTORS

Leroy-Somer Inc. is one of the world leaders in electric motor sales. We have sales subsidiaries and facilities on every continent and we are the major supplier of traction motors in Europe.

We would like very much to help the future market of electric cars. Leroy-Somer has already equipped an electric car in the United States which has proven itself to be completely satisfactory.

We are pleased to provide the following information:

Our parent company is located at: Moteurs Leroy-Somer
B.P. 119
16004 Angouleme France

Our Division is: Leroy-Somer Inc.
16 Passaic Ave.
Fairfield, New Jersey 07006
(201) 227-9277

Name of Item: Traction and AC and DC Electric Motors

Function of Item: Various

Production Status: All phases

Availability: Stock

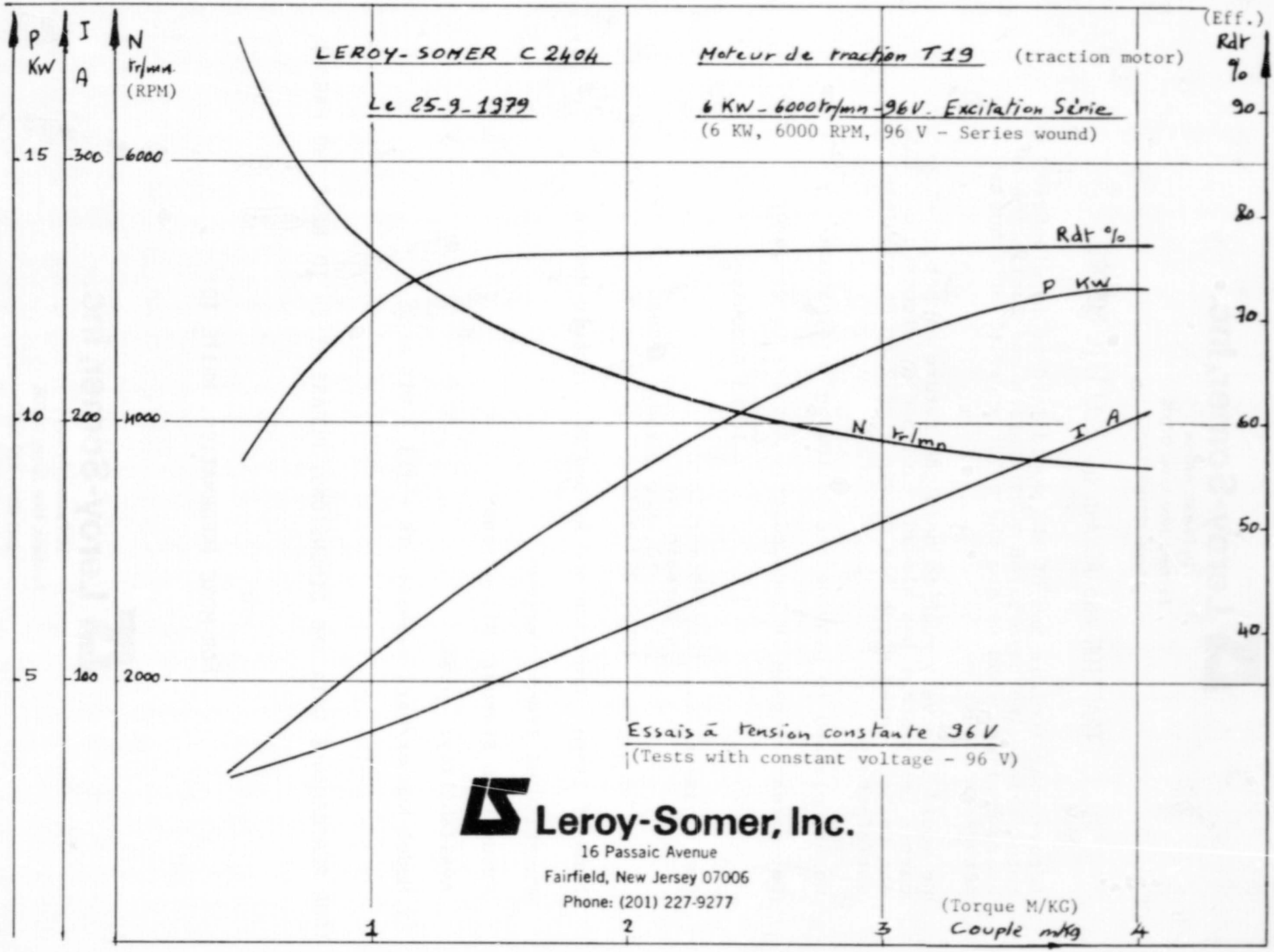
Model Number/Part Number: T6 - T11 - T19 etc.

(FOR PERFORMANCE DATA AND DIMENSIONS, PLEASE REFER TO NEXT TWO PAGES)

FOR MORE INFORMATION, WRITE TO:

Leroy-Somer, Inc.
16 Passaic Avenue
Fairfield, New Jersey 07006
Phone: (201) 227-9277

MT-16



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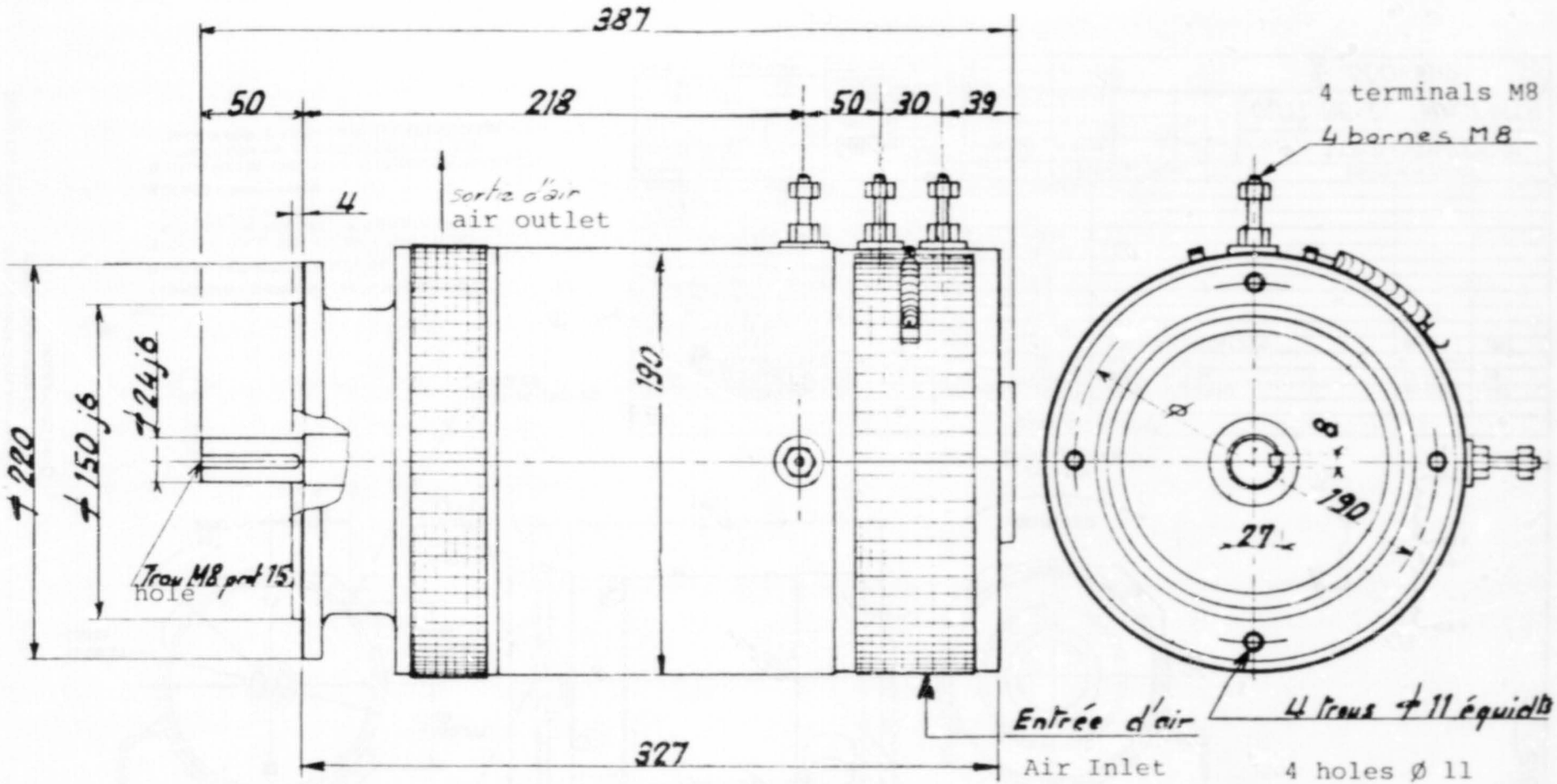


Leroy-Somer, Inc.
16 Passaic Avenue
Fairfield, New Jersey 07006
Phone: (201) 227-9277

TRACTION AND AC AND DC ELECTRIC MOTORS

CHARACTERISTICS				
TORQUE CONSTANT (MAX FLD)	LBS FT/AMP	35	ARMATURE INERTIA	LBS-FT² 1.23
ARMATURE RESISTANCE AT 25°C	OHMS	0.0022	STATIC FRICTION	OZ-IN 16
FIELD RESISTANCE AT 25°C	OHMS	30/7.5	COOLING AIR	
RATED ARMATURE VOLTAGE	VOLTS	96	INTERPOLE RES AT 25°C	OHMS .012
RATED FIELD VOLTAGE	VOLTS	96/48		
NO LOAD SPEED AT RATED VOLTS	RPM	1825		
NO LOAD CURRENT AT RATED VOLTS	AMPS	3.0		
MAXIMUM ARMATURE CURRENT (CONT)	AMPS	105		
MAXIMUM ARMATURE CURRENT (5 MIN)	AMPS	116		
MINIMUM FIELD VOLTAGE	VOLTS	40/20		
NO LOAD SPEED AT MINIMUM FIELD VOLTS	RPM	2770		
ROTOR POLE (FOUR)		12		
HORSE POWER (5 MIN)	HP	18		
RATED FLD CURRENT (HOT)	AMPS	2.4/4.8		

QTY	PART NO	DESCRIPTION OR MATERIAL
		A DIVISION OF ONAN CORPORATION

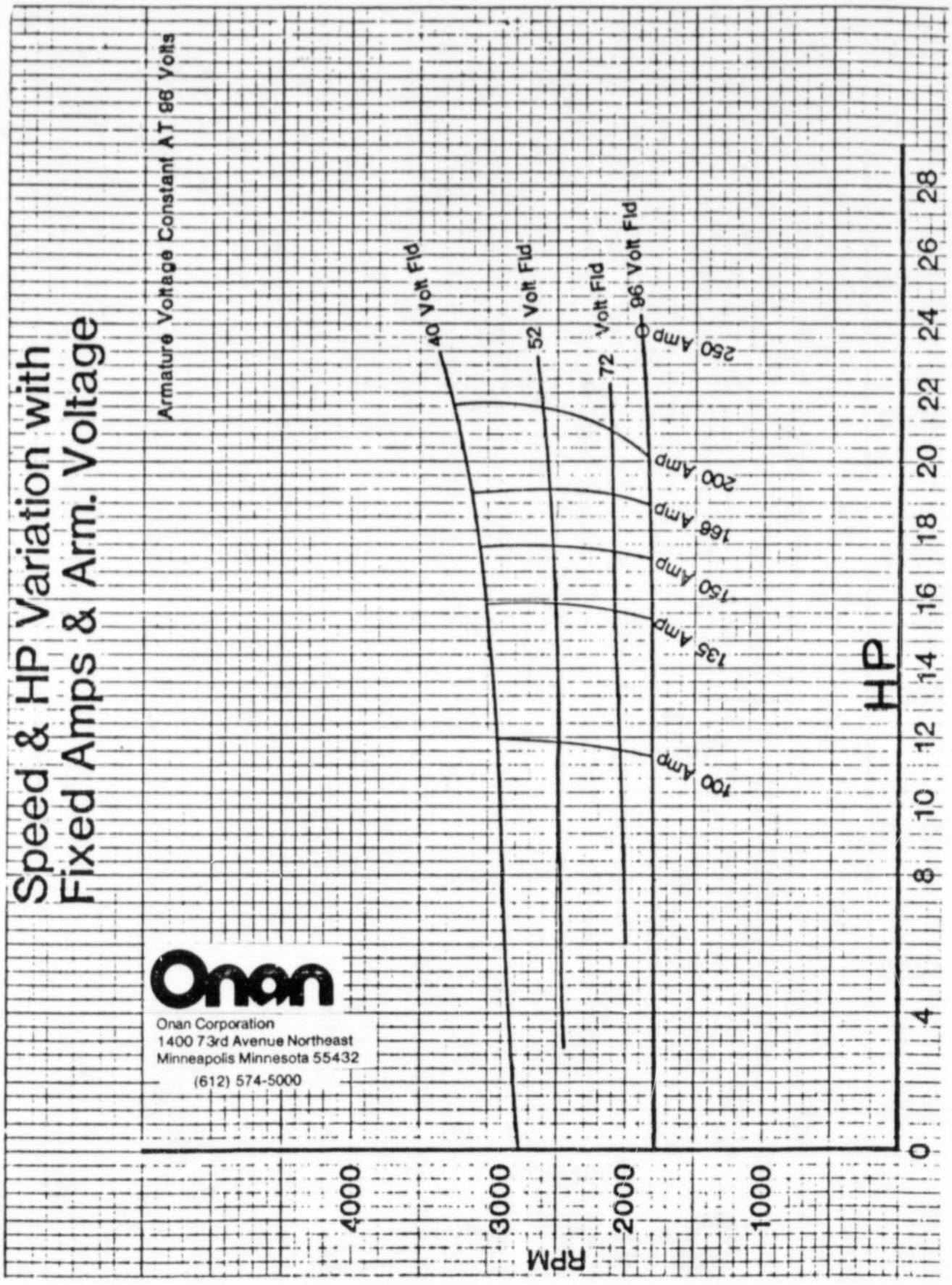
DRAWN			OUTLINE-DC TRACT MTR
CHECKED			500-1912 C

Onan Corporation
1400 73rd Avenue Northeast
Minneapolis Minnesota 55432 (612) 574-5000

ORIGINAL PAGE IS
OF POOR QUALITY

NOTES:

1. DIMENSIONS SHOWN IN ( ) ARE MILLIMETRES
2. RATING PER IEEE 11.8 IEEE 96
3. MACHINE WILL OPERATE BOTH DIRECTIONS RATINGS ARE FOR DIRECTION SHOWN WITH SELF VENTILATING FAN.
4. CLASS F INSULATION.
5. FIELD MAY BE OPERATED IN SERIES OR PARALLEL CONNECTION FIELD CHARACTERISTIC ARE SHOWN FOR SERIES/PARALLEL CONNECTION.


Speed & HP Variation with
Fixed Amps & Arm. Voltage
Armature Voltage Constant AT 86 Volts
40 Volt Fld
52 Volt Fld
72 Volt Fld
96 Volt Fld
250 Amp
200 Amp
168 Amp
150 Amp
135 Amp
100 Amp
HP
0
4
8
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28
RPM
1000
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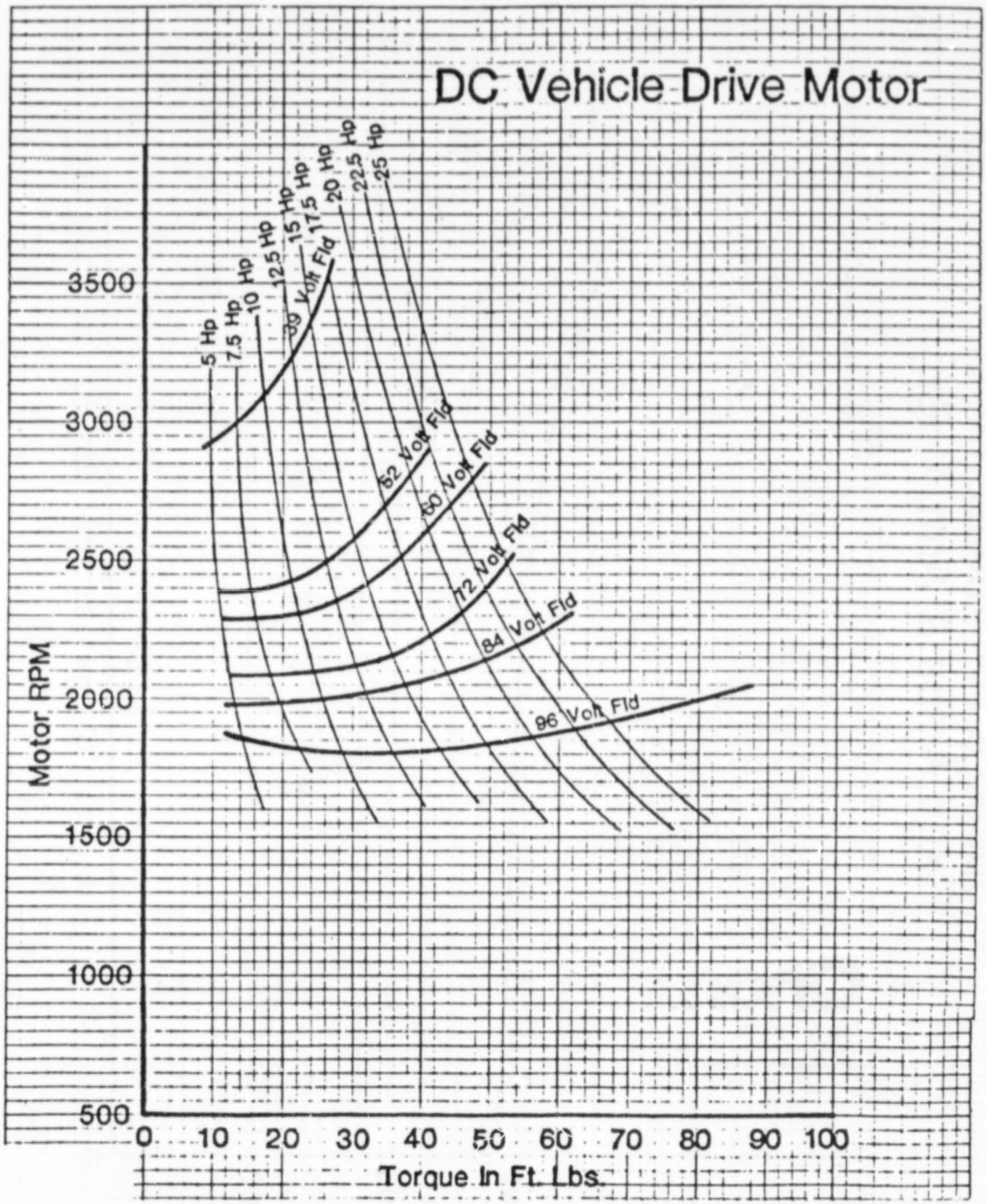
3000
4000
Onan
Onan Corporation
1400 73rd Avenue Northeast
Minneapolis Minnesota 55432
(612) 574-5000



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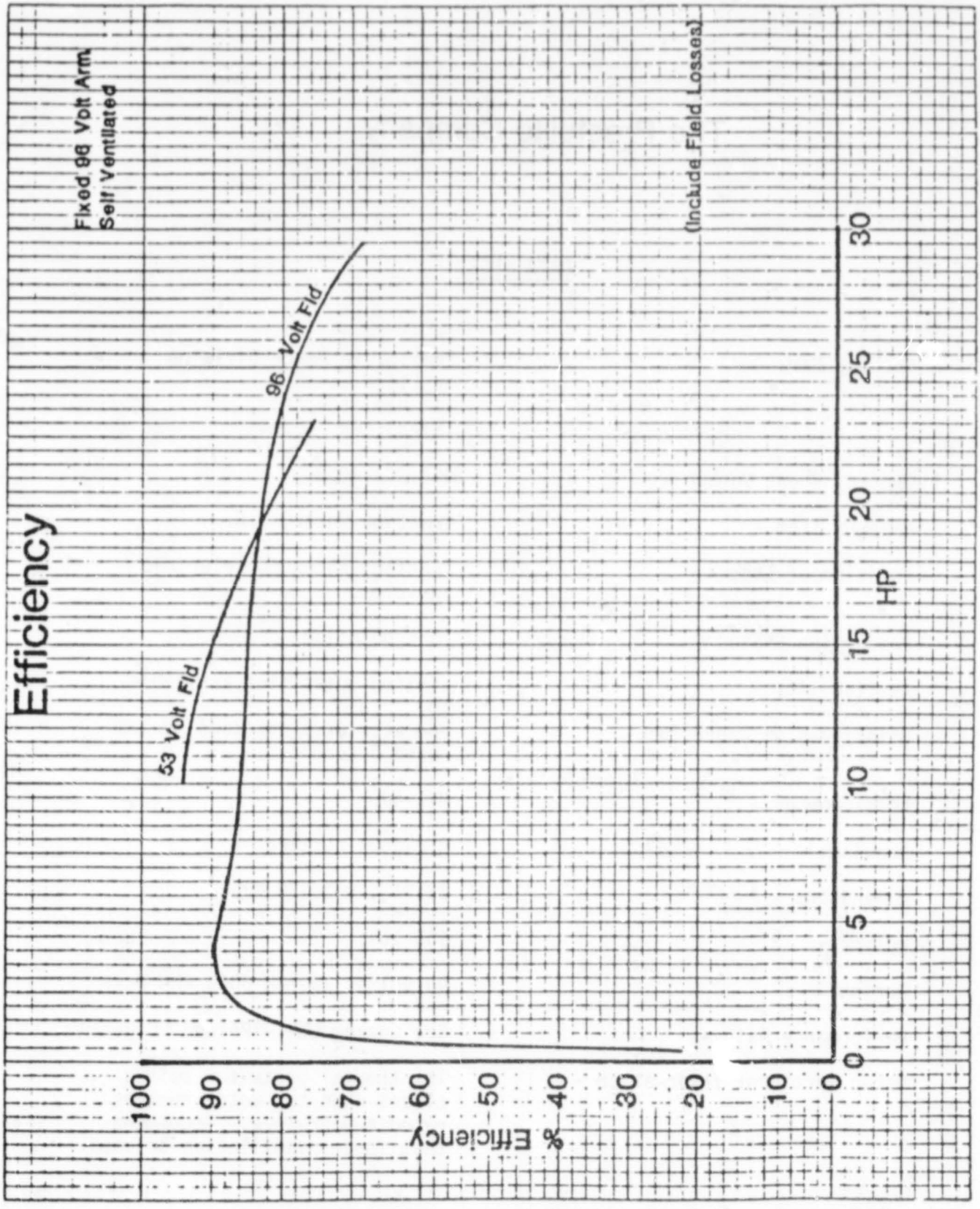
Minneapolis Minnescta 55432
(612) 574-5000



Onan Corporation
1400 73rd Avenue Northeast
Minneapolis Minnesota 55432
(612) 574-5000

The Prestolite Company

DATA SHEET

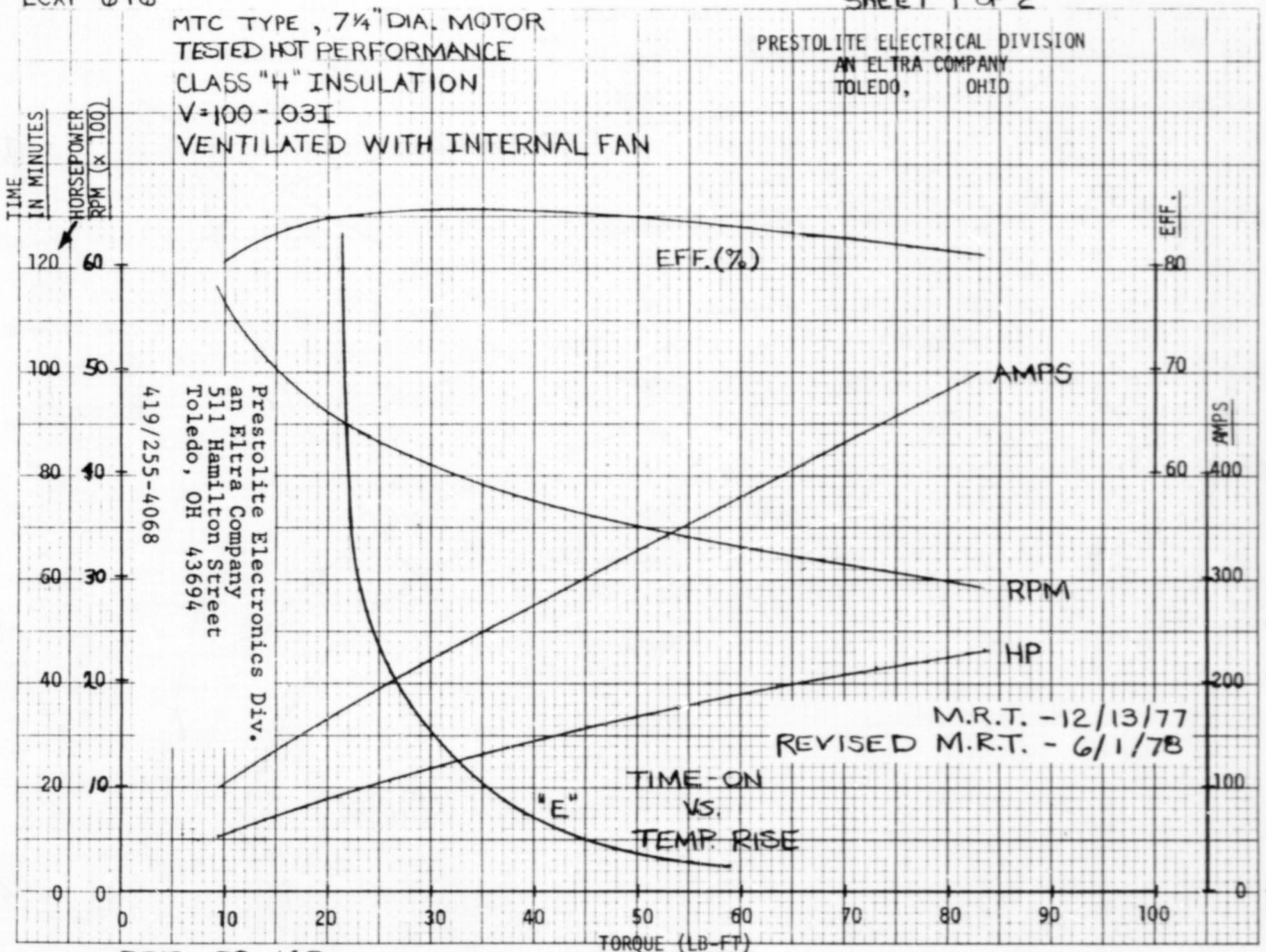
Company Name -	Prestolite Motor Division an Eltra Company 511 Hamilton St. Toledo, OH 43694
Company Phone Number -	419-255-4068
Name of Item -	Traction Motor, D.C.
Function of Item -	Traction motor for electric vehicles.
Production Status -	In production.
Availability -	Limited quantities available.
Principles of Operation -	Operates as a standard series wound D.C. motor.
Model Number -	MTC-4001
Drawings -	MTC-4001 outline
Dimensions -	16.34 L x 7.178 Dia.
Weight -	105 lbs.
Rating -	96 volts, 20 HP, 5000 RPM Max.
Performance Data -	See Curves LCXF-696 and LCXF-719.
Other Pertinent Information -	The thermal protector switch closes when the motor reaches rated temperature. Recommend that forced ventilation be used.

LCXF-696

SHEET 1 OF 2

MTC TYPE, 7¼" DIA. MOTOR
TESTED HOT PERFORMANCE
CLASS "H" INSULATION
V=100-.03I
VENTILATED WITH INTERNAL FAN

PRESTOLITE ELECTRICAL DIVISION
AN ELTRA COMPANY
TOLEDO, OHIO



Prestolite Electronics Div.
an Eltra Company
511 Hamilton Street
Toledo, OH 43694
419/255-4068

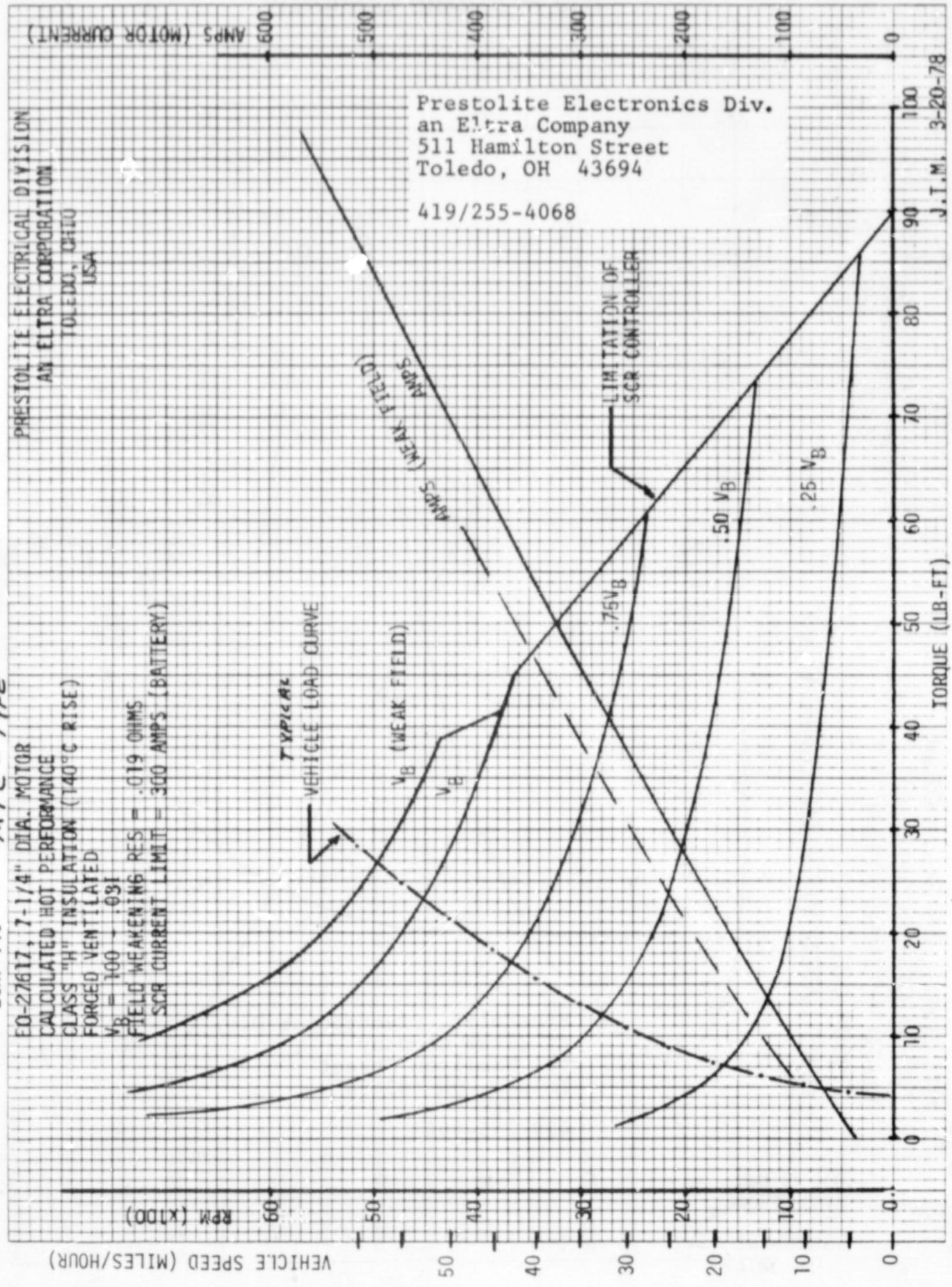
M.R.T. - 12/13/77
REVISED M.R.T. - 6/1/78

REF: 78-163

The Prestolite Company

LCXF - 696

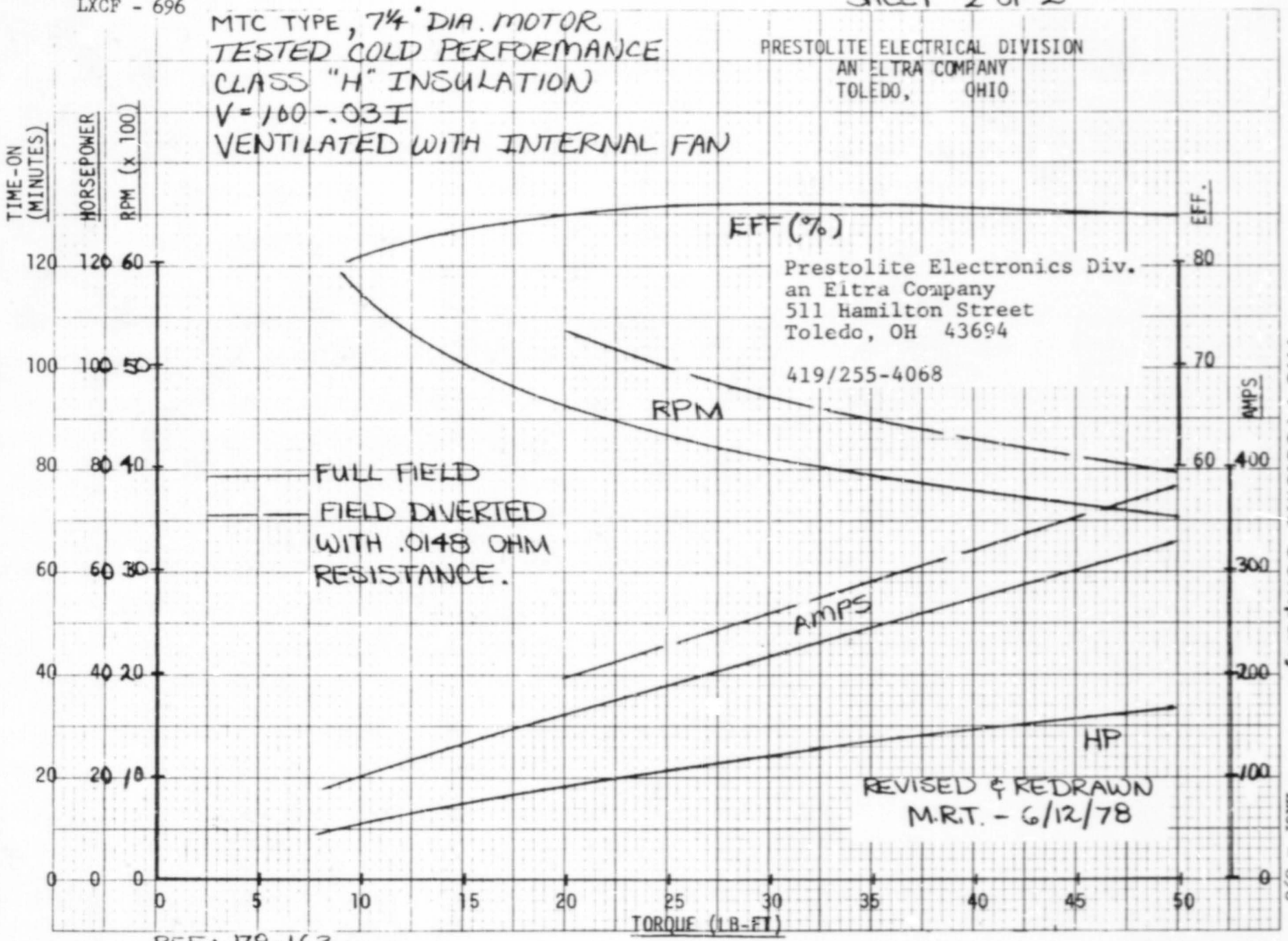
MT-23


Prestolite Electronics Div.
an Eltra Company
511 Hamilton Street
Toledo, OH 43694
419/255-4068
PRESTOLITE ELECTRICAL DIVISION
AN ELTRA CORPORATION
TOLEDO, OHIO
USA
J.I.M. 3-20-78
LCXF-719
MTC - TYPE
EO-27612; 7-1/4" DIA. MOTOR
CALCULATED HOT PERFORMANCE
CLASS "H" INSULATION (T40°C RISE)
FORCED VENTILATED
V_B = 100 - 031
FIELD WEAKENING RES = .019 OHMS
SCR CURRENT LIMIT = 300 AMPS (BATTERY)
TYPICAL VEHICLE LOAD CURVE
V_B (WEAK FIELD)
V_B
.75 V_B
.50 V_B
.25 V_B
AMPS (WEAK FIELD)
LIMITATION OF SCR CONTROLLER
AMPS (MOTOR CURRENT)
TORQUE (LB-FT)
VEHICLE SPEED (MILES/HOUR)
RPM (x100)

LXCF - 696

MTC TYPE, 7¼" DIA. MOTOR
TESTED COLD PERFORMANCE
CLASS "H" INSULATION
V = 160 - .03I
VENTILATED WITH INTERNAL FAN

PRESTOLITE ELECTRICAL DIVISION
AN ELTRA COMPANY
TOLEDO, OHIO



Prestolite Electronics Div.
an Eitra Company
511 Hamilton Street
Toledo, OH 43694

419/255-4068

REVISED & REDRAWN
M.R.T. - 6/12/78

REF: '78-163

The Prestolite Company

LXCF - 696

MT-25

PULLEYS, POWER DRIVE

FIXED and VARIABLE

(CODE **PU**)

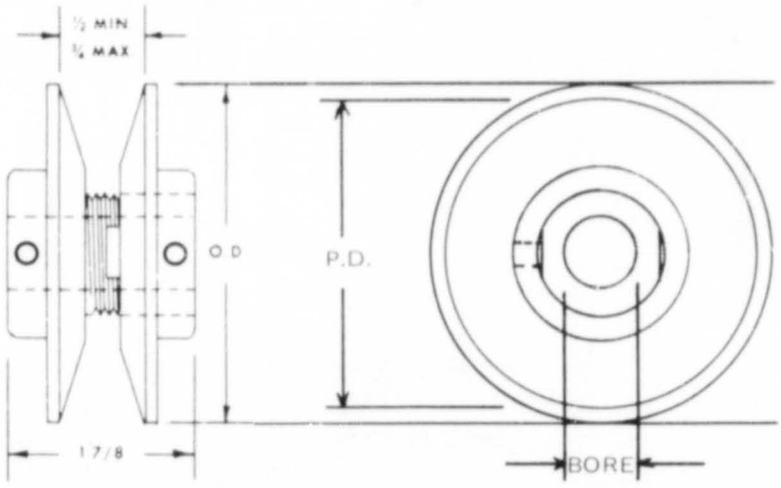
CLIMAX

LIGHT DUTY

SINGLE GROOVE PULLEYS

Climax light duty single groove pulleys are accurately machined from close grain permanent mold cast iron. Bore and groove faces are completely finished in one chucking to provide absolute concentricity and freedom from belt vibration and noise. Light weight in design, the Climax Variable Pitch and Fixed Pitch pulleys make ideal drives for heating, air conditioning, and similar applications.

VARIABLE PITCH PULLEYS



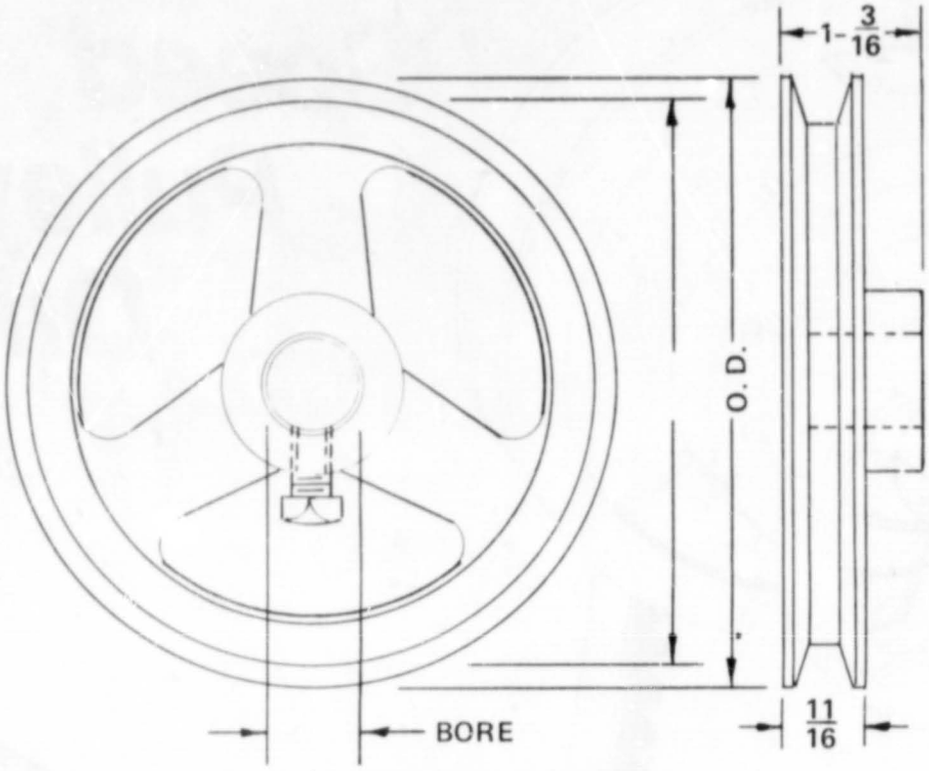
SPECIFICATIONS										
Part No.	Outside Dia.	Type	PITCH DIAMETER RANGE "O" Belts Min.	"O" Belts Max.	"A" Belts Min.	"A" Belts Max.	"B" Belts Min.	"B" Belts Max	Bore Range	Wt. Lbs.
VP-32	3¼	1	1.8	2.6	1.9	3.0	2.2	3.1	¼ to ¾	1.1
VP-35	3½	1	2.0	2.8	2.1	3.2	2.3	3.2	½ to ¾	1.3
VP-37	3¾	1	2.3	3.1	2.4	3.4	2.6	3.5	½ to ¾	1.4
VP-40	4	1	2.5	3.3	2.6	3.6	2.8	3.7	½ to ¾	1.5

CLIMAX METAL PRODUCTS CO.

30202 LAKELAND BLVD. • WICKLIFFE, OHIO 44092

AREA CODE 216 · 585-0300

FIXED PITCH PULLEYS



SPECIFICATIONS

Part No.	Outside Diameter	Pitch Diameter	Weight
AVL-51	5.15	4.95	1.2
AVL-61	6.15	5.95	1.4
AVL-71	7.15	6.95	1.6
AVL-81	8.15	7.95	1.9
AVL-91	9.15	8.95	2.7
AVL-101	10.15	9.95	4.2
AVL-111	11.15	10.95	4.9
AVL-121	12.15	11.95	5.2

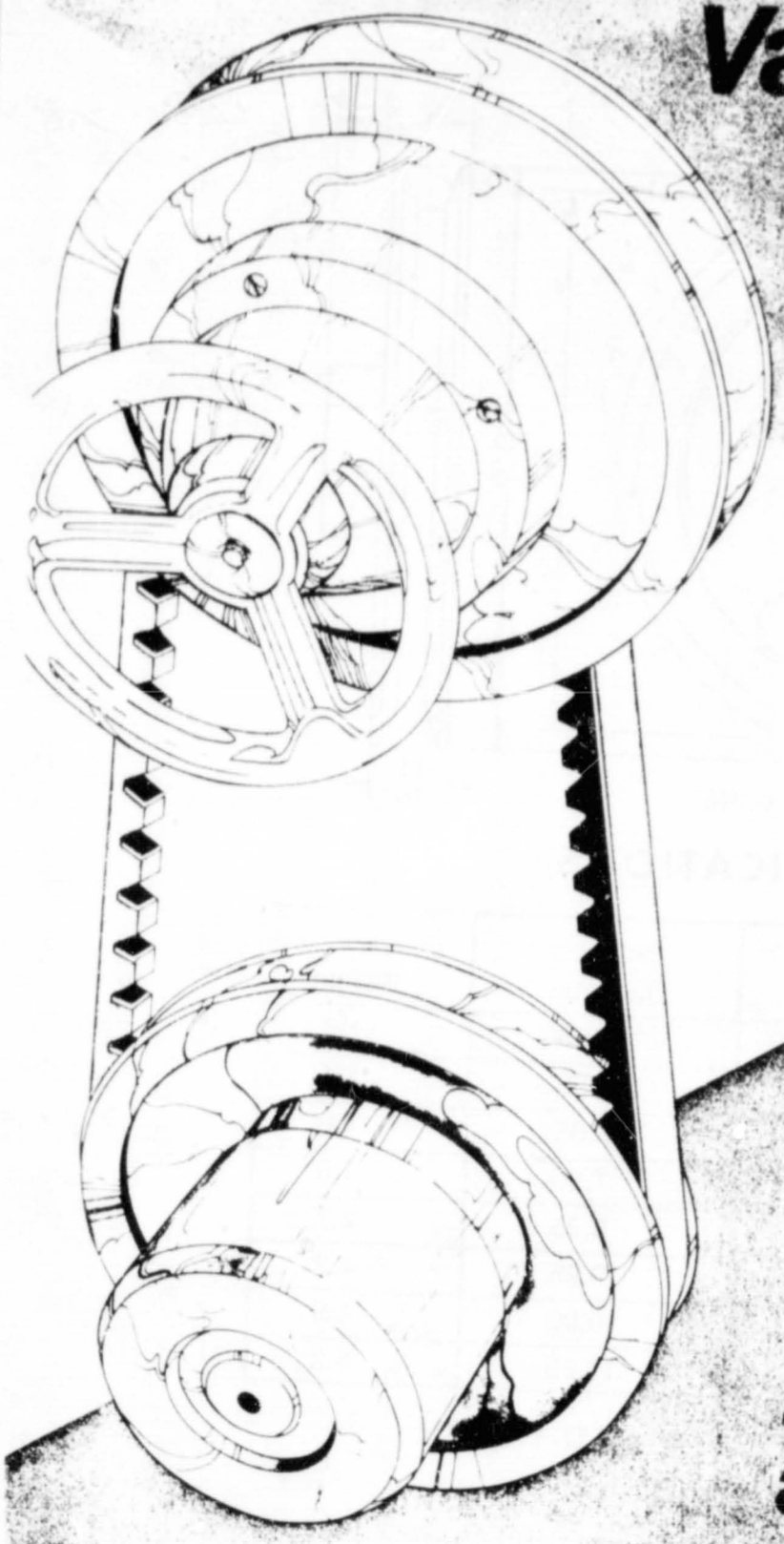
STOCK BORES 3/4 AND 1 INCH

CLIMAX METAL PRODUCTS CO.

30202 LAKELAND BLVD. • WICKLIFFE, OHIO 44092

AREA CODE 216 - 585-0300

Hi-Lo Variable Speed Pulley Drives



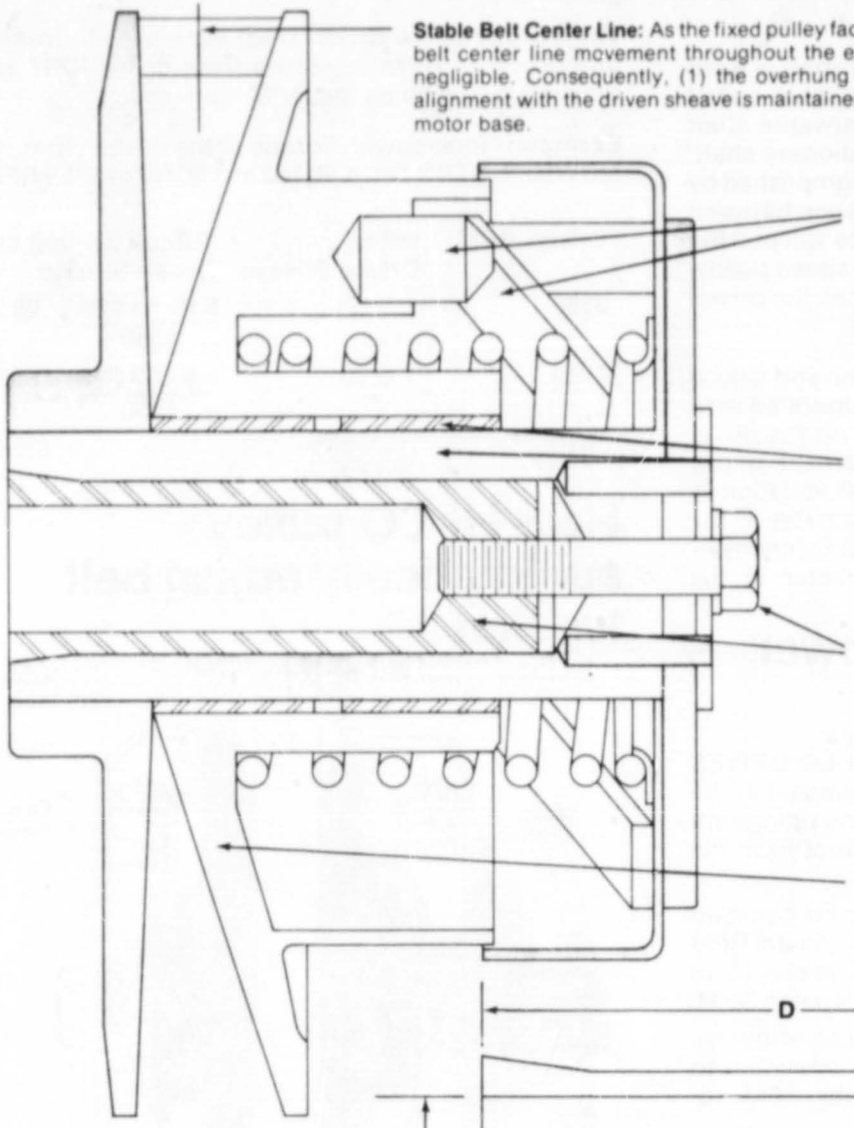
hi-lo

Hi-Lo Manufacturing Company
1700-G Freeway Blvd.
Minneapolis, MN 55430
Phone: 612-566-2510

... with automatic belt tensioning.

Asymmetric Adjustable Center Distance Pulleys

offer outstanding features



Stable Belt Center Line: As the fixed pulley face is nearly perpendicular, the belt center line movement throughout the entire pitch diameter range is negligible. Consequently, (1) the overhung load is minimal and (2) belt alignment with the driven sheave is maintained while using an in-line sliding motor base.

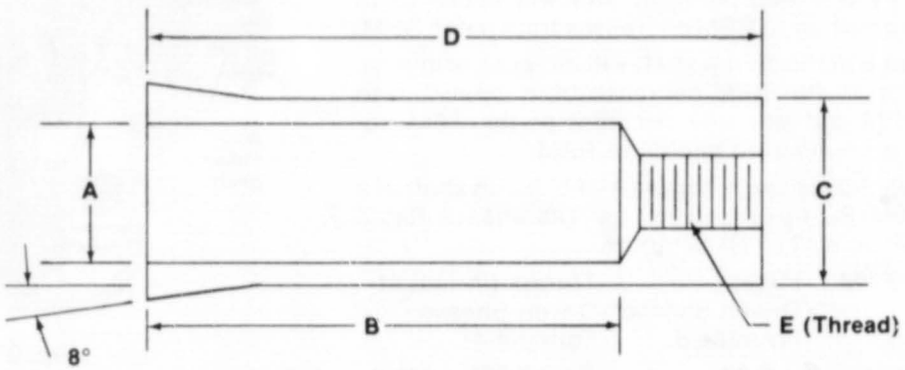
Automatic Torque Controlled Belt Tensioning: The cam and cam follower mechanism adjusts belt tension to the load requirement and stabilizes the pitch diameter setting regardless of load fluctuations. The peripheral support of the cam followers also reduce wear on the sliding face bearing surface.

Lubrication-Free: The combination of a stainless steel pulley shaft and steel-backed non metallic bushings eliminate the necessity of lubrication and prevent fretting corrosion.

Interchangeable Collet Bushings: (1) Eliminate side wobble and vibration due to bad fits between the motor shaft and pulley shaft and (2) ease assembly to and disassembly from the motor shaft. Tighten bolt to lock pulley on shaft. Loosen bolt and tap to remove pulley.

Design Simplicity: The reduction of parts in the single sliding face design minimizes the possibility of a crucial breakdown and (2) simplifies repairs and replacement of parts.

Collet Bushings



Collet No.	A Standard Bore Sizes (Inches)											B in.	C in.	D in.	E in.
	½	⅝	¾	⅞	1	1⅛	1¼	1⅜	1½	1⅝	1⅞				
7707	X	X	X	X								2½	1	3¼	⅜-16
508		X	X	X	X	X						3	1¼	3¾	⅜-16
510			X	X	X	X	X	X				3⅝	1½	4⅝	½-13
512					X	X	X	X	X	X		4	1¾	5	½-13
7713								X	X	X	X	4⅞	2⅛	6⅛	⅝-11

Hi-Lo Manufacturing Company
1700-G Freeway Blvd.
Minneapolis, MN 55430
Phone: 612-566-2510

Hi-Lo pulley drive types

There are two basic types of variable speed pulley drives: ADJUSTABLE CENTER DISTANCE and FIXED CENTER DISTANCE.

Adjustable Center Distance Drive. One shaft is fixed and the other can be moved. The variable speed pulley is normally mounted on the movable shaft and a fixed diameter sheave on the stationary shaft. Speed variation of the driven shaft is accomplished by mechanically changing the center distance between the shafts. An increase in center distance will pull the belt to a smaller diameter in the variable speed pulley. This increases the drive ratio and reduces the driven shaft RPM. See Fig. 5.

Fixed Center Distance Drive. The driver and driven shafts are both stationary. A manually-operated variable pitch pulley is normally mounted on the driver shaft and an automatic variable pitch diameter pulley is mounted on the driven shaft. Speed variation is accomplished by changing the belt diameter in the manually operated pulley. This causes a compensating opposite change of the belt diameter in the automatic pulley. See Fig. 6.

Hi-Lo Pulley Horsepower Ratings

ADJUSTABLE CENTER DISTANCE HI-LO DRIVES are rated at the horsepower they will transmit at the driven shaft's maximum RPM. The catalog ratings are based on using either 1750 or 1150 RPM motors as the driver.

The Horsepower at the driven shaft will be constant from the maximum to the mean RPM (Mean RPM = Max. RPM + Min. RPM/2) and will decrease in direct proportion to RPM decreases from mean RPM.

The Torque at the driven shaft will increase in inverse proportion to the RPM decrease from maximum to mean RPM and will stay constant as the RPM decreases from mean to minimum RPM.

Example: Horsepower-Torque at the driven shaft of a Model 1590 Pulley driving an 11.6" Dia. sheave. Rated at 5.0 HP on a 1750 RPM motor.

Driven RPM	HP at Driven Sheave Formula 3	Torque (in-lbs) at Driven Sheave Formula 4
1300	5.00	$\frac{5 \times 63{,}025}{1300} = 242.4$
867	5.00	$\frac{5 \times 63{,}025}{867} = 363.5$
433	$\frac{363 \times 433}{63{,}025} = 2.5$	363.5

FIXED CENTER DISTANCE HI-LO DRIVES are rated at the driven pulley when the drive is at a 1:1 ratio (running at the driver RPM).

Hi-Lo Manufacturing Company
1700-G Freeway Blvd.
Minneapolis, MN 55430
Phone: 612-566-2510

The Horsepower at the driven shaft will be constant as the driven RPM increases from the driver RPM and will decrease in direct proportion to decreases from driver RPM.

The Torque at the driven shaft decreases in inverse proportion to RPM increases from driver RPM and remains the same as the RPM decreases.

Example: Horsepower-Torque at the driven shaft of a MCW90/106TBR Drive. Rated at 5.00 HP at 1750 RPM.

Driven RPM	HP at Driven Sheave	Torque (in-lbs) at Driven Sheave
3380	5.00	$\frac{5.0 \times 63{,}025}{3380} = 93.2$
1750	5.00	$\frac{5.0 \times 63{,}025}{1750} = 180.0$
410	$\frac{180 \times 410}{63{,}025} = 1.2$	180.0

How HI-LO pulleys automatically adjust belt tension

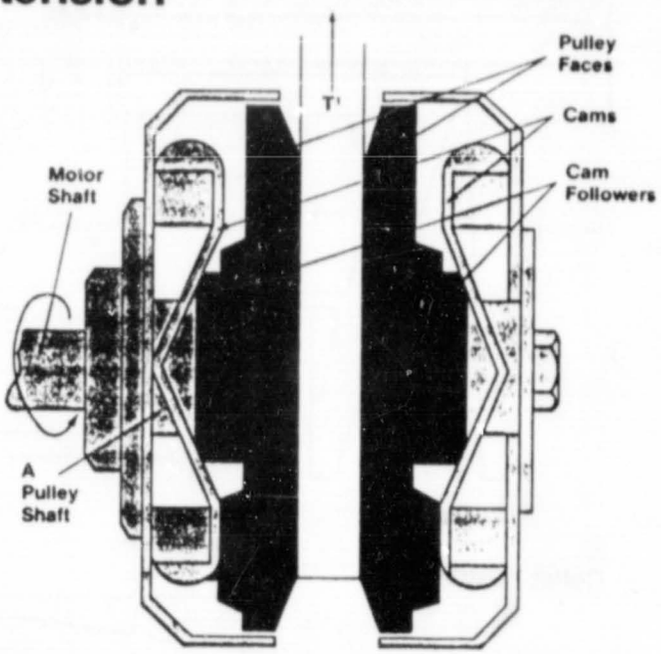


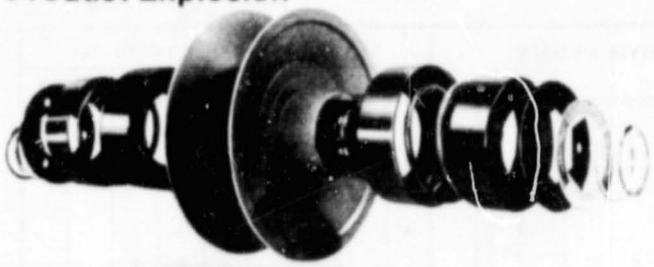
Fig. 3 Hi-Lo Pulley

When a Hi-Lo Pulley is mounted on a motor shaft, the pulley shaft, with the cams attached, rotates in the same direction. The pulley faces, with integral cam followers, are free to move axially and to rotate on the pulley shaft. Due to the effect of the tight side belt tension, the pulley faces will rotate in an opposite direction to the motor shaft until the cam followers contact the cams. With an increase in belt tension requirement because of an increased load, the cam followers will move up the cams. This movement forces the pulley faces axially towards the belt, reducing the groove width, forcing the belt to a slightly larger diameter and thereby increasing belt tension. A decreased load has the opposite effect.

Heavy Duty Variable Speed Pulley

Hex II Series; DriveR and DriveN Pulleys: 7½-30 HP

Product Explosion





DISASSEMBLED VIEW OF TWO SIDE MOVEABLE HEX II PULLEY

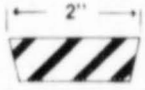
FACTORY STOCK BORES

10 HP	1-3/8"
15 thru 20 HP	1-5/8", 1-7/8"
25 thru 30 HP	1-5/8", 1-7/8", 2-1/8"

Hex II Features:

1. A rubber bonded steel shaft transmitting torque through six sides to a matching broached hub.
2. No drive keys to wear and fail.
3. No lubrication required.
4. No lubrication present to spill or leak onto the application.
5. Precision machined cast iron flanges for cooler performance and longer belt life.
6. Flange centering device to eliminate belt misalignment.
7. A unique tapped center hole for easy pulley removal with a simple jack screw.
8. Every pulley is carefully balanced before shipping.
9. Separate pulley designs for driven and driver pulley requirements.
10. Designed to withstand the heavy duty applications found in foundries and textile plants.

DriveR Pulley — for mounting on motor shaft

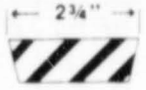


One Side Moveable

Lovejoy Belt Series 20
Industry Series 3230V

Model Number	Horsepower At 1750 RPM
13210	10
13215	15
13220	20
13225	25
13230	30
13230	30HD

MAXIMUM SPEED: 3550
SPEED RATIO: 2.3 to 1
MAXIMUM P.D. 10.35"
MINIMUM P.D. 4.43"
MINIMUM MOTOR TRAVEL FOR FULL RANGE: 4-1/4"

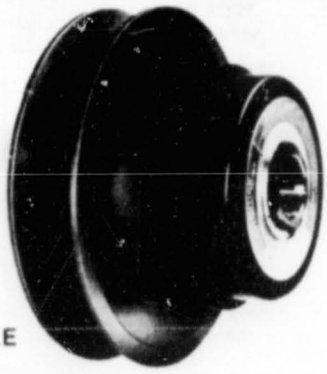


One Side Moveable

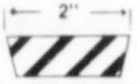
Lovejoy Belt Series 27
Industry Series 4430V

Model Number	Horsepower At 1750 RPM
14410	10
14415	15
14420	20
14425	25
14430	30
14430	30HD

MAXIMUM SPEED: 3300
SPEED RATIO: 2.7 to 1
MAXIMUM P.D. 12.1"
MINIMUM P.D. 4.43"
MINIMUM MOTOR TRAVEL FOR FULL RANGE: 5-5/8"



ONE-SIDE MOVEABLE

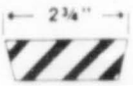


Two Side Moveable

Lovejoy Belt Series 20
Industry Series 3230V

Model Number	Horsepower At 1750 RPM
23210	10
23215	15
23220	20
23225	25
23230	30
23230HD	30HD

MAXIMUM SPEED: 3550
SPEED RATIO: 2.3 to 1
MAXIMUM P.D. 10.35"
MINIMUM P.D. 4.43"
MINIMUM MOTOR TRAVEL FOR FULL RANGE: 4-1/4"

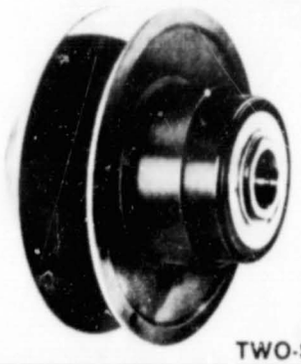


Two Side Moveable

Lovejoy Belt Series 27
Industry Series 4430V

Model Number	Horsepower At 1750 RPM
24410	10
24415	15
24420	20
24425	25
24430	30
24430HD	30HD

MAXIMUM SPEED: 3300
SPEED RATIO: 2.7 to 1
MAXIMUM P.D. 12.1"
MINIMUM P.D. 4.43"
MINIMUM MOTOR TRAVEL FOR FULL RANGE: 5-5/8"



TWO-SIDE MOVEABLE

DriveN Pulley — where the driveR pulley is a fixed sheave and the driveN pulley is spring loaded

Only available as a two-side moveable pulley



Lovejoy Belt Series 27
Industry Series 4430V

Model Number	Horsepower At 1750 RPM
SG2-100-4430	7½ (HD) thru 10
SG2-200-4430	15 thru 20
SG2-300-4430	25 thru 30

MAXIMUM SPEED: 3300 rpm
SPEED RATIO: 2.7 to 1
MAXIMUM P.D. 12.1"
MINIMUM P.D. 4.43"
MINIMUM MOTOR TRAVEL FOR FULL RANGE: 4-3/4"



Lovejoy Belt Series 20
Industry Series 3230V

Model Number	Horsepower At 1750 RPM
SG2-100-3230	7½ (HD) thru 10
SG2-200-3230	15 thru 20
SG2-300-3230	25 thru 30

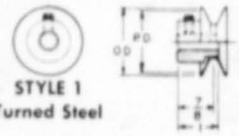
MAXIMUM SPEED: 3550 rpm
SPEED RATIO: 2.3 to 1
MAXIMUM P.D. 10.35"
MINIMUM P.D. 4.43"
MINIMUM MOTOR TRAVEL FOR FULL RANGE: 4"

Lovejoy Engineering is available to assist you in all special application requirements, call 312-852-0500 and ask for Pulley Engineering.

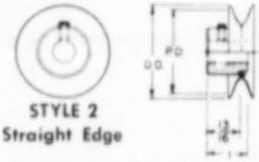
OHIO PULLEYS TYPE O



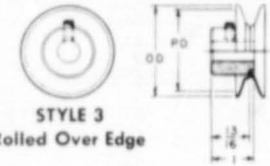
3L (Same as "O")



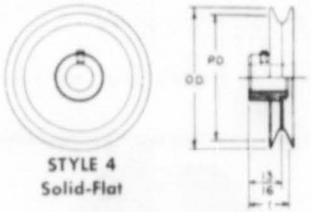
STYLE 1
Turned Steel



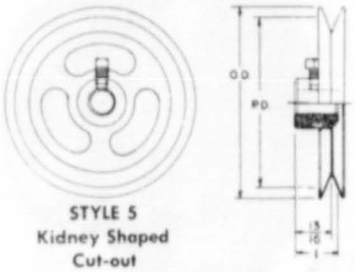
STYLE 2
Straight Edge



STYLE 3
Rolled Over Edge



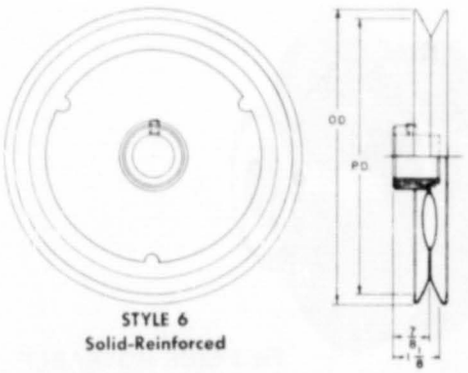
STYLE 4
Solid-Flat



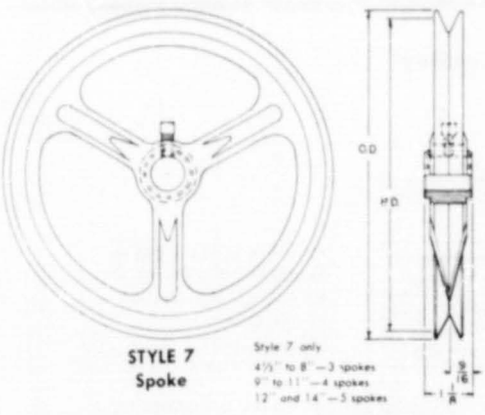
STYLE 5
Kidney Shaped
Cut-out

PART NUMBER TYPE O	O.D. (INCHES)	P.D. (INCHES)	STYLE NUMBER							STANDARD BORE MARKED "x"								
										¼	5/16	⅜	7/16	½	⅝	¾	⅞	1
150	1.5	1.33	1							x		x		x				
160	1.625	1.45	1							x		x		x				
175	1.750	1.58	1							x		x		x				
180	1.875	1.7	1	2						x		x		x	x			
200	2.00	1.83		2	3					x		x		x	x	x		
225	2.250	2.08		2	3									x	x	x	x	x
250	2.500	2.33		2	3									x	x	x	x	x
275	2.750	2.58		2	3									x	x	x	x	x
300	3.00	2.83		2	3									x	x	x	x	x
350	3.50	3.33		2	3	4								x	x	x	x	x
375	3.75	3.58		2	3	4								x	x	x	x	x
400	4.00	3.83				4								x	x	x	x	x
450	4.50	4.33				4	5							x	x	x	x	x
500	5.00	4.83				4	5		7					x	x	x	x	x
550	5.50	5.33				4	5	6						x	x	x	x	x
600	6.00	5.83						6	7					x	x	x	x	x
700	7.00	6.83						6	7					x	x	x	x	x
800	8.00	7.83						6	7					x	x	x	x	x
900	9.00	8.83						6	7					x	x	x	x	x
1000	10.00	9.83							7					x	x	x	x	x
1100	11.00	10.83							7					x	x	x	x	x
1200	12.00	11.83							7					x	x	x	x	x
1400	14.00	13.83							7					x	x	x	x	x
			BORE DIAMETER—INCHES—							¼	5/16	⅜	7/16	½	⅝	¾	⅞	1

All pulleys 3" and smaller furnace brazed. Styles 4 and 6 are normally argon welded to hub. Other sizes and pitch diameters available on request.



STYLE 6
Solid-Reinforced



STYLE 7
Spoke

Style 7 only
4½" to 8" — 3 spokes
9" to 11" — 4 spokes
12" and 14" — 5 spokes

Hubs are machined from solid C.R.S.

Stampings are formed from prime C.R.S.

Sheaves are finished with zinc plate and bulk packaged in suitable shipping containers.

Standard setscrews with cup point. Socket head cup point setscrews in all solid pulleys. Square head cup point setscrews in all spoke pulleys.

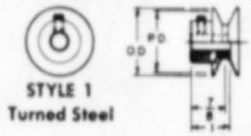
OHIO MANUFACTURING COMPANY

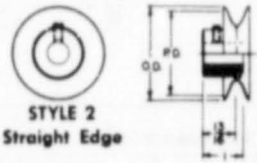
P.O. BOX 456 - 220 FIFTH AVENUE CHARDON, OHIO 44024
PHONE: (216) 286-9535

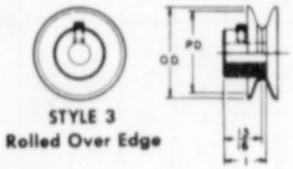
OHIO PULLEYS TYPE A

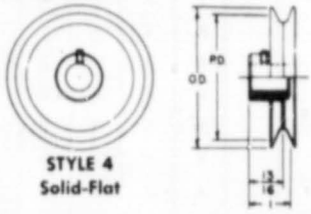
Combination Groove
3L (Same as "O")
4L (Same as "A")

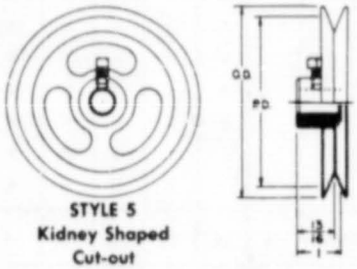



STYLE 1
Turned Steel


STYLE 2
Straight Edge

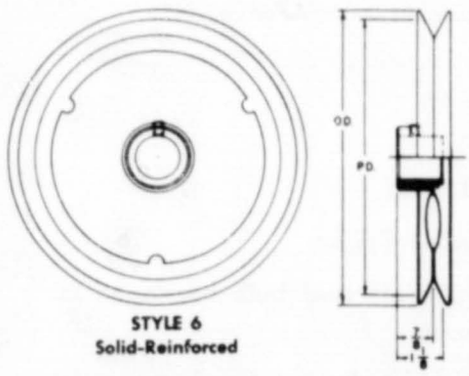

STYLE 3
Rolled Over Edge

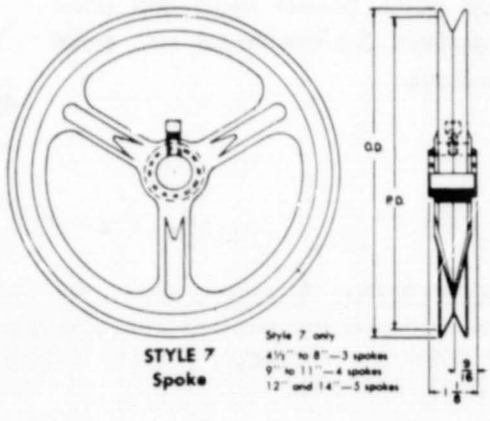

STYLE 4
Solid-Flat


STYLE 5
Kidney Shaped
Cut-out

PART NUMBER TYPE A	O.D. (INCHES)	P.D. 3L (INCHES)	P.D. 4L (INCHES)	STYLE NUMBER						STANDARD BORES MARKED "x"							
										¼	5/16	3/8	½	5/8	¾	7/8	1
180	1.875	1.3	1.6	2						x		x	x	x			
200	2.00	1.4	1.7	2	3							x	x	x			
225	2.25	1.7	2.0	2	3							x	x	x	x		
250	2.50	1.9	2.2	2	3							x	x	x	x		
275	2.75	2.2	2.5	2	3							x	x	x	x	x	x
300	3.00	2.4	2.7	2	3								x	x	x	x	x
325	3.25	2.7	3.0	2	3								x	x	x	x	x
350	3.50	2.9	3.2	2		4							x	x	x	x	x
375	3.75	3.2	3.5	2		4							x	x	x	x	x
400	4.00	3.4	3.7			4							x	x	x	x	x
450	4.50	3.9	4.2			4	5						x	x	x	x	x
500	5.00	4.4	4.7			4	5		7				x	x	x	x	x
550	5.50	4.9	5.2			4	5	6					x	x	x	x	x
600	6.00	5.4	5.7					6	7				x	x	x	x	x
700	7.00	6.4	6.7					6	7				x	x	x	x	x
800	8.00	7.4	7.7					6	7				x	x	x	x	x
900	9.00	8.4	8.7					6	7				x	x	x	x	x
1000	10.00	9.4	9.7						7				x	x	x	x	x
1100	11.00	10.4	10.7						7				x	x	x	x	x
1200	12.00	11.4	11.7						7				x	x	x	x	x
1400	14.00	13.4	13.7						7				x	x	x	x	x
				BORE DIAMETER—INCHES—						¼	5/16	3/8	½	5/8	¾	7/8	1

All pulleys 3" and smaller furnace brazed. Styles 4 and 6 are normally argon welded to hub. Other sizes and pitch diameters available on request.


STYLE 6
Solid-Reinforced



STYLE 7
Spoke

OHIO MANUFACTURING COMPANY

Hubs are machined from solid C.R.S.

Stampings are formed from prime C.R.S.

Sheaves are finished with zinc plate and bulk packaged in suitable shipping containers.

Standard setscrews with cup point. Socket head cup point setscrews in all solid pulleys. Square head cup point setscrews in all spoke pulleys.

OHIO MANUFACTURING COMPANY

P.O. BOX 456 - 220 FIFTH AVENUE CHARDON, OHIO 44024
PHONE: (216) 286-9535

OHIO PULLEYS

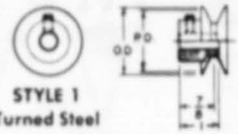
TYPE B



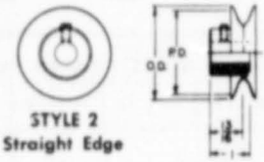
Combination Groove

4L (Same as "O")

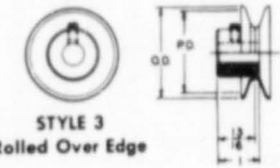
5L (Same as "B")



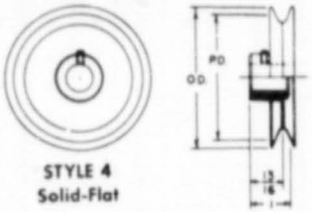
STYLE 1
Turned Steel



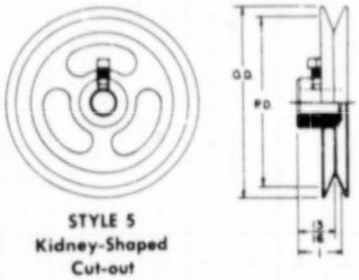
STYLE 2
Straight Edge



STYLE 3
Rolled Over Edge



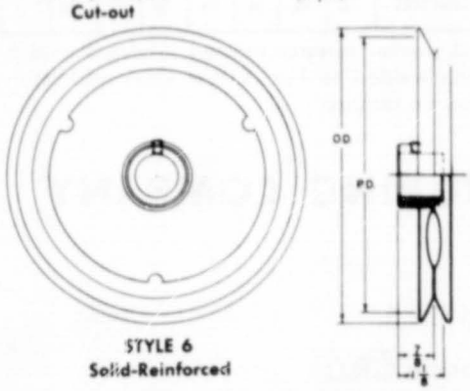
STYLE 4
Solid-Flat



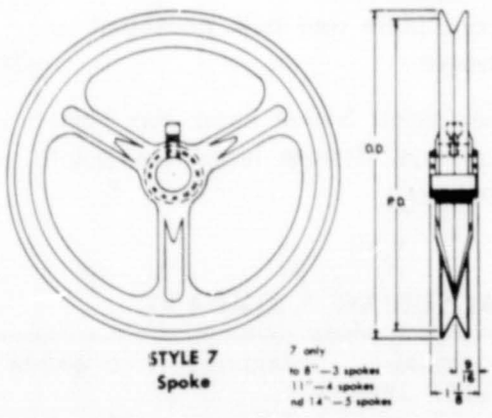
STYLE 5
Kidney-Shaped
Cut-out

PART NUMBER TYPE B	O.D. (INCHES)	P.D. 4L (INCHES)	P.D. 5L (INCHES)	STYLE NUMBER						STANDARD BORES MARKED "x"					
										⅜	½	⅝	¾	⅞	1
250	2.5	1.7	2.1	2	3						x	x	x	x	x
275	2.75	2.0	2.4	2	3						x	x	x	x	x
300	3.00	2.2	2.6	2	3						x	x	x	x	x
325	3.25	2.5	2.9	2	3						x	x	x	x	x
350	3.50	2.7	3.1	2	3						x	x	x	x	x
375	3.75	3.0	3.4		3	4					x	x	x	x	x
400	4.00	3.2	3.6		3	4					x	x	x	x	x
450	4.50	3.7	4.1			4	5				x	x	x	x	x
500	5.00	4.2	4.6			4	5	6	7		x	x	x	x	x
550	5.50	4.7	5.1			4	5	6			x	x	x	x	x
600	6.00	5.2	5.6					6	7		x	x	x	x	x
700	7.00	6.2	6.6					6	7		x	x	x	x	x
800	8.00	7.2	7.6					6	7		x	x	x	x	x
900	9.00	8.2	8.6					6	7		x	x	x	x	x
1000	10.00	9.2	9.6						7		x	x	x	x	x
1100	11.00	10.2	10.6						7		x	x	x	x	x
1200	12.00	11.2	11.6						7			x	x	x	x
1400	14.00	13.2	13.6						7			x	x	x	x
BORE DIAMETER—INCHES—										⅜	½	⅝	¾	⅞	1

All pulleys 3" and smaller furnace brazed. Styles 4 and 6 are normally argon welded to hub. Other sizes and pitch diameters available on request.



STYLE 6
Solid-Reinforced



STYLE 7
Spoke

7" only
to 8" — 3 spokes
11" — 4 spokes
nd 14" — 5 spokes

Hubs are machined from solid C.R.S.

Stampings are formed from prime C.R.S.

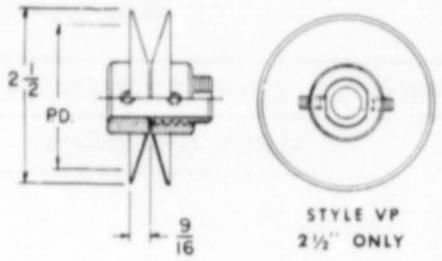
Sheaves are finished with zinc plate and bulk packaged in suitable shipping containers.

Standard setscrews with cup point. Socket head cup point setscrews in all solid pulleys. Square head cup point setscrews in all spoke pulleys.

OHIO MANUFACTURING COMPANY

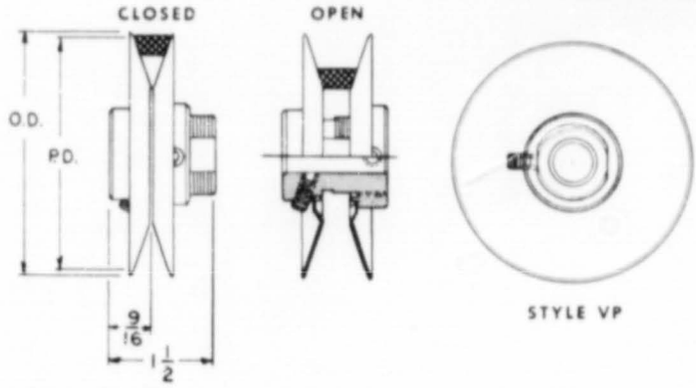
P.O. BOX 456 - 220 FIFTH AVENUE CHARDON, OHIO 44024
PHONE: (216) 286-9535

OHIO PULLEYS VARIABLE PITCH PULLEYS



PART NUMBER	O.D. (INCHES)	P.D. 4L CLOSED (INCHES)	P.D. 4L OPEN (INCHES)	P.D. 3L CLOSED (INCHES)	P.D. 3L OPEN (INCHES)	BORE (INCHES)
VP2500	2½	—	—	2.4	1.6	⅜ ½
VP3250	3¼	3	2	—	—	½ ⅝
VP3500	3½	3.25	2.25	—	—	½ ⅝
VP3750	3¾	3.5	2.5	—	—	½ ⅝
VP4000	4	3.7	2.7	—	—	½ ⅝
VP4250	4¼	4	3	—	—	½ ⅝

3¼" and Larger—⅝" Bore furnished with $^{3}/_{16}$" Keyway
Standard hub thread—1 $^{1}/_{16}$-24 (also available—1⅛-16)



Construction—16 gauge flanges securely welded on hub and nut.

Hub and nut made from C.R.S.

$^{5}/_{16}$-18 socket head set screws.

Nut set 2½ turns open.

Flanges are rolled on an arbor between two forms to run true with bore.

STANDARD KEYWAYS	
Bore	Keyway
$^{1}/_{2}$	$^{1}/_{8}$ x $^{1}/_{16}$
$^{5}/_{8}$ through $^{7}/_{8}$	$^{3}/_{16}$ x $^{3}/_{32}$
1	$^{1}/_{4}$ x $^{1}/_{8}$

OHIO MANUFACTURING COMPANY

P.O. BOX 456 - 220 FIFTH AVENUE CHARDON, OHIO 44024
PHONE: (216) 286-9535

The ROGERS Mfg. Co.



Area Code 216
Phone: 376-5113

PLANT & MAIN OFFICE: 275 N. ARLINGTON ST.,
AKRON, OHIO 44305

Company Name

THE ROGERS MFG. CO.
Progressive Pulley Division
275 North Arlington Street
Akron, Ohio 44305

Telephone

(216) 376-5113

Name of Items

Single, multiple and poly-v groove pulleys

Function of Items

To provide drive for accessories - generators, alternators, fan belts, etc.

Production Status

Current production for conventional vehicles. Have in-house Research and Development Department as well as ability to provide prototypes for experimental use.

Availability

On demand for pulleys we currently supply. Two to four weeks after sample approval from customer's drawing.

ipm pulleys — replacement parts for prestolite alternators



IPM NO. 1B-5000
PULLEY
3/8 DG X 2.63 X .67
Former No. 3851
OEM No. C5TZ-10344E



IPM NO. 1B-5001
PULLEY
3/8 DG X 2.84 X .67
Former No. 3853
OEM No. C5AZ-10344L,
GP-494



IPM NO. 1B-5002
PULLEY
3/8 SG X 2.84 X .67
Former No. 3850
OEM No. C5AZ-10344F
GP-467



IPM NO. 1B-5003
PULLEY 70 AMP.
3/8 SG X 3.15 X .67
Former No. 01-2601
OEM No. D2OZ-10344A
GP-511



IPM NO. 1B-5004
PULLEY
3/8 SG X 2.50 X .67
Former No. 3852
OEM No. C5AZ-10344G,
GP-493



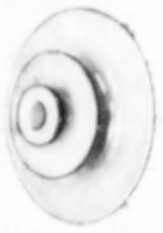
IPM NO. 1A-5004
PULLEY 3/8 DG x 2.750
Former No. 2586
OEM No. PU-587



IPM NO. 1B-5004
PULLEY 3/8SG x 2.50 x .067
Former No. 3852
OEM No. PU-585



IPM NO. 1B-5005
PULLEY 90AMP
3/8DG x 3 x .67
Former No. 01-2540
OEM No. D2AF-10A352AA



IPM NO. 1B-5006
PULLEY/FAN
3/8SG x 5.50 x .67
Former No. 3075
OEM No. C3SF-10344A,B



IPM NO. 1B-5011
PULLEY
1/2 DG X 3.07 X .67
Former No. 3854
OEM No. C5TZ-10344J/L
GP-471



IPM NO. 1A-5000
PULLEY 3/8" DG
x 2 5/16" OD x
.670 Bore
Former No. 3171
OEM No. 1944312



IPM NO. 1A-5001 HD
PULLEY 1/2" DG
x 3" OD x .875 Bore
Former No. 01-1601
OEM No. 1953071



IPM NO. 1A-5002
PULLEY 1/2" SG
x 2 3/4" OD x
.670 Bore
Former No. 2588
OEM No. 1961291



IPM NO. 1A-5003
PULLEY 3/8" SG
x 2 3/4" x .670 Bore
Former No. 2582
OEM No. 1949355



IPM NO. 1A-5004
PULLEY 3/8" DG
x 2 3/4 OD x
.670 Bore
Former No. 2586
OEM No. 1961408



IPM NO. 1A-5005
PULLEY 3/8" SG
x 3" OD x .670 Bore
Former No. 1268
OEM No. 1949358



IPM NO. 1A-5006 HD
PULLEY 1/2" DG
x 3" OD x .670 Bore
Former No. 7688
OEM No. –



IPM NO. 1A-5007 HD
PULLEY 5/8" DG
x 3 5/16," OD x
.670 Bore
Former No. 7685
OEM No. –



IPM NO. 1A-5008 HD
PULLEY 3/4" SG
x 2 13/16" OD x
.670 Bore
Former No. 7686
OEM No. –

wabash ipm
200 E. Daniels Road
Palatine, Illinois 60067
(312) 359-4710

ipm replacement parts for motorola alternators

pulleys



IPM NO. 1C-5000
PULLEY
3/8 SG x 3-3/16 OD
Former No. 2865
OEM No. 2095005



IPM NO. 1C-5001
PULLEY
3/8 DG x 3-1/4 OD
Former No. 2973
OEM No. 2095059



IPM NO. 1C-5002
PULLEY
3/8 SG x 2-3/4 OD
Former No. 8050
OEM Nos. 2095430
2444478



IPM NO. 1C-5003
PULLEY
1/2 DG x 3-5/16 OD
Former No. 8083
OEM No. 2098272



IPM NO. 1C-5004
PULLEY
3/8 DG x 3-1/4 OD
Former No. 6282
OEM No. 2875711



IPM NO. 1C-5005
PULLEY/FAN 100A
3/8 DG x 2-7/8 OD
OEM No. 3974327
4091243



IPM NO. 1C-5006
PULLEY
3/8 DG x 2-3/4 OD
OEM No. 3656571



IPM NO. 1F-5000
PULLEY 3/8 SG X 2.625
Former No. 6260
OEM No. 7-1
AMC 933664



IPM NO. 1F-5001
PULLEY 3/8 DG X 2.875
Former No. 01-6501
OEM No. 7-37



IPM NO. 1F-5002
PULLEY 3/8 SG X 2.875
Former No. 01-6502
OEM No. 7-5
AMC 3204139

•wabash• ipm
200 E. Daniels Road
Palatine, Illinois 60067
(312) 359-4710

RELAYS, AC & DC

UP TO 300 V, AC & DC

(CODE **RE**)

TRADE-OFFS IN RELAY SELECTION

Understanding design compromises in relay selection can reduce ultimate product costs or represent significant gains in product performance for dollar expended. Here is how the most common pitfalls can be avoided.

In selecting relays for a particular application or class of applications, you must consider the circuit design and the operating environment as well as the relay.

Cost and relay sensitivity, switching capability, relay performance, and mechanical arrangement represent the primary trade-offs in relay selection. But the particular application may place a premium upon other considerations that ordinarily would be of secondary importance. For example, interchangeability (standardization or availability when two or more sources of supply must be considered); operating characteristics such as pull-in, drop-out, or the ratio of pull-in to drop-out; operate or release time; and contact bounce may be very important. For appliance design UL or CSA construction may be controlling. Each of these trade-offs should be examined with reference to the parameters that have the greatest influence upon them.

Cost and Sensitivity

Cost is an important consideration in any design but is becoming an even more important factor in relay selection with the advent of inexpensive and widely available solid-state devices and integrated circuits. The cost of a relay is a function of sensitivity (coil watts or milliwatts dissipated to reliably perform the switching function), relay adjustment time, mechanical complexity or enclosure, wire cost, and production volume.

For a given sensitivity range, a relay type that can be adjusted to operate properly must be selected. Extra cost will be involved if the relay selected is more sensitive than required or if it is required to operate very near its limit of sensitivity. The graph of Fig. 1 shows adjustment time expected for a typical relay versus required sensitivity

A.C. relays, when low volt-ampere operation is desired, may require a unit utilizing components specially designed for low core losses or particularly advantageous pole shading arrangements.

The next most important cost trade-off is coil cost. For a given bobbin, a 10,000-ohm coil always costs more than a 2000-ohm coil. Wire sizes smaller than #43 or #45 usually require special winding techniques. See Fig. 2.

It is seldom economical to buy increased impedance by specifying high-resistance coils when other circuit changes would accomplish the same purpose. Relays may often be obtained at a lower cost by specifying a lower coil resistance, provided that the impedance loss can either be made up elsewhere or can be ignored without overheating the coil. In this way operating voltage may often be traded off against the cost of higher coil resistance. The same relay will have a much less expensive coil to operate 24 volts d.c. than 100 volts d.c.

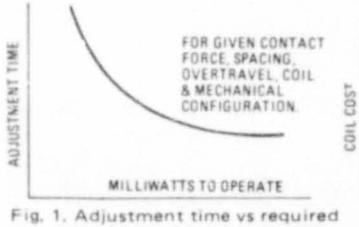


Fig. 1. Adjustment time vs required sensitivity for typical relay.

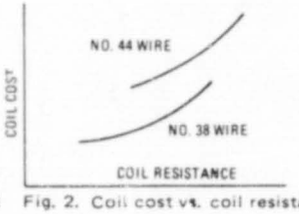


Fig. 2. Coil cost vs. coil resistance.

On the other hand, production volume alone may be traded off against the cost of an otherwise expensive relay. Use of specially tooled components, automatic winding equipment, and automated assembly techniques will reduce costs. Operator skill in adjusting a particular high-volume relay results in lower costs.

Production volume may be traded off against a complete redesign, tooled specifically for the application. Other trade-offs, e.g. switching capability, are very important.

Switching Capability

Switching capability is another fundamental circuit consideration. Up to eight-poles, double-throw with isolated contacts are commonly available in various relay types and the need for multi-pole operation must be traded off against cost to perform a given function, with a given interchangeability, reliability, and mechanical configuration. Sometimes several single-pole relays are less expensive than a single multi-pole relay, although this may call for more power and space for the switching.

Performance

Primary performance factors are pull-in and drop-out and the spread between them. Other factors to consider are type, size, material of contacts, mechanical life, use of materials, and noise or hum in a.c. relays.

The absolute amount of pull-in and drop-out current or voltage is closely associated with performance and cost and may be traded off for each. Performance will be improved by specifying characteristics applicable to the particular relay. A too close ratio of pull-in to drop-out (less than 2/1) or too wide (greater than 8/1) a ratio will result in either increased cost or decreased performance.

When very close ratio or high drop-outs are required, this may be traded off against high contact forces on the normally open contacts. Adjustable residuals or non-magnetic separators to hold the armature a controlled distance from the pole face can be incorporated. The use of these materials usually must be traded off against higher cost and a loss in performance.

The use of contact material is fundamental to relay performance. Contact trade-offs must be used in the light of three general switching classes; dry-circuit switching, where the current and voltage are so low that practically the same contact performance can be obtained from switching no load; low-power switching from about 100 mA up to 3 to 5 A; and power switching from about 5 A and over.

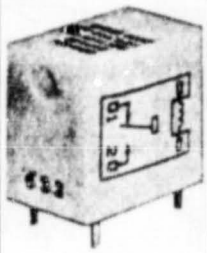
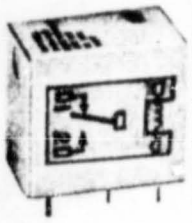
Dry-circuit switching generally requires precious metals such as gold, palladium, platinum, or alloys of such metals. The use of silver or silver alloys is usually a poor trade-off. Occasionally it is possible to trade off higher gram pressure, extra contact wipe, short required life, or less severe operating environment against the higher cost of more expensive contacts. Sometimes contact configuration may be traded for material when it is possible to get localized high pressures. Crossbar contacts are an example—they also help with contact alignment problems and are generally a good trade-off for dry circuits. But the ability to stay clean, to resist mechanical wear, and to exhibit low-contact resistance usually overrides other trade-offs for dry-circuit switching. Sometimes the use of gold plating or contacts made by bonding a surface material to a base material may reduce cost without degrading performance.

Low-power switching is more subject to trades because there are so many types of relays available in this class and because such a wide variety of contacts is available. Silver combined with cadmium oxide (usually 90%—10% or 85%—15%) has become popular but fine silver, coin silver, and other alloys should be traded off against cost and tested in the application for performance. Usually the difference in contact cost is such that a contact material compromise becomes a poor trade-off against superior performance.

Relay Selector Chart

CDE CORNELL-DUBILIER

CORNELL DUBILIER ELECTRONICS
DIVISION OF FEDERAL PACIFIC ELECTRIC COMPANY
118 E. Jones St., Fuquay Varina, N.C. 919 552-2281

Style	Miniature		
			
TYPE	600 SERIES	613 SERIES	813 SERIES
CONTACT RATING	low level to 5 amps	10 amps @ 240 VAC/28 VDC	10 amps @ 240 VAC/28 VDC
CONTACT CONFIGURATION	up to DPDT	SPDT	SPST or SPDT
NOMINAL OPERATING POWER	100 MW - SPDT 360 MW - DPDT	240 MW	240 MW
MAX. POWER INPUT	1 watt	1 watt	1 watt
MIN. OPERATING POWER	60 MW - SPDT 200 MW - DPDT	135 MW	135 MW
NOMINAL OPERATING TIME	10 MS	10 MS	10 MS
NOMINAL RELEASE TIME	8 MS	8 MS	8 MS
LIFE-MECHANICAL	Over 50,000,000	Over 50,000,000	Over 50,000,000
LIFE-ELECTRICAL @ RATED LOAD	100,000 Min.	100,000 Min.	100,000 Min.
MAX. COIL RESISTANCE	12,000 ohms	12,000 ohms	12,000 ohms
MOUNTING	PC	PC	PC
APPROX. WEIGHT	1.0 oz.	1.0 oz.	1.5 oz.
CLASS NUMBER	240.05	240.07	240.19

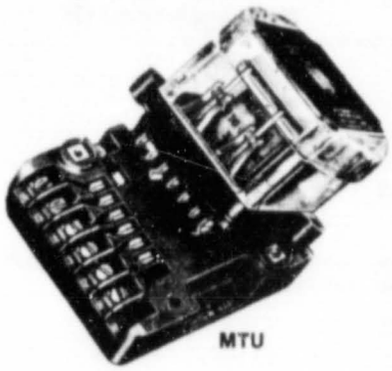
Relay Selector Chart

CORNELL DUBILIER ELECTRONICS
DIVISION OF FEDERAL PACIFIC ELECTRIC COMPANY
118 E. Jones St., Fuquay Varina, N.C. 919 552-7281

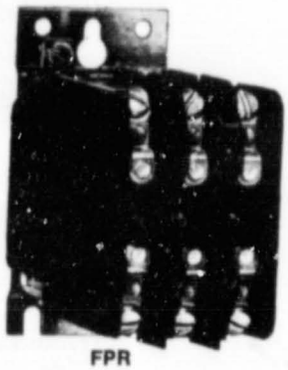
Style	General Purpose		Time Delay
			
TYPE	**30 SERIES**	**20 SERIES**	**TS**
CONTACT RATING	10 amp @ 120 VAC/28 VDC	10 amp @ 120 VAC/28 VDC	10 amp @ 120 VAC/28 VDC
CONTACT CONFIGURATION	up to 3 PDT	up to 3 PDT	DPDT
NOMINAL OPERATING POWER	DC 1.2 W AC 2.75 VA	DC 1.2 W AC 2.75 VA	DC 1.2 W AD 2.75 VA
MAX. POWER INPUT	DC 1.5 W AC 3.0 VA	DC 1.5 W AC 3.0 VA	DC 1.5 W AC 3.0 VA
MIN. OPERATING POWER	DC 0.9 W AC 2.5 VA	DC 0.9 W AC 2.5 VA	DC 0.9 W AC 2.5 VA
NOMINAL OPERATING TIME	15 MS	15 MS	Adjustable
NOMINAL RELEASE TIME	10 MS	10 MS	25 MS
LIFE-MECHANICAL	Over 20,000,000	Over 20,000,000	Over 20,000,000
LIFE-ELECTRICAL @ RATED LOAD	100,000 Min.		100,000
MAX. COIL RESISTANCE	10,000 ohms	10,000 ohms	7,000 ohms
MOUNTING	Solder lug/stud octal plug	Solder lug, quick connect, plug-in	Octal plug
APPROX. WEIGHT	open 2.3 oz. — closed 3.0 oz.		6 oz.
CLASS NUMBER	**240.10**	**240.09**	**245.10**

ARROW HART DIVISION

AC & DC MAGNETIC CONTROL RELAYS



MTU



FPR



MR

AC & DC MAGNETIC RELAYS

ARROW HART AC and DC Magnetic Control Relays are Pilot-Duty Devices designed to switch coil currents of contactors, starters, solenoids and other control relays. Applications include machine tool control, refrigeration control and a wide variety of other industrial and commercial uses.

Available in a number of pole configurations to 8 poles maximum and in 10 and 15 ampere ratings to 300 volts maximum, these relays will provide long life and dependable operation.

TYPES MTS & MTU

Type MTS and MTU Gold Bonded Relays are available with combinations of contact configurations, normally open, normally closed, normally open and normally closed to six poles maximum and ratings up to 10 amperes 300 volts AC and 2 amperes 125 volts DC or .5 amperes 250 volts DC. Both the surface mounting type MTS, and receptacle mounting type MTU are available in two basic types:

ELECTRICALLY HELD: The relay coil is energized to operate the contacts and the current to the coil is maintained to hold the contacts in the operating position. This is the most common type of relay, and is most often used in 2 and 3 wire control circuits.

MECHANICALLY HELD: The relay coil is energized momentarily to operate the contacts which are then held in the operating position by means of a mechanical latch. A second coil is energized to trip the latch and open the relay contacts. No power is consumed while the relay is in the closed or latched position.

TYPE FPR & FPRL

Type FPR and FPRL Relays are available with combinations of contact configurations, normally open or normally closed to eight poles maximum and ratings up to 15 amperes 300 volts AC and 10 amperes 125 volts DC or 5 amperes 250 volts DC.

Type FPR Relays are designed for switching control circuit loads where hi-cycling and long life are required. The contacts are designed for power circuits up to 15 amperes.

Type FPRL Relays are of the same basic construction as the FPR Relays, except that the contacts are designed for "Low-Energy" circuits up to 10 amperes.

TYPE MR

Type MR Midget Relays are available with combinations of contact configurations, normally open, normally closed, normally open and normally closed to 4 poles maximum and ratings up to 10 amperes 220 volt AC and 2.5 amperes 125 volt DC or .5 amperes 250 volt DC. Designed primarily for use in 2-wire control circuits, they are available as unit only or in a compact NEMA 1 enclosure.

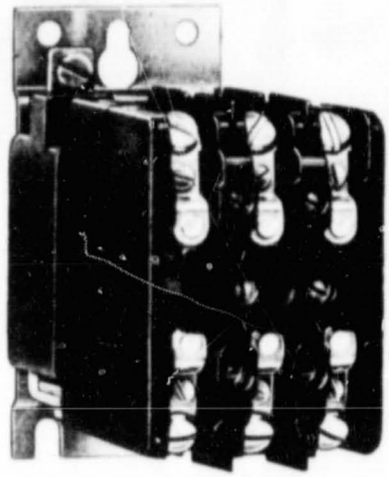
ARROW HART DIVISION

CROUSE-HINDS COMPANY/ARROW HART DIVISION/Hartford, Conn. 06101/(203) 249-8471

ARROW HART DIVISION

TYPE FPR & FPRL
AC & DC MAGNETIC RELAYS

DESCRIPTION, TECHNICAL DATA & DIMENSIONS



TYPE FPR & FPRL — MODEL N

AC Magnets are laminated, shaded pole, plunger type. Contacts are vertically mounted and operate directly from the movable armature which is free-floating via silicone rubber coupling for self-alignment and vibration control. Double break contacts are silver alloy and coils are of molded construction. Line and load wiring is straight through and accessible from the front. Standard relays can be mounted in any position on the vertical plane. Relay coils will pick up at 85% of rated voltage or less. Relays are available with up to 8 poles maximum. These can be furnished with up to 8 poles normally open, or in combination with up to 4 poles maximum normally closed. Either power or low-energy contacts are available.

NOTE: FOR D.C. APPLICATIONS CONSULT HARTFORD FOR PRICING & MINIMUM ORDER QUANTITIES.

TYPE FPR & FPRL — MODEL N

CONTACT RATINGS (Per Pole)

AC Ratings (Type FPR) ..... 15A,20V min., 250V max. 90A locked rotor at 240V.

AC Ratings (resistive) for low energy applications (Type FPRL) ..... Max. amps: 10
Max. volts: 250
Min. V.A.: 0.01
Max. V.A.: 150

CONTACT RESISTANCE

Type FPR ..... 0.10 ohms at 1A,10V
Type FPRL ..... 0.02 ohms at 1A,25V

NOTE: Silver cadmium oxide contact buttons not recommended for services below 10V.

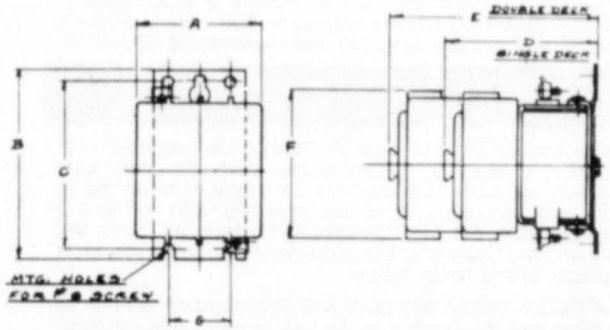
TERMINAL CAPACITIES

Type FPR and FPRL ..... #14 wire, 6-32 screw

COILS

Class A molded coils are standard. All coils are designed to operate from 85% or less of lower value through 110% of higher value. Temperature rises safe up to 55°C ambient.

Description	AC COIL VOLTAGE		
	24V 60Hz	110/120V 60Hz	208/220V 60Hz
Min. pick-up volts (or less)	20	94	175
Max. drop-out volts (or less)	15	65	135
Avg. DC resistance ± 10% cold 20°C	3.4	158	670
Max. inrush VA (or less)	50	50	50
Max. sealed VA (or less)	15	15	15
Max. sealed watts (or less)	7.5	7.5	7.5
Approx. power-factor (sealed)	50%	50%	50%



WITH AC MAGNETS

Poles	Dimensions in Inches						
	A	B	C	D	E	F	G
3	1 5/16	3 3/16	2 13/16	2 1/16	3 3/16	2 1/16	1
4	2 1/16	3 3/16	2 13/16	2 1/16	3 3/16	2 1/16	1
6	1 5/16	3 3/16	2 13/16	2 1/16	3 3/16	2 1/16	1
8	2 1/16	3 3/16	2 13/16	2 1/16	3 3/16	2 1/16	1

APPROXIMATE DIMENSIONS, NOT SUITABLE FOR CONSTRUCTION

ARROW HART DIVISION

CROUSE-HINDS COMPANY/ARROW HART DIVISION/Hartford, Conn. 06101/(203) 249-8471

ARROW HART DIVISION

TYPE MR AC & DC MAGNETIC RELAYS

TECHNICAL DATA, SELECTION INFORMATION & DIMENSIONS

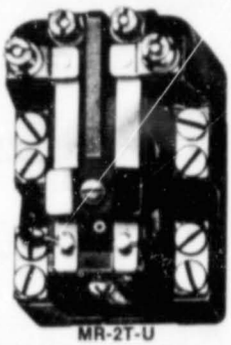
TYPE "MR" RELAYS are midget types designed specifically for 2-wire control systems. They provide efficient control of single-phase fractional horsepower motors, and other light loads including pilot lights, signalling devices, and a variety of circuit control duties.

Available as open and closed types, they are principally used to control 2-wire circuits. The enclosed type, housed in a compact metal enclosure, is designed for installation where space is limited. Mounting and contact screws are in full view, and readily accessible. Type "MR" relays are available with either one or two poles, single or double throw construction, for both AC & DC use. Three- and four-pole types are available for AC use only, and offer a variety of normal contact positions to meet specific requirements. Double throw contacts not suitable for opposite polarity. On three- and four-pole relays, contacts located one above the other must not be used on opposite polarity.

ARROW HART magnetic relays are built for mounting in limited space, and offer low wattage consumption and high power factor.

The clapper type magnet is equipped with a continuous duty shading coil that reduces magnetic hum. Removable silver-to-silver contact tips are easy to install, and inexpensively maintained. Small moving tips abut against large, flat-faced stationary tips, insuring proper contact. Make and break contact is instantaneous.

Control relays are available in open types for surface or panelboard mounting, and enclosed types with metal housing, General Purpose NEMA 1 Enclosures.



MR-2T-U

HORSEPOWER and AMPERE RATINGS

HP Single Phase	Volts	Amps Per Pole	Two In Series
½	110AC	10	10
½	220AC	10	10
—	115DC	0.5	2.5
—	230DC	0.3	0.5

Double throw contacts not suitable for opposite polarity. On 3- and 4-pole relays, contacts located one above the other must not be used on opposite polarity.

HOW TO ORDER

1. Specify CATALOG NUMBER of relay required from the catalog number selection table below.
2. Specify COIL CODE for the required control circuit voltage and frequency from the coil selection table below.
3. Order and price by complete catalog number. **EXAMPLE:**

Relay Catalog Number	+	Coil Code	=	Complete Relay Catalog Number
MR-20-U		**20**		**MR-20-U-20**

CATALOG NUMBER SELECTION TABLE

Number of Poles	CONTACT CONFIGURATION	OPEN TYPE Unit Only CAT. NO.	OPEN TYPE Unit Only LIST	NEMA 1 General Purpose Enclosure CAT. NO.	NEMA 1 General Purpose Enclosure LIST
1	OPEN	MR-10-U		MR-10-G	
	CLOSED	MR-01-U		MR-01-G	
	OPEN & CLOSED	MR-1T-U		MR-1T-G	
2	OPEN	MR-20-U		MR-20-G	
	CLOSED	MR-02-U		MR-02-G	
	OPEN & CLOSED	MR-2T-U		MR-2T-G	
	1 OPEN - 1 CLOSED	MR-11-U		MR-11-G	
3	OPEN	MR-30-U		MR-30-G	
	CLOSED	MR-03-U		MR-03-G	
	2 OPEN - 1 CLOSED	MR-21-U		MR-21-G	
	1 OPEN - 2 CLOSED	MR-12-U		MR-12-G	
4	OPEN	MR-40-U		MR-40-G	
	CLOSED	MR-04-U		MR-04-G	
	3 OPEN - 1 CLOSED	MR-31-U		MR-31-G	
	2 OPEN - 2 CLOSED	MR-22-U		MR-22-G	
	1 OPEN - 3 CLOSED	MR-13-U		MR-13-G	

AC COIL SELECTION TABLE

VOLTAGE	FREQUENCY	CODE ①
6	50/60 Hz	01
12	50/60 Hz	02
24	50/60 Hz	10
48	50/60 Hz	11
110	50/60 Hz	20
220	50/60 Hz	40

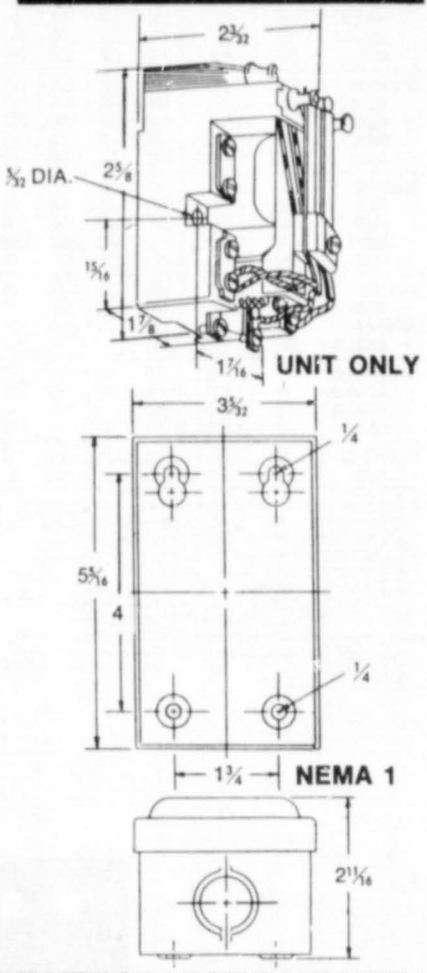
① *For VOLTAGE & FREQUENCY not listed specify CODE 99 and required voltage and frequency.*

DC COIL SELECTION TABLE

VOLTAGE	FREQUENCY	CODE ②
6	DC	AA
12	DC	AC
24	DC	AE
28	DC	AF
36	DC	AH
50	DC	AJ
75	DC	AL
115	DC	AN
230	DC	AP

② *For voltage not listed specify CODE YY and required voltage.*

DIMENSIONS



APPROXIMATE DIMENSIONS, NOT SUITABLE FOR CONSTRUCTION

ARROW HART DIVISION

CROUSE-HINDS COMPANY/ARROW HART DIVISION/Hartford, Conn. 06101/(203) 249-8471

Non-Sealed Power Relays

ENGINEERING DATA

Catalog Number	Continuous Contact Ampere Rating	Poles and Throw	Power Contact Duty Cycle Ratings														Maximum Time On (Minutes)	Coil Data					
			28 Volt dc								115/200 Volt ac 400 Hertz							Res. (Ohms) +15% −10%		Power Requirements			
			Continuous				15 Minute	5 Minute	1 Minute	Max. Peak ❶	Continuous		15 Minute	5 Minute	1 Minute	Max. Peak ❶				Volts	Amperes (Maximum)		Max. Volts Pick-up	Max. Volts Drop-out
			Resistive	Inductive	Motor	Lamp					Resistive	Motor						Pick-up	Sealed		Pick-up	Sealed		
6041H11B	100	1 P.S.T.	100	80	80	40	130	150	200	600							Continuous		73	28Vdc		0.45	18	7
H50A	55	2 P.S.T.	55	40	40	20	50	75	100	300							❷		16	12Vdc		0.75	10	4.5
H53A	50/25	1 P.D.T.	50❸	50❸	50❸	25❸	65	75	100	300							Continuous		26	12Vdc		0.46	9	3.5
6041H80A	100	1 P.S.T.	100	80	80	40	130	150	200	600									75	28Vdc		0.45	18	7
H105A	200	1 P.S.T.	200	100	200	100	260	300	400	1200									10.4	12Vdc		0.72	9	3.5
H109A	200	1 P.S.T.	200	100	200	100	260	300	400	1200							Continuous		10.4	12Vdc		0.72	9	3.5
H123A	200	1 P.S.T.	200	100	200	100	260	300	400	1200									66	28Vdc		0.50	18	7
H144A	100	1 P.S.T.	100	80	80	40	130	150	200	600									73	28Vdc		0.45	18	7
6041H149A	50	1 P.S.T.	50	50	50	25	65	75	100	300							Continuous		23.6	12Vdc		0.60	9	3.5
6041H200	50	1 P.S.T.	50	50	50	25	65	75	100	300							Continuous		94			0.35	18	7
H201A	50	1 P.S.T.	50	50	50	25	65	75	100	300							Continuous		94			0.35	18	7
H202A	200	1 P.S.T.	200	100	200	100	260	300	400	1200							Continuous		66	28Vdc		0.50	18	7
H203A	200	1 P.S.T.	200	100	200	100			400	1200							1-1/2 Min.❹		10			3.30	7.5	2
H204A	200	2 P.S.T.	200	100	150	75	200	300	400	1200							❷		41			0.80	20	9
6041H236A	400	1 P.S.T.	400	100	400	200	520	600	800	2400							Continuous		66			0.50	18	7
H209A	100	2 P.S.T.	100	80	80	40	100	150	200	600							❷		47.5	28Vdc		0.70	20	9
H212A	200		200	100	200	100	260	300	400	1200							Continuous		66			0.50	18	7
H215	200	1 P.S.T.	200	100	200	100	260	300	400	1200							Continuous		67			0.50	18	7
6041H216	200		200	100	200	100	260	300	400	1200							1-1/2 Min.❹		10			3.30	7.5	2
H217	400		400	100	400	200	520	600	800	2400							Continuous		66			0.50	18	7
H218	400	1 P.S.T.	400	100	400	200			800	2400							1-1/2 Min.❹		6.8	28Vdc		4.80	7.5	2
H219	55	2 P.S.T.	55	40	40	20	50	75	100	300							❷		66			0.50	20	9
H220	50/25	1 P.D.T.	50❸	50❸	50❸	25❸	65	75	100	300							Continuous		101			0.33	18	7
6046H1D	50	2 P.D.T.	50	50	50	25	50	75	100	300							❷		66			0.50	18	7
H2D	100	2 P.D.T.	100	80	80	40	100	150	200	600							❷		47.5			0.70	18	7
H3D	200	2 P.D.T.	200	100	150	75	200	300	400	1200							❷		41	28Vdc		0.80	18	7
H39A	50/25	1 P.D.T.	50❺	50❺	50❺	25❺	50	75	100	300							3 Min.		26			1.25	....	....
H46	200	2 P.D.T.	200	100	150	75	200	300	400	1200							❷		41			0.80	18	7
6048H51	50	2 P.D.T.	50	50	50	25	50	75	100	300							❷		66			0.50		
H53	100	2 P.D.T.	100	80	80	40	100	150	200	600							❷		47.5			0.70		
9566H2B	25	3 P.S.T.	25	25	25	12	32	37	50	150	25❼	25	32	37	50	150	Continuous	22	92	28Vdc	1.46	0.35	18	7
H13A❽	100	3 P.S.T.	100	....	75	37	130	150	200	600	100	75❼	130	150	200	600	Continuous	9	53		3.6	0.61		
9565H29A❽	25	3 P.D.T.	25	25	25	12	32	37	50	150	25❼	25	32	37	50	150		22	92		1.46	0.35		
H70A❽	50	3 P.D.T.	50	50	50	25	65	75	100	300	50❼	50	65	75	100	300	Continuous	13.5	71.5	28Vdc	2.35	0.45	18	7
H75A❽	100	3 P.D.T.	100	....	75	37	130	150	200	600	100	75❼	130	150	200	600		9	53		3.6	0.61		
H94❽	50	3 P.S.T.	50	50	50	25	65	75	100	300	50❼	50	65	75	100	300		13.5	71.5		2.35	0.45		
9565H95❽	25	3 P.S.T.	25	25	25	12	32	37	50	150	25❼	25	32	37	50	150		364	1948	120Vdc	0.38	0.071	70	40
H99	25	3 P.S.T.	25	25	25	12	32	37	50	150	25❼	25	32	37	50	150	Continuous	....	....	115V, 400 Hz.	0.38	0.071	70	30

❶ Maximum inrush rating based on assumption aircraft power system is capable of maintaining coil voltage as given in table to hold contactor completely sealed.

❷ These coils will exceed 95° C temperature rise when left on continuously in 25° ambient, but will not be damaged. At maximum ambient temperature of 71° C, the duty cycle should be limited to 15 minutes "on" time per half hour to obtain maximum coil life.

❸ Continuous and intermittent duty ratings shown are for N.O. pole. N.C. pole rated at 1/2 the listed continuous D-c duty ratings. N.C. pole on 6041H53A and H220 good for 15 g's shock.

❹ Time limit shown is at 29V. D-c. Minimum OFF time 3 minutes.

❺ All continuous duty resistive and motor load ratings and all intermittent duty ratings for these relays listed under 28V. D-c apply for 120V. D-c systems with 3 poles of relay connected in series. For 120V. D-c service the 5 amp. relays are rated 2 amp. resistive instead of 5 amp. as listed.

❻ Ratings shown are for main contacts. Dynamic braking contacts rated 25 amp.

❼ Rating also applies for inductive load.

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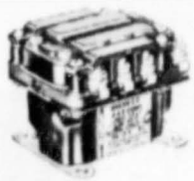
Non-Sealed Power Relays

SPECIFICATIONS

- Meet MIL-R-6106 requirements
- Operable at altitudes to 50,000 feet
- Ambient temperature range—−55°C to +71°C
- Inverted or upright termination
- All moving parts, contacts and magnet coil are enclosed and gasketed
- Acceleration—10 G's
- Vibration from 10 to 55 hertz
- Impact shock—25 G's
- Terminal hardware furnished
- Twin break contact
- Insulated coil

SELECTION TABLE (**Bold** Face Type indicates items normally in Distributor Stock)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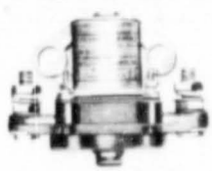
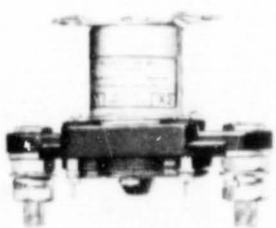
Cat. No. 6041A201A


Cat. No. 6041H209A

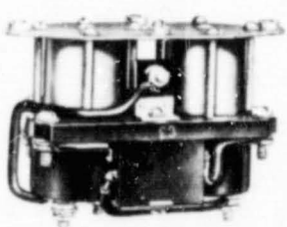

Cat. No. 6041H202A


Cat. No. 6041H217

Continuous Ampere Contact Rating	Poles and Throw	Number of Coils	Mechanical Interlock: Type of Service: Reversing	Mechanical Interlock: Type of Service: Transfer	Mechanical Interlock: Type of Service: Braking	Type of Mounting	Duty Rating of Coil	Position of Terminals	Dimension Drawing Figure Number	Wiring Diagram Figure Number	Coil Operating Voltage	Government Type Number	Catalog Number
25	3 P.S.T.	1	...	...	...	Base	Cont.	Upright	11	10	28Vdc 115V, 400 Hz 120Vdc	MS24192-D1	**9565H2B** **H99** **H95**
	3 P.D.T.	2	...	X	...	Base	Cont.	Upright	12	16	28Vdc	MS24152-D1	**H29A**
25 N.C. 50 N.O.	1 P.D.T.	1 1 2	 X	... ...	 X	Top	Cont.	Inverted	3 3 7	3 4 6	12Vdc 28Vdc 28Vdc	..... MS24187-D1	**6041H53A** **H220** **6046H39A**
50	1 P.S.T.	1	...	...	...	Side	Cont.	Upright	4	1	28Vdc 12Vdc	AN-3350-1	**6041H201A** **H148A**
						Top	Cont.	Inverted	1	1	28Vdc	MS24166-D1	**6041H200**
			X	...	...	Top	❶	Upright	8	7	28Vdc	C-1	6046H1D
	2 P.D.T.	2	...	X	...	Top	❶	Inverted	7	9	28Vdc	MS25030-D1B	6046H51
	3 P.S.T. 3 P.D.T.	1 2	... ...	... X	... ...	Base	Cont.	.....	11 12	10 18	28Vdc	MS24193-D1 AN-3342-2	**9565H94** **H70A**
55	2 P.S.T.	1	...	...	...	Top	❶	Inverted	3	2	12Vdc 28Vdc	..... MS24178-D1	**6041H55A** **H219**
100	1 P.S.T.	1	...	...	...	Side Side Top	Cont.	Upright Coil Inv. Inverted	4 4 3	1	28Vdc	NAF-1204-2 B-6B	6041H80A H144A **H11B**
	2 P.S.T.	1	...	...	...	Top	❶	Inverted	3	2	28Vdc	AN-3362-1	6041H209A
	2 P.D.T.	2	X ...	... X	... ...	Top	❶	Upright Inverted	8 7	7 9	28Vdc	C-2 MS25031-D1B	6046H2D H53
	3 P.S.T.	1	...	...	...	Base	Cont.	.....	11	12	28Vdc	AN-3343-1	**9565H13A**
	3 P.D.T.	2	...	X	...	Base	Cont.	.....	12	18	28Vdc	AN-3344-2	9565H75A
200	1 P.S.T.	1	...	...	...	Side	Cont.	Upright Upright Inverted	5 5 6	1	28Vdc 12Vdc 28Vdc	AN-3370-1	**6041H202A** **H105A** **H123A**
							Int.	Upright	5	1	28Vdc	AN-3371-1	6041H203A
						Side Battery	Cont.	Upright	5	1	28Vdc 12Vdc	B-4A	**6041HZ12A** H109A
						Top	Cont.	Inverted	1	1	28Vdc	MS24171-D1	**6041HZ15**
							Int.	Inverted	1	1	28Vdc	MS24172-D1	**6041HZ16**
	2 P.S.T.	1	...	...	...	Top	Cont.	Inverted	3	2	28Vdc	AN-3372-1	6041H204A
	2 P.D.T.	1	X ...	... X	... ...	Top	❶ ❶	Upright Inverted	8 7	7 8	28Vdc	C-3 MS25032-1	6046H3D H46
400	1 P.S.T.	1	...	...	...	Side	Cont.	Upright	5	1	28Vdc	B-14 & AN-3380-1	**6041HZ05A**
						Top	Cont.	Inverted	1	1	28Vdc	MS24185-D1	**6041HZ17**
							Int.	Inverted	1	1	28Vdc	MS24179-D1	6041H218

❶ These coils will exceed 95°C temperature rise when left on continuously in 25° ambient, but will not be damaged. At maximum ambient temperature of 71°C, the duty cycle should be limited to 15 minutes "on" time per half hour to obtain maximum coil life.

Reversing and Dynamic Braking Relays


Cat. No. 6046H39A

- Control of split field series motors
- 50,000 operations
- Available for 12 or 28 Vdc service

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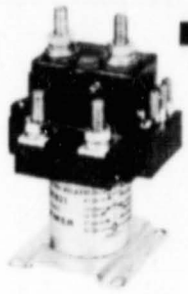
Non-Sealed Power Relays With Auxiliary Contacts

SPECIFICATIONS

- Designed to meet the general requirements of Mil-R-6106
- All moving parts are covered and gasketed
- Operable at altitudes to 50,000 feet
- Impact shock — 25 G's
- Vibration from 5 to 500 hertz
- Ambient temperature range — 55°C to +71°C
- Twin break contacts
- 2PDT auxiliary contacts with screw terminals or IWTS terminals available

SELECTION TABLE





Poles and Throws	Contact Rating❶	Coil Duty Rating	Aux. Contacts Termination	[redacted]
1PST	150 Amps	Continuous	Screw	
1PST	150 Amps	Continuous	IWTS	
1PDT	150 Amps	Intermittent	Screw	
1PDT	150 Amps	Intermittent	IWTS	

ENGINEERING DATA

- **Power Contact Ratings**

	SPST	SPDT
Voltage	28VDC	28VDC
Resistive Load	150 Amps❶	150 Amps❶
Motor Load	600 Amps Make	600 Amps Make
	200 Amps Break	200 Amps Break
Rupture	1200 Amps	1200 Amps

❶ Will carry 200 Amps at a 20% Duty Cycle

- **Auxiliary Contacts**

Configuration	DPDT
Voltage	28VDC
Resistive Load	5 Amps
Inductive Load	3 Amps

- **Coil Data**

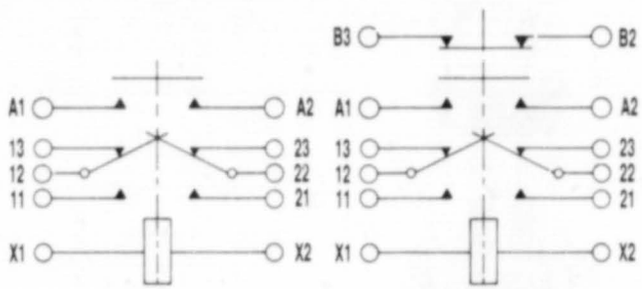
	Continuous Duty	Intermittent Duty
Operate — Max.	32VDC	30VDC
— Min.	24VDC	10VDC
Pick-Up — Max.❷	16.5VDC	6.5VDC
Drop-Out — Max.❷	7.0VDC	3.0VDC

❷ At 25°C Ambient

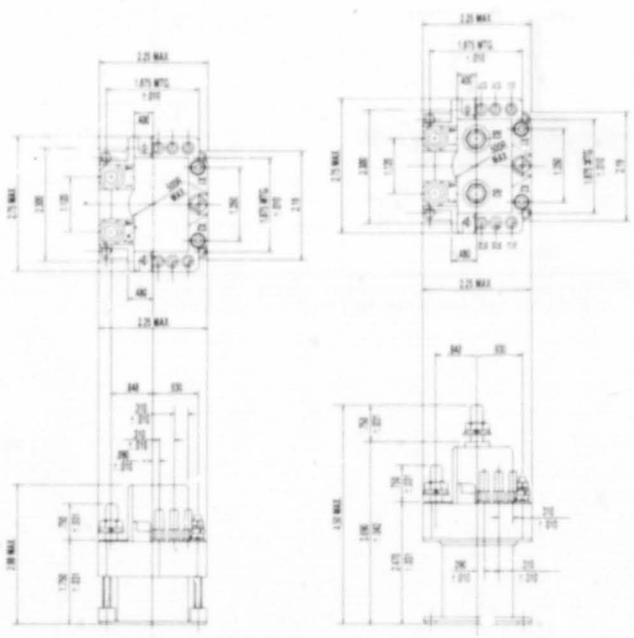
- **Physical Dimensions**

Weight	1 Lb. 5 Oz.
Size —	
1PST	2.25 x 2.75 x 2.88 Inches
1PDT	2.25 x 2.75 x 4.50 Inches

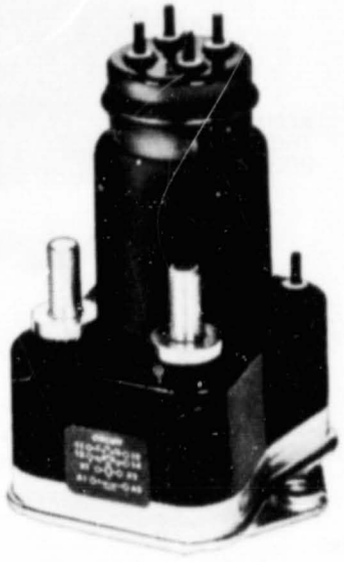
TYPICAL WIRING DIAGRAMS



APPROXIMATE DIMENSIONS

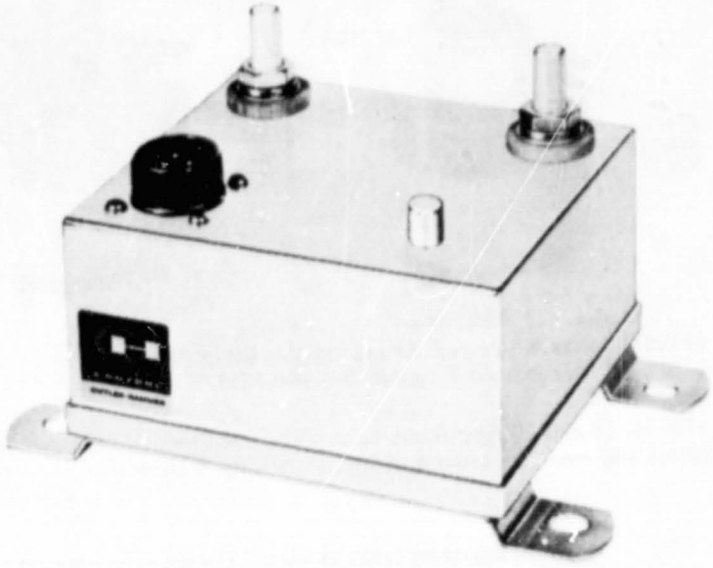


HYBRID ELECTRONIC/ELECTROMECHANICAL RELAY CAPABILITIES



COIL VOLTAGE SENSING RELAY

A 6042H152 with Electronic Voltage Sensing added to boost coil power when applied voltage drops below a predetermined level. This prevents relay damage due to low battery voltage during engine starts.



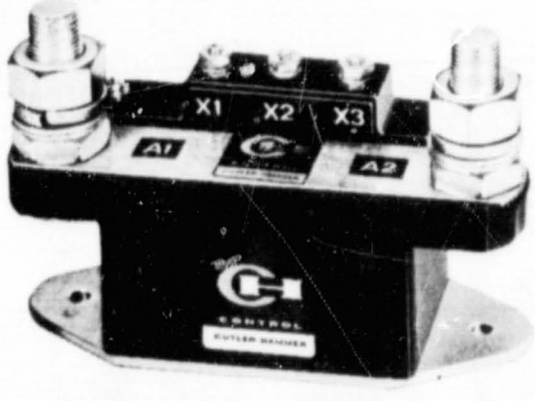
200 AMP REMOTE CONTROL CIRCUIT BREAKER

A SPST 200 amp Relay and Electronic Current Sensing, overload trip, and remote indication combined in a single package to be used as a battery contactor for a small jet aircraft. The circuit senses current in the forward direction only.



150 AMP BI-DIRECTIONAL CURRENT SENSING RELAY

A SPST Relay combined with an Electromagnetic Current Sensing Circuit to provide an overcurrent trip threshold, in both forward and reverse directions to protect the Ni-Cad Battery on a helicopter. The relay also provides a short time delay to prevent a false trip upon starting inrush.



400 AMP CURRENT SENSING MODULE

An electronics-only package which when used in conjunction with a 6041H217 becomes a remote control circuit breaker. Could be adapted to various relays and trip time curves.

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GENERAL PURPOSE RELAYS — 10 AMP — 15 AMP — 20 AMP

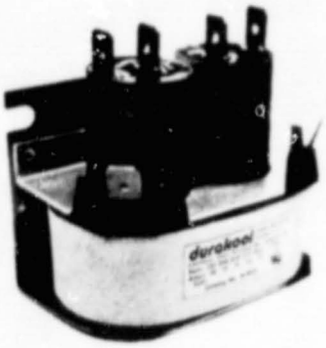
AFM Series — Normally Open

UL CSA

AFM — SINGLE POLE



AFM2 — TWO POLE



AFM3 — THREE POLE



AFM300 Series Single Pole Relays are U.L. Component Rated — General Purpose and Tungsten/U.L. file #35126 and C.S.A. file #22416.

AFM 10, 15 and 20 Amp relays have been tested for 100,000 cycles and meet the criteria of the Underwriter's Laboratory requirements for General Purpose loads and 6000 cycles for Tungsten loads.

Only popular operating coil voltages are shown, consult the factory for part numbers of other AC and DC coils. Leaded versions are also available. See page 15 for U.L. and non-U.L. contact ratings.

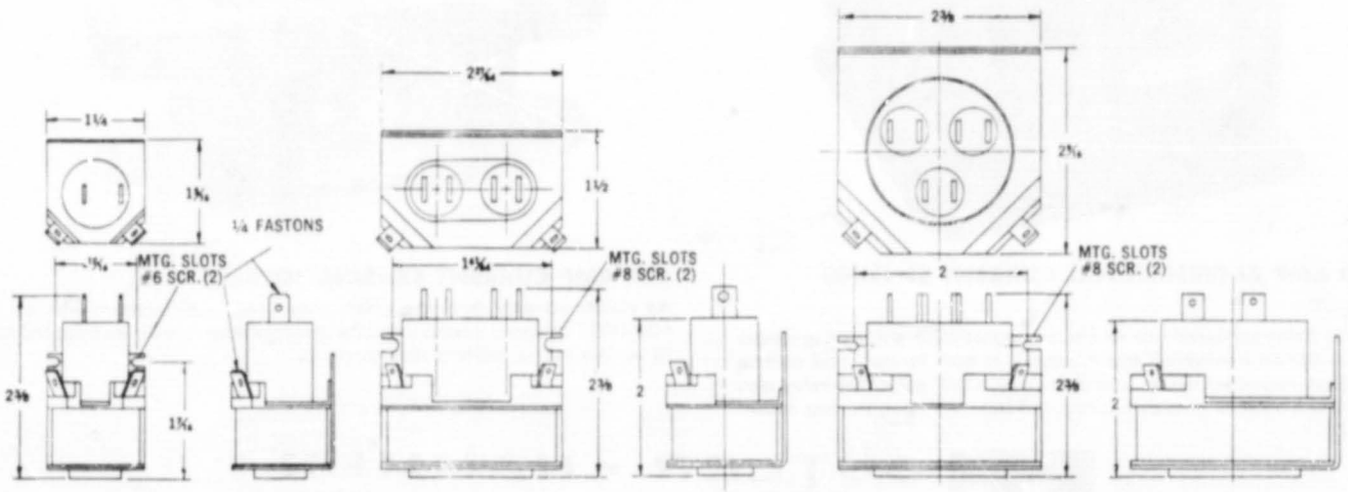
Typical operating times at normal voltage — operate .04 sec/release .10 sec

Contact Rating	Relay Selection Information — Relay Series: One Pole	Two Pole	Three Pole
10 Amp	AFM10-	AFM210-	AFM310-
15 Amp	AFM15-	AFM215-	AFM315-
20 Amp	AFM20-	AFM220-	AFM320-

* When ordering, the appropriate operating coil suffix number should follow the selected relay series.

Coil Voltage Suffix*	AFM SPST — Coil Data — Typical: Coil Voltage	DC Ohms	Steady State Amps	VA	Wattage	Max. Low Pull In Volts
-315	6V 60 Hz	8.8	.368	2.2	1.7W	5.1V
-316	12V	35	.184	2.2	1.7W	10.2V
-301	24V	140	.092	2.2	1.7W	20.4V
-302	48V	560	.046	2.2	1.7W	40.8V
-303	120V	3900	.018	2.2	1.7W	102 V
-304	208V	11500	.011	2.2	1.7W	177 V
-305	240V	15600	.009	2.2	1.7W	204 V
-306	277V	25000	.008	2.2	1.7W	236 V
-307	480V	62400	.0045	2.2	1.7W	408 V
-308	6V DC	15.4	.390	2.4	2.4W	5.1V
-309	12V DC	62	.194	2.4	2.4W	10.2V
-310	24V DC	247	.097	2.4	2.4W	20.4V
-311	48V DC	986	.049	2.4	2.4W	40.8V

Above coil data applies only to single pole device. Consult the factory for coil data on two and three pole configurations.



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GENERAL PURPOSE RELAYS—30 AMP

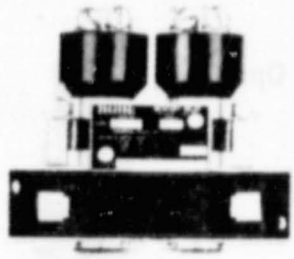
UL CSA

BF Series—Normally Open

BB Series—Normally Closed



Model BF7000



Model BF2 7000



Model BF3 7000

BF and BB 7000 series devices are U.L. listed under file #E35126 and C.S.A. file #22416. Catalog numbers other than the 7000 series do not carry either U.L. or C.S.A. listings. Contact ratings for this series of relays are shown on last page.

Leaded versions are also available; consult the factory office for part numbers. Many other AC and DC coil voltages are available. See BFL series for industrial lug type terminations on top and bottom of contact tubes.

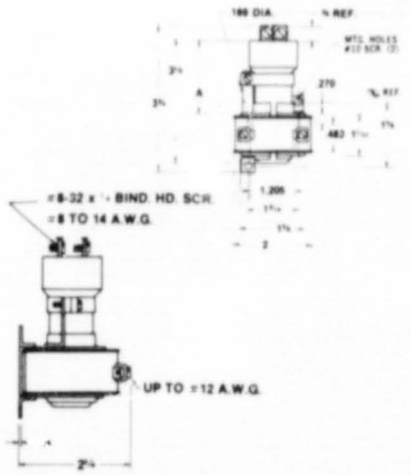
BF SERIES/Normally Open

Contacts	Part #	Volts	COIL DATA—TYPICAL Power (Watts)	Current (Amps)	V.A.	Resistance (DC Ohms)
One Form "A" S.P.S.T. N.O.	BF-7031	24V60Hz	3.2	.228	5.47	36
	BF-7032	120V60Hz	2.5	.047	5.64	915
	BF-7033	208V60Hz	2.7	.025	5.20	3100
	BF-7034	240V60Hz	2.4	.022	5.28	3700
	BF-7035	277V60Hz	2.4	.019	5.26	5410
	BF-7036	480V60Hz	2.7	.011	5.28	14700
	BF-7058	12VDC	2.7	.210	—	57
	BF-7046	24VDC	2.7	.110	—	230
Two Form "A" D.P.S.T. N.O.	BF2-7026	24V60Hz	5.3	.450	10.8	15
	BF2-7027	120V60Hz	4.9	.098	11.8	350
	BF2-7028	208V60Hz	5.5	.065	13.5	960
	BF2-7029	240V60Hz	4.8	.049	11.8	1400
	BF2-7030	277V60Hz	4.6	.040	11.1	2300
	BF2-7031	480V60Hz	4.8	.025	11.8	5600
	BF2-7041	12VDC	6.0	.500	—	24
	BF2-7032	24VDC	6.1	.255	—	95
Three Form "A" 3P.S.T. N.O.	BF3-7023	24V60Hz	9.0	.941	22.6	5
	BF3-7024	120V60Hz	8.7	.200	24.6	135
	BF3-7025	208V60Hz	8.2	.110	22.9	480
	BF3-7026	240V60Hz	7.8	.102	24.5	520
	BF3-7027	277V60Hz	7.0	.078	21.6	830
	BF3-7028	480V60Hz	7.8	.050	24.0	2100
	BF3-7037	12VDC	11.0	.940	—	13
	BF3-7038	24VDC	11.0	.470	—	51

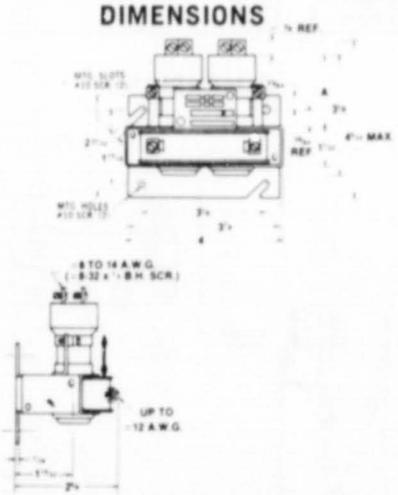
BB SERIES/Normally Closed

Contacts	Part #	Volts	COIL DATA—TYPICAL Power (Watts)	Current (Amps)	V.A.	Resistance (DC Ohms)
One Form "B" S.P.S.T. N.C.	BB-7001	24V60Hz	2.5	.204	4.90	36
	BB-7002	120V60Hz	2.0	.039	4.68	915
	BB-7003	208V60Hz	2.2	.023	4.78	3100
	BB-7004	240V60Hz	2.0	.019	4.56	3700
	BB-7005	277V60Hz	2.0	.017	4.71	5410
	BB-7006	480V60Hz	2.0	.010	4.80	14700
	BB-7027	12VDC	2.7	.220	—	57
	BB-7007	24VDC	2.7	.110	—	230
Two Form "B" D.P.S.T. N.C.	BB2-2001	24V60Hz	4.0	.390	9.36	15
	BB2-2020	120V60Hz	4.3	.09	10.80	350
	BB2-2002	208V60Hz	4.8	.06	12.50	960
	BB2-2023	240V60Hz	3.8	.042	10.08	1400
	BB2-2024	277V60Hz	3.8	.035	9.70	2300
	BB2-2003	480V60Hz	4.0	.021	10.08	5600
	BB2-2018	12VDC	6.0	.50	—	24
	BB2-2004	24VDC	6.1	.225	—	95
Three Form "B" 3P.S.T. N.C.	BB3-2008	24V60Hz	7.7	.910	21.84	5.0
	BB3-2002	120V60Hz	7.4	.175	21.0	135
	BB3-2009	208V60Hz	6.8	.095	19.76	480
	BB3-2010	240V60Hz	6.4	.090	21.6	520
	BB3-2011	277V60Hz	6.2	.070	19.39	830
	BB3-2012	480V60Hz	7.0	.045	21.6	2100
	BB3-2013	12VDC	11.0	1.00	—	12.8
	BB3-2014	24VDC	11.0	.470	—	51

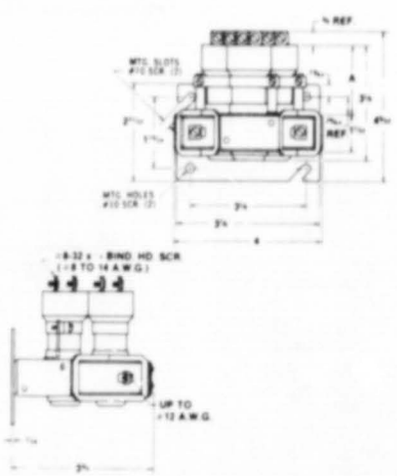
DIMENSIONS



CATALOG DESIGNATION	A 60 Hz	A DC
BF	1 15/64	1 47/64
BB	1 27/64	1 3/8



CATALOG DESIGNATION	A 60 Hz	A DC
BF2	1 15/64	1 47/64
BB2	1 27/64	1 3/8



CATALOG DESIGNATION	A 60 Hz	A DC
BF3	1 15/64	1 47/64
BB3	1 27/64	1 3/8

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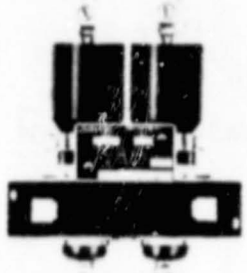
GENERAL PURPOSE RELAYS—35 AMP

UL CSA

BFL Series — Normally Open



Model BFL 7000



Model BFL2 7000



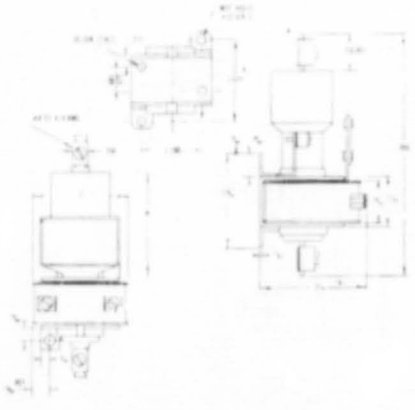
Model BFL3 7000

BFL 7000 series devices are U.L. listed under file #E35126 and C.S.A. file #22416. Catalog numbers other than the 7000 series do not carry either U.L. or C.S.A. listings. Contact ratings for this series of relays are shown on last page. Leaded verisions are also available; consult the factory office for part numbers. Many other AC and DC coil voltages are available. Durakool's BF series feature top tube screw type terminations for installations where wire routing requires in and out wiring from the top of the contact tubes. See detailed drawings and data in this catalog.

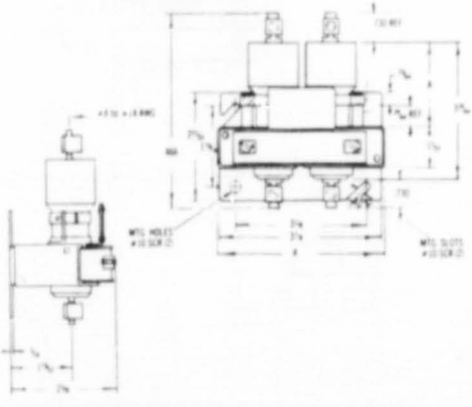
BFL SERIES/Normally Open

		COIL DATA — TYPICAL				
Contacts	Part #	Volts	Power (Watts)	Current (Amps)	V.A.	Resistance (DC Ohms)
One Form "A" S.P.S.T. N.O.	BFL-7031	24V60Hz	3.2	.228	5.47	36
	BFL-7032	120V60Hz	2.5	.047	5.64	915
	BFL-7033	208V60Hz	2.7	.025	5.20	3100
	BFL-7034	240V60Hz	2.4	.022	5.28	3700
	BFL-7035	277V60Hz	2.4	.019	5.26	5410
	BFL-7036	480V60Hz	2.7	.011	5.28	14700
	BFL-7058	12VDC	2.7	.210	—	57
	BFL-7048	24VDC	2.7	.110	—	230
Two Form "A" D.P.S.T. N.O.	BFL2-7026	24V60Hz	5.3	.450	10.8	15
	BFL2-7027	120V60Hz	4.9	.098	11.8	350
	BFL2-7028	208V60Hz	5.5	.065	13.5	960
	BFL2-7029	240V60Hz	4.8	.049	11.8	1400
	BFL2-7030	277V60Hz	4.6	.040	11.1	2300
	BFL2-7031	480V60Hz	4.8	.025	11.8	5600
	BFL2-7041	12VDC	6.0	.500	—	24
	BFL2-7032	24VDC	6.1	.255	—	95
Three Form "A" 3P.S.T. N.O.	BFL3-7023	24V60Hz	9.0	.941	22.6	5
	BFL3-7024	120V60Hz	8.7	.200	24.0	135
	BFL3-7025	208V60Hz	8.2	.110	22.9	480
	BFL3-7026	240V60Hz	7.8	.102	24.5	520
	BFL3-7027	277V60Hz	7.0	.078	21.6	830
	BFL3-7028	480V60Hz	7.8	.050	24.0	2100
	BFL3-7037	12VDC	11.0	.940	—	13
	BFL3-7038	24VDC	11.0	.470	—	51

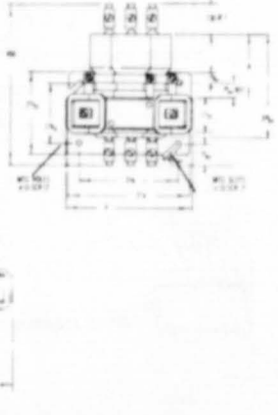
DIMENSIONS



A Dimension	Frequency
1 1/64	DC
2 1/32	50 Hz
2 1/8	60 Hz



A Dimension	Frequency
1 1/64	DC
2 1/32	50 Hz
2 1/8	60 Hz



A Dimension	Frequency
1 1/64	60 Hz
2 1/32	50 Hz
2 1/8	DC



13445-3 A/C Relay

American Motors	1978-68
Buick	1976-65
Chevy & GMC Truck	1972
Chrysler & Imperial	1968-67
Special & Skylark	1976-69



13445-7 A/C Relay

Cadillac	1978-69



13445-8 A/C Relay

Cadillac	1970-68



13445-13 A/C Relay

Buick	1976-72
Riviera	1976-73
Toronado	1978



13445-14 A/C Relay

Buick	1969-68; '65
Cadillac	1968-66
Chevy & GMC Truck	1972-64
Chevelle	1971-64
Chevrolet	1970-62
Chevy II & Nova	1971-61
Corvette	1968-61
F-85 & Cutlass	1974-66
Firebird	1968-67
Oldsmobile	1974-66
Omega	1974-73
Special & Skylark	1967-65
Toronado	1974-66



66-2600-3 A/C Relay

Chrysler	1976-74
Dodge	1976-74
Imperial	1975-74
Plymouth	1976-74



68-2555-2 A/C Relay

F-85 & Cutlass	1968
Oldsmobile	1968
Toronado	1968



69-2555-2 A/C Relay

F-85 & Cutlass	1970-69
Toronado	1970-69



69-2555-? A/C Relay

Cutlass	1973
Oldsmobile	1973-71
Toronado	1973-71



69-2575-2 A/C Relay

Chrysler	1972
Dodge	1972
Imperial	1972
Plymouth	1972



69-4500-1 A/C Relay

Oldsmobile	1970-69



70-4525-2 A/C Relay

Buick	1973-71
Chevrolet	1975-72



71-2495-1 A/C Relay

Chevrolet	1978
Oldsmobile	1966-65
Pontiac	1975-65
Starfire	1978
Tempest & LeMans	1975-65
Toronado	1966-65



71-2495-3 A/C Relay

Firebird	1975-72
Pontiac	1975-71



71-2495-4 A/C Relay

Oldsmobile	1973-71
Pontiac	1967-65
Toronado	1973-71



71-2495-5 A/C Relay

Pontiac	1966

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AIR CONDITIONING RELAYS



71-2495-7 A/C Relay

Pontiac ----------1972-67



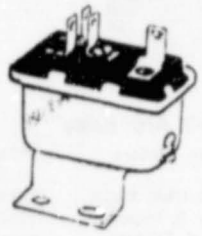
71-2645-3 A/C Relay

Apollo ----------1976-73
Cadillac ----------1978-76
Chevrolet ----------1977-71
Checy & GMC Truck ----1977-73
Corvette ----------1978
Omega ----------1976-75
Skyhawk ----------1976-75
Skylark ----------1976-73
Starfire ----------1976-75
Sunbird ----------1976
Vega ----------1976-75
Ventura ----------1976-75



71-2645-9 A/C Relay

Pontiac ----------1964
Tempest ----------1964



72-2645-4 A/C Relay

Dodge ----------1973
Plymouth ----------1973



71-2610-8 A/C Relay

Ford ----------1971
Mercury ----------1971



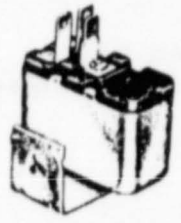
71-2645-4 A/C Relay

Oldsmobile ----------1973-71
Toronado ----------1973-71



71-4515-1 A/C Relay

Buick ----------1973-71



73-2565-1 A/C Relay

Chrysler ----------1973
Dodge ----------19/3
Plymouth ----------19/3



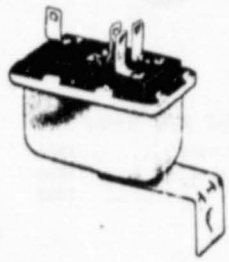
71-2610-9 A/C Relay

Lincoln & Mark III ------1971-70



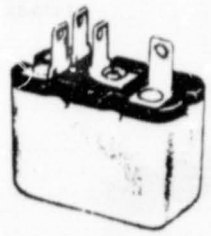
71-2645-5 A/C Relay

Camaro ----------1975-71
Chevelle ----------1975-71
Chevrolet ----------1976-71
Chevy II, Nova ----------1975-71
Chevy & GMC Truck ----1971
Corvette ----------1976-69
Firebird ----------1971-70
Omega ----------1973
Ventura II ----------1974-70



72-2645-3 A/C Relay

Chrysler ----------1973-72
Dodge ----------1973-72
Plymouth ----------1973-72



77-4560-2 A/C Relay

Cadillac ----------1978-77



71-2645-1 A/C Relay

Buick ----------1972-71
Pontiac ----------1978-77

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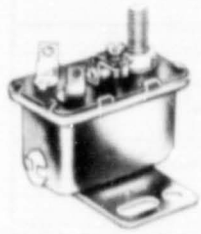
13460-1 Starter Relay
12 Volt

Chrysler, w/A.T.	1964-61
Dart, w/A.T.	1966-63
DeSoto, w/A.T.	1961
Dodge, w/A.T.	1964-62
Dodge Truck, w/A.T.	1978-63
Imperial, w/A.T.	1964-61
Lancer, w/A.T.	1962
Plymouth, w/A.T.	1964-62
Valiant, w/A.T.	1964-62



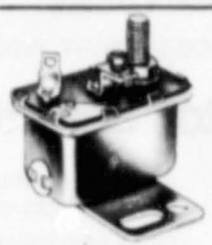
13460-4 Starter Relay
12 Volt

Aspen	1976
Barracuda	1974-65
Belvedere	1970-67
Challenger	1974-70
Charger	1976-67
Chrysler	1976-74; '66-65
Cordoba	1976-75
Coronet	1976-67
Dart & Demon	1976-66
Dodge & Monaco	1976-74; '66-65
Imperial	1975; '66
Plymouth, Fury	1976-74; '66-65
Satellite, Sebring	1974-67
Valiant & Duster	1976-66
Volare	1976



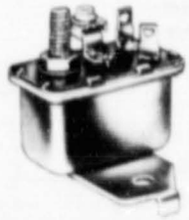
13465-1 Starter Relay
12 Volt

Chrysler, w/S.T.	1964-61
Dart, w/S.T.	1964-63
DeSoto, w/S.T.	1961
Dodge, w/S.T.	1964-62
Dodge Truck w/S.T.	1978-63
Imperial, w/S.T.	1964-61
Lancer, w/S.T.	1962
Plymouth, w/S.T.	1964-62
Valiant, w/S.T.	1964-62



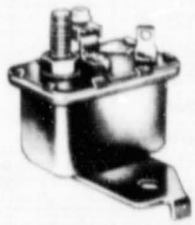
13465-4 Starter Relay
12 Volt

Barracuda, w/S.T.	1970-65
Belvedere, w/S.T.	1970-67
Challenger, w/S.T.	1970
Charger, w/S.T.	1970-67
Chrysler, w/S.T.	1966-65
Coronet, w/S.T.	1970-67
Dart, w/S.T.	1970-63
Dodge, w/S.T.	1966-65
Plymouth, w/S.T.	1966-65
Satellite, w/S.T.	1970-67
Valiant, w/S.T.	1970-65



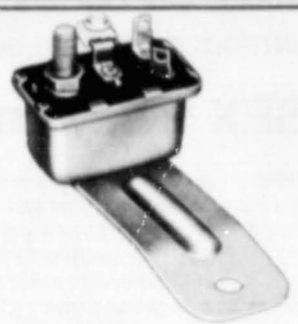
66-2660-2 Starter Relay
12 Volt

Chrysler, w/A.T.	1968-67
Fury, w/A.T.	1968-67
Imperial, w/A.T.	1968-67
Monaco, w/A.T.	1968-67
Polara, w/A.T.	1968-67



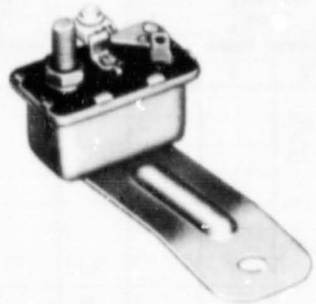
66-2665-2 Starter Relay
12 Volt

Chrysler, w/S.T.	1968-67
Fury, w/S.T.	1968-67
Monaco, w/S.T.	1968-67
Polara, w/S.T.	1968-67



69-2660-2 Starter Relay
12 Volt

Chrysler	1973-69
Fury	1973-69
Imperial	1973-69
Monaco	1973-69
Polara	1973-69



69-2665-2 Starter Relay
12 Volt

Chrysler, w/S.T.	1970-69
Fury, w/S.T.	1970-69
Monaco, w/S.T.	1970-69
Polara, w/S.T.	1970-69



77-2660-2 Starter Relay
12 Volt

Chrysler	1978-77
Dodge	1978-77
Plymouth	1978-77

STARTER RELAY O.E.M. INTERCHANGE

O.E.M.	ESSEX
CHRYSLER	
2095608	13460-1
2095609	13465-1
2444442	13460-4
2444453	13465-4
2444516	13465-1
2444517	13460-1
2642782	66-2665-2
2642783	66-2660-2
2875618	69-2660-2
2875619	69-2665-2
3874950	77-2660-2

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ESSEX GROUP UNITED TECHNOLOGIES.
ESSEX CONTROLS DIVISION 131 GODFREY STREET, LOGANSPORT, INDIANA 46947 219/753-7521

ESSEX Relay and Contactor Selection Guide

This selection guide has ordinates for Essex relay or contactor type, VA contact ratings in amperes and voltage. The pole forms listed are the maximum number of either normally open or double throw poles for the device listed. Exceptions occur under double throw where a combination of normally open plus normally closed poles could exist.

The minimum load values shown are approximate and should not be used as final values. Consult the factory for your specific contact loads as requested in the Ordering Instructions.

Once your contact load and pole form are known, a quick selection of relay or contactor type can be made. To find the type of device you require, simply refer to the Catalog Index, then turn to the correct pages for a full description of the device for coil voltages, contact ratings, pole forms, general engineering specifications, and the outline dimensions.

Relay Type Selection Chart (AC Loads)

Normally Open — Number Poles				Double Throw — Number Poles				Contact Voltage	Amperes AC (Inductive)
1	2	3	4	1	2	3	4		
112								277 V	
	75							240 V	
	143							277 V	
		154						600 V	
			136					240 V	
	584							120 V	
				64				120 V	
				84				120 V	
				84				250 V	
				184	*			120 V	
				184				277 V	
				129	*			240 V	
					91			125 V	
					91			250 V	
					164			120 V	
					98000			240 V	
						93		240 V	
						192		125 V	
						192		250 V	
							98000	240 V	

0 5 10 15 20 30 40

*Can be furnished INO & INC Isolated Poles (Same Polarity)

Relay Type Selection Chart (D.C. Loads).

Normally Open — Number Poles		Double Throw — Number Poles		Contact Voltage	Amperes DC (Resistive)
1	2	1	2		
	584			6 & 12 V	
	584			24 & 36 V	
64		64		28 V	
	164		164	28 V	
70&71				6 & 12 V	
70&71				24 & 36 V	
		70&71		6 & 12 V	
		70&71		24 & 36 V	
124				6 thru 36 V	
		124		6 & 12 V	
		124		24 & 36 V	
150		150		6 & 12 V	
150		150		24 V	
*85600				6 & 12 V	
				24 & 32 V	

0 2 4 6 8 10 40 80 100

NOTE: Double throw includes any combination of normally open and normally closed contacts.
*Furnished SPNO or SPNC ONLY.

Power Switching Solid State Relays

- Optically Isolated
- DC Control of AC Loads to 15 Amps
- Includes Zero Voltage Turn-on and Transient Protection
- Logic Compatible, Responds to 3-30 VDC at Low Current
- UL Recognized, File No. E58632

Nominal Load Voltage 120 VAC

Load Current Amps			PACKAGE			
.25 to 6	.25 to 10	.25 to 15	Taper Tab Std.	Taper Tab Comm.	PC Mount	Part Number
X					X	70S2-03-B-06-C
X			X			70S2-03-B-06-B
X				X		70S2-03-B-06-D
	X		X			70S2-03-B-10-B
	X			X		70S2-03-B-10-D
		X	X			70S2-03-B-15-B
		X		X		70S2-03-B-15-D

Nominal Load Voltage 220 VAC

Load Current Amps			PACKAGE			
.25 to 6	.25 to 10	.25 to 15	Taper Tab Std.	Taper Tab Comm.	PC Mount	Part Number
X					X	70S2-03-C-06-C
X			X			70S2-03-C-06-B
X				X		70S2-03-C-06-D
	X		X			70S2-03-C-10-B
	X			X		70S2-03-C-10-D
		X	X			70S2-03-C-15-B
		X		X		70S2-03-C-15-D

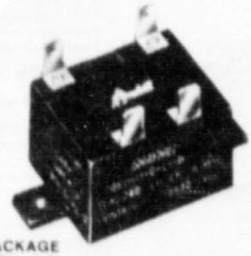
Transformer Isolated and Hybrid Solid State Relays, and Screw Adapters are also available. See Grayhill Solid State Relay Catalog.



STANDARD PACKAGE
APPROX. 2.1" x 1.1" x 1.4"



PC MOUTN PACKAGE
APPROX. 2.1" x 1.1" x 1.4"



COMMERCIAL PACKAGE
APPROX. 2.8" x 1.5" x 1.4"

Additional relays available. Contact Grayhill.

Grayhill, Inc. / 617 Hillgrove Ave. / La Grange, Illinois 60525 / (312) 354-1040

D-C Pneumatic Time Delay Relays

Class A, Folio 2 — 95, 120, 240 Volt

Type PMT

SYLVANIA GTE
Electrical Equipment Group
GTE Sylvania Incorporated
One Stamford Forum
Stamford CT 06904
203 357 2000

Bulletin 7314 D-c Time Delay Relays are identical in construction to the Bulletin 7313 Timing Relays described on page 248 except for the use of a conventional 2-lead operating coil rather than a tapped (3-lead) coil. They feature the same accurate piston-type timing head as used on all other timing relays in the PM family. Universal poles, with two electrically isolated contacts per pole—one normally open and one normally closed—are also used. These timing relays are available for either On Delay or Off Delay operation in three basic models: (1) with one timed pole; (2) with one timed and one instantaneous pole or (3) with two timed poles.



← Relay for On Delay operation



→ Relay for Off Delay operation

CATALOG NUMBERS

CLASS A RELAYS (Timing Range Adjustable From 0.2 Second to 3 Minutes — Accuracy ± 10%)

Type of Operation ①	No. of Universal Poles ②	TIME DELAY CONTACTS ③		INSTANTANEOUS AUXILIARY CONTACTS ③		OPEN TYPE RELAYS		NEMA ENCLOSURES (Supplied Separately)
		Normally Open	Normally Closed	Normally Open	Normally Closed	Universal Pole Arrangement ④	Cat. No. Without Dial ⑤ ⑥	
ON DELAY	1	1	1	None	None	T	714UP	Type 1 Cat. No. P6E-01 or Type 4 & 12 with hub Cat. No. EPM1-104
OFF DELAY	1	1	1	None	None		714UPD	
ON DELAY	2	1	1	1	1	T I	714UPA	
OFF DELAY	2	1	1	1	1		714UPDA	
ON DELAY	2	2	2	None	None	T T	714UPE	
OFF DELAY	2	2	2	None	None		714UPDE	

CONTACT RATINGS

The continuous current rating is 10 amperes on a-c or d-c applications. D-c ratings below show current breaking ability. The a-c ratings apply to either the N.O. or N.C. contact.

VOLTS	D-C AMPERES		A-C AMPERES		
	RESISTIVE LOAD (Non-Inductive)		VOLTS	MAKE	BREAK
	N.O.	N.C.			
64 or less	10	10	110	60	6
120	8	6	220	30	3
240	2	1			

NOTE: Each contact may be used to make, break and carry a maximum of any one of the following d-c coil loads (64 volts to 240 volts only):

Relays	Contactors
6—Bul. 7304 Type PM	8—Bul. 7400, 50KD & 50KS
6—Bul. 7314 Type PMT	3—Bul. 7400, 100KD & 150KD
6—Bul. 7307 Type KC	2—Bul. 7400, 100KS, 150KS & 300KD
	1—Bul. 7400, 300KS & 600RD

SUFFIX TABLE FOR COIL VOLTAGE

Select Catalog Number of relay and add suffix number from below:

VOLTS	SUFFIX	ADDITION PRICE
240	—240	None
120	—120	None
95	—095	

NOTES:

① ON DELAY—timed interval occurs between **energization** of the coil and actuation of timed contact.
OFF DELAY—timed interval occurs between **de-energization** of the coil and actuation of timed contact.
Field conversion of relays from ON-DELAY to OFF-DELAY operation, or vice-versa, is not recommended because a special technique is required.

② Each universal pole consists of 1 N. O. & 1 N. C. independent isolated contacts suitable for 600 volts at opposite polarity, a-c or d-c.

③ Overlapping contacts are available in the **same** contact block.

④ Letter T on relay sketches indicates location of time delay poles. Letter I on relay sketches indicates location of instantaneous poles. Dotted lines indicate where universal poles may be added.

⑤ For timer with dial, specify "with dial."

⑥ Price includes open type relay complete with timing head and d-c operating coil rated 240 or 120 volts. See suffix table below for 95 volt coils.

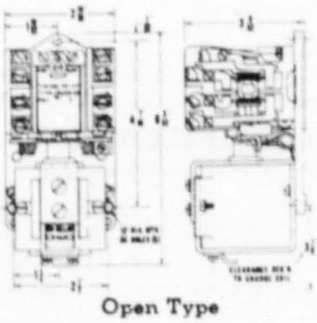
ORDER RELAYS AND ENCLOSURES AS SEPARATE ITEMS:

(Quantity) Catalog No. ( ) Relays
(Quantity) Catalog No. ( ) Enclosures

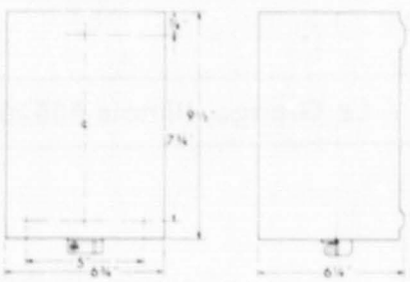
COIL DATA

Operating Coil	17.2 Watts

APPROXIMATE DIMENSIONS

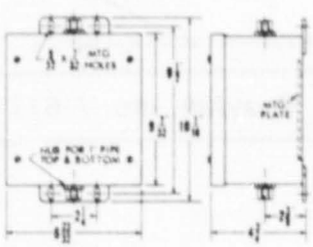


Open Type



← Type 1 Enclosure Cat. No. P6E-01

→ Type 4 & 12 Enclosure Cat. No. EPM1-104

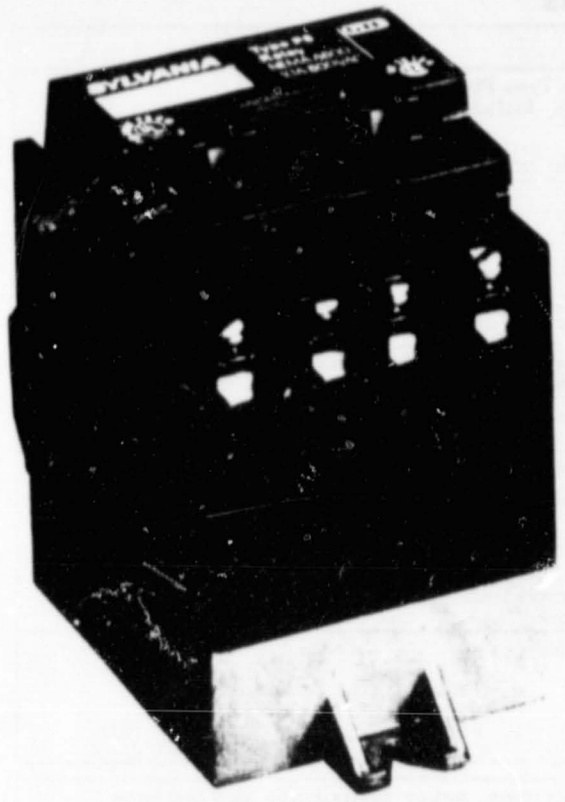


A-C Control Relays

10 Ampere — 600 Volt Max. — 50-60 Hertz

Type P6 Convertible Cartridge Relay

SYLVANIA GTE
Electrical Equipment Group
GTE Sylvania Incorporated
One Stamford Forum
Stamford CT 06904
203 357 2000



THE TYPE P6 RELAY

The Bulletin 7306 Type P6 Sylvania Relay is a heavy duty machine tool type relay, with a NEMA A600 rating. It is available with up to 12 poles and arranged for straight through wiring.

Contacts are rated for 10 amps and provide a dual current path (juxtaposed contacts). They are visible inside a plastic cartridge, which is common across the P6 line, and are designed to be field converted without disturbing wires connected at relay terminals. The mode of the installed contact cartridges in 4 and 8 pole relays is visible directly through the relay front cover.

The Type P6 Relay, which is interchangeable with popular competitive relays, is in the press safety relay class. All cartridges are mechanically linked by a double bar, so that uniform restraint is maintained on all cartridges in each deck or level. This feature restricts contacts of opposite mode from changing state if any contact becomes welded.

A maximum of 8 contacts may be converted to normally closed.

NO. OF NORMALLY OPEN CONVERTIBLE CONTACTS ①	OPEN TYPE CATALOG NO.	
2	P6-20	
4	P6-40	
6	P6-60	
8	P6-80	
10	P6-100	
12	P6-120	

SUFFIX TABLE FOR COIL VOLTS AND HERTZ

Select catalog number of relay and add suffix from following table.

Volts/Hertz	Suffix
110-120/60 or 110/50	—76
220-240/60 or 220/50	—26
440-480/60 or 440/50	—46
550-600/60 or 550/50	—56
200-208/60	—86
24/60	—96
380/50	—35

EXAMPLE:
Cat. No. P6-20-76
2 Pole Relay with
120V-60HZ Coil

CONTACT RATINGS

MAXIMUM A-C CONTACT RATING PER POLE—50 OR 60 HERTZ

NEMA Rating Designation	Maximum Voltage	Amperes			Volt-amperes	
		Make	Break	Continuous	Make	Break
A600	120	60	6	10	7200	720
	240	30	3			
	480	15	1.5			
	600	12	1.2			
MAXIMUM D-C CONTACT RATING PER POLE						
P300	125	1.1		5	138	
	250	0.55				

COIL BURDEN

TOTAL NUMBER OF POLES	60 HERTZ		50 HERTZ	
	Sealed V-a	Inrush V-a	Sealed V-a	Inrush V-a
2 to 12	23	138	26.5	120

ORDER AS FOLLOWS: (Quantity)—Catalog No. ( ) Bulletin 7306, Type P6 relays.

Sylvania quality is based on innovation, integrity and reliability.

A-C Control Relays

10 Ampere — 600 Volt Max. — 50-60 Hertz

Type P6 Convertible Cartridge Relay

SYLVANIA GTE
Electrical Equipment Group
GTE Sylvania Incorporated
One Stamford Forum
Stamford CT 06904
203 357 2000

CATALOG NUMBERS









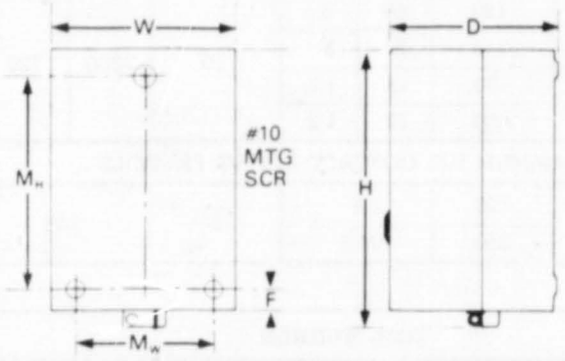
Description		Cat. No.	
Mounting Rail—Simplifies mounting Type P6 relays. Also accepts other popular industrial relays. Includes mounting instructions and captive screws.			
	Relays Per Rail: 4, Length "L": 9"	P6R-4	
	8, 18"	P6R-8	
	12, 27"	P6R-12	
	16, 36"	P6R-16	
Adder Deck—For mounting on basic 4 pole relay.			
	With 2 standard N.O. relay cartridges. Will accept 2 additional cartridges (4 total).	P6B-20	
	With 6 standard N.O. relay cartridges. Will accept 2 additional cartridges (8 total).	P6D-60	
Standard Contact Cartridge—Convertible and interchangeable on all Type P6 relays.		CP6 ①	
Overlap Contact Kit—Kit includes 2 contact cartridges. To obtain overlap, install 1 cartridge N.O. and the other N.C.		P6C-1 ②	
Surge Suppressor—Protects devices and systems sensitive to high current interference. When connected across 120V coils, voltage is limited to peaks of 400V or less.		P6K-1	
Enclosure—Will accept two 8 pole relays.	NEMA 1	P6E-01	
	NEMA 4	P6E-04	
	NEMA 12	P6E-12	

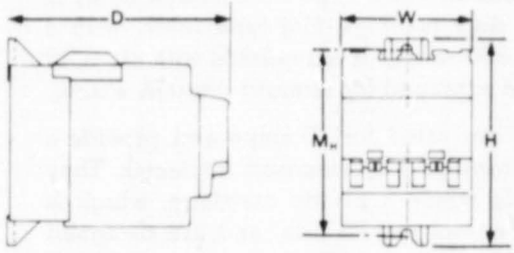
APPROX. ENCLOSURE DIMENSIONS

Catalog No.	NEMA Type	W	H	D	M_H	M_W	F
P6E-01	1	6¼"	10¼"	6⅛"	7¾"	5"	⅜"
P6E-04	4	7¼"	11"	6⅛"	10½"	4"	¾"
P6E-12	12						

APPROX. RELAY DIMENSIONS AND WEIGHTS

No. Of Poles	W	H	D	M_H	Wt. (lbs.)
2-4	2⅛"	3½"	3¼"	3¼"	1.8
5-8			4⅞"		2.2
9-12			6"		2.5



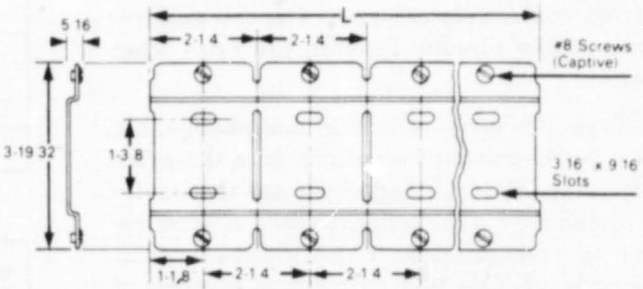


TERMINAL MARKINGS, LEFT TO RIGHT

"A" Deck (Basic Relay)	A1X A1Y	A2X A2Y	A3X A3Y	A4X A4Y
"B" Deck (Second Deck)	B1X B1Y	B2X B2Y	B3X B3Y	B4X B4Y

The terminals for each pole are identified by raised symbols to indicate deck (first character), pole location (second character) and terminal location (X—upper, Y—lower).

MOUNTING RAIL DIMENSIONS



NOTES:
① Sold only in packages of four (4) CP6 cartridges per package.
② Sold only in packages of two (2) P6C-1 kits per package.
③ Using No. 10 screws, mount the rail with two screws at each end and in alternate upper and lower horizontal slots.

ORDER AS FOLLOWS: (Quantity)—Catalog No. ( ) Bulletin 7306, Type P6 (Accessory Name).

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GUARDIAN® CALIFORNIA

For more than 20 years Guardian California has produced high quality solid state devices, including timers, sensors, switches and relays. We excel at designing and building hi-rel control devices to your custom specifications—and we do it on time and at a competitive price.

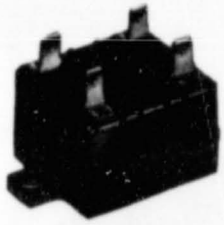
Our catalog products are available nationwide from over 100 authorized Distributors. Call our representative in your area or the factory at (213) 542-8651 for engineering assistance with your solid state switching and control application.

SOLID STATE RELAYS



10, 25, 40 Amp SPNO—GSR Series

Standard size, industrial relay with photo isolated input, "zero voltage" turn-on and internal snubber. Fully encapsulated for general purpose use. Termination: 6 - 32 screws (2) and 8 - 32 screws (2). Mounting: 2 holes on 1.87" centers. Shipping weight: 4 oz.
L-2.25"—W-1.75"—H-0.88".



7, 10, 25 Amp SPNO—SSR/HSSR Series

Rugged nylon case. Snubbered triac output. Available with photo isolated, "zero voltage" turn-on (SSR Series) or economical reed switch input (HSSR Series). Termination: 0.25" QC. Mounting: 2 holes on 2.25" centers. Shipping weight: 3 oz.
L-2.6"—W-1.5"—H-1.0".



10 Amp SPNO Miniature—MSSR Series

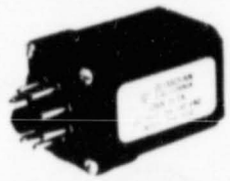
High performance, miniature relay offers 50% reduced weight and size. Photo isolated, "zero voltage" switching. Snubbered triac output. Optional 1mA microprocessor input. Termination: 6 - 32 screws. Mounting: 2 holes on 1.87" centers. Shipping weight: 2 oz.
L-2.25"—W-1.25"—H-0.81".

Guardian No.	Input VDC	Input mA (max)	Output VAC	Output A (max)	Cont. Comb.
GSR-1B-10	3-32	10	20-140	10	SPNO
GSR-2B-10	3-32	10	40-280	10	SPNO
GSR-1E-10	3-32	10	20-140	25	SPNO
GSR-2E-10	3-32	10	40-280	25	SPNO
GSR-1K-10	3-32	10	20-140	40	SPNO
GSR-2K-10	3-32	10	40-280	40	SPNO
SSR-1A-10	3.5-12	35	24-140	7	SPNO
SSR-1A-20	12-32	35	24-140	7	SPNO
SSR-2A-10	3.5-12	35	24-280	7	SPNO
SSR-2A-20	12-32	35	24-280	7	SPNO
SSR-1B-10	3.5-12	35	24-140	10	SPNO
SSR-1B-20	12-32	35	24-140	10	SPNO
SSR-2B-10	3.5-12	35	24-280	10	SPNO
SSR-2B-20	12-32	35	24-280	10	SPNO
SSR-1E-10	3.5-12	35	24-140	25	SPNO
SSR-1E-20	12-32	35	24-140	25	SPNO
SSR-2E-10	3.5-12	35	24-280	25	SPNO
SSR 2E-20	12-32	35	24-280	25	SPNO
HSSR-1A-10	4.2-10	27	24-140	7	SPNO
HSSR-1A-20	10-16	27	24-140	7	SPNO
HSSR-1A-30	21-27	27	24-140	7	SPNO
HSSR-2A-10	4.2-10	27	24-280	7	SPNO
HSSR-2A-20	10-16	27	24-280	7	SPNO
HSSR-2A-30	21-27	27	24-280	7	SPNO
HSSR-1B-10	4.2-10	27	24-140	10	SPNO
HSSR-1B-20	10-16	27	24-140	10	SPNO
HSSR-1B-30	21-27	27	24-140	10	SPNO
HSSR-2B-10	4.2-10	27	24-280	10	SPNO
HSSR-2B-20	10-16	27	24-280	10	SPNO
HSSR-2B-30	21-27	27	24-280	10	SPNO
HSSR-1E-10	4.2-10	27	24-140	25	SPNO
HSSR-1E-20	10-16	27	24-140	25	SPNO
HSSR-1E-30	21-27	27	24-140	25	SPNO
HSSR-2E-10	4.2-10	27	24-280	25	SPNO
HSSR-2E-20	10-16	27	24-280	25	SPNO
HSSR-2E-30	21-27	27	24-280	25	SPNO
MSSR-1B-10	3-32	5	20-140	10	SPNO
MSSR-1B-20	3-32	1	20-140	10	SPNO
MSSR-1B-30	3.5-8	12	20-140	10	SPNO
MSSR-2B-10	3-32	5	40-280	10	SPNO
MSSR-2B-20	3-32	1	40-280	10	SPNO
MSSR-2B-30	3.5-8	12	40-280	10	SPNO
TSSR-1H-10	3-32	5	20-140	2.5	SPNO
TSSR-1H-20	3-32	1	20-140	2.5	SPNO
TSSR-1H-30	3.5-8	12	20-140	2.5	SPNO
TSSR-2H-10	3-32	5	40-280	2.5	SPNO
TSSR-2H-20	3-32	1	40-280	2.5	SPNO
TSSR-2H-30	3.5-8	12	40-280	2.5	SPNO
TSSR-1B-10	3-32	5	20-140	10	SPNO
TSSR-1B-20	3-32	1	20-140	10	SPNO
TSSR-1B-30	3.5-8	12	20-140	10	SPNO
TSSR-2B-10	3-32	5	40-280	10	SPNO
TSSR-2B-20	3-32	1	40-280	10	SPNO
TSSR-2B-30	3.5-8	12	40-280	10	SPNO
TSSR-1G-10	3-32	5	20-140	20	SPNO
TSSR-1G-20	3-32	1	20-140	20	SPNO
TSSR-1G-30	3.5-8	12	20-140	20	SPNO
TSSR-2G-10	3-32	5	40-280	20	SPNO
TSSR-2G-20	3-32	1	40-280	20	SPNO
TSSR-2G-30	3.5-8	12	40-280	20	SPNO
TSSR-1F-10	3-32	5	20-140	30	SPNO
TSSR-1F-20	3-32	1	20-140	30	SPNO
TSSR-1F-30	3.5-8	12	20-140	30	SPNO
TSSR-2F-10	3-32	5	40-280	30	SPNO
TSSR-2F-20	3-32	1	40-280	30	SPNO
TSSR-2F-30	3.5-8	12	40-280	30	SPNO
OSR-1I-1A	3-32	5	20-140	5	SPNO
OSR-2I-1A	3-32	5	40-280	5	SPNO
OSR-1I-1C	3-32	5	20-140	5	SPDT
OSR-2I-1C	3-32	5	40-280	5	SPDT



2.5, 10, 20, 30 Amp SPNO—TSSR Series

High performance, economical relay in miniature size. Photo isolated, "zero voltage" switching. Snubbered triac output. Optional 1mA microprocessor input. Termination: 0.187" QC (2) and 0.25" QC (2). Mounting: 2 holes on 0.187" centers. Shipping weight: 2 oz.
L-2.25"—W-1.25"—H-0.81".



5 Amp 1 or 2 Pole Plug-In—OSR Series

Solid state replacement for octal socket, electromechanical relays. Photo isolated input circuits fire two high-powered triacs. "Zero voltage" switching. Snubbered triac output. Self-contained heat sink. Available SPNO or SPDT. Termination: Octal plug. Shipping weight: 4 oz.
L-1.38"—W-1.38"—H-2.18".



2.5 Amp SPNO PC Mount—PSSR Series

Compact, low profile for printed circuit board applications. Photo isolated, "zero voltage" switched triac output for use with external snubber. Termination: PC - 0.041" dia. wire. Shipping weight: 2 oz.
L-1.38"—W-1.0"—H-0.5".

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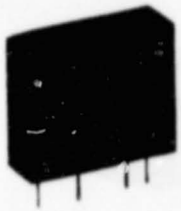
SOLID STATE RELAYS



2.5 Amp SPNO PC Mount—ISSR Series

Mounts horizontally or vertically to save space. Photo isolated, "zero voltage" switched, snubbered triac output. Optional 1mA microprocessor input. Termination: PC - 0.041" dia. wire. Shipping weight: 2 oz. L-1.7"—W-0.4"—H-1.0".

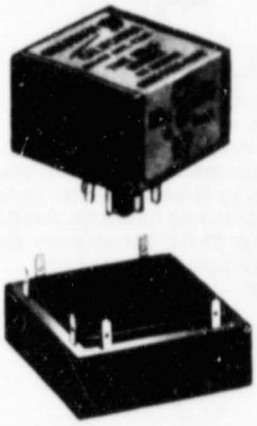
Guardian No.	Input		Output		Cont. Comb.
	VDC	mA (max)	VAC	A (max)	
PSSR-1H-10	3-32	5	20-140	2.5	SPNO
PSSR-1H-20	3-32	1	20-140	2.5	SPNO
PSSR-1H-30	3.5-8	12	20-140	2.5	SPNO
PSSR-2H-10	3-32	5	40-280	2.5	SPNO
PSSR-2H-20	3-32	1	40-280	2.5	SPNO
PSSR-2H-30	3.5-8	12	40-280	2.5	SPNO
ISSR-1H-10	3-32	5	20-140	2.5	SPNO
ISSR-1H-20	3-32	1	20-140	2.5	SPNO
ISSR-1H-30	3.5-8	12	20-140	2.5	SPNO
ISSR-2H-10	3-32	5	40-280	2.5	SPNO
ISSR-2H-20	3-32	1	40-280	2.5	SPNO
ISSR-2H-30	3.5-8	12	40-280	2.5	SPNO
FSSR-1H-10	3-32	5	20-140	2.5	SPNO
FSSR-1H-20	3-32	1	20-140	2.5	SPNO
FSSR-1H-30	3.5-8	12	20-140	2.5	SPNO
FSSR-2H-10	3-32	5	40-280	2.5	SPNO
FSSR-2H-20	3-32	1	40-280	2.5	SPNO
FSSR-2H-30	3.5-8	12	40-280	2.5	SPNO



2.5 Amp SPNO PC Mount—FSSR Series

Low profile for ½" center mount applications. Photo isolated, "zero voltage" switching. TTL compatible. Snubbered triac output. Optional 1mA microprocessor input. Termination: PC - 0.032" dia. wire. Shipping weight: 2 oz. L-1.5"—W-1.4"—H-0.38"

TIMING MODULES



Timing Modules—TMP/TMT Series

Octal plug or "Flat Pack" configuration. Externally adjustable delay on operate (TMP-O and TMT-O Series) or release (TMP-R and TMT-R Series). AC or DC inputs available. Repeatability: 1% under normal conditions. Standard delay ranges: 0.5 - 100, 100 - 300 sec. Life expectancy: 1 million operations.

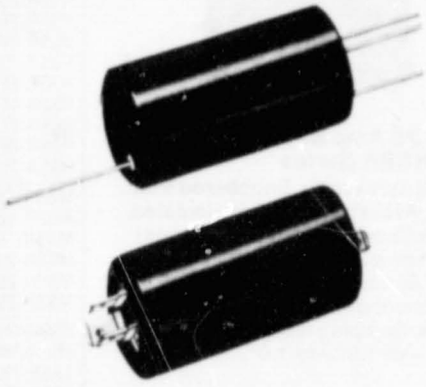
TMP Series

Termination: Octal plug. Shipping weight: 4 oz. L-1.5—W-1.5"—H-1.0".

TMT Series

Termination: Solder lug. Shipping weight: 4 oz. L-2.0"—W-2.0"—H-0.63". Relay illustrated on module not included.

Guardian No.	Volts	Time Range (Sec.)
TMT-O-100-24D	24VDC	0.5-100
TMT-O-300-24D	24VDC	100-300
TMT-O-100-24A	24VAC	0.5-100
TMT-O-300-24A	24VAC	100-300
TMT-O-100-120A	120VAC	0.5-100
TMT-O-300-120A	120VAC	100-300
TMT-R-100-24D	24VDC	0.5-100
TMT-R-300-24D	24VDC	100-300
TMT-R-100-24A	24VAC	0.5-100
TMT-R-300-24A	24VAC	100-300
TMT-R-100-120A	120VAC	0.5-100
TMT-R-300-120A	120VAC	100-300
TMP-O-100-24D	24VDC	0.5-100
TMP-O-300-24D	24VDC	100-300
TMP-O-100-24A	24VAC	0.5-100
TMP-O-300-24A	24VAC	100-300
TMP-O-100-120A	120VAC	0.5-100
TMP-O-300-120A	120VAC	100-300
TMP-R-100-24D	24VDC	0.5-100
TMP-R-300-24D	24VDC	100-300
TMP-R-100-24A	24VAC	0.5-100
TMP-R-300-24A	24VAC	100-300
TMP-R-100-120A	120VAC	0.5-100
TMP-R-300-120A	120VAC	100-300
6425-2L-10	12-48VDC	0.1-10
6425-2H-10	90-130VDC	0.1-10
6425-2L-120	12-48VDC	5-120
6425-2H-120	90-130VDC	5-120
6425-2L-300	12-48VDC	10-300
6425-2H-300	90-130VDC	10-300
6435-2L-10	12-48VDC	0.1-10
6435-2H-10	90-130VDC	0.1-10
6435-2L-120	12-48VDC	5-120
6435-2H-120	90-130VDC	5-120
6435-2L-300	12-48VDC	10-300
6435-2H-300	90-130VDC	10-300



In-Line Timing Module—6425/6435 Series

Economical time delay in a semi-cylinder package for quick and easy PC board mounting. Delay on operate. Accuracy: 10% of setting. Repeatability: 2% for fixed line output. Three externally adjustable time ranges: 0.1 - 10, 5 - 120, 10 - 300 sec. Expected life: 1.0 million operations minimum. Termination: Leads (6425) or ¾₆" QC (6435). Shipping weight: 2 oz. L-2.125"—D-1.0".

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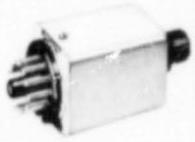
GUARDIAN® CALIFORNIA

SOLID STATE TIME DELAY RELAYS



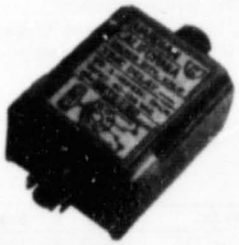
7, 10 Amp SPNO— SSRT Series

Compact, economical relay with time delay adjustable by external resistance. Rugged nylon cover and isolated metal base. Three standard delay ranges: 0.1 - 1, 1 - 10, 5 - 50 sec. Termination: 0.25" QC. Shipping weight: 3 oz.
L-2.6"—W-1.5"—H-1.0".



5 Amp DPDT Plug-In— BD2/BD3 Series

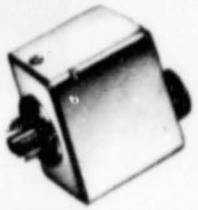
Excellent repeatability particularly suited for exposure control or dispensing applications. AC or DC inputs available. BD2 Series: Delay on operate. BD3 Series: 3 wire, delay on release. Three standard delay ranges: 1 - 10, 5 - 50, 10 - 100 sec. Termination: Radio type plug, 8 pin (BD2) or 11 pin (BD3). Shipping weight: 3 oz.
L-1.39"—W-1.39"—H-2.15".



10 Amp DPDT— MET Series

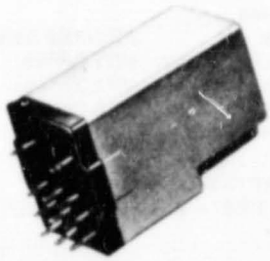
Low cost, excellent repeatability. AC or DC inputs available. 10 A output rating at 120VAC, 50-60 Hz resistive. Three standard delay ranges: 0.5 - 15, 0.5 - 100, 100 - 300 sec. Accuracy: 10% of nominal setting. Repeatability: 1% within fixed conditions. MET-O Series: Delay on operate. MET-R Series: Delay on release. Termination: Radio type plug. Shipping weight: 6 oz.
L-2.4"—W-1.9"—H-2.9".

Guardian No.	Input Voltage	Output VAC	Output Amp	Cont. Comb.	Time Delay, Sec.
SSRT-1A-11	3.5-12DC	24-140	7	SPNO	0.1-1.0
SSRT-1A-12	3.5-12DC	24-140	7	SPNO	1.0-10
SSRT-1A-13	3.5-12DC	24-140	7	SPNO	5.0-50
SSRT-1A-21	12-32DC	24-140	7	SPNO	0.1-1.0
SSRT-1A-22	12-32DC	24-140	7	SPNO	1.0-10
SSRT-1A-23	12-32DC	24-140	7	SPNO	5.0-50
SSRT-2A-11	3.5-12DC	24-280	7	SPNO	0.1-1.0
SSRT-2A-12	3.5-12DC	24-280	7	SPNO	1.0-10
SSRT-2A-13	3.5-12DC	24-280	7	SPNO	5.0-50
SSRT-2A-21	12-32DC	24-280	7	SPNO	0.1-1.0
SSRT-2A-22	12-32DC	24-280	7	SPNO	1.0-10
SSRT-2A-23	12-32DC	24-280	7	SPNO	5.0-50
SSRT-1B-11	3.5-12DC	24-140	10	SPNO	0.1-1.0
SSRT-1B-12	3.5-12DC	24-140	10	SPNO	1.0-10
SSRT-1B-13	3.5-12DC	24-140	10	SPNO	5.0-50
SSRT-1B-21	12-32DC	24-140	10	SPNO	0.1-1.0
SSRT-1B-22	12-32DC	24-140	10	SPNO	1.0-10
SSRT-1B-23	12-32DC	24-140	10	SPNO	5.0-50
SSRT-2B-11	3.5-12DC	24-280	10	SPNO	0.1-1.0
SSRT-2B-12	3.5-12DC	24-280	10	SPNO	1.0-10
SSRT-2B-13	3.5-12DC	24-280	10	SPNO	5.0-50
SSRT-2B-21	12-32DC	24-280	10	SPNO	0.1-1.0
SSRT-2B-22	12-32DC	24-280	10	SPNO	1.0-10
SSRT-2B-23	12-32DC	24-280	10	SPNO	5.0-50
BD2-10-24D	24DC	120	5	DPDT	1-10
BD2-50-24D	24DC	120	5	DPDT	5-50
BD2-100-24D	24DC	120	5	DPDT	10-100
BD2-10-120A	120AC	120	5	DPDT	1-10
BD2-50-120A	120AC	120	5	DPDT	5-50
BD2-100-120A	120AC	120	5	DPDT	10-100
BD3-10-24D	24DC	120	5	DPDT	1-10
BD3-50-24D	24DC	120	5	DPDT	5-50
BD3-100-24D	24DC	120	5	DPDT	10-100
BD3-10-120A	120AC	120	5	DPDT	1-10
BD3-50-120A	120AC	120	5	DPDT	5-50
BD3-100-120A	120AC	120	5	DPDT	10-100
MET-O-100-24A	24AC	120	10	DPDT	0.5-100
MET-O-300-24A	24AC	120	10	DPDT	100-300
MET-O-015-120A	120AC	120	10	DPDT	0.5-15
MET-O-100-120A	120AC	120	10	DPDT	0.5-100
MET-O-300-120A	120AC	120	10	DPDT	100-300
MET-O-100-240A	240AC	120	10	DPDT	0.5-100
MET-O 015-24D	24DC	120	10	DPDT	0.5-15
MET-O-100-24D	24DC	120	10	DPDT	0.5-100
MET-O-300-24D	24DC	120	10	DPDT	100-300
MET-R-100-24A	24AC	120	10	DPDT	0.5-100
MET-R-300-24A	24AC	120	10	DPDT	100-300
MET-R-015-120A	120AC	120	10	DPDT	0.5-15
MET-R-100-120A	120AC	120	10	DPDT	0.5-100
MET-R-300-120A	120AC	120	10	DPDT	100-300
MET-R-015-24D	24DC	120	10	DPDT	0.5-15
MET-R-100-24D	24DC	120	10	DPDT	0.5-100
MET-R-300-24D	24DC	120	10	DPDT	100-300
TDO-62C30-120A	120AC	120	5	DPDT	0.5-30
TD-33C15-24D	24DC	120	10	3PDT	1-15
TD-33C60-24D	24DC	120	10	3PDT	10-60
TD-33C180-24D	24DC	120	10	3PDT	50-180
TD-63C15-120A	120AC	120	10	3PDT	1-15
TD-63C60-120A	120AC	120	10	3PDT	10-60
TD-63C180-120A	120AC	120	10	3PDT	50-180



5 Amp DPDT— TDO Series

Economical relay rated 5 A at 120 VAC. Standard delay range: 0.5 - 30 sec. Repeatability: 5% after line interruption of 100 ms. Termination: 8 pin radio type plug. Shipping weight: 6 oz.
L-2.63"—W-2.06"—H-2.38".



10 Amp 3PDT— TD Series

Accurate, compact time delay on attract. AC or DC inputs available. Three delay ranges: 1 - 15, 10 - 60, 50 - 180 sec. Accuracy: 5% of nominal setting. Repeatability: 2% after line interruption of 100 ms. Termination: Solder lug. Shipping weight: 5 oz.
L-1.7"—W-1.58"—H-3.0".

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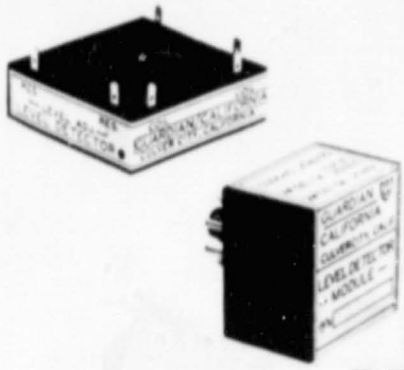
GUARDIAN® CALIFORNIA

SOLID STATE CONTROLS

VOLTAGE LEVEL DETECTORS



LDT/LDP Series
Economical detectors combining a peak detecting voltage differential amplifier, signal amplifier and solid state output switch suitable for driving a number of Guardian relays. May be used as an over or under level detector. Two units form band pass or pedestal level sensing. May be used with TMT/TMP Series timing modules to ignore normal line fluctuations. Four sense levels adjustable by external resistance: 85-135 VAC at 50-60 Hz, 20-30 VAC at 50-60 Hz, 180-250 VAC at 50-60 Hz, 20-30 VDC. Termination: Solder lug (LDT) or radio type plug (LDP).

LDT Shipping weight:
4 oz. L-2.0"—W-2.0"— H-0.63".
LDP Shipping weight:
4 oz. L-1.5"—W-1.5"— H-1.0".

Guardian No.	Volts
LDT-100-24A	24VAC
LDT-100-120A	120VAC
LDT-100-230A	230VAC
LDT-100-24D	24VDC
LDP-100-24A	24VAC
LDP-100-120A	120VAC
LDP-100-230A	230VAC
LDP-100-24D	24VDC

PROTECTIVE SENSORS

Guardian No.	Nominal Input	Current Sensing Range
CS1-220	90-125VAC, 50-60Hz	Time Delay Range 25-500 ms
CT1-201		0.1-1A, 50-60Hz
CT1-202		1-10A, 50-60Hz
CT1-203		5-50A, 50-60Hz
CT1-204		10-100A, 50-60Hz
AV2-611	120VAC, 60Hz	
AV2-621	120VAC, 400Hz	
PR1-610	120VAC, 60Hz	
PR1-620	120VAC, 400Hz	

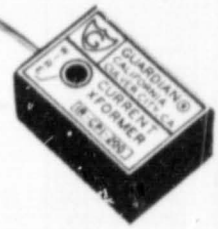
Guardian No.	Nominal Input	Adjustable Voltage Range
VS1-610	120VAC, 60Hz	90-130VAC
VS1-620	120VAC, 400Hz	90-130VAC
VS1-300	24VDC	18-32VDC
VS1-410	24VAC, 60Hz	18-32VAC
VS1-420	24VAC, 400Hz	18-32VAC
VS2-610	120VAC, 60Hz	90-130VAC
VS2-620	120VAC, 400Hz	90-130VAC
VS2-300	24VDC	18-32VDC
VS2-410	24VAC, 60Hz	18-32VAC
VS2-420	24VAC, 400Hz	18-32VAC

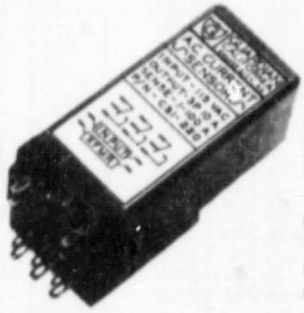
Guardian No.	Nominal Input	Adjustable Freq. Range
FS1-610	120VAC, 60Hz	45-66Hz
FS1-620	120VAC, 400Hz	360-440Hz
FS2-610	120VAC, 60Hz	45-66Hz
FS2-620	120VAC, 400Hz	360-440Hz

Guardian No.	Nominal Input	Sense Point	Differential
VS3-610	120VAC, 60Hz	105-130VAC	2.5-15VAC
VS3-620	120VAC, 400Hz	105-130VAC	2.5-15VAC
VS3-300	24VDC	23-32VDC	1-5VDC
VS3-410	24VAC, 60Hz	23-32VAC	1-5VAC
VS3-420	24VAC, 400Hz	23-32VAC	1-5VAC

AC Current Sensors	CS1 Sensor with CT1 XFormer
3-Phase 4-Wire Phase Sequence	AV2 Series
Adjustable Frequency	FS1/FS2 Series
Over-Voltage	PR1 Series
Under-Voltage	VS1 Series
Close Differential Voltage	VS2 Series
	VS3 Series

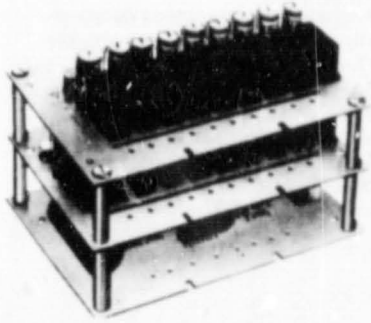
CT1 L-1.87"—W-1.25"—H-1.00"
Sensor L-1.58"—W-1.58"—H-3.00"





Industrial sensors with 3PDT 10A relay in 24VDC, 24VAC and 120VAC versions. Transient voltage protection: 2500 V (600 V on AV2). Life expectancy: 100,000 operations minimum. Termination: Universal 0.110" tabs for socket, chassis mount or direct PC mount. Shipping weight: 5 oz.

SOLID STATE LOGIC STEPPER



SLS Series
Industrial steppers accept either high or logic level inputs with high noise immunity. Modular construction for versatility. May be paralleled or cascaded. Self-steppers available. 10 or 20 steps. Output switch on each step rated 2½A at 120 VAC. Two input ranges: 120 VAC at 50-60 or 400 Hz and 24 VDC. Shipping weight: 15 oz. L-6.0"—W-4.19"—H-3.0" (10 steps), 4.32" (20 steps).

Guardian No.	Volts	Steps
SLS-110-2A111*	120VAC	10
SLS-110-1A211*	24VDC	10
SLS-120-2A111*	120VAC	20
SLS-120-1A211*	24VDC	20
SLS-110-25111†	120VAC	10
SLS-110-15211†	24VDC	10
SLS-120-25111†	120VAC	20
SLS-120-15211†	24VDC	20
SLS Connector Kit		

* Step advance by either mechanical switch closure or DC Pulse.

† Self-stepping.

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4030 West Spencer Street • Torrance, CA 90503 • (213) 542-8651

Gulf + Western Manufacturing Company

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Danville, Illinois 61832
Telephone: 217/446-3710

Heat Exchangers	Air to air, liquid to air and liquid to liquid designs. Custom manufacture.

Michigan Plating & Stamping Division

1860 Alpine Avenue, N.W.
Grand Rapids, Michigan 49504
Telephone: 616/363-4847

Fuel Tanks	Supplier to automotive industry of terneplate stamped and welded tanks.

Automotive Marketing and Engineering Center

Detroit Sales and Engineering Office
24114 Research Drive
Farmington Hills, Michigan 48024
Telephone: 313/478-8140

Relays	Miniaturized 12VDC to control circuits to 20 amperes.
Solenoids	Build to customer requirements.
Switches	Build to customer requirements.
Transducers	Current, Position, Pressure, Speed, Temperature, Torque, Voltage - Build to customer requirements.
Voltage Regulators	12VDC Solid State

Collyer Insulated Wire Division

100 Higginson Ave.
Lincoln, RI 02865
Telephone: 401/723-7800

Apparatus Cables	**Single conductor, Type A.I.A.** IPCEA S-28-357, NEMA WC-1; Underwriters' Lab. Sizes #4 AWG and larger. Asb. covered, 300V and 600V.
Appliance Wires	**Single conductor** Collyer P-400 THHN/THWN PVC/NYLON in those sizes which are 19W uncompressed. U.L. Listed Rate AWM 105°C Dry and 80°C in oil
Control Cables	**Single and multi conductor** THERMOPLASTIC: Collyer C-141 — PZR — PE/NYLON condrs. PVC Jacket 600V, 1000V, 75°C. Collyer C-140 — PVC insulated and jacketed 600V. Collyer C-143 — PE/PVC conductors, PVC jacket 600V, 1000V. Collyer C-153 — PE/NYLON, PZR 90°C, PVC jacket 600V, 1000V. Collyer C-154 — THHN/THWN conductors Type T.C. U.L. Listed.

Collyer Insulated Wire Division

100 Higginson Ave.
Lincoln, RI 02865
Telephone: 401/723-7800

Control Cables	THERMOSET: Collyer C-150, C-151 — XLP insul. — PVC or Neoprene jacket 600V. Collyer C-148 — XLP XHHW FR-1 conductors, Type T.C. U.L. Listed. Collyer C-191 — EPR/HYPALON conductors — Neoprene or PVC jacket U.L. Listed Type T.C. Collyer C-190 — EPR insul. — Hypalon jacketed extra — flame resistant for nuclear station use. C-140, C-143, C-153, C-150, C-151, C-148, C-190 meet IPCEA — NEMA requirements. C-154, C-148, C-190 meet U.L. Type T.C. requirements.
Machine Tool Wire	**Single conductor** Collyer P-400 U.L. Type THHN/THWN when supplied with 19 wire or more stranding, non compressed, has U.L. Listing as MTW 90°C dry and 60°C in oil. Must be specially ordered.
Motor Lead Cables	**Single conductor — Flexible** IPCEA S-19-81, NEMA WC-3 — RUB. insul., neoprene jacket, 600V 75°C. IPCEA S-68-516, NEMA WC-8 — EPR insul., neoprene or hypalon jkt. 600V, 1000V, 2000V, 90°C. AAR581.3 — Rub. insul., Neop. jkt. diesel locomotive cable — 600V. AAR589 — Hypalon insul., 600V. — Also 1000V non AAR spec.
Traction Cable	**Single conductor** Collyer "Track Star", EPR insulated, Neoprene jacketed, 1000 volt. Also XLP insulated & EPR Insulated manufactured to any Transit company's specifications. 600V., 1000V, 2000V
Tray Cable	**Multi-conductor power and control — U.L. Listed Type TC per NEC article 340** C-148 — XLP, XHHW FR-1 conductors, PVC jacket, 600V. C-154 — THWN/THHN conductors, PVC jacket, 600V. C-191 — EPR/Hypalon FR-1 conductors — Neop., or PVC jacket, 600V.

Eagle Signal Corporation

8004 Cameron Road
Austin, Texas 78753
Telephone: 512/837-8300

Battery Charger	In conjunction with the G+W zinc chloride battery program, Eagle Signal is currently developing a battery charger. Basic specifications are given below. Custom chargers or adaptations of the basic charger will be considered. Basic Specifications: AC Input Voltage — 230 VAC single phase 60Hz DC Rating — 140VDC 85 amperes continuous Control Range — From 10% voltage and current to 100% voltage and current Cooling — Convection Transformer — Class H insulation, Class B temperature rise Circuit Configuration — Single phase full wave thyristor bridge on secondary side of rectifier transformer Off Board Design
Controllers, Motor, Variable Speed	DC traction motor controller now under development. Custom manufacture.
DC-DC Converters (on board)	Under development. Custom manufacture.

Eagle Signal Industrial Controls Division

736 Federal St.
Davenport, IA 52803
Telephone: 319/326-8111

Control Relays

For very competitive specifications and prices contact EAGLE SIGNAL, 925 Lake Street, Baraboo, Wisconsin 53913, Telephone (608) 356-8321.

DESCRIPTION	CONFIGURATION	POLES	AMPERES
GENERAL PURPOSE			
6/12/24/120/240 VAC	Open Type, solder lug	1, 2, 3	5, 10
6/12/24/48/110 VDC	Open Type, quick disconnect	1, 2, 3	5, 10
	Open Type, printed circuit	1, 2, 3	5, 10
	Enclosed, Plug-in Octal Base	1, 2, 3	5, 10
	Enclosed, Plug-in, Octal base w/light	1, 2, 3	5, 10

Eagle Signal Industrial Controls Division
736 Federal St.
Davenport, IA 52803
Telephone: 319/326-8111

Control Relays

DESCRIPTION	CONFIGURATION	POLES	AMPERES
ECONOMY			
6/12/24/120/240VAC	Open Type, solder lug	1, 2, 3	10
6/12/24/48/110 VDC	Enclosed, Plug-in Octal Base	1, 2, 3	10
SQUARE BASE			
6/12/24/120/240 VAC	Open type, plug-in	1, 2, 3	5, 10
6/12/24/48/110 VDC			
LATCHING			
6/12/24/120/240 VAC	Open Type, solder lug	1, 2, 3, 4, 5, 6	5
6/12/24/48/110 VDC	Open Type, solder lug	1, 2, 3, 4, 5, 6	10
	Open Type, plug-in	1, 2, 3, 4, 5	5
	Open Type, plug-in	1, 2, 3, 4, 5	10
POWER			
6/12/24/120/240 VAC	Open Type	1	20, 25
6/12/24/48/110 VDC	Open Type*	1	20, 25
	Open Type	1	30
MINIATURE			
6/12/24/120 VAC	Open Type, plug-in	2 and 4	3
6/12/24/48/110 VDC	Open Type, solder terminals	2	6
	Open Type, solder terminals	2	10
PLATE CIRCUIT			
1,000; 2,500; 5,000;	Open Type, solder lug	1, 2, 3	5
10,000; 20,000 ohms	Open Type, quick disconnect	1, 2, 3	5
DC Only	Open Type, printed circuit	1, 2, 3	5
	Enclosed, plug-in, octal base	1, 2, 3	5
SENSITIVE			
1,000; 2,500; 5,000;	Open Type, solder lug	1, 2, 3	5
10,000; 20,000; 40,000 ohms	Open Type, 187 quick disconnect	1, 2, 3	5
	Open Type, printed circuit	1, 2, 3	5
	Enclosed, plug-in, octal base	1, 2, 3	5

*Normally open, double break.
All others listed are double throw.

Interval (Reset) Time Delay Relays

Hi-Accuracy "ON" Delay Solid State	**CG400**	2 Sec. to 120 Sec.	±1% at 102 to 132V Variation	60 MS	120V 50/60 Hz	10 Amp 120VAC
Transistorized "ON" Delay	**CG10**	2 Sec. to 60 Sec.	±2%	50 MS	120V + 15% - 10% 50/60 Hz	DPDT 10 Amp 120VAC
Transistorized "OFF" Delay	**CG300**	10 Sec. to 60 Sec.	±2%	125 MS	120V 50/60 Hz	DPDT 10 Amp 120VAC
Pneumatic	**AF4**	0.2 Sec. to 60 Sec.	±15% of the Avg. Time Setting	0.5 Sec. Max.	120, 240V 50/60 Hz 12, 24, 120, 240VDC	1 SPDT 10 Amp 120VAC
Single Switch Reset	**HD**	14 Sec. to 110 Min.	1½% of Total Scale	0.2 Sec. or Less	120, 240V 50/60 Hz	1 SPDT 10 Amp 120VAC
Manual Set	**AB**	5 Min. to 60 Hrs.	N/A	N/A	120, 240V 50/60 Hz	SPDT 15 Amp 120VAC
Versatile Inexpensive	**BR1 & 2**	5 Sec. to 60 Min.	3.5% of Full Scale Setting	0.5 Sec. at Max. Setting	120, 240V 50/60 Hz	10 Amp ¼ HP 120, 240VAC
Accurate	**BR3**	5 Sec. to 60 Min.	¾% of Full Scale	250 MS at Max. Setting	120, 240V 50/60 Hz	10 AMp ¼ HP 120, 240VAC
Panel Mount	**BR4**	5 Sec. to 60 Min.	3.5% of Full Scale Setting	0.5 Sec. at Max. Setting	120, 240V 50/60 Hz	10 Amp ¼ HP 120, 240VAC

Eagle Signal Industrial Controls Division

736 Federal St.
Davenport, IA 52803
Telephone: 319/326-8111

Interval (Reset) Time Delay Relays	**Push Button**	**191**	8 Sec. to 16 Hrs.	1½% of Full Scale	Push Button	120, 240V 50/60 Hz	10 Amp 120, 240VAC
	Push Button Pneumatic	**86**	0.5 Sec. to 60 Sec.	+15%	Push Button	120, 240V	1 SPDT Switch, 15 Amp ½ HP 120V

	DESCRIPTION	SERIES
Control Unit Non-Illuminated	Round Momentary Pushbuttons	AF, AE, AH, AS
	Square Momentary Pushbuttons	BF, BE
	Special Pushbuttons	AP, AL, AK, BT
	Mushroom Momentary Operators	AM, AD, AB, AR, AJ
	Maintained Operators	WV, WG, WC, WT, WW
	Single Rod Selectors	SK, SL, SY
	Twin Rod Selectors	TK, TL
Control Unit Illuminated	Pushbuttons	LO, SO, MO
	Maintained Operators	LB
	Pilot Lights	PA, PB, PJ, PK
		PF, PG

CONTACT BLOCKS
N.C. 3BT N.O. Early Make 3BM
N.C. 3BC N.C. Early Break 3BL

TRANSFORMER WITH 6V LAMP
120V 3LT-A
240V 3LT-C
480V 3LT-F

LENS AND CAP COLORS
Red White Gray
Green Clear Blue
Amber Black Orange

LEVER, TOGGLE, KNOB COLORS
Black, Red

ALUMINUM LEGEND PLATES
Natural Legend on Black Anodized
46 Standard Legends
4 Styles - 8 Sizes

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2250 Park Place
El Segundo, CA 90245
Telephone: 213/675-3311

Electrical Connectors

PC Board Card Edge
- For 1/16" PC card
- Bifurcated Bellows Contact
- Ten series available with current ratings from 3 to 5 amps
- Contacts on .100 x .200, .125 x .250, .156 x .200 spacings
- Gold plating 10 microinches over nickel of 30 to 100 microinches
- Phosphor bronze contacts
- Diallyl Pthalate, polyester and phenolic insulators available MIL-M-14F and UL 94V0 where applicable

Crimp PC Card Edge
PC Varicon Connectors
- 6 to 10 amperes current rating
- Tuning fork design
- Wire wrap, wire crimp and solder type tails
- Meets MIL-E-5400, MIL-E-8189, MIL-T-21200, MIL-E-19600 specifications
- Various configurations and custom designs

2 Piece Metal to Metal Connectors
- 3 to 5 amperes rating

Rack and Panel Connectors
High Density Metal to Metal PC Connectors
Military Weather and Moisture Proof Pin Connectors
Transistor PC Sockets

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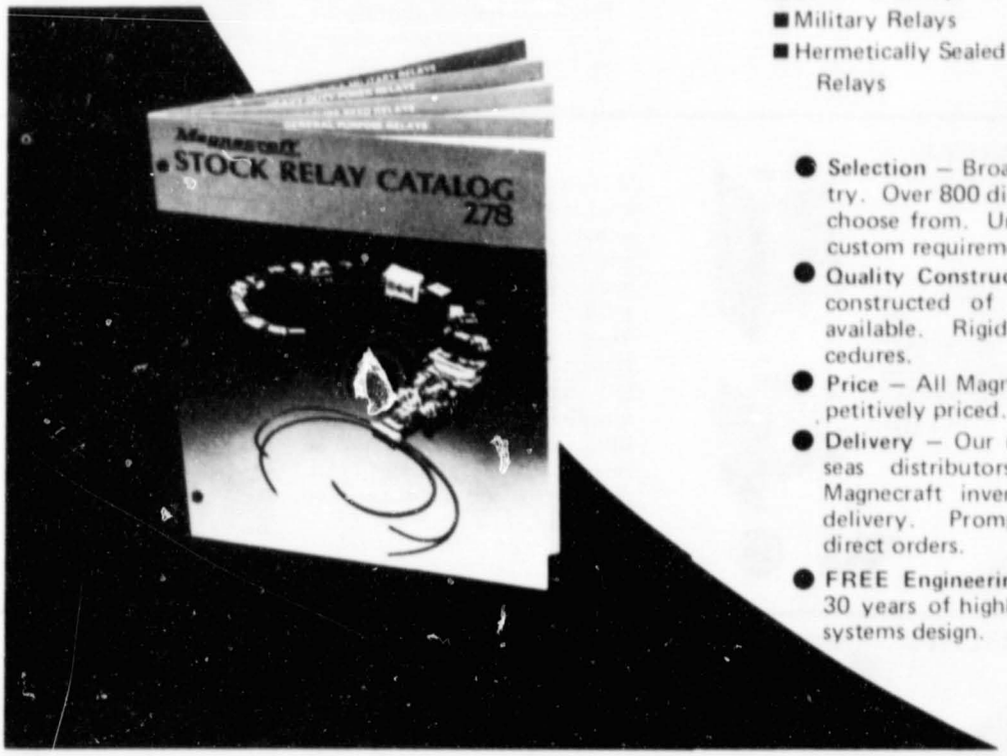
Magnecraft El Paso Warehouse.
MEC de MEXICO S.A. de C.V.
Magnecraft de MEXICO Plant

This pocket guide is your introduction to the broadest relay line in the industry. All standard models are in stock for immediate delivery.

The switching capabilities of this remarkable family of products begins with relays rated for loads of 5VDC and only a Milliamp of current; and extends thru to relays conservatively rated for 60Amps @ 480VAC. The major product groups are listed below for your convenience.

- Low Profile Relays
- DIP Reed Relays
- MIP Reed Relays
- SIP Reed Relays
- Miniature Printed Circuit Relays
- Time Delay Relays
- Sensitive Relays
- Military Relays
- Hermetically Sealed Relays
- Coaxial & R.F. Switching Relays
- Solid State Relays
- Mercury Displacement Relays
- Miniature Industrial Relays
- General Purpose & Power Relays
- Telephone Type Relays
- High Voltage Relays



- **Selection** – Broadest line in the industry. Over 800 different stock relays to choose from. Unlimited capability on custom requirements.
- **Quality Construction** – Each relay is constructed of the finest materials available. Rigid quality control procedures.
- **Price** – All Magnecraft relays are competitively priced.
- **Delivery** – Our nationwide and overseas distributors maintain a large Magnecraft inventory for immediate delivery. Prompt delivery on factory direct orders.
- **FREE Engineering Assistance** – Over 30 years of highly qualified relay and systems design.

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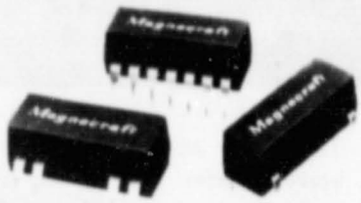
ELECTRIC COMPANY

5575 NORTH LYNCH, CHICAGO, ILLINOIS 60630
312/282-5500

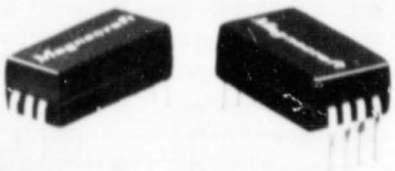
DIP RELAYS



Magnecraft DIP Relays (dual-inline packages).
Immersion proof: Molded epoxy.
Packaging: 8 Pin Dual-Inline standard.
Control Voltage: 5, 6, 12, 24 VDC standard.
Standard Contact Types: SPST-NO, DPST-NO, SPST-NC, SPDT, DPDT, SPST-NO Mercury Wetted, SPST-NO, Position Free Mercury Wetted.
Options: A. Internal Clamping diode B. Electrostatic shielding C. 14 Pin Arrangements.



MIP RELAYS



Magnecraft Mip Relays (molded-inline packages).
Immersion proof: Molded epoxy.
Packaging: 6 and 8 Pin Molded-Inline standard.
Control Voltage: 5, 12, 24, VDC standard.
Standard Contact Types: SPST-NO, SPST-NC, SPDT, DPST-NO, DPDT, 3PST-NO, Mercury-Wetted (SPST-NO and SPDT), Position Free Mercury Wetted (SPST-NO).
Options: A. Internal Clamping diode. B. Electrostatic shielding. C. Compact Printed Circuit Mounting on either 1" x .100 pin spacing or 1" x .150 pin spacing.



CLASS 67 MINIATURE INDUSTRIAL RELAYS

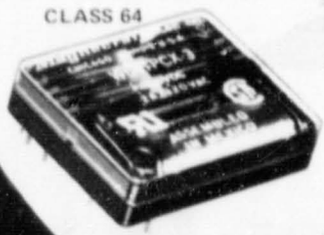


Miniature Industrial Relays are designed and engineered to meet the requirement for a 2 to 8 pole, DPDT relay.....where space, weight, and cost are important factors. Rated at 3 or 5 amps, these relays are available with printed circuit, solder, and plug-in mountings. These Miniature industrial Relays are available for AC or DC operation, and also in sensitive and ultra-sensitive versions. Mating sockets for all versions are available. UL recognized and CSA certified (DC only).



LOW PROFILE RELAYS

CLASS 64



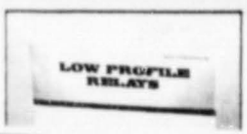
CLASS 63





CLASS 65

Magnecraft Low Profile Relays are designed to serve the requirements of close rack mounting of printed circuit boards. Rated at 2 amps for DPDT , 4PDT,and 6PDT application. Another version is rated at 8 amps with SPDT contacts. All are available for DC operation only, UL recognized and CSA certified.



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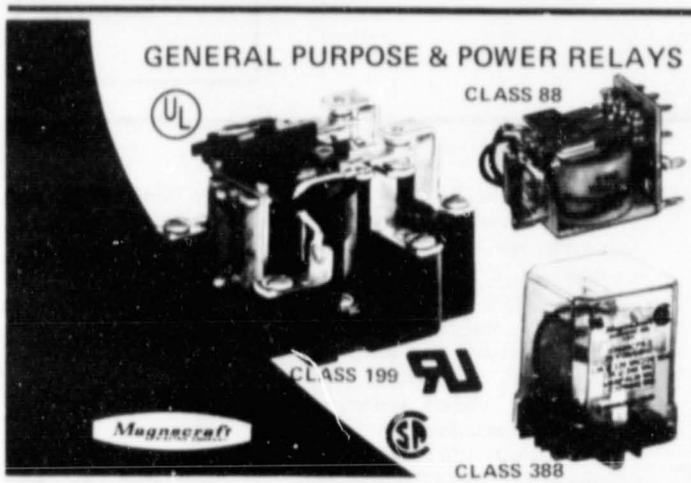
CLASS 78 GENERAL PURPOSE INDUSTRIAL RELAYS



Widely used General Purpose Industrial Relays are interchangeable with all comparable types. Contacts range from 1 to 10 amps, DPDT or 4PDT. Available in plug-in, solder DPDT or printed circuit, or quick connect terminals. Also flange mounted versions. AC or DC operated. Dust proof cover. Mating sockets available. UL recognized and CSA certified.



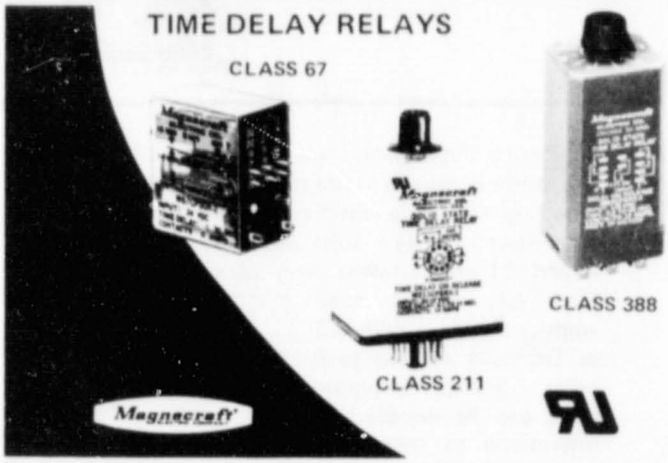
GENERAL PURPOSE & POWER RELAYS



General Purpose and Power Relays are available in a wide variety for many commercial, industrial, electronic, and other applications. Contacts are rated from 10 to 50 amps at 28VDC or 115/220VAC with a large selection of contact combinations. Over 518 different types offered from stock. Multiple and auxiliary contacts, magnetic blowout for DC switching, latching, indicators, test buttons, enclosed plug-in or stud mounting and hermetically sealed. Most are UL and CSA types.



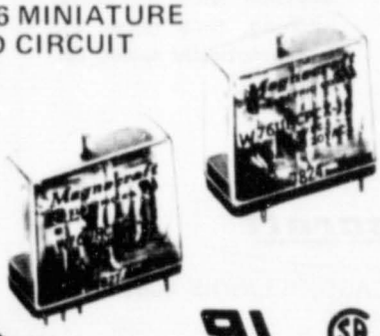
TIME DELAY RELAYS



Magnecraft Time Delay Relays are available from stock as both slow operate and slow release units, with AC or DC operation. Also available are time delay functions such as interval timer, flasher, one shot, and slow operate - slow release. Timing ranges are from .2 seconds to 120 minutes, and longer. Mating sockets are available. UL recognized.



CLASS 76 MINIATURE PRINTED CIRCUIT RELAYS



2 and 10 amp, general purpose, high current, Miniature Printed Circuit Relays. They are versatile, provide long life and reliable performance. Designed for continuous duty operation. Single and double pole versions. UL recognized and CSA certified. Dust proof cover. DC operation only.



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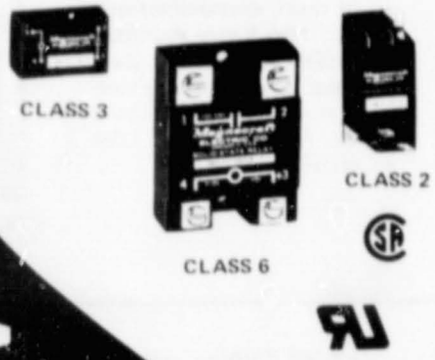
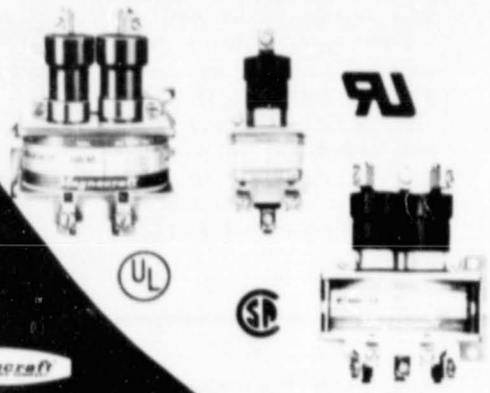
SOLID STATE RELAYS



We offer a line of Solid State relays which handle from 2.0 amps to 40 amps and switch up to 480VAC. Both SCR and Triac outputs are available with either AC or DC controlled inputs. This group of relays features high transient protection, photo-isolation, and zero switching. Our SSR's are also ideal for quiet operation, inductive loads, contaminated environments and long life.



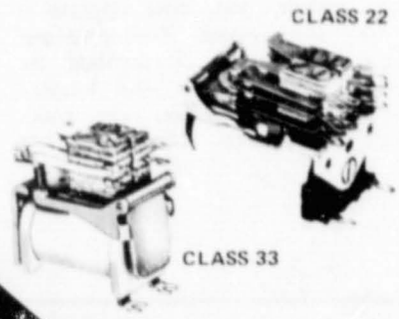
MERCURY DISPLACEMENT RELAYS



Available as 1, 2 or 3 pole, normally open, or normally closed relays, Mercury Displacement Relays switch up to 60 amps. Liquid mercury furnishes a new set of contact surfaces after every operation. Perpetually self-renewing, mercury cannot pit, weld, disintegrate or oxidize. Hermetically sealed switch for silent operation, reliability and long life. UL recognize/listed and CSA certified.



TELEPHONE TYPE RELAYS



Telephone Type Relays are one of the most reliable and versatile designs in use today. Ideal for situations requiring multi-pole switching, they allow intermixing of contact materials, sizes and contact forms (A, B, C and D) on the same relay and different current loads (dry circuits to 50 amps). Available with AC or DC coils and up to 8 poles. Special configurations can be designed or intermixed to meet customer requirements. Also available with mechanical latching, time delay and in hermetically sealed versions.



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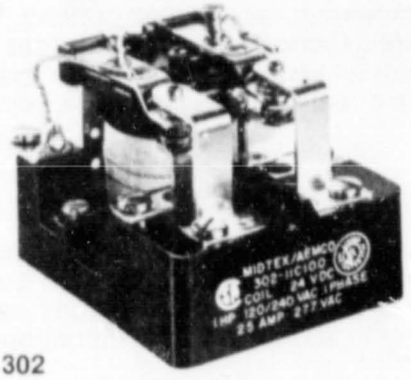
MIDLAND ROSS

Midland-Ross Corporation
Midtex Division
1650 Tower Boulevard, North Mankato, MN 56001
507/625-6521

Midtex Industrial Power Relays



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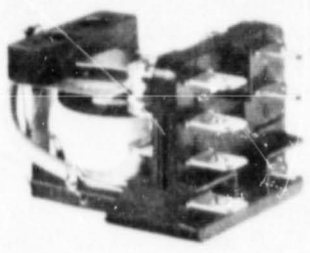

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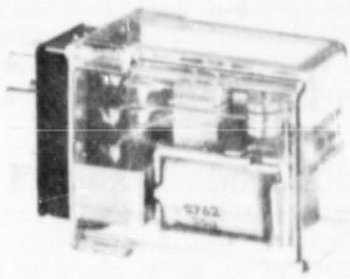

136 PLUG-IN

Midtex, Incorporated has manufactured contact switching devices for over 60 years. While relays as such have been manufactured by Midtex since the early years of World War II, the Company is probably more well known for its broad line of modern style, general purpose industrial grade relays, both in the low-level to 10 ampere contact switching category, and in the 20 to 50 ampere power switching range of products. Both categories of products have added a new dimension to reliable switching in mass produced, economical versions of relatively compact state-of-the-art assemblies. Essentially all of the devices described herein are recognized under the Component Program of Underwriter's Laboratories, Incorporated, and Canadian Standard Association.

Midtex's manufacturing process is heavily vertically integrated, comprised of stamping and punch-press operations, plastic molding and high-speed coil winding, and a wide variety of custom, in-house developed automated assembly equipment. The magnitude of this integration, coupled with rigorous quality assurance standards on purchased raw material and in-process operations insures our customers the utmost in product quality.

Our applications engineering and sales support staff are experienced and ready to assist you in the relay selection process, to assure the optimum economic and technical choice of product for even the most demanding of applications.

This catalog section presents electromechanical power relays in the 20 to 50 ampere switching range.

Midtex General Purpose Relay Selection Factors

Midland-Ross Corporation
Midtex Division
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The selection process for a relay generally involves an analysis of six major parameters:

1. The environment in which the device will function.
2. The mechanical aspects sought, including size, method of mounting and termination options.
3. The input power requirements, whether AC or DC.
4. The contact load switching requirements.
5. Speed of response.
6. Reliability requirements over useful life.

ENVIRONMENT

Midtex offers general purpose industrial relays in open style, dust covered or hermetically sealed options. The open style and dust covered versions are suitable for almost all industrial applications. Dust covers protect the contact system during handling, installation and unexpected abuse in the field. While a contact chamber that is free to "breathe" is often desirable, printed circuit relay dust covers can be quasi-sealed to preclude certain amounts of flux contamination during printed circuit board assembly.

MECHANICAL ASPECTS

The general purpose relays described herein are of three basic sizes, as determined by the number of contact poles and rated switching current of the contacts. The methods of mounting range from printed circuit board mounting to metal frame or socket plug-in. A variety of terminations are available to suit most any need, including: solder lug, ¼" and $^{3}/_{16}$" quick-connect, printed circuit tab, octal plug-in and wire-wrap terminations.

POWER REQUIREMENTS

General purpose relay operating power requirements are normally defined in terms of an operate/release voltage or current level, rather than in terms of a power input level. Circuit parameters should be reviewed to insure that even under extreme limits of ambient and self-heating temperatures and voltage variations that a sufficient level of overdrive is supplied to the relay coil to insure adequate operation.

SPEED OF RESPONSE

General purpose electromechanical relays are normally designed to operate in the 10 to 30 millisecond range, when operated at nominal voltage and at 25° C. This operate time is defined as the time from coil power applied to the time of first contact closure; contact bounce will generally persist for up to two or three times the first closure period, and in most instances is not an objectionable factor.

CONTACT LOADS

The contact switching capability of the general purpose relays described herein range from low-level (dry circuitry) to 20 amperes, depending upon the device selected and the choice of contact material. Reference should be made to the individual specification sheets, which describe the contact capabilities of each product type.

RELIABILITY

Life expectancy of the mechanical system on the relays described in this section are typically in excess of 10 million operations. While contact reliability is a function of contact load, electrical life is generally defined in terms of 100,000 operations at the rated loads, as presented on the individual product specification sheets.

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General Purpose Relay Selection Factors continued

CONTACT MATERIALS

GOLD ALLOY

For use at switching levels from dry circuit to 0.5 amp where contact resistance must be very low and stable in the presence of potentially contaminating atmospheres. Gold has the best resistance to surface film formation under adverse environments, therefore, maintaining low, stable contact resistance even when very light contact forces are present. However, it is high in cost and shows poor resistance to material transfer especially at higher DC currents and poor resistance to welding or sticking and mechanical wear.

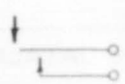
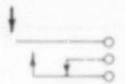
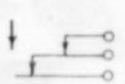
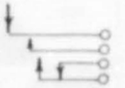
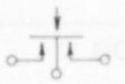
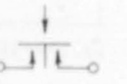
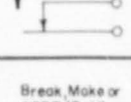
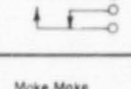
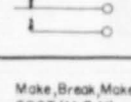
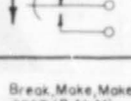
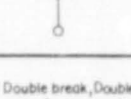
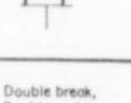
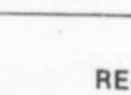
PURE FINE SILVER GOLD FLASHED

Generally applied in circuits switching at intermediate levels (100 to 500 ma.) to 5 or 10 amps (depending on contact size) and where inrush currents are nominal. Silver is an excellent general purpose contact material being low in cost and having good resistance to film formation except in the presence of sulfur compounds wherein the gold flash protects it during storage. Heavier coatings of gold such as used on the diffused gold over silver contacts provide a low cost method of switching low level loads if some variation in contact resistance is allowable. Silver also has fair to good resistance to erosion, material transfer and welding or sticking. Silver has the highest electrical and thermal conductivity thereby producing the least heat at the contact interface for a given current and contact size of any of the contact materials available today.

SILVER CADMIUM OXIDE

A semi-refractory material having excellent resistance to welding or sticking and erosion. It is generally used in intermediate to high load current circuits where high inrush currents occur as in switching tungsten lamps, capacitors or motors, or where heavy arcing occurs as in breaking inductive loads. Silver Cadmium Oxide contacts are also used in some low level circuits where comparatively large variations in contact resistance are acceptable, however, relatively high contact forces are required to obtain reasonably low contact resistance. AgCdO is comparable to pure fine silver in cost making it also a fairly good general purpose contact material.

CONTACT ACTION NOMENCLATURE

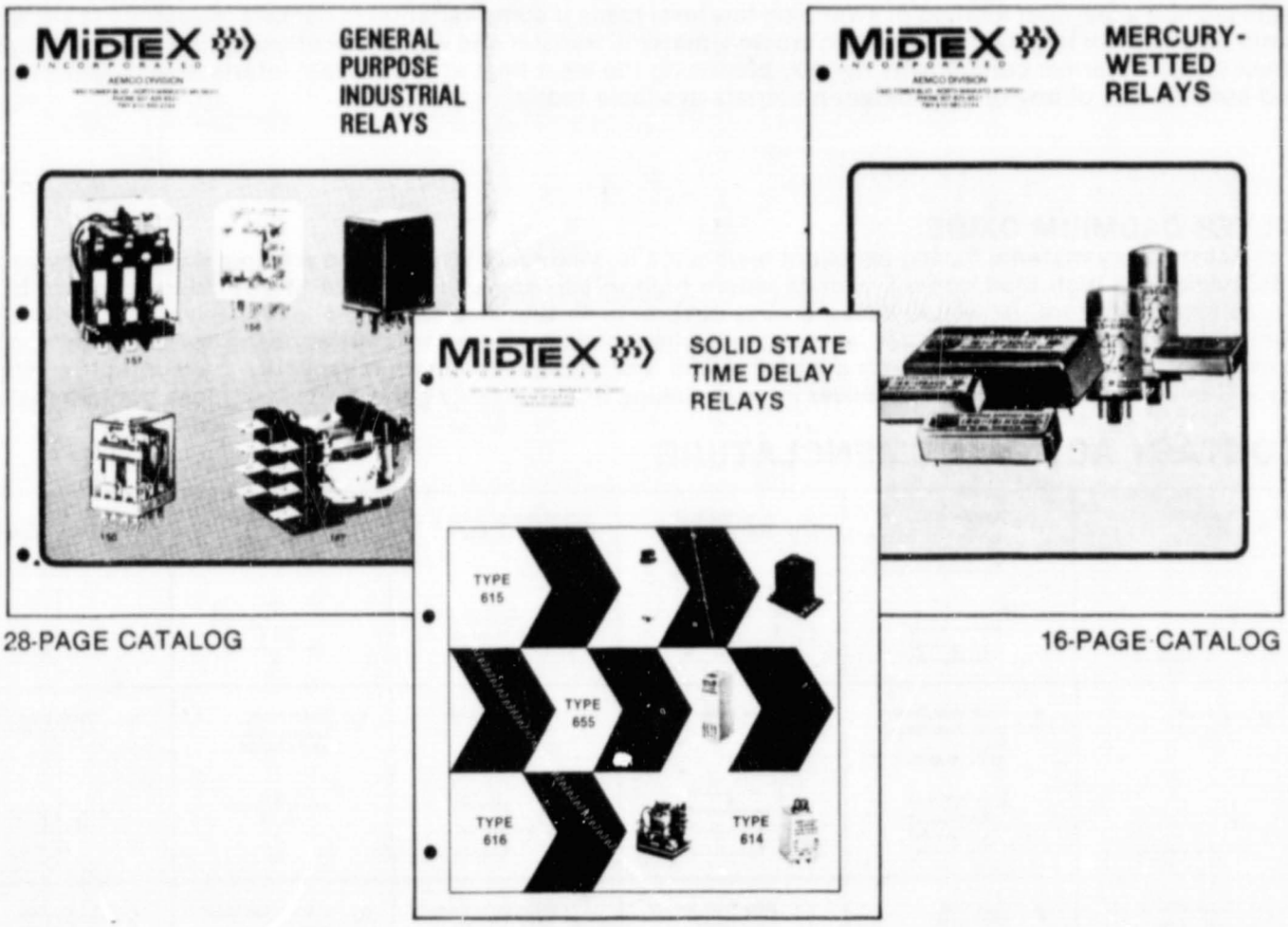
A MAKE OR SPST NO 	D Make, Break or Make Before-Break, or SPDT (M-B), or "Continuity transfer" 	G Break, Break or SPST (B-B) 	J Make, Make, Break or SPST (M-M-B) 	U Double make, Contact Arm. SPST NO DM 	X Double make, or SP ST NO DM 
B Break or SPST NC 	E Break, Make, Break, or Break-Make-Before-Break, SPDT (B-M-B) 	H Break, Break, Make or SPST (B-B-M) 	K Single pole, Double throw Center of, or SPDTNO 	V Double break, Contact Arm. SP ST NC DB 	Y Double break or SP ST NC DB 
C Break, Make or SPDT (B-M), or transfer	F Make, Make SPST (M-M)	I Make, Break, Make or SPST (M-B-M)	L Break, Make, Make, or SPST (B-M-M)	W Double break, Double make, Contact on Arm. ST DT NC-NO(DB-DM)	Z Double break, Double make SP DT NC-NO(DB-DM) 

THE TOTAL RELAY COMPANY

Midland-Ross Corporation
Midtex Division
1650 Tower Boulevard, North Mankato, MN 56001
507/625-6521

INDUSTRIAL RELAYS
MERCURY-WETTED RELAYS
TIME DELAY RELAYS
COAXIAL RELAYS
SYNCHRONOUS MOTOR TIMERS
GENERAL PURPOSE RELAYS
SOLID STATE RELAYS
DIP RELAYS
MICROINTERFACE™ MODULES

Through its AEMCO Division, Midtex, Inc. has manufactured electromechanical components for over 60 years. By specializing in quality products with unique engineering content, Midtex has earned its recognition as the TOTAL RELAY COMPANY and now offers one of the broadest relay product lines in the industry. Midtex, Inc. also manufactures telephone grade transformers and digital and analog microinterface modules for microprocessor interface applications.



28-PAGE CATALOG

16-PAGE CATALOG

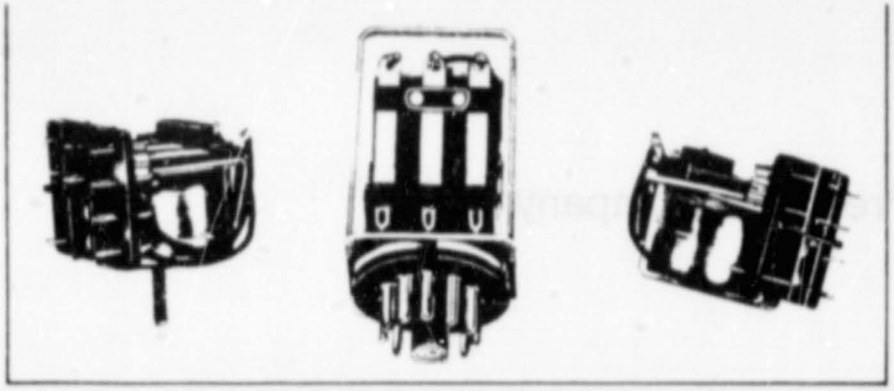
16-PAGE CATALOG

Shown above are just three of the many specialized product catalogs, which describe in detail the mechanical and electrical parameters of Midtex, Inc. products.

The Prestolite Company

DATA SHEET

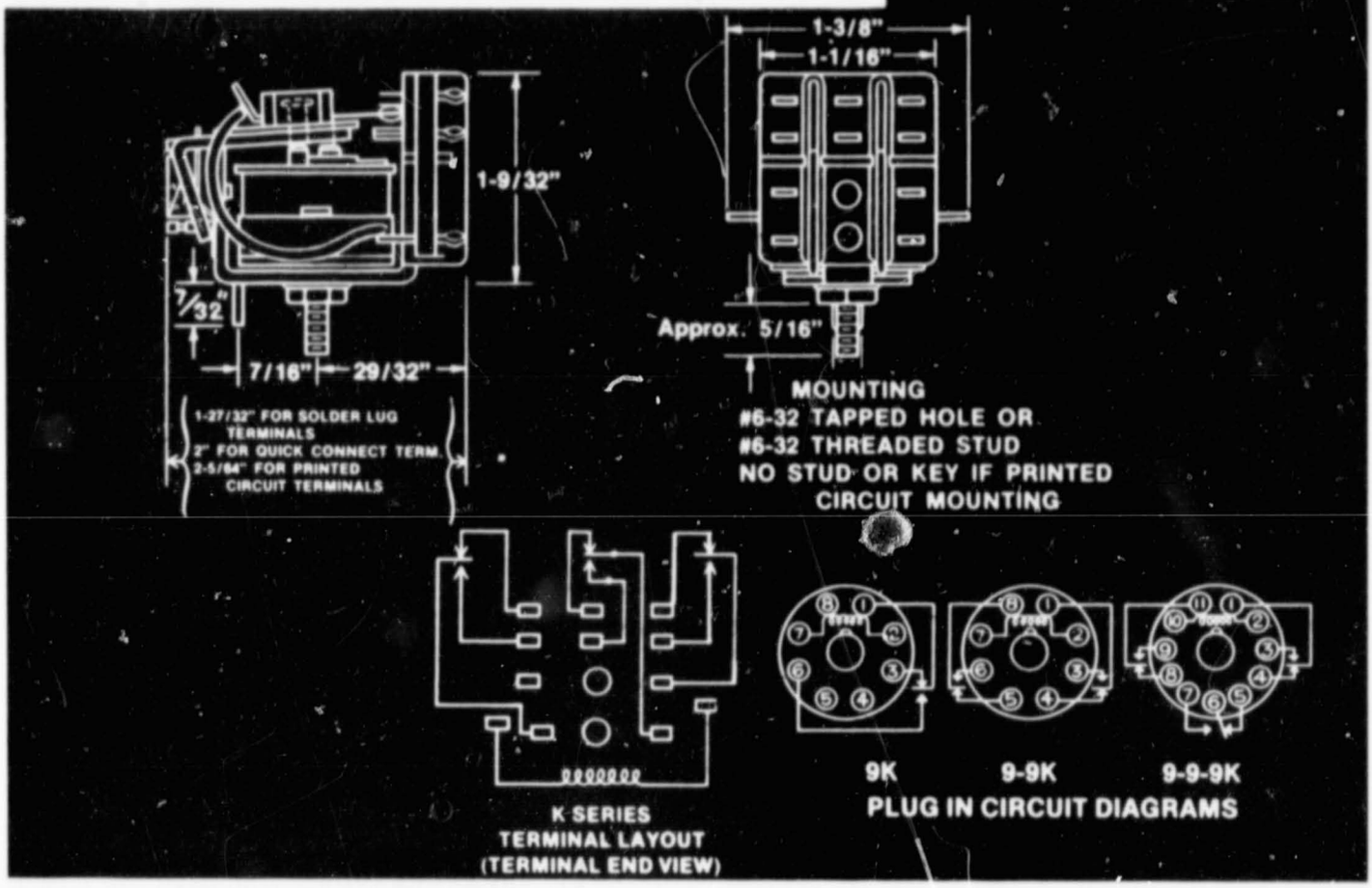
Company Name -	Prestolite Electronics Div. an Eltra Company 511 Hamilton Street Toledo, OH 43694
Company Phone Number -	419/255-4068
Name of Items -	
DC - DC Converters (on board)	Low Power (Instrument lighting only)
Relays, AC & DC (up to 300V, AC & DC)	Low Voltage, only i.e. 6 to 24 volt (horn relays, etc.)
Solenoids	Up to 72 Volt; SAZ, SBC, SAW, SAS, etc.
Switches (6-3000V, 1-20 Amp, AD&DC)	High Current low voltage push type switches
Transducers, Control Current	Brush Wear Indicators
Voltage Regulators	Generator & Alternator Voltage Regulators for 6 to 36 volt applications Solid state and Electro Mechanical types, i.e. VSH, VBC, VCA, etc.
Production Status of Above Items -	All are currently in production



The [illegible] Co.

TYPE K RELAY

for
AC or DC Operation
(240 Volts Maximum)



K series relay has a multi-pole switching arrangement – SPDT, DPDT, and/or 3PDT. Relay is available in AC or DC operation at any voltage up to 220 Volts.

Termination is available in (1) solder lug terminals; (2) 3/16" quick-connect terminals; and (3) printed circuit terminals.

Relay is also available as a plug-in unit – 8 pin or 11 pin octal plug configuration – and encapsulated in a clear plastic case.

K series relay is Underwriters' Laboratories, Inc. (UL) and Canadian Standards Association (CSA) recognized under the component listings.

Engineering recommendations, quotations, and delivery schedules immediately available upon request. Relays can be custom built to most any special request.

(Tel. 312-252-2700)

RELAY SERVICE COMPANY

1310-12 NORTH PULASKI ROAD • CHICAGO, ILLINOIS 60651

Manufacturers of "Low-Cost" Relays, Coils, AC Buzzers, Mechanical Leaf (Blade) Switch Assemblies

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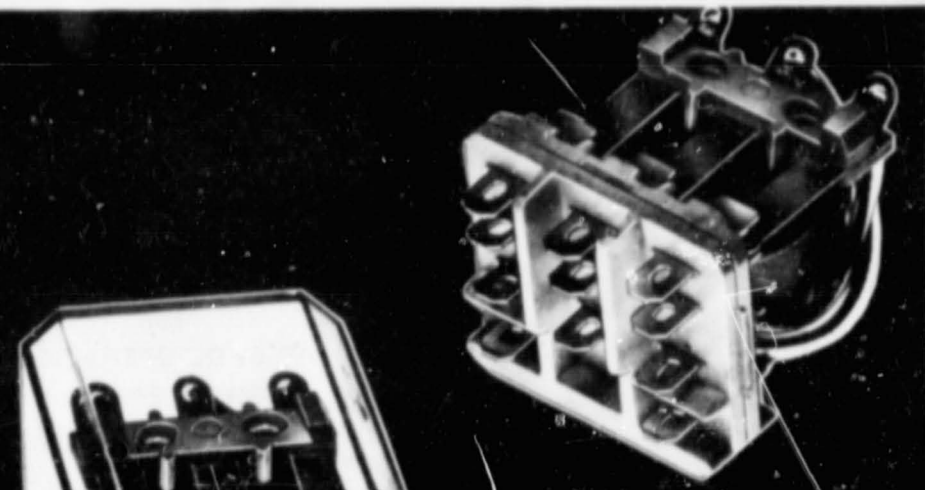
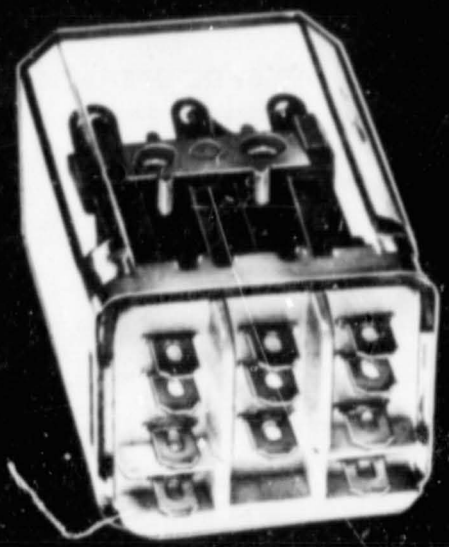
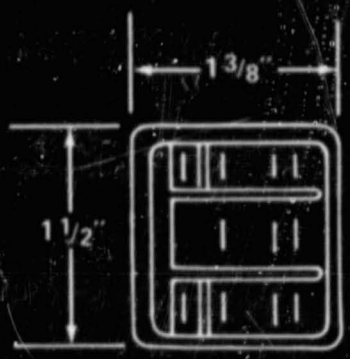
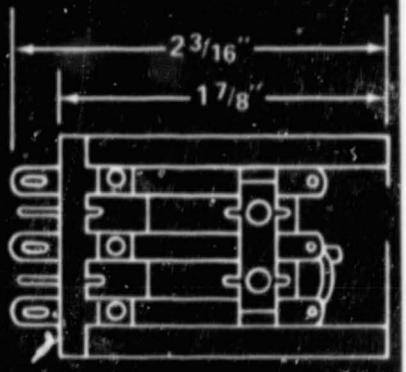
The RS Co.
TYPE KU RELAY

for
AC or DC OPERATION
(240 volts maximum)

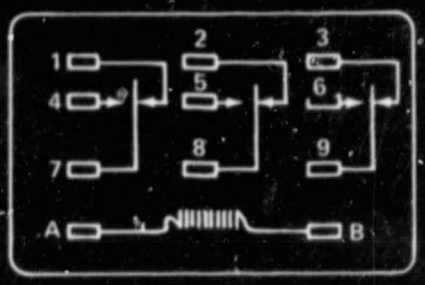








DC OPERATION			AC OPERATION		
Nominal Voltage	DC RESISTANCE (Ohms)	NOMINAL CURRENT (Amps)	Nominal Voltage	DC RESISTANCE (Ohms)	NOMINAL CURRENT (Amps)
6	32	.188	6	6	.300
12	120	.100	12	20	.165
24	470	.051	24	75	.110
48	1800	.026	120	1800	.024
110	10000	.012	240	9100	.009



This Type KU RELAY is a general purpose, quality relay in relationship to its primary cost.

FEATURES

1. Available in SPDT, DPDT, 3PDT (1 Form C, 2 Form C, 3 Form C) contact combination.
2. Standard terminals .187" tab type for quick connect or solder lug connection.
3. Contact capability up to 10 amperes @ 28 VDC or 240 VAC for 3 Form C; up to 15 amperes for 1 or 2 Form C.
4. Relay is recognized by the Underwriters' Laboratories, Inc., and the Canadian Standards Association under the component program listing.

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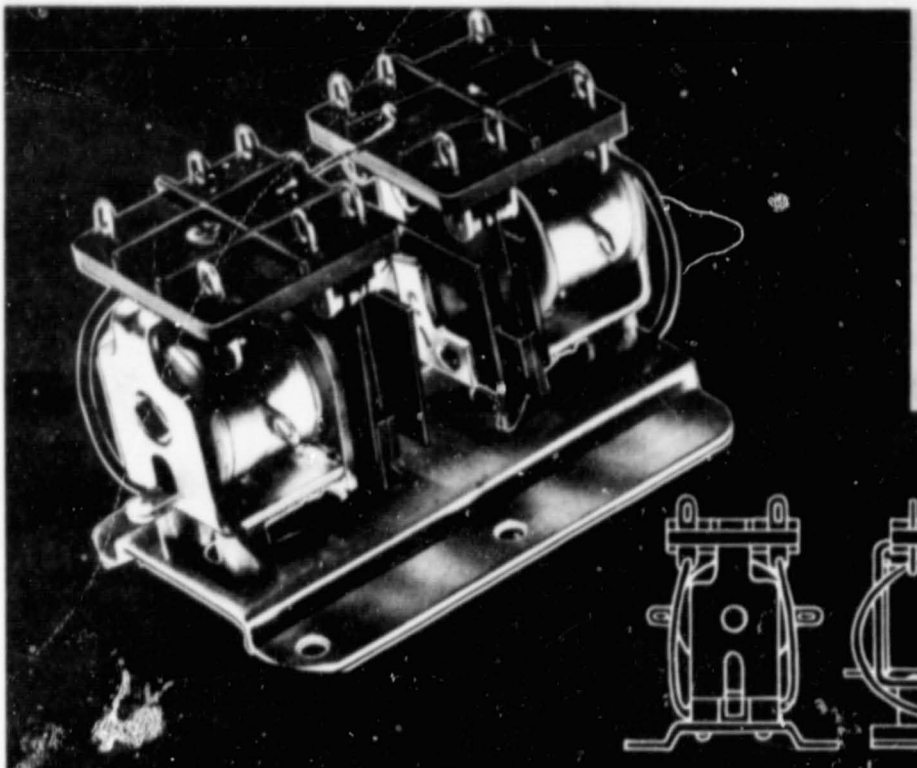
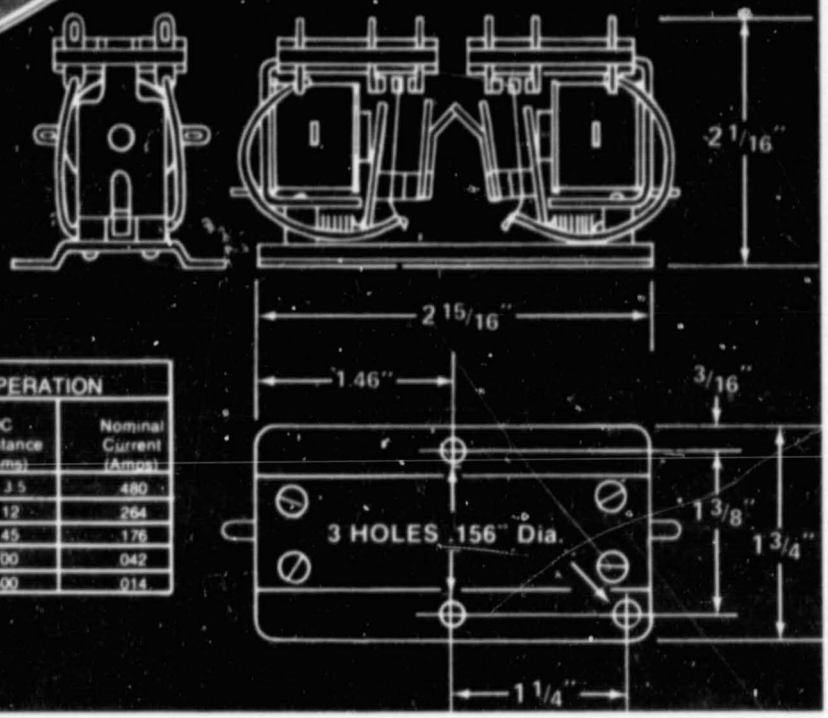
(Tel. 312-252-2700)

RELAY SERVICE COMPANY
1310-12 NORTH PULASKI ROAD • CHICAGO, ILLINOIS 60651
Manufacturers of "Low-Cost" Relays, Coils, AC Buzzers, Mechanical Leaf (Blade) Switch Assemblies

The RS Co.
TYPE KL
LATCHING (INTERLOCK)
RELAY
for
AC or DC OPERATION
(240 Volts Maximum)





DC OPERATION			AC OPERATION		
Nominal Voltage	DC RESISTANCE (Ohms)	NOMINAL CURRENT (Amps)	Nominal Voltage	DC Resistance (Ohms)	Nominal Current (Amps)
6	20	300	6	3.5	480
12	70	170	12	12	264
24	300	080	24	45	176
48	1100	043	120	1100	042
110	6000	018	240	5500	014

This unit is a two (2) coil mechanical LATCHING (INTERLOCK) RELAY whose function is to transfer and hold contact changeovers without any power being continually applied. A single pulse operates one relay setting the latch mechanism, another single pulse to the other coil releases the original latch.

FEATURES

1. Two coil and two individual pulsing circuits.
2. Any contact combination up to 4 PDT, 2 PDT maximum on each relay.
3. Contact capability up to 10 amperes @ 28 VDC or 240 VAC.
4. Unit is recognized by the Underwriters' Laboratories, Inc., and the Canadian Standard Association under the component program listing.

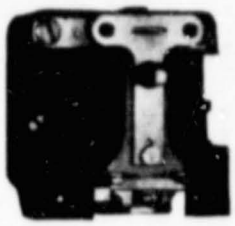
(Tel. 312-252-2700)

RELAY SERVICE COMPANY
1310-12 NORTH PULASKI ROAD • CHICAGO, ILLINOIS 60651
Manufacturers of "Low-Cost" Relays, Coils, AC Buzzers, Mechanical Leaf (Blade) Switch Assemblies

425 Series

GENERAL PURPOSE

30 AMP
1 & 2 POLE



425HXX



425XBX

Type 425 power relays are modern, low-cost general purpose relays available in many configurations. Enclosed, snap-action auxiliary contacts are available as an option.

High Inrush models are also available. Any of the contacts can be specified for loads up to 250 amps inrush when contacts make and 20 amps carrying. For multi-pole relays, specify which contacts require high inrush.

MODELS AVAILABLE:

Type No.	Contact Arrange.	Dim. Fig.
"Hot" Armature Types (300V)		
425AXX	SPST-NO	2
425XXA	SPST-NC	2
425XAX	SPDT	2
425HXX	SPST-NO-DM	2
425XXH	SPST-NC-DB	1
425XHX	SPDT-DB	1
Insulated Armature Types (600V)		
425HXX2	SPST-NO-DM	2
425XXH2	SPST-NC-DB	1
425XHX2	SPDT-DB	1
425BXX	DPST-NO	2
425XXB	DPST-NC	1
425XBX	DPDT	1

If arc extinguishing permanent magnet blowouts are required for the relays listed at left below, the relays listed at right must be substituted.

Types without blowouts	Substitute Types w/blowouts
425AXX	425HXX69
425XXA	425XXH69
425XAX	425XAX2-69
425XHX	425XHX2-69

COILS:

Voltage	AC, 50/60 Hz (9.3VA) mA	AC, 50/60 Hz (9.3VA) Ω	DC, (2.0 W) mA	DC, (2.0 W) Ω
6	1600	0.86	333	18
12	820	3.2	169	71
24	410	12	84	288
120*	85	290	18-21	6050
240	43	1200	—	—
480**	22	4500	—	—

*AC Coil is 120V, 50/60 Hz. DC Coil is 110-125 Vdc
**U.L. and C.S.A. Listing only for insulated armature.

Min. Operate: AC—85% of nominal voltage
DC—75% of nominal voltage
Max. Overvoltage: 110% of nominal

CONTACT RATING: (silver-cadmium oxide contacts)

Type	Load	28Vdc	120-240Vac	125Vdc	600Vac
"Hot Armature" (300V)	Resistive	30A	30A	*	—
	Motor (80% PF)	—	1HP	—	—
Insulated Armature (600V)	Resistive	30A	30A	*	10A
	Motor (80% PF)	—	1HP	—	—

*Contact rating for models with pm blowouts

Contacts	125Vdc
NO	5A
NC	10A

NOTE: For 220 Vdc, use 6,000 ohm 5-watt resistor in series with coil of 125Vdc relay.

GENERAL SPECIFICATIONS:

U.L. Listed: Basic Types—File No. E13224A. Features 18 and/or 90—yellow card, U.L. Listed Component.
C.S.A. Listed: File No. LR9494
Dielectric: 2500Vac, 60Hz, between mutually insulated current carrying parts and all current carrying parts to ground.
Operate Time: 30 ms typical
Release Time: 15 ms typical
Ambient Temperature Range: AC Relays: −55° to +45°C
DC Relays: −55° to +80°C
Life Expectancy: Mechanical—10 million operations, minimum, no load.
100,000 operations, minimum, at rated loads.
Terminals: Screw terminals (8-32 contacts, 6-32 coil) are standard.
Options: 0.25" Quick Connect Terminals: Add suffix 18.
SPDT Aux. Contacts: suffix 90.
PM Blowouts for dc: suffix 69

DIMENSIONS

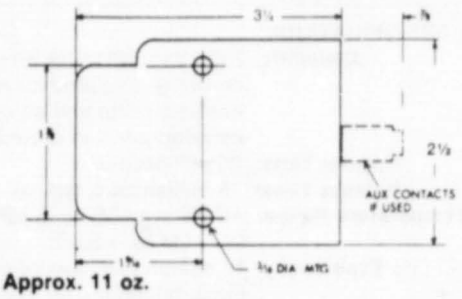


Fig. 1
Weight Approx. 11 oz.

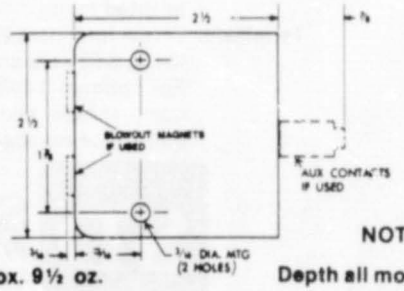


Fig. 2
Weight Approx. 9½ oz.

NOTE:
Depth all models 2½".

STRUTHERS-DUNN, INC., Pitman, N.J. 08071, TEL: 609-589-7500

30 AMP 3-POLE GENERAL PURPOSE

425 Series



- **SCO Contacts**
- **30 AMP to 240 VAC**
- **10 AMP to 600 VAC**

Type 425XCX 3PDT and 425CXX 3PNO are general purpose relays rated for loads up to 10 amps at 600 Vac and 30 amps up to 240 Vac. Models identified with a suffix "C" are enclosed in a clear plastic cover. Full Floating movable contacts with excellent wiping action are specifically designed for industrial environments. Suitable for control of single-phase or three-phase loads such as motors, solenoids, heaters, and compressors.

MODELS AVAILABLE:

425CXX 3PNO Open Type
425CXXC 3PNO Enclosed in clear plastic cover*
425XCX 3PDT Open Type
425XCXC 3PDT Enclosed in clear plastic cover*
*Cover open at both ends for wiring

COILS:

Voltage	AC, 50/60Hz (11VA) Resistance, Ω	DC, (4W) Resistance, Ω
12	1.8	35.5
24	6.7	142
48	27	565

Min. Operate: AC--85% of nominal voltage
DC--75% of nominal voltage
Max. Overvoltage: 110% of nominal

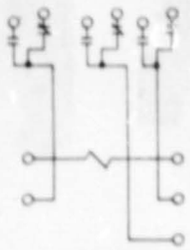
CONTACT RATINGS:

Load	28Vdc	120-240Vac	240-600Vac
Resistive	30A	30A	10A
Motor (80%PF)	1Ø, 1 HP per pole	1Ø, 1HP per pole	3Ø, 3HP

GENERAL SPECIFICATIONS:

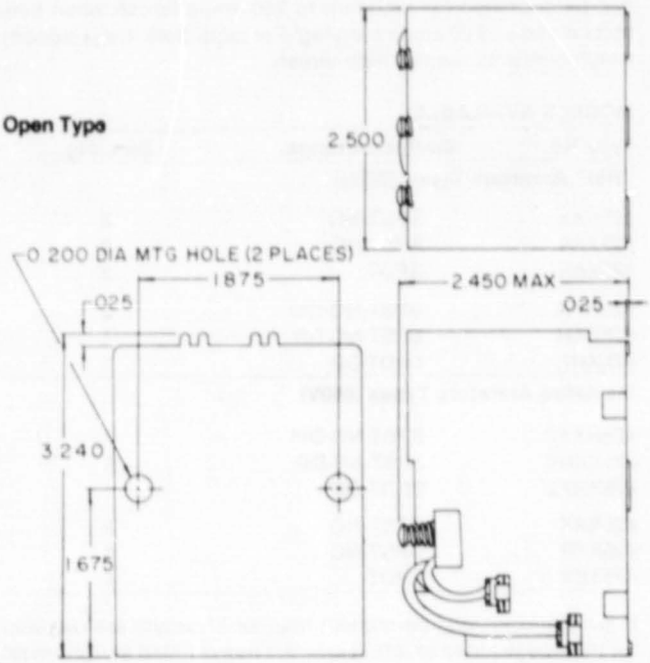
Dielectric: 2500 Vac. 60Hz, between mutually insulated current carrying parts and all current carrying parts to ground.
Operate Time: 30 millisecond
Release Time: 15 millisecond, typical
Ambient Temperature Range: AC Relays –55° to +45°C
DC –55° to +80°C.
Life Expectancy: 10 million mechanical operations, minimum, no load.
100,000 operations, minimum, at rated loads.
Terminals: Screw terminals (8-32 contacts, 6-32 coil) are standard. For optional 0.250" quick-connect tabs, add suffix 18 to basic type number.

INTERNAL WIRING (Viewed from front of relay.)

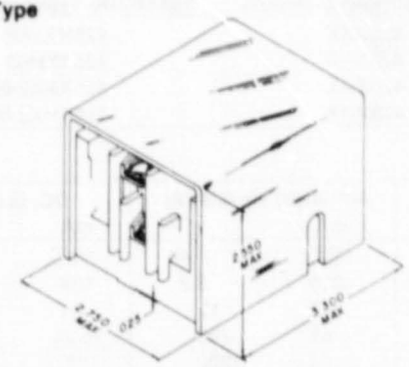


DIMENSIONS

Open Type



Enclosed Type



NOTE: Mount in Vertical Position with Contacts Up.

STRUTHERS-DUNN, INC.
PITMAN, NEW JERSEY 08071
Manufacturers of Relays and Solid State Controls
Telephone: 609-589-7500 TWX: 510-686-7510

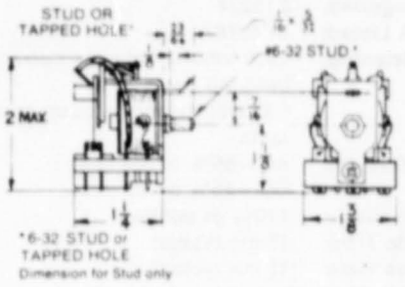


Fig. 1
Open Style

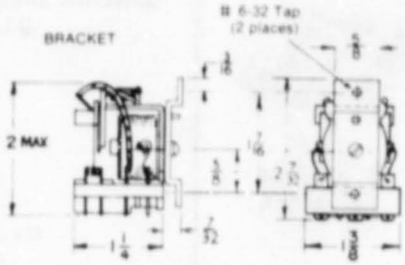


Fig. 2
Open, Bracket Mount

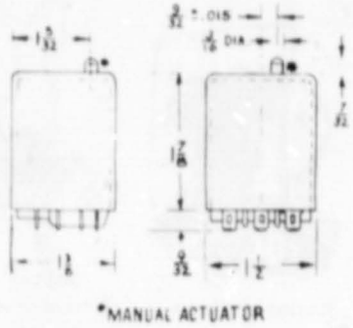


Fig. 3
Enclosed, Plug-In

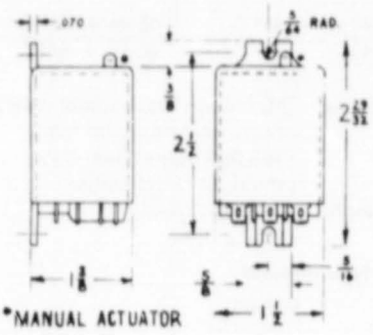


Fig. 4
Enclosed, Bracket Mount

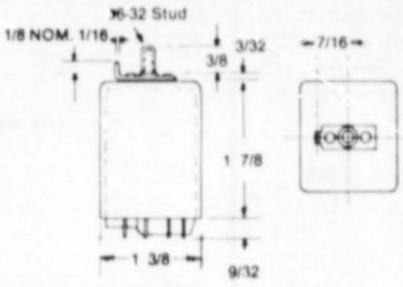


Fig. 5
Enclosed, Top Stud

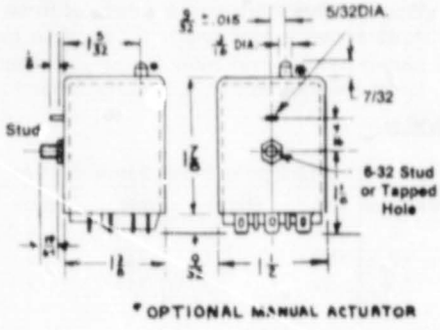


Fig. 6
Enclosed, Side Stud, or Tapped Hole

STANDARDS SOCKETS FOR PLUG-IN TYPES

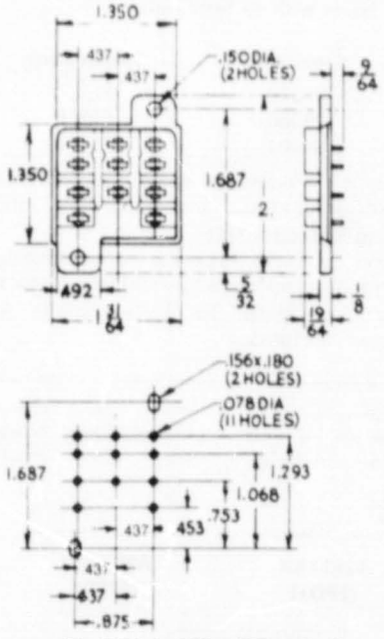


Fig. 7 Printed Circuit Terminals
#36579

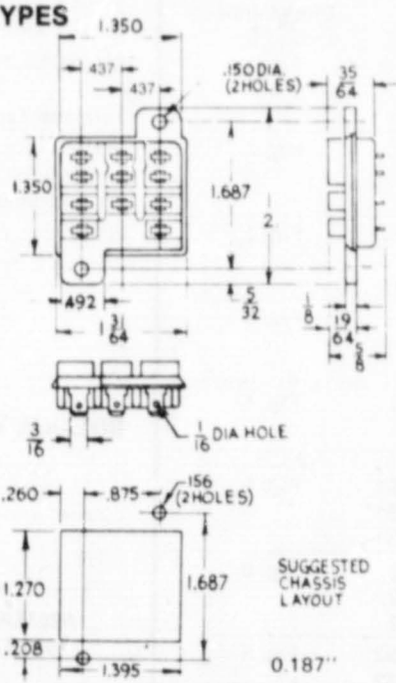


Fig. 8 Quick-Connect Terminals
#36580

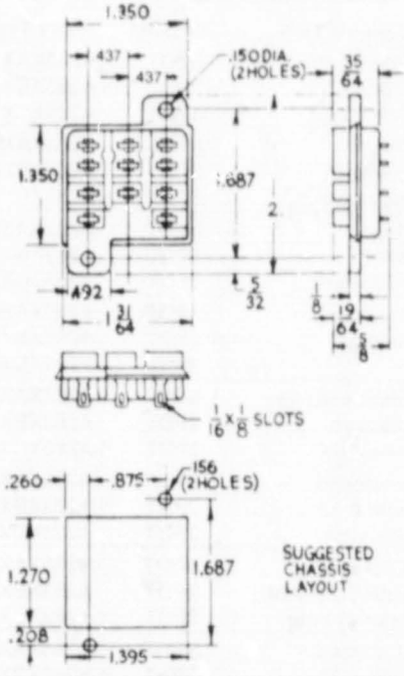


Fig. 9 Pierced Solder Lug Terminals
#36581

A283 Series

GENERAL PURPOSE

SQUARE BASE PLUG-IN



Enclosed Plug-in



Socket & Hold-down Spring



Open Type

Type A283 General Purpose relays are available in many standard open and enclosed mounting styles as shown on page 17. All types offer SPDT, DPDT or 3PDT contacts rated at 10 amps. Plug-in types mate with a choice of three square sockets. The A283 series is just one in a complete family of square base plug-in relays that include the 292 sensitive, 285 magnetic latch, 284 four-pole G.P., and the 286 and 287 time delay relays.

COILS:

	AC 1& 2 pole (2VA)		3 pole (2.7VA)		DC (1.2W)	
Voltage	mA	Ohms	mA	Ohms	mA	Ohms
6	335	6	460	4.2	188	32.1
12	168	21	230	18	100	120
24	83	85	115	72	51	472
48					26.6	1,800

CONTACT RATING:

Load	28Vdc	120Vdc	240Vac
Resistive	10A	10A	10A
Motor 80% (PF)		⅓ HP	½ HP

STANDARD MODELS:

Construction	Contacts	Relay Type	Dimensions (p. 17)
Open, with tapped 6-32 hole	SPDT 2PDT 3PDT	A283XAX A283XBX A283XCX	Fig. 1
Open, bracket-mounted	SPDT 2PDT 3PDT	A283XAXB A283XBXB A283XCXB	Fig. 2
Open, with 6-32 stud	SPDT 2PDT 3PDT	A283XAXS A283XBXS A283XCXS	Fig. 1
Enclosed plug-in	SPDT 2PDT 3PDT	A283XAXC A283XBXC A283XCXC	Fig. 3
Enclosed bracket-mounted	SPDT 2PDT 3PDT	A283XAXC1 A283XBXC1 A283XCXC1	Fig. 4
Enclosed with 6-32 top stud	SPDT 2PDT 3PDT	A283XAXCS1 A283XBXCS1 A283XCXCS1	Fig. 5
Enclosed with 6-32 side tapped hole	SPDT 2PDT 3PDT	A283XAXC2 A283XBXC2 A283XCXC2	Fig. 6
Enclosed, with 6-32 side stud	SPDT 2PDT 3PDT	A283XAXCS2 A283XBXCS2 A283XCXCS2	Fig. 6

GENERAL SPECIFICATIONS:

U.L. Recognized: E13224
CSA Listed: LR40787
Dielectric: 1500 V/60Hz between current carrying parts.
500 V/60Hz across open contacts
Min. Operate: AC—85% of nominal
DC—75% of nominal
Max. Overvoltage: 110% of nominal
Operate Time: 15 ms typical
Release Time: 10 ms typical

Ambient Temperature Range:

	Enclosed	Open
1 & 2 Pole AC Relays:	-45 to + 55°C	-45 to + 70° C
3 Pole AC Relays:	-45 to + 45° C	-45 to + 60° C
DC Relays:	-45 to + 70° C	-45 to + 85°C

Life Expectancy: 10 million mechanical operations, minimum, no load, 100,000 operations, minimum, at rated loads.
Weight: 3 oz enclosed
2.5 oz open

OPTIONS: Add suffix to type number

Suffix	Option
L	Indicator lamp (120 or 240 Vac, 110-125 Vdc only)
M	Manual Actuator
LM*	Lamp and actuator (120 or 240 Vac, 110-125 Vdc only)

*Not available for CS1 and open types.

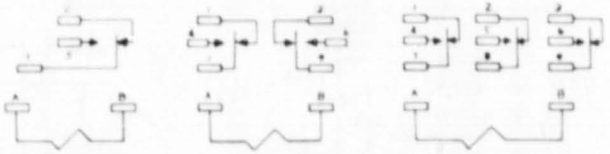
Models are available for direct P.C. mounting or 0.205 - inch quick connect.

SOCKETS: For plug-in types with 11 terminals

Terminal Type	Stock No.	Dimensions
Printed Circuit	36579	Fig. 7
0.187" Quick Connect	36580	Fig. 8
Pierced Solder Lugs	36581	Fig. 9

NOTES:
1. Stock #37067 hold-down spings available for A283XAXC, A283XBXC, and A283XCXC relays when using above sockets.
2. In addition to above sockets, front-connected, screw terminal sockets and mounting track are available from many distributor stocks and several manufactures.

INTERNAL WIRING



A283XAX (SPDT) **A283XBX (2PDT)** **A283XCX (3PDT)**

(Terminal plug view)



Introduction . . .

Vapor Corporation manufactures a wide range of relays and contactors to meet specific applications with maximum reliability and minimum maintenance requirements. Items shown in this catalog are meeting with high approval in the transportation, heavy construction, off road equipment, industrial, and commercial fields.

Vapor began designing relays and contactors out of necessity in the 1920's. As a pioneer in railroad passenger car heating, Vapor required tough, long life relays for temperature control circuits that could withstand the rigors of rail application. When no satisfactory existing product could be found, Vapor engineers were forced to design relays to the exacting specifications required. Ever since, the Vapor relay and contactor line has been continuously expanded and improved as the need for rugged, dependable relays grew.

In the 1940's Vapor developed a line of heavy duty relays and contactors for locomotive control. In the 1960's the product line was again expanded to include industrial relays and contactors. This constant expansion and improvement program has led to a full line of relays and contactors designed to meet severe operating conditions where long mechanical life and high reliability are paramount. Vapor relays and contactors provide a 1 to 2 million cycle load life and 20 million mechanical cycles with control relays; 5 million mechanical cycles with contactors.

For better service and reliability a relay or a contactor should always be designed to fit a particular application. This is why we invite discussion of your particular application. The use of our Customer Relay and Contactor Specification Sheet makes it easier to select or design a specific device for your engineering problem; use it in your inquiry.

Closely associated with its relay and contactor line, Vapor also designs and manufactures many solid state devices to customer's particular specifications. Close-differential relays, temperature compensated and time delay relays, and transistorized switching circuits are just a few of the many items manufacured in our modern, well-equipped facilities.

Whatever your needs are in the transportation, industrial, or commercial fields, contact our Vapor Sales Engineer in your territory. Our many years of experience in these fields will save you time and money.

VAPOR CORPORATION

TRANSPORTATION SYSTEMS DIVISION
6420 West Howard Street, Chicago, Illinois 60648
Telephone No. 312/631-9200

Table of Contents . . .

INTRODUCTION

A Guide to Using the General Catalog
Table of Contents
Basic Specifications
Customer Relay and Contactor Specification Sheet

DC CONTROL RELAYS

572-2 Two & Three Form "C" Type — Quick Disconnect Terminals
572-3 "Bottle" Type
572-4 Six-Pole Type — Quick Disconnect Terminals
572-5 Eight Pole Type — Quick Disconnect Terminals
572-6 Twelve Pole Type — Quick Disconnect Terminals
572-7 Fourteen Pole Type — Quick Disconnect Terminals
572-8 Two Form "C" Type — Solder Type Terminals
572-9 Three Form "C" Type — P.C. Type Terminals
572-10 Four Form "C" Type — Quick Disconnect Terminals
572-11 Two Form "C" Type — Printed Circuit Type Terminals
572-12 Two Form "C" Type — Plug-In Type Terminals
572-13 One Form "C" Type — Quick Disconnect Terminals

CONTROL RELAYS (CRITICAL CIRCUITS)

572-20 One Form "C" Type — Quick Disconnect Type Terminals
572-21 Two Form "C" Type — Quick Disconnect Type Terminals
572-22 Three Form "C" Type — Quick Disconnect Type Terminals
572-23 Four Form "C" Type — Quick Disconnect Type Terminals
572-24 Six Pole Type — Quick Disconnect Type Terminals
572-25 Eight Pole Type — Quick Disconnect Type Terminals
572-26 Twelve Pole Type — Quick Disconnect Type Terminals
572-27 Fourteen Pole Type — Quick Disconnect Type Terminals

MEDIUM DUTY DC CONTACTORS

572-100 Two, Three and Four Pole Type Screw Type Terminals
572-101 Three Pole Type (w or w/o aux. contacts) for 3 phase AC Loads
572-102 Four Pole Type — Quick Disconnect Terminals
572-103 Two, Three, Four and Six Pole Type — Lug Type Terminals
572-104 Three Pole Type (with arc barriers) — Lug Type Terminals
572-105 Six Pole Type — Quick Disconnect Terminals

VAPOR Transportation Systems
A BRUNSWICK COMPANY

6420 West Howard Street, Chicago, Illinois 60648
Telephone No. 312/631-9200

Table of Contents (cont.)

HEAVY DUTY DC CONTACTORS

572-200 One to Six Pole Type — Pierced Lug Type Terminals
572-201 Two Pole Type — Hex Head Screw Type Terminals
572-202 One Pole Type — Hex Head Screw Type Terminals
572-203 Two Pole Type — Top Mounted Main Contact Terminals, Quick Disconnect Auxiliary Contact and Coil Terminals
572-204 Two Pole Type — Top Mounted Contact Terminals, Quick Disconnect Coil Terminals
572-205 Two Pole Type with Optional Auxiliary Contacts — Top Mounted Main Contact Terminals, Quick Disconnect Auxiliary Contact and Coil Terminals
572-206 One Pole Type — Top Mounted Contact Terminals, Quick Disconnect Coil Terminals
572-207 One Pole Type with Auxiliary Contacts — Top Mounted Main Contact Terminals, Quick Disconnect Auxiliary Contact and Coil Terminals
572-208 Two Pole Type for AC or DC — Top Mounted Main Contact Terminals, Screw Type Coil Terminals
572-210 Four Pole DC Reversing Type — Hex Head Screw Type Terminals
572-300 Two Pole DC Starting Type — Stud Type Terminals

DC CURRENT ACTUATED RELAYS

572-400 "Bottle" Type — Binder Head Screw Type Terminals
572-401 Two Pole Type — Hex Head Screw Type Terminals
572-402 Six Pole Type — Hex Head Screw Type Terminals

DC CLOSE DIFFERENTIAL RELAY

572-500 One Form "C" Type — Quick Disconnect Terminals
572-502 Four Form "A" Type — Solder Type Terminals
572-503 Two Form "A", Two Form "B" Type — Solder Type Terminals

DC LATCHING RELAYS

572-700 Two Form "C" Mechanical Type — Quick Disconnect Type Terminals
572-702 Two Form "C" Electrical Type — Quick Disconnect Type Terminals

AC/DC RELAYS AND CONTACTORS

572-801 Three Form "C" Type Relay — Quick Disconnect Type Terminals
572-802 One Form "C" Type Relay — Quick Disconnect Type Terminals
572-826 One Pole Type Contactor — DC Contact Action, AC Coil Operation

VAPOR CORPORATION • TRANSPORTATION SYSTEMS
6420 West Howard Street, Chicago, Illinois 60648
Telephone No. 312/631-9200

Basic Specifications . . .

Relay Type	Current Load Rating @ 28 VDC	Current Load Rating @ 140 VDC	Number of Poles	Type of Terminations	Bulletin Number
General Control	4 Amps	1 Amp	3 Form "C"	.03" dia. Pins	572-9
Heavy Duty Control	20 Amps	5 Amps	1 Form "C"	Fast-ons	572-13
Heavy Duty Control	20 Amps	5 Amps	2 Form "C"	Fast-ons	572-2
Heavy Duty Control	15 Amps	3 Amps	2 Form "C"	Solder	572-8
Heavy Duty Control	15 Amps	3 Amps	2 Form "C"	.045" Square Printed Circuit	572-11
Heavy Duty Control	15 Amps	3 Amps	2 Form "C"	Plug-in	572-12
Heavy Duty Control	20 Amps	5 Amps	3 Form "C"	Fast-ons	572-2
Heavy Duty Control	20 Amps	5 Amps	4 Form "C"	Fast-ons	572-10
Heavy Duty Control	20 Amps	5 Amps	6 Pole	Fast-ons	572-4
Heavy Duty Control	20 Amps	5 Amps	8 Pole	Fast-ons	572-5
Heavy Duty Control	20 Amps	5 Amps	12 Pole	Fast-ons	572-6
Heavy Duty Control	20 Amps	5 Amps	14 Pole	Fast-ons	572-7
"Bottle" Type Control	15 Amps	5 Amps	2 & 4 Pole	Fast-ons, Screw Type	572-3
Critical Circuit Control	15 Amps	3 Amps	1 Form "C"	Fast-ons	572-20
Critical Circuit Control	15 Amps	3 Amps	2 Form "C"	Fast-ons	572-21
Critical Circuit Control	15 Amps	3 Amps	3 Form "C"	Fast-ons	572-22
Critical Circuit Control	15 Amps	3 Amps	4 Form "C"	Fast-ons	572-23
Critical Circuit Control	10 Amps	2 Amps	6 Pole	Fast-ons	572-24
Critical Circuit Control	10 Amps	2 Amps	8 Pole	Fast-ons	572-25
Critical Circuit Control	10 Amps	2 Amps	12 Pole	Fast-ons	572-26
Critical Circuit Control	10 Amps	2 Amps	14 Pole	Fast-ons	572-27
Medium Duty Contactor	25 Amps	5 Amps	2 & 4 Pole	Self Locking Screw	572-100
Medium Duty Contactor - for 3 phase loads	15 Amps	5 Amps	3 Pole	Self Locking Screw	572-101
Medium Duty Contactor	25 Amps	5 Amps	4 Pole	Fast-ons	572-102
Medium Duty Contactor	50 Amps	15 Amps	1 thru 6 Pole	Lug Type	572-103
Medium Duty Contactor - with arc barriers	15 Amps	5 Amps	3 Pole	Self Locking Screw	572-104
Medium Duty Contactor	20 Amps	5 Amps	6 Pole	Fast-ons	572-105
Current Actuated	20 Amps	4 Amps	2,4 and 6 Pole	Binder-head, Screw	572-400
Current Acutated	25 Amps	5 Amps	2 Pole	Self Locking Screw	572-401
Current Acutated	25 Amps	5 Amps	6 Pole	Self Locking Screw	572-402
Mechanical Latching	20 Amps	5 Amps	2 Form "C"	Fast-ons	572-700
Mechanical Latching - indicating light	20 Amps	5 Amps	2 Form "C"	Fast-ons	572-700
Electrical Latching	20 Amps	5 Amps	2 Form "C"	Fast-ons	572-702
AC/DC Control	20 Amps	5 Amps	3 Form "C"	Fast-ons	572-801
AC/DC Control	20 Amps	5 Amps	1 Form "C"	Fast-ons	572-802
Close Differential	10 Amps		1 Form "C"	Fast-ons	572-500

Contactor Type	Current Load Rating	Number of Poles	Type of Terminations	Bulletin Number
Heavy Duty DC	15A @ 140 VDC/60A @ 36 VDC	1 to 4 Pole	Pierced Lug	572-200
Heavy Duty DC	15A @ 750 VDC/30A @ 300 VDC	2 Pole	Self Locking Screw	572-201
Heavy Duty DC	15A @ 750 VDC/30A @ 300 VDC	1 Pole	Self Locking Screw	572-202
Heavy Duty DC	15A @ 1500 VDC/40A @ 750 VDC	2 Pole	Stud Type	572-203
Heavy Duty DC	15A @ 1500 VDC/40A @ 750 VDC	2 Pole	Stud Type	572-204
Heavy Duty DC	25A @ 140 VDC/50A @ 74 VDC	2 Pole	Stud Type	572-205
Heavy Duty DC	50A @ 600 VDC/200A @ 140 VDC	1 Pole	Stud Type	572-206
Heavy Duty DC	50A @ 600 VDC/200A @ 140 VDC	1 Pole	Stud Type	572-207
Heavy Duty DC	30A @ 140 VDC/160A @ 40 VDC	2 Pole	Stud Type	572-208
DC Reversing	5A @ 600 VDC/30A @ 150 VDC	4 Pole	Self Locking Screw	572-210
DC Starting	1800A @ 74 VDC/2000A @ 28 VDC	2 Pole	Stud Type	572-300
AC/DC	30A @ 750 VDC	1 Pole	Self Locking Screw	572-826

NOTE: AC resistive rating @ 110 VAC equals current load rating @ 28VDC

VAPOR Transportation Systems
A BRUNSWICK COMPANY

6420 West Howard Street, Chicago, Illinois 60648
Telephone No. 312/631-9200

MAGNETIC RELAYS

latch type

10 AMPS MAX. A.C. or D.C.
MULTI-POLE INDUSTRIAL

Ward Leonard
31 South St.
Mt. Vernon NY 10550
Phone (914) 664-1000
Subsidiary of
The Unimax Group Inc.

DESCRIPTION

Series 110 latch relays consist of a standard a.c. or d.c. Series 110 two, three or four pole relay on which a latch assembly is mounted. They are designed for machine tool and other applications where control circuits must function independently of circuit or power failure. As relays are mechanically held, they are useful for circuits that must be held open or closed for long periods of time without dissipating coil power.

Latch assembly consists essentially of an operating coil, magnet frame and armature with metal roller. When relay coil is momentarily energized, latch roller engages a metal latch on relay armature, holding relay closed. Momentarily energizing the latch assembly coil allows relay armature to drop out.

Latch relay mounting dimensions are identical with standard Series 110 relays affording a compact relay assembly.

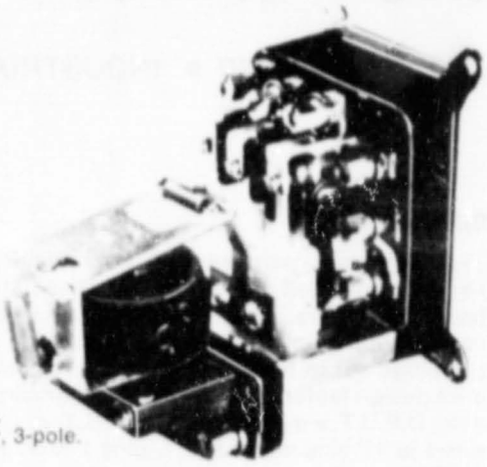


Fig. 1 Series 110L Latch Relay, 3-pole.

COIL DATA

Standard latch relays are furnished with latch coils of the same voltage and frequency as the main relay coil. All main relay coils are designed for continuous duty. A.C. latch coils are for continuous duty. D.C. latch coils are for intermittent duty and require an extra pole to interrupt the coil when coil circuit is energized continuously. Special voltages and frequencies to order.

Average main coil consumption: D.C. 3.5 watts, A.C.60 Hz. 9 volt-amp. Average latch coil consumption: D.C. 3.5 watts, A.C.60 Hz. 9 volt-amp. See Table 2 for standard coil operating voltages and frequency.

CONTACT RATINGS*

Table 1

Volts (Max.)	D.C. Amps. (max.)		A.C. 60 Hz. Amps. (max.)	
	Normally Open	Normally Closed	Normally Open	Normally Closed
24	10	10	10	10
125	1	1	10	10
250	—	—	10	10

*Open or enclosed ratings are non-inductive.

ORDER BY SERIES NO. and TYPE NO.

EXAMPLE: 110 — L4522
Series No. Type No.

LATCH RELAYS—2, 3, & 4 POLE

Table 2

Coil Volts	D.C.			A.C. 60 Hz.		
	2-Pole D.T. Type No.	3-Pole D.T. Type No.	4-Pole D.T. Type No.	2-Pole D.T. Type No.	3-Pole D.T. Type No.	4-Pole D.T. Type No.
6	—L1422	—L1432	—L1442	—L1522	—L1532	—L1542
10	—L2422	—L2432	—L2442	—L2522	—L2532	—L2542
12	—L3422	—L3432	—L3442	—L3522	—L3532	—L3542
24	—L4422	—L4432	—L4442	—L4522	—L4532	—L4542
32	—L5422	—L5432	—L5442	—L5522	—L5532	—L5542
115	—L6422	—L6432	—L6442	—L6522	—L6532	—L6542
230	.....	.....	.....	—L7522	—L7532	—L7542
PRICE	$22.40	$26.65	$31.20	$22.40	$26.65	$31.20

DIMENSIONS — Approximate

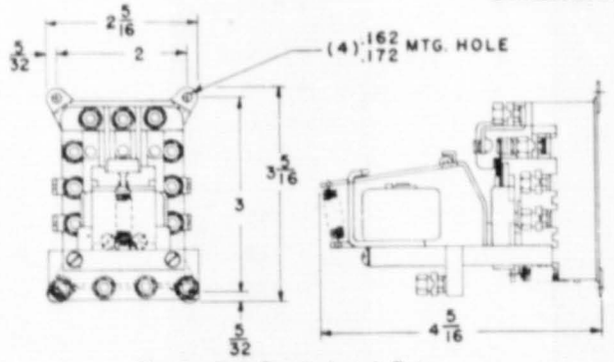


Fig. 2 2 or 3-pole Latch Relay.

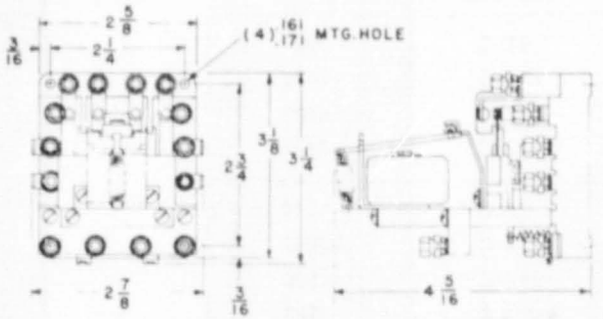


Fig. 3 4-pole Latch Relay.

MAGNETIC RELAYS

Ward Leonard
31 South St.
Mt. Vernon NY 10550
Phone (914) 664-1000
Subsidiary of
The Unimax Group Inc

plug-in type mpp

U. L. RECOGNIZED • INDUSTRIAL GRADE • 10 AMP. • A.C. or D.C.

DESCRIPTION

Type MPP multi-purpose multi-pole relays are of the magnetically operated plug-in type designed for industrial control circuit uses. See-thru dust resistant Lexan plastic covers, wiping action silver cadmium oxide contacts, sturdy pin plugs set in high quality molded phenolic, are among their design features. Three contact combinations are available: D.P.D.T. wired to 8 pins; D.P.D.T. plus 2 N.O. contacts wired to 12 pins and D.P.D.T. plus 1 N.O. and 1 N.C. wired to 12 pins.

All type MPP relays must be used with Cat. No. 114B heavy-duty, front-connected industrial sockets.

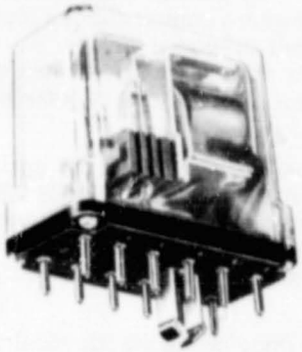


Fig. 1 Type MPP Relay

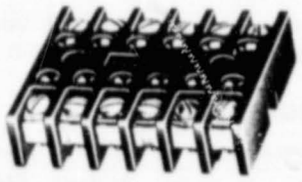


Fig. 2 Industrial Socket Cat. 114B

SPECIFICATIONS

Contact Rating: 10 amps, 115V. A.C. non-inductive

Coils: Continuous duty. A.C. to 230V. — 5.0 VA approx.
D.C. to 115V. — 3 watts approx.

Operation: A.C. — 85% nominal voltage
D.C. — 80% nominal voltage

Operate Time: 15 MS maximum

Release Time: 15 MS maximum

Overvoltage: 110% on both A.C. and D.C. relays without damage

Insulation: ⅛" through air, ¼" over the surface, 1500V. dielectric test

Maximum Ambient: 50°C

ORDER BY Series No. and Type Number

EXAMPLE: 114 — 6420
Series No. Type No.

PLUG-IN RELAYS

Table 1

Coil Volts and Freq.	DPDT plus 2 N.O. Type No.	DPDT plus 1 N.O., 1 N.C. Type No.	DPDT Type No.
	Series 114 MPP		
6 D.C.	—1420	—1421	—1422
12 D.C.	—3420	—3421	—3422
24 D.C.	—4420	—4421	—4422
115 D.C.	—6420	—6421	—6422
6 A.C. *	—1520	—1521	—1522
12 A.C. *	—3520	—3521	—3522
24 A.C. *	—4520	—4521	—4522
115 A.C. *	—6520	—6521	—6522
230 A.C. *	—7520 †	—7521 †	—7522 †

* 60 hertz

† Not U. L. Recognized

MAGNETIC RELAYS

sensitive type

A.C. or D.C.

Ward Leonard

31 South St.
Mt. Vernon NY 10550
Phone (914) 664-1000
Subsidiary of
The Unimax Group Inc.

DESCRIPTION

Series 250 Sensitive Relays are for control applications requiring a relay capable of operating on low power in the order of milliwatts. Relay features: good contact torque at pull-up and crisp drop-out; silver-to-silver contacts and provision for adjustment of pick-up and drop-out. Where reduced contact gaps are permissible, operation on approximately 50% of normal current may be obtained.

Relays without auxiliary contacts are furnished with hex nut-stud type terminals; those with N.O. auxiliary contacts are equipped with solder type terminals.

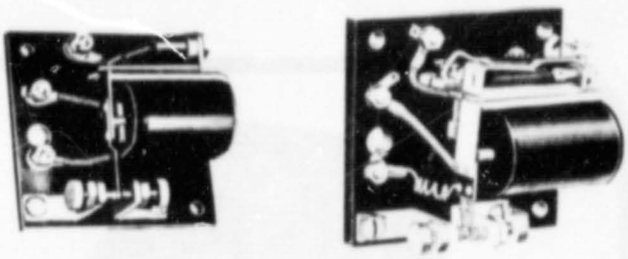


Fig. 1 A.C. Sensitive Relay without auxiliary (left). D.C. Sensitive Relay with auxiliary (right).

CONTACT RATINGS* Table 1

Volts	D.C. Amps.	A.C. Amps
0-24	2	2
25-125	0.75	2
126-250	0.5	1.5

*Non-inductive

COIL DATA Table 2

Coil Freq.	with Auxiliary	without Auxiliary
D.C.	56 milliwatts	14 milliwatts
A.C. 60 Hz.	—	0.33 V.A.

SENSITIVE RELAYS Series 250 Table 3

D.C. with N.O. Auxiliary			D.C. without Auxiliary				A.C. 60 Hz. without Aux.		
Current M.A.	Voltage Drop	Type No.	Resist. Ohms	Current M.A.	Voltage Drop	Type No.	Current M.A.	Voltage Drop	Type No.
540	0.10	–218	0.18	270	0.05	–18	450	0.8	–118
324	0.18	–220							
210	0.26	–222	1.25	105	0.13	–22	180	1.8	–122
133	0.40	–224	3.0	66.5	0.21	–24	110	3.0	–124
84	0.65	–226	7.7	42.2	0.32	–26	75	5.0	–126
54	1.00	–228							
33	1.7	–230	50	16.6	0.83	–30	30	11.0	–130
22	2.6	–232	120	10.7	1.28	–32	20	17.0	–132
14	4.2	–234	300	6.76	2.03	–34	12	29.0	–134
9	6.9	–236					8	43.0	–136
5.5	10.7	–238	1,950	2.65	5.17	–38	5	70.0	–138
3.4	16.1	–240	4,750	1.70	8.07	–40	3.5	120.0	–140
2.1	25.0	–242					2.2	160.0	–142
1.4	40.0	–244	27,900	0.72	20.20	–44	1.5	300.0	–144

Steel Knockout Box Cat. No. 250-2 .....

DIMENSIONS — Approximate

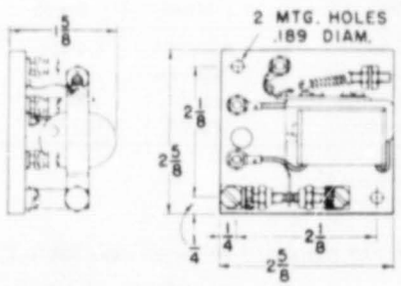


Fig. 2 A.C. or D.C. Sensitive Relay without Auxiliary.

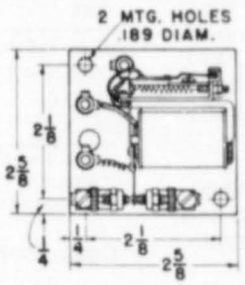


Fig. 3 D.C. Sensitive Relay with Auxiliary.

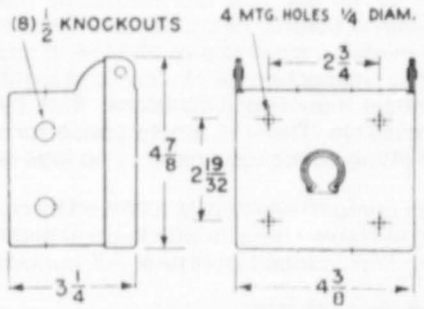


Fig. 4 Cat. No. 250-2 Steel Knockout Box.

ORDER BY **Series Number followed by Type Number.**

EXAMPLE 250 - 140

Series No. Type No.

MAGNETIC RELAYS

600 volt industrial control type

MULTIPOLE • A. C. U. L. LISTED AND D. C.

Ward Leonard

31 South St.
Mt. Vernon NY 10550
Phone (914) 664-1000
Subsidiary of
The Unimax Group Inc.

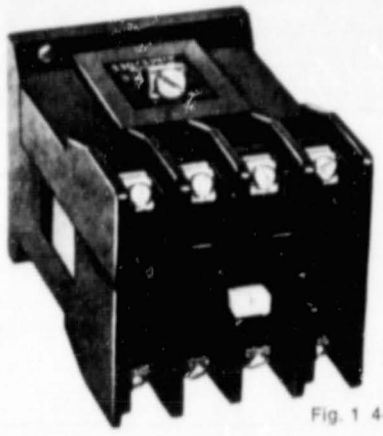


Fig. 1 4-pole relay.

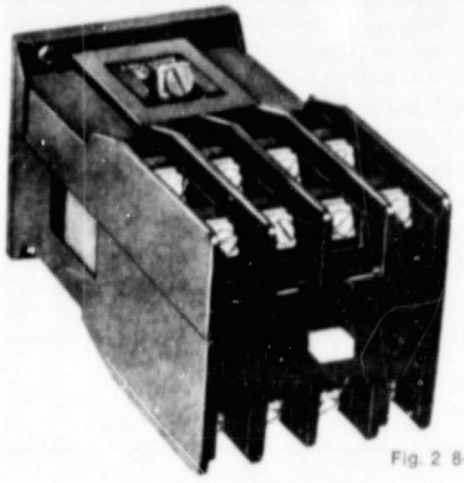


Fig. 2 8-pole relay.

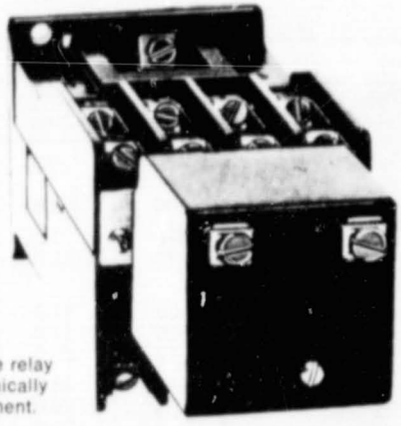


Fig. 3 4-pole relay with mechanically held attachment.

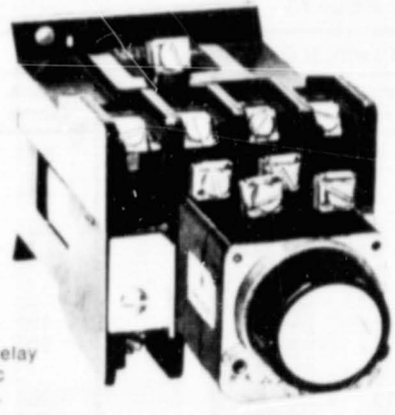


Fig. 4 4-pole relay with pneumatic timing module.

DESCRIPTION

The Series 300 line represents the modern approach to industrial control relays for 600 volts max. service. They are modular, small in size and low in cost. Installation is fast . . . inspection quick. Four and eight pole models have identical mounting dimensions. Side by side mounting is permissible. There is ample space for wiring to up-front self-lifting clamp terminals . . . no lugs needed.

High contact reliability is achieved by combining wiping action movable contacts with knurled stationary contacts and very high contact pressure. All contacts are convertible.

SPECIFICATIONS

Pick-up volts: 85% or less of minimum voltage rating.

Overvoltage: 10% without damage.

Insulation: Meets 600 volt requirements for general industrial control devices.

Contact Ratings:

Volts	Continuous Rating	Pilot Duty	
		Make	Break
Up to 120 A.C.	10 amps.†	60 amps.*	6 amps.*
121-600 A.C.	10 amps.†	7200 VA*	720 VA*
115 D.C.	5 amps.	125 VA**	125 VA**
230 D.C.	0.5 amps.	125 VA**	125 VA**

† Based on 75% power factor minimum.
* Based on 35% power factor minimum.
** Based on inductive loads (solenoids, coils, etc.)

Coils: Continuous duty. For standard voltages see Table 2.

	4-Pole	8-Pole
Coil Volts A.C. 60 Hz.	120	120
Inrush ma.	590	780
Sealed VA	16	20
D.C. Resistance (Ohms @ 25C)	130	83

Net Weight: 4-pole 21.5 oz. avg.
8-pole 26.0 oz. avg.

ZENITH CONTROLS, INC., 830 40th St., Chicago, IL 60609
PHONE: 312-247-6400

ZENITH MULTIPOLE RELAYS



mechanically held — 30 amperes

FOR HEAVY-DUTY MULTI-CIRCUIT CONTROL

The MSC mechanically held relays are rated 30 amperes per pole. They are designed for single or double throw multipole control of electrical circuits. The mechanically held design is used wherever the relay must be unaffected by voltage drop or line failure, or where the minor AC hum of electrically held units cannot be allowed.

When voltage is applied to the top coil of the contactor, the coil is energized and the top contacts close. The coil cutout switch then operates to disconnect the top coil and the switch is locked in the top position mechanically only. The coil cutout switch also operates to complete the circuit to the lower coil for the next operation.

Features MSC

- U.L.-508 listed for ballast, tungsten, resistive and general use. (12 poles N.O. or 6 poles N.O./6 poles N.C.)
- Rated 30 amps to 600V A.C.
- Available to 18 poles N.O. or 9 poles N.O./9 poles N.C.
- Contacts protected by heavy-duty arc grids.
- Heavy-duty silver contacts.
- Coil voltages: 120, 208, 240, 277, 480—50/60 hz.

Load	When Connected 1 Pole To Load	When Connected 2 Poles To Load On 1 Phase and 3 Poles To Load On 3 Phase
Ballast	277 V. AC	480 V. AC
Tungsten	250 V. AC	250 V. AC
General Use & Resistive	347 V. AC	600 V. AC

ORDERING INFORMATION, DIMENSIONS AND WEIGHTS

TOTAL POLES	POLES NO	POLES NC	MODEL NO.	OPEN TYPE H	OPEN TYPE W	OPEN TYPE D	OPEN TYPE WT.	ENCLOSED H	ENCLOSED W	ENCLOSED D	ENCLOSED WT.
1	1	0	MSC- 10	8	6½	3⅞	4	12	10	4½	12
2	2	0	MSC- 20	8	6½	3⅞	5	12	10	4½	13
	1	1	MSC- 11	9	6½	3⅞	5	12	10	4½	13
3	3	0	MSC- 30	8	7¼	3⅞	5	12	10	4½	13
	2	1	MSC- 21	9	9	3⅞	5	12	10	4½	13
4	4	0	MSC- 40	8	9	3⅞	6	12	10	4½	14
	3	1	MSC- 31	9	10	3⅞	6	15	12	6	14
	2	2	MSC- 22	9	9	3⅞	6	12	10	6	14
6	6	0	MSC- 60	8	11½	3⅞	8	18	15	6	24
	5	1	MSC- 51	9	12	3⅞	8	18	15	6	20
	4	2	MSC- 42	9	11	3⅞	8	18	15	6	20
	3	3	MSC- 33	9	10	3⅞	8	15	12	6	16

TOTAL POLES	POLES NO	POLES NC	MODEL NO.	OPEN TYPE H	OPEN TYPE W	OPEN TYPE D	OPEN TYPE WT.	ENCLOSED H	ENCLOSED W	ENCLOSED D	ENCLOSED WT.
8	8	0	MSC- 80	8	14	3⅞	10	18	15	6	35
	6	2	MSC- 62	9	14	3⅞	10	18	15	6	26
	4	4	MSC- 44	9	11	3⅞	10	15	12	6	22
10	10	0	MSC-100	8	16½	4½	11	18	18	6	36
	5	5	MSC- 55	9	12	6	11	18	15	6	36
12	12	0	MSC-120	8	19	6	12	24	24	10	52
	6	6	MSC- 66	9	14	6	12	18	15	6	37
14	14	0	MSC-140	8	21½	6	14	24	24	10	54
	7	7	MSC- 77	9	16	6	14	18	18	6	39
16	16	0	MSC-160	8	24	6	15	26	32	10	55
	8	8	MSC- 88	9	16	6	15	18	18	6	40
18	18	0	MSC-180	8	26½	6	17	26	32	10	37
	9	9	MSC- 99	9	18	6	17	24	24	10	42

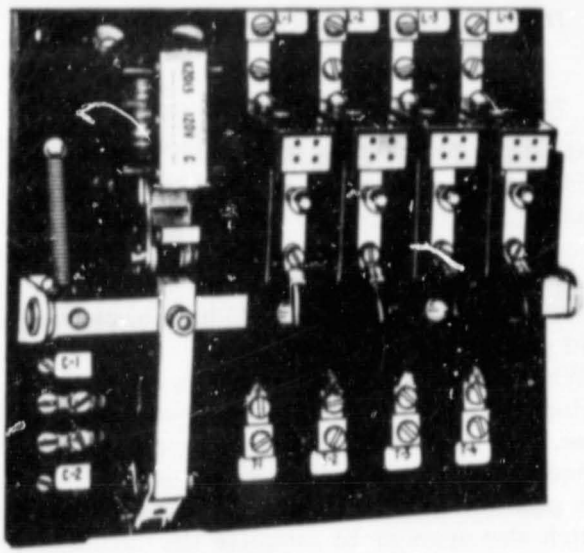
Add suffix X to model numbers to indicate open type units. Accessories: The MSC series relays can be supplied with any accessories listed on page B-7 for MH series contactors.

Note: When NO and NC poles are provided they are not interwired. If a common is required, specify "double throw."

When Ordering, Specify model number, coil voltage and frequency and whether open or enclosed type.

ZENITH CONTROLS, INC., 830 40th St., Chicago, IL 60609
PHONE: 312-247-6400

ZENITH MULTIPOLE RELAYS



electrically held — 30 amperes

FOR HEAVY-DUTY MULTI-CIRCUIT CONTROL

The ESS electrically held contactors are rated 30 amperes per pole. They are designed for single or double throw multipole control of electrical circuits. The electrically held design is used for rugged highly frequent operations, and where minor AC coil hum can be permitted.

The powerful magnetic solenoid provides positive operation and the quietest possible seating. Liberal contact design permits full load rating whether enclosed or tungsten rated.

Features ESS

- U.L.-508 listed for ballast, tungsten, resistive and general use. (12 poles N.O. or 6 poles N.O./6 poles N.C.)
- Rated 30 amps to 600V A.C.
- Contacts protected by heavy duty arc grids.
- Heavy-duty silver contacts.
- Coil voltages: 120, 208, 240, 277, 480—50/60 hz.

Load	When Connected 1 Pole To Load	When Connected 2 Poles To Load On 1 Phase and 3 Poles To Load On 3 Phase
Ballast	277 V. AC	480 V. AC
Tungsten	250 V. AC	250 V. AC
General Use & Resistive	347 V. AC	600 V. AC

ORDERING INFORMATION, DIMENSIONS AND WEIGHTS

TOTAL POLES	POLES NO	POLES NC	MODEL NO.	OPEN TYPE H	OPEN TYPE W	OPEN TYPE D	OPEN TYPE WT.	ENCLOSED H	ENCLOSED W	ENCLOSED D	ENCLOSED WT.
1	1	0	ESS- 10	8	5¼	3⅜	4	10	8	4	12
	0	1	ESS- 01	9	5¼	3⅜	4	12	10	4	12
2	2	0	ESS- 20	8	6½	3⅜	5	12	10	4	13
	1	1	ESS- 11	9	6½	3⅜	4	12	10	4	12
	0	2	ESS- 02	9	6½	3⅜	5	12	10	4	13
3	3	0	ESS- 30	8	7¾	3⅜	5	12	10	4	13
	2	1	ESS- 21	9	9	3⅜	5	12	10	4	13
	1	2	ESS- 12	9	9	3⅜	5	12	10	4	13
	0	3	ESS- 03	9	7¾	3⅜	5	12	10	4	13
4	4	0	ESS- 40	8	9	3⅜	6	12	10	4	14
	3	1	ESS- 31	9	9	3⅜	6	12	10	4	14
	2	2	ESS- 22	9	9	3⅜	6	12	10	4	14
	1	3	ESS- 13	9	9	3⅜	6	12	10	4	14
	0	4	ESS- 04	9	9	3⅜	6	12	10	4	14
5	5	0	ESS- 50	8	10¼	3⅜	8	15	12	6	16
	4	1	ESS- 41	9	10¼	3⅜	8	15	12	6	16
	3	2	ESS- 32	9	9	3⅜	8	15	12	6	16
	2	3	ESS- 23	9	9	3⅜	8	15	12	6	16
	1	4	ESS- 14	9	10¼	3⅜	8	15	12	6	16
	0	5	ESS- 05	9	10¼	3⅜	8	15	12	6	16

TOTAL POLES	POLES NO	POLES NC	MODEL NO.	OPEN TYPE H	OPEN TYPE W	OPEN TYPE D	OPEN TYPE WT.	ENCLOSED H	ENCLOSED W	ENCLOSED D	ENCLOSED WT.
6	6	0	ESS- 60	8	11½	3⅜	8	18	15	6	16
	5	1	ESS- 51	9	11½	3⅜	8	18	15	6	16
	4	2	ESS- 42	9	10¼	3⅜	8	18	15	6	16
	3	3	FSS- 33	9	9	3⅜	8	15	12	6	16
	2	4	ESS- 24	9	10¼	3⅜	8	18	15	6	16
	1	5	ESS- 15	9	11½	3⅜	10	18	15	6	22
	0	6	ESS- 06	9	11½	3⅜	9	18	15	6	17
8	8	0	ESS- 80	8	14	3⅜	10	18	18	8	28
	6	2	ESS- 62	9	12¾	3⅜	10	18	18	8	22
	4	4	ESS- 44	9	10¼	3⅜	10	15	12	6	22
	2	6	ESS- 26	9	12¾	3⅜	10	18	18	8	22
	0	8	ESS- 08	9	14	3⅜	10	18	18	8	28
10	10	0	ESS-100	8	16½	3⅜	12	18	18	8	37
	5	5	ESS- 55	9	11½	3⅜	12	18	15	6	37
12	12	0	ESS-120	8	19	3⅜	12	24	24	10	37
	6	6	ESS- 66	9	12¾	3⅜	12	18	18	8	52

Add suffix X to model numbers to indicate open type units. Accessories: The ESS series relays can be supplied with any accessories listed on page B-3 for E and Q series contactors.

Note: When NO and NC poles are provided they are not interwired. If a common is required, specify "double throw."

When Ordering, Specify model number, coil voltage and frequency and whether open or enclosed type.

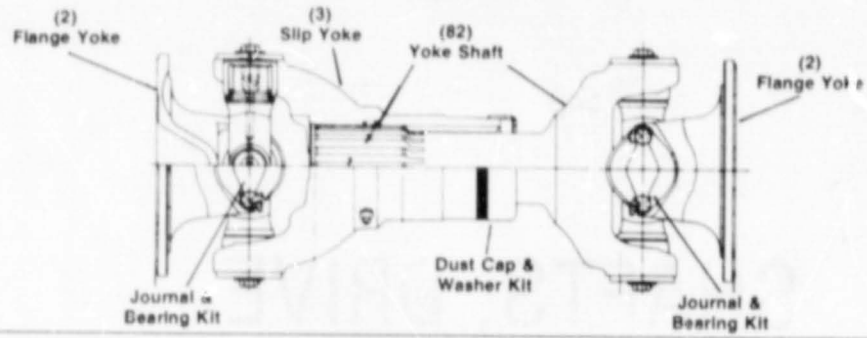
SHAFTS, DRIVE

(CODE **SD**)

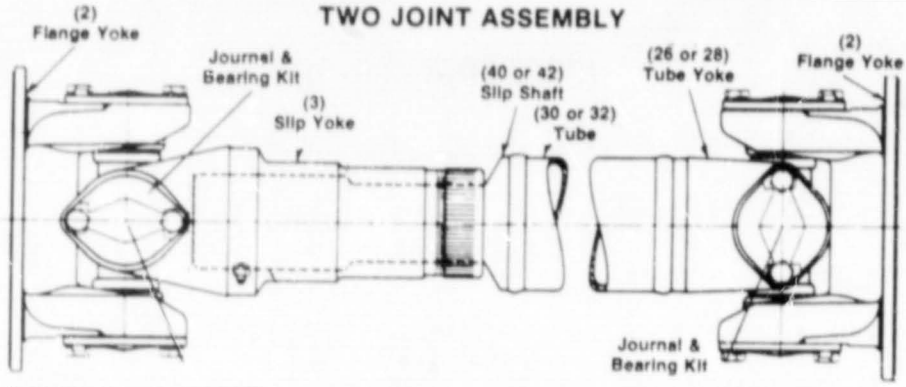
GENERAL INFORMATION

TYPICAL SPICER ASSEMBLIES

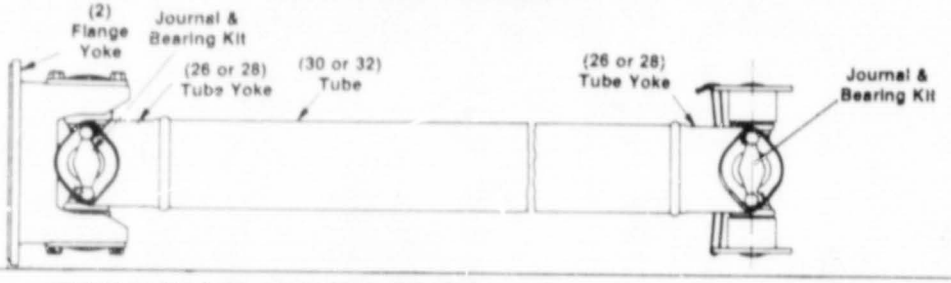
SHORT COUPLED ASSEMBLY



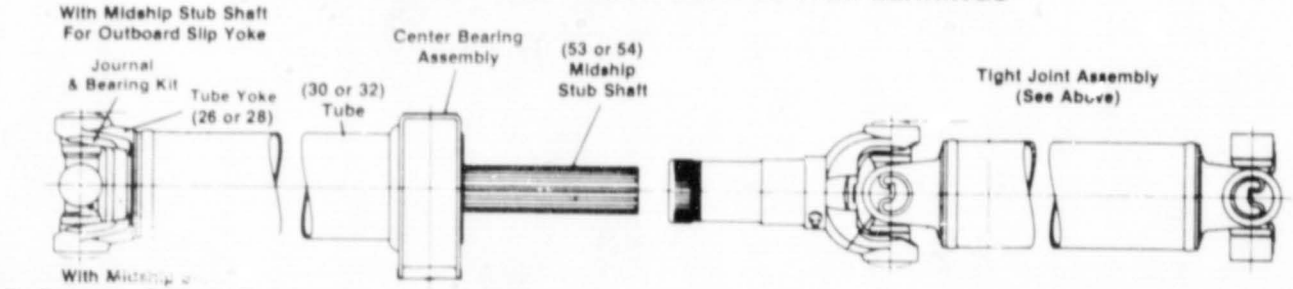
TWO JOINT ASSEMBLY

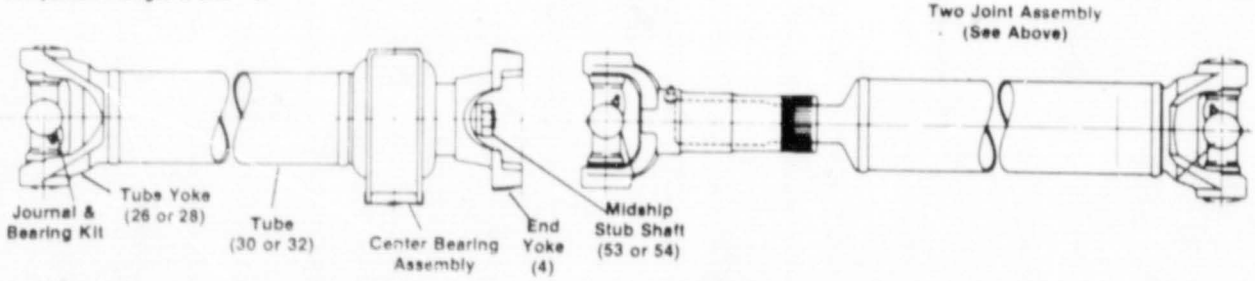


TIGHT JOINT ASSEMBLY



JOINT & SHAFT ASSEMBLIES WITH CENTER BEARINGS





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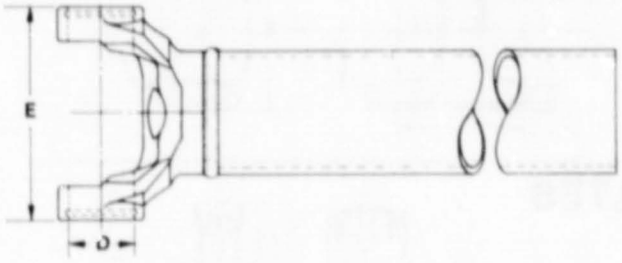
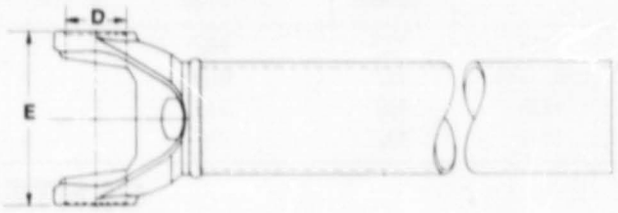
TUBING AND TUBE & YOKE ASSEMBLIES

TUBE & YOKE ASSEMBLIES



SNAP RING CONSTRUCTION

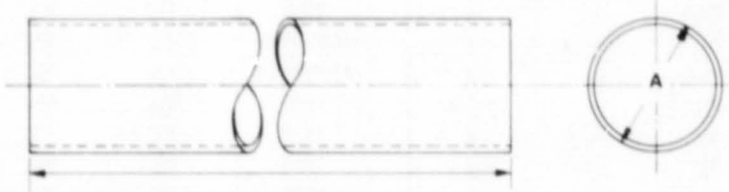


BEARING PLATE CONSTRUCTION

Series	E Across Lugs	D Bearing Diameter	Page
SNAP RING			
1000	2 3/16"	15/16"	2
1260/1310	3 15/32"	1 1/16"	2
1350	3 1/8"	1 1/16"	2
1410	4 1/16"	1 1/16"	3
1480	4 1/16"	1 1/8"	3
1550	5 1/4"	1 1/8"	3

Series	E Across Lugs	D Bearing Diameter	Page
BEARING PLATE			
1600/1610	5 5/16"	1 7/8"	4
1700/1710	6 3/32"	1 15/16"	4
1810	7 35/64"	1 15/16"	4

TUBING



LENGTHS

A Outside Diameter	Lengths			Page
	54"	74"	108"	
1 1/4"	54"	—	108"	5
1 1/2"	54"	—	108"	5
2"	54"	74"	108"	5
2 1/4"	54"	—	108"	5
2 1/2"	54"	74"	108"	5
2 3/4"	54"	74"	108"	5
3"	—	74"	108"	6
3 1/4"	—	74"	108"	6

A Outside Diameter	Lengths			Page
	54"	74"	108"	
3 1/2"	—	74"	108"	6
3.550	—	74"	108"	6
4"	—	74"	108"	6
4.095"	—	74"	108"	6
4 1/2"	—	74"	108"	6
4.680"	—	74"	108"	6
6"	—	As Required		6
8"	—	As Required		6

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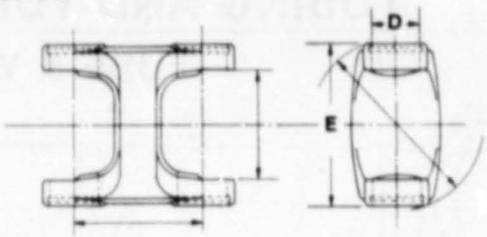
CENTER YOKES

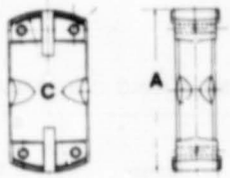
SNAP RING CONSTRUCTION

Series	D Bearing Diameter	E Across Lugs	Page Location
1000	15/16"	2 3/16"	2
1280/1310	1 1/16"	3 15/32"	2
1330	1 1/16"	3 1/8"	2
1350	1 3/16"	3 1/8"	2

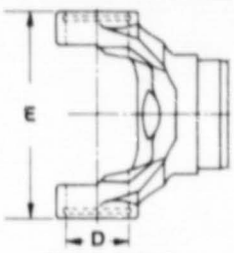


CENTER PLATES

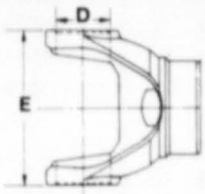
Series	A Outside Diameter	C Female Pilot	Page Location
1880	8 5/8"	8 1/4"	2



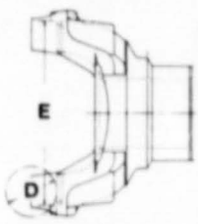
TUBE YOKES



SNAP RING



BEARING PLATE



CAP & BOLT

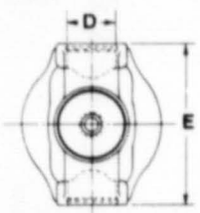
Series	D Bearing Diameter	E Across Lugs	E Between Bearing Shoulders	Page Location
SNAP RING				
1000	15/16"	2 3/16"	—	3
1100	15/16"	2 21/32"	—	3
1110	1"	2 15/16"	—	3
1280/1310	1 1/16"	3 15/32"	—	3 & 4
1330	1 1/16"	3 7/8"	—	4
1350	1 3/16"	3 7/8"	—	4 & 5
1410	1 3/16"	4 7/16"	—	5
1480	1 3/8"	4 7/16"	—	5
1550	1 3/8"	5 1/4"	—	5
1650	1 3/8"	5 31/32"	—	6
1850	2 3/16"	8 11/16"	—	6
1900 H.D.	2 13/16"	9 3/8"	—	6

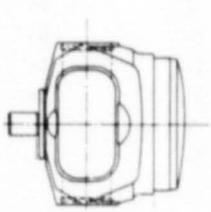
Series	D Bearing Diameter	E Across Lugs	E Between Bearing Shoulders	Page Location
BEARING PLATE				
1500	1 5/16"	4 5/16"	—	7
1600/1610	1 1/8"	5 1/16"	—	7
1700/1710	1 5/16"	6 3/32"	—	7
1800	2 5/16"	6 19/32"	—	8
1810	1 5/16"	7 35/64"	—	8
1880	2 3/16"	8 3/32"	—	8
1900	2 13/16"	8 25/32"	—	8
CAP & BOLT				
1950	3 1/16"	—	10 3/64"	8
2050	3 13/16"	—	12 11/32"	8

BALL STUD TUBE YOKES

SNAP RING CONSTRUCTION

Series	D Bearing Diameter	E Across Lugs	Page Location
1280/1310	1 1/16"	3 15/32"	9
1330	1 1/16"	3 1/8"	9





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DANA

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Universal Joint Sizes / Ratings / Speeds / Tube Sizes

SPICER U-JOINT SIZES	Electric Motor H.P per 100 r.p.m.	Electric Motor Torque Lb. In.	Electric Motor Torque Lb. Ft.	Gas or Diesel Torque Lb. In.	Gas or Diesel Torque Lb. Ft.	Short Duration Torque Lb. In.	Short Duration Torque Lb. Ft.	Torsional Strength Min. Elastic Limit Lb. In.	Torsional Strength Min. Elastic Limit Lb. Ft.	* Max. r.p.m.	Standard Tube Size	**Max. Length ℄–℄ Installed @ Max. Rated r.p.m.
Light Duty												
1000	1.42	900	75	600	50	3,720	310	5,040	420	2,500	1¼" x .065	55"
1280	2.66	1,680	140	1,140	95	6,840	570	15,000	1,250	6,000	2½" x .083	43"
1310	3.71	2,340	195	1,560	130	9,600	800	19,200	1,600	6,000	3" x .083	47"
1330	4.18	2,640	220	1,800	150	10,680	890	22,200	1,850	5,000	3½" x .083	50.5"
											4" x .083	54"
Medium Duty												
1350	5.90	3,720	310	2,520	210	14,880	1,240	27,120	2,260	5,000	3" x .083	51"
											3½" x .083	55"
											4" x .083	59"
1410	7.14	4,500	375	3,000	250	18,000	1,500	32,400	2,700	5,000	3" x .083	51"
											3½" x .083	55"
											4" x .083	59"
1480	9.52	6,000	500	4,080	340	24,000	2,000	39,960	3,330	5,000	3½" x .083	55"
											4" x .083	59"
											4½" x .095	63"
Heavy Duty												
1550	12.18	7,680	640	5,160	430	28,800	2,400	52,800	4,400	5,000	3½" x .095	55"
											4" x .083	59"
											4½" x .095	63"
1650	18.13	11,424	952	7,620	635	43,680	3,640	76,800	6,400	4,000	3½" x .134	61"
											4" x .134	66"
											4½" x .095	70"
1610	18.56	11,700	975	7,680	640	43,800	3,650	78,000	6,500	4,500	3½" x .134	58"
											4" x .134	62"
											4½" x .095	66"
1710	25.33	15,960	1,330	10,800	900	57,600	4,800	96,000	8,000	4,500	4" x .134	62"
											4½" x .134	66"
1810	35.23	22,200	1,850	15,000	1,250	78,000	6,500	144,000	12,000	4,500	4½" x .134	66"
											4½" x .259	65"
1880	48.55	30,600	2,550	20,400	1,700	106,800	8,900	192,000	16,000	3,000	4½" x .259	80"
Extra Heavy Duty												
1900	68.55	43,200	3,600	28,800	2,400	144,000	12,000	249,600	20,800	2,500	4½" x .188 (Seamless)	80"
1950	102.82	64,800	5,400	43,200	3,600	216,000	18,000	408,000	34,000	2,500	5¼" x .375	80"
2050	218.96	138,000	11,500	90,000	7,500	432,000	36,000	816,000	68,000	2,000	8" x .375	80"
2150	428.40	270,000	22,500	180,000	15,000	864,000	72,000	1,632,000	136,000	[illegible]	8" x .625	80"

*Rating applies to Universal Joint.

**Lengths shown with exception of 1900 thru 2150 sizes are based on .66 of the calculated critical speed at max rated RPM (for [illegible] to industrial applications). For vehicle applications or driveshaft assembly lengths exceeding 80 inches, consult Spicer Universal Joint Division [illegible] ation Engineering with complete design requirements.

†Based on application experience (1000 rad/sec² acceleration).

Operating Angles† For Two Joint Shafts with Equal Or Intersecting A[illegible]

Driveshaft RPM	Maximum Operating Angle	Driveshaft RPM	Maximum Operating Angle
5000	3° 15′	3000	5° 50′
4500	3° 40′	2500	7° 0′
4000	4° 15′	2000	8° 40′
3500	5° 0′	1500	11° 30′

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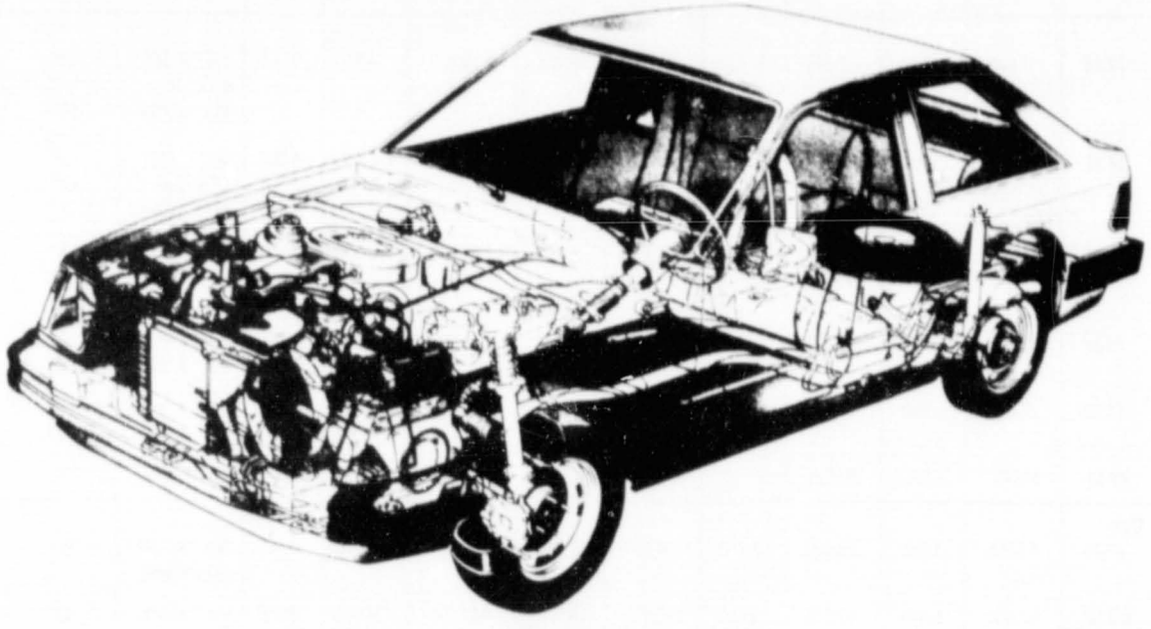
Automotive Components



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Gasoline Engines - Automatic Transmissions - Manual Transmissions - Front Axles - Rear Axles - Drive Shafts - Power Steering Pumps -Power Steering Gears - Metal Stampings - Plastic Stampings - Frame Components - Steel Forgings - Latching Mechanisms - Emission Components - Steering Columns - Trim and Accessories - Gasoline Engines - Automatic Transmissions - Manual Transmissions - Front Axles - Rear Axles - Drive Shafts - Power Steering Pumps -Power Steering Gears - Metal Stampings - Plastic Stampings - Frame Components - Steel Forgings - Latching Mechanisms - Emission Components - Steering Columns - Trim and Accessories - Gasoline Engines - Automatic Transmissions - Manual Transmissions - Front Axles - Rear Axles - Drive Shafts - Power Steering Pumps -Power Steering Gears - Metal Stampings - Plastic Stampings - Frame Components - Steel Forgings - Latching Mechanisms - Emission Components - Steering Columns - Trim and Accessories - Gasoline Engines - Automatic Transmissions - Manual Transmissions - Front Axles - Rear Axles - Drive Shafts - Power Steering Pumps -Power Steering Gears - Metal Stampings - Plastic Stampings - Frame Components - Steel Forgings - Latching Mechanisms - Emission Components - Steering Columns - Trim and Accessories - Gasoline

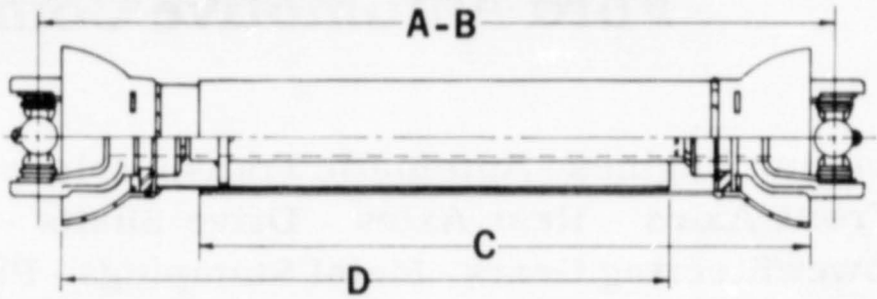
Industrial Engine Operations
Ford Parts and Service Division
300 Renaissance Center, Suite 1800
P.O. Box 43338
Detroit, Michigan 48243
Telephone 313/568-7435

Ford
Power Products

HUB CITY DIVISION
SAFEGUARD POWER TRANSMISSION CO.
Phone (605) 225-0360 — P.O. BOX 1089 — ABERDEEN, S. DAKOTA 57401

SERIES 1700 DRIVE SHAFT ASSEMBLIES

- Shielded
- Telescoping
- Constructed of rectangular tubing and shafting



SERIES 1700 DRIVE SHAFT ASSEMBLIES
INCLUDING END YOKES ASSEMBLED

COMPLETE SHAFT PART NUMBER (WITH END YOKES)	COMPRESSED LENGTH (B)	MAXIMUM EXTENDED LENGTH (A)	OUTER SHIELD LENGTH (C)	INNER SHIELD LENGTH (D)	TRACTOR P.T.O. YOKE	EQUIPMENT YOKE
03-33-20206-028	28"	36"	23⅛"	23⅛"	1⅜-6 SPLINE Q.D.	1" Rd., with ¼" KW
03-33-20206-040	40"	60"	35⅛"	35⅛"	1⅜-6 SPLINE Q.D.	1" Rd., with ¼" KW
03-33-20206-052	52"	72"	47⅛"	47⅛"	1⅜-6 SPLINE Q.D.	1" Rd., with ¼" KW
03-33-20216-028	28"	36"	23⅛"	23⅛"	1⅜-6 SPLINE Q.D.	1¼" Rd., with ¼" KW
03-33-20216-040	40"	60"	35⅛"	35⅛"	1⅜-6 SPLINE Q.D.	1¼" Rd., with ¼" KW
03-33-20216-052	52"	72"	47⅛"	47⅛"	1⅜-6 SPLINE Q.D.	1¼" Rd., with ¼" KW
03-33-20217-028	28"	36"	23⅛"	23⅛"	1⅜-6 SPLINE Q.D.	1⅜" Rd., with 5/16" KW
03-33-20217-040	40"	60"	35⅛"	35⅛"	1⅜-6 SPLINE Q.D.	1⅜" Rd., with 5/16" KW
03-33-20217-052	52"	72"	47⅛"	47⅛"	1⅜-6 SPLINE Q.D.	1⅜" Rd., with 5/16" KW

SERIES 1700 DRIVE SHAFT ASSEMBLIES
WITHOUT END YOKES

DRIVE SHAFT PART NUMBER (LESS END YOKES)	COMPRESSED LENGTH (B)	MAXIMUM EXTENDED LENGTH (A)	OUTER SHIELD LENGTH (C)	INNER SHIELD LENGTH (D)
03-30-20000-028	28"	36"	23⅛"	23⅛"
03-30-20000-040	40"	60"	35⅛"	35⅛"
03-30-20000-052	52"	72"	47⅛"	47⅛"

To order complete Drive Shaft Assembly with End Yokes other than listed above, order Assembly (less end yokes) and select two Yokes from chart below. Specify if they are to be assembled. If assembled, shipping papers and invoice will show complete Assembly Number (see page 234). A small assembly charge will be added.

STANDARD YOKES

ROUND HOLE

PART NUMBER	BORE SIZE	YOKE LENGTH	KEYWAY	WEIGHT
03-35-01706	1.000"	3¼"	¼"	2.3
03-35-01715	1.125"	3⅜"	¼"	2.3
03-35-01716	1.250"	3¼"	¼"	2.3
03-35-01717	1.375"	3¼"	5/16"	2.3
03-35-01720	1.500"	3¼"	⅜"	2.0

SPLINE AND SQUARE HOLES

PART NUMBER	SPLINE OR SQUARE SIZE	YOKE LENGTH	WEIGHT
03-35-01702	1⅜-6 Spline—Q.D.	4¼"	2.5
03-35-01718	1⅛" Square	3¼"	2.3

CROSS AND BEARING KIT

PART NO.	DESCRIPTION	WEIGHT
03-35-90073	Needle Bearing	.6

TO ORDER UNIVERSAL JOINTS:

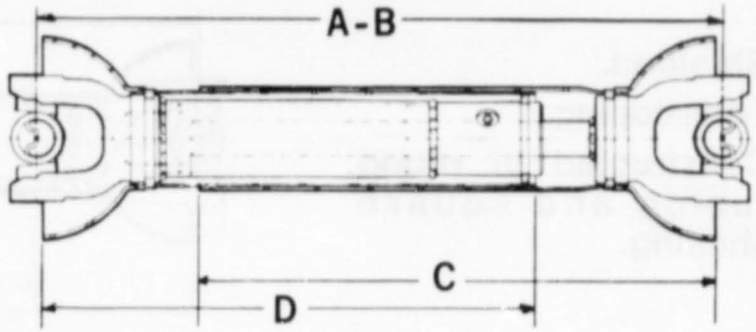
A Universal Joint consists of two Yokes and a Cross and Bearing Kit. Factory assembled Universal Joints will be supplied whenever an order contains two Yokes and a Cross and Bearing Kit (or multiples thereof) with a request that they be assembled. Shipping papers and invoices will show the assembly numbers (see page 234). A small assembly charge will be added.



HUB CITY DIVISION
SAFEGUARD POWER TRANSMISSION CO.
Phone (605) 225-0360 — P.O. BOX 1089 — ABERDEEN, S. DAKOTA 57401

SERIES 2100 DRIVE SHAFT ASSEMBLIES

- Shielded
- Telescoping
- Constructed of round tubing and square shafting.



SERIES 2100 DRIVE SHAFT ASSEMBLIES
INCLUDING END YOKES ASSEMBLED

COMPLETE SHAFT PART NUMBER (WITH END YOKES)	COMPRESSED LENGTH (B)	MAXIMUM EXTENDED LENGTH (A)	OUTER SHIELD LENGTH (C)	INNER SHIELD LENGTH (D)	TRACTOR P.T.O. YOKE	EQUIPMENT YOKE
03-33-30217-029	28½"	44½"	23⅜"	24⅛"	1⅜-6 SPLINE Q.D.	1⅜" Rd., with 5/16" KW
03-33-30217-039	39"	65"	32⅜"	34⅛"	1⅜-6 SPLINE Q.D.	1⅜" Rd., with 5/16" KW
03-33-30217-051	51"	77"	44⅜"	46⅛"	1⅜-6 SPLINE Q.D.	1⅜" Rd., with 5/16" KW

SERIES 2100 DRIVE SHAFT ASSEMBLIES
WITHOUT END YOKES

DRIVE SHAFT PART NUMBER (LESS END YOKES)	COMPRESSED LENGTH (B)	MAXIMUM EXTENDED LENGTH (A)	OUTER SHIELD LENGTH (C)	INNER SHIELD LENGTH (D)
03-30-30000-029	28½"	44½"	23⅜"	24⅛"
03-30-30000-039	39"	65"	32⅜"	34⅛"
03-30-30000-051	51"	77"	44⅜"	46⅛"

To order complete Drive Shaft Assembly with End Yokes other than listed above, order Assembly (less end yokes) and select two Yokes from chart below. Specify if they are to be assembled. If assembled, shipping papers and invoice will show complete Assembly Number (see page 234). A small assembly charge will be added.

STANDARD YOKES

ROUND HOLE

PART NUMBER	BORE SIZE	YOKE LENGTH	KEYWAY	WEIGHT
03-35-02116	1.250"	4 3/16"	¼"	3.0
03-35-02117	1.375"	4 3/16"	5/16"	3.0
03-35-02123	1.375"	4 3/16"	⅜"	3.0
03-35-02120	1.500"	4 3/16"	⅜"	3.0

SPLINE AND SQUARE HOLES

PART NUMBER	SPLINE OR SQUARE SIZE	YOKE LENGTH	WEIGHT
03-35-02102	1⅜-6 Spline—Q.D.	5 5/16"	3.5
03-35-02136	1⅜-21 Spline—Q.D.	4"	3.5
03-35-02128	1¼" Square	4⅛"	2.5

CROSS AND BEARING KIT

PART NO.	DESCRIPTION	WEIGHT
03-35-90076	Needle Bearing	1.2

TO ORDER UNIVERSAL JOINTS:

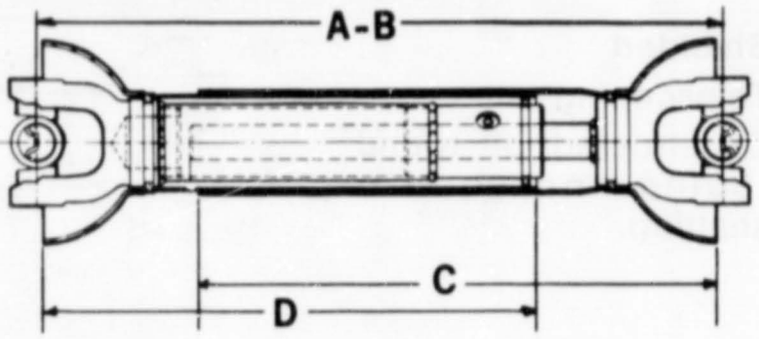
A Universal Joint consists of two Yokes and a Cross and Bearing Kit. Factory assembled Universal Joints will be supplied whenever an order contains two Yokes and a Cross and Bearing Kit (or multiples thereof) with a request that they be assembled. Shipping papers and invoices will show the assembly numbers (see page 234). A small assembly charge will be added.



HUB CITY DIVISION
SAFEGUARD POWER TRANSMISSION CO.
Phone (605) 225-0360 — P.O. BOX 1089 — ABERDEEN, S. DAKOTA 57401

SERIES 2600 DRIVE SHAFT ASSEMBLIES

- Shielded.
- Telescoping.
- Constructed of round tubing and square shafting.



SERIES 2600 DRIVE SHAFT ASSEMBLIES
INCLUDING END YOKES ASSEMBLED

COMPLETE SHAFT PART NUMBER (WITH END YOKES)	COMPRESSED LENGTH (B)	MAXIMUM EXTENDED LENGTH (A)	OUTER SHIELD LENGTH (C)	INNER SHIELD LENGTH (D)	TRACTOR P.T.O. YOKE	EQUIPMENT YOKE
03-33-43620-029	28⅛"	43⅜"	22¾"	23½"	1⅜-21 SPLINE Q.D.	1½" Rd., with ⅜" KW
03-33-43620-039	38¼"	63⅜"	32½"	32⅞"	1⅜-21 SPLINE Q.D.	1½" Rd., with ⅜" KW
03-33-43620-051	51"	78⅜"	45¾"	32⅞"	1⅜-21 SPLINE Q.D.	1½" Rd., with ⅜" KW

SERIES 2600 DRIVE SHAFT ASSEMBLIES
WITHOUT END YOKES

DRIVE SHAFT PART NUMBER (LESS END YOKES)	COMPRESSED LENGTH (B)	MAXIMUM EXTENDED LENGTH (A)	OUTER SHIELD LENGTH (C)	INNER SHIELD LENGTH (D)
03-30-40000-029	28⅛"	43⅜"	22¾"	23½"
03-30-40000-039	38¼"	63⅜"	32½"	32⅞"
03-30-40000-051	51"	78⅜"	45¾"	32⅞"

To order complete Drive Shaft Assembly with End Yokes other than listed above, order Assembly (less end yokes) and select two Yokes from chart below. Specify if they are to be assembled. If assembled, shipping papers and invoice will show complete Assembly Number (see page 234). A small assembly charge will be added.

STANDARD YOKES

ROUND HOLE

PART NUMBER	BORE SIZE	YOKE LENGTH	KEYWAY	WEIGHT
03-35-02617	1.375"	4½"	5/16"	6.0
03-35-02620	1.500"	4½"	⅜"	6.0
03-35-02637	1.750"	4 1/16"	⅜"	5.0

SPLINE AND SQUARE HOLES

PART NUMBER	SPLINE OR SQUARE SIZE	LENGTH YOKE	WEIGHT
03-35-02602	1⅜-6 Spline—Q.D.	5¼"	5.0
03-35-02636	1⅜-21 Spline—Q.D.	5 1/16"	6.0

CROSS AND BEARING KIT

PART NO.	DESCRIPTION	WEIGHT
03-35-90067	Needle Bearing	2.6

TO ORDER UNIVERSAL JOINTS:

A Universal Joint consists of two Yokes and a Cross and Bearing Kit. Factory assembled Universal Joints will be supplied whenever an order contains two Yokes and a Cross and Bearing Kit (or multiples thereof) with a request that they be assembled. Shipping papers and invoices will show the assembly numbers (see page 234). A small assembly charge will be added.



SOLENOIDS

(CODE **S0**)

century
BRASS PRODUCTS INC.

59 Mill Street
Waterbury, CT. 06720
203/574-7700

General Products Division

The General Products Division of Century Brass Products Incorporated make several items found in hybrid vehicles.

I. Solenoid Valves

1. E.G.R. Valves

   (Exhaust gas recirculation)

2. Carburetor Dump Valves

3. General purpose solenoid for:

   a. Air Control
   b. Electric Current Control

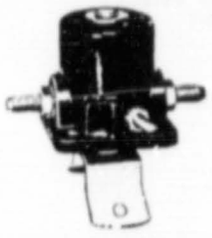
II. Speed Sensor

1. Signal generator works in conjunction with speedometer cable, and via electrical current converts RPM's into NPH's and is an integral part of the cruise control system.



2215-9 Solenoid Switch 6 Volt

Diamond T 1956-50
Federal ..... 1953-50; '48-46
IHC 1956-50
Packard ..... 1947-46; '42-41
Reo 1956-40
White ..... 1959-46; '43-40
Allis Chalmers 1960-40
B. F. Avery & Sons 1952-47
John Bean 1960-58
J. I. Case 1960-50
and other Tractor and Industrial Engines



8300-1 Solenoid Switch 6 Volt

Ford Tractor 1952-47



8310-1 Solenoid Switch 12 Volt

Valiant 1961-60



8700-0 Solenoid Switch 6 Volt

Divco 1960-48
IHC 1940-36
Packard 1938-37
Pontiac 1934-33
White Truck 1951-50



8800-1 Solenoid Switch 6 Volt

Ford & Tractor 1955-52
Lincoln 1955-52
Mercury 1956-52
Thunderbird 1955



8800-2 Solenoid Switch 6 Volt

Divco 1955-48
Federal ..... 1954-46; '41-37
Ford & Tractor 1955-52
Hudson 1956-51
IHC 1949-37
Kaiser 1955-50
Lincoln 1955-52
Mercury 1956-52
Oliver 1957-49
J. I. Case 1958-55
Thunderbird 1955
and other Tractor and Industrial Engines



8820-1 Solenoid Switch* 12 Volt

American Motors 1974-66
Bronco 1966-65
Comet 1966-60
Divco 1969-66
Edsel 1960-58
Fairlane 1966-62
Falcon 1966-60
Ford & Truck ..... 1978; '66-56
Jeep 1978
Lincoln ..... 1978; '66-56
Mercury ..... 1978; '66-56
Mustang 1966-65
Studebaker & Truck 1963-56
Thunderbird 1966-56
Ford Tractor 1964-59
* May require **24502-6** harcware on some applications



8825-1 Solenoid Switch 6 Volt

Diamond T 1951-49
Dodge 1955-46
Dodge Truck 1956-53
Fargo 1955
Plymouth 1955-46



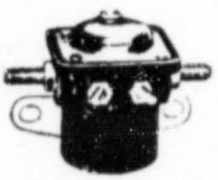
8830-1 Solenoid Switch 12 Volt

DeSoto 1959-57
Dodge 1960-56
Dodge Truck 1964-57
Fargo 1966-56
Ford Truck 1955-62
Plymouth 1960-56



8830-5 Solenoid Switch 12 Volt

Dodge Truck ..... 1974-6[illegible]



8835-1 Solenoid Switch 12 Volt

DeSoto 1959-57
Dodge 1960-56
Dodge Truck 1956
Plymouth 1960-56



8835-2 Solenoid Switch 6 Volt

Dodge 1955
Plymouth 1955



8850-1 Solenoid Switch 12 Volt

AMC 1976-75
Bobcat 1978-75
Cougar 1978-74
Fairlane/Torino 1976-72
Ford 1978-73
Granada 1978-75
Mercury 1978-73
Monarch 1978-75
Montego 1976-72
Mustang 1978-74
Pinto 1978-75
Thunderbird 1978-72
American LaFrance 1964-48
Brockway 1969-49
Checker 1960-57
Federal 1040-39
Flxible Bus ..... 1962-53; '50-49
FWD 1951-50
IHC Tractor 1959-58
Hudson 1956
IHC ..... 1949-46; '43-40
Jeep 1978-75
Studebaker Truck 1964-60
White ..... 1960-49; '40-38
and others



8860-0 Solenoid Switch 6 Volt

Checker 1958-50
Hudson 1950
IHC 1954-50
Kaiser Jeep 1965-52
Nash 1955-51
Packard 1954-35
Rambler 1955-52

ESSEX GROUP Subsidiary of UNITED TECHNOLOGIES
6233 CONCORD AVENUE • DETROIT, MICHIGAN 48211



8865-0 Solenoid Switch
12 Volt

Checker	1960-57
Diamond T	1956-50
Fixible Bus	1954-44
IHC	1956-47
Kaiser Jeep	1968-58
Minneapolis-Moline	1966-53
Oliver	1970-58
Reo	1953-46
Studebaker	1958-56
White	1966-49
John Deere	1959-49
Allis Chalmers	1968-60
J. I. Case	1966-55
Cockshutt	1961-57

and other Tractors and Industrial Engines



8870-0 Solenoid Switch
6 Volt

Ford & Truck	1951-37
Lincoln	1951-40
Mercury	1953-39
Studebaker & Truck	1955-51
Ford Tractor	1957-53



8875-0 Solenoid Switch
12 Volt

Ford Truck	1947-46



8890-2 Solenoid Switch
6 Volt

Ford Tractor	1962-53

8890-3 Solenoid Switch
12 Volt

AMC	1977-75
Ford Tractor	1968-58



66-2000-2 Solenoid Switch*
12 Volt

AMC	1974-71
Bobcat	1974
Bronco	1976-67
Comet/Montego	1976-67
Cougar	1973-67
Fairlane/Torino	1973-67
Falcon	1970-67
Ford & Truck	1976-67
Lincoln	1976-75; '70-67
Mark IV	1976-75; '70-69
Maverick	1974-70
Mercury/Meteor	1973-67
Mustang	1973-67
Pinto	1974-71
Thunderbird	1976-75; '70-67

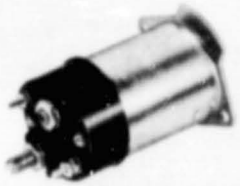
* May require **24502-7** hardware on some applications

72-2005-2 Solenoid Switch
12 Volt

American Motors	1978; '73-72

77-2005-2 Solenoid Switch
12 Volt

American Motors	1978-77



68-2080-2 Starter Solenoid
12 Volt

American Motors	1969-59
Apollo	1978-73
Astre	1977-75
Buick	1978-57
Buick Special, Skylark	1978-61
Cadillac	1978-56
Camaro	1978-67
Checker	1971-66
Chevrolet & Truck	1978-57
Chevelle	1978-64
Chevette	1978-76
Chevy II, Nova	1978-62
Corvair	1969-60
Corvette	1978-57
Cutlass, F-85	1978-61
Diamond T	1958-57
Divco	1965-63
Firebird	1978-67
Fixible Bus	1964-63
GMC	1978-56
IHC	1975-57
Oldsmobile	1978-57
Omega	1978-73
Pontiac	1978-56
Skyhawk	1978-75
Skylark	1978-75
Starfire	1978-75
Studebaker	1966-65
Sunbird	1978-76
Tempest/LeMans	1976-61
Toronado	1978-66
Vega	1977-71
Ventura II	1977-71
J. I. Case	1964-59
John Deere	1964-59; '57
IHC Tractor	1964-59
Massey-Ferguson	1964-58
McCormick-Deering	1962-58
Minneapolis-Moline	1964-53

and many other Truck, Tractor, Marine and Industrial Engines



68-2080-7 Starter Solenoid
12 Volt

Cougar	1977-75; '71-70
Ford	1977-69
Ford Truck	1977-64
Lincoln	1977-68
Mark IV	1977-69
Mercury/Meteor	1977-69
Montego	1976-70
Mustang	1972-71; '69
Thunderbird	1977-68
Torino	1976-70

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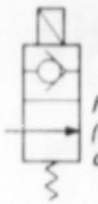
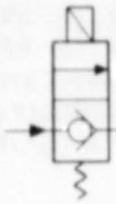


Normally open (unidirectional only)



NORMALLY CLOSED
FREE REVERSE FLOW
WHEN DE-ENERGIZED
(unidirectional when energized)

SOLENOID CARTRIDGE

PILOT OPERATED, POPPET STYLE, TWO WAY VALVE
NORMALLY OPEN, NORMALLY CLOSED
FOR OIL - TO 20 G.P.M. (75 L/MIN), 3000 P.S.I. (210 bar)

Fluid Controls, Inc.

8341 TYLER BLVD.
MENTOR, OH 44060
Phone 216-255-9711

USE

A pilot operated poppet style two-way for use as a directional control in any hydraulic system with flows up to 20 GPM.

OPERATION

Normally Open.

In the de-energized mode, spring force holds the pilot poppet away from the pilot seat. The main poppet contains an orifice which allows fluid to fill the cavity behind the main poppet. This control orifice is smaller than the pilot seat. Flow enters through the control orifice and flows to the outlet through the open pilot seat. This pilot flow unbalances the main poppet, compressing the main section spring and opening the poppet. A unique feature is a poppet which fits directly behind the main poppet and seals at the top of the main assembly sleeve. This second poppet seals against leakage between the poppet and sleeve, allowing the use of greater clearances without excessive leakage.

When the coil is energized, the armature pushes the pilot poppet onto the pilot seat. Pilot flow stops. The control orifice allows pressure on both sides of the main section to equalize and the spring pushes the main section closed.

Normally Closed.

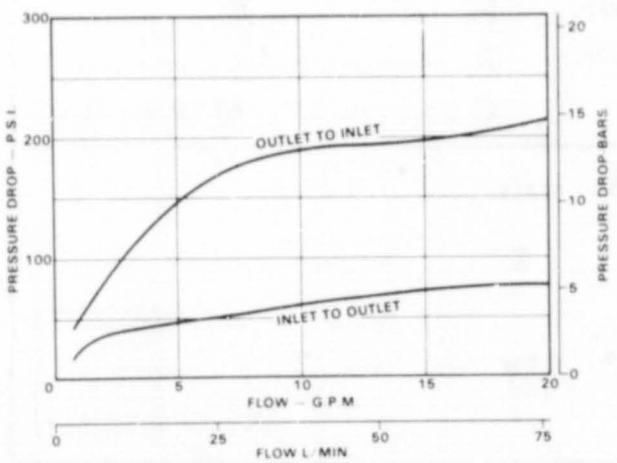
In the de-energized mode, spring force holds the pilot poppet on the pilot seat. The main section is held closed by the main section spring and by the hydraulic pressure behind the main poppet.

When the coil is energized, the pilot poppet is pulled from the pilot seat and pilot flow occurs. The pilot flow creates a pressure difference which unbalances the main poppet, opening against the main section spring.

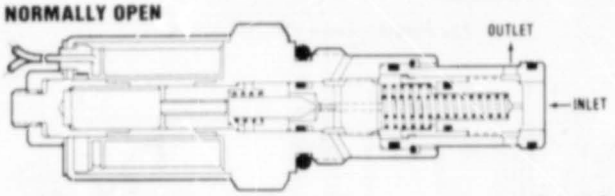
Optional Application.

The normally open valve is unidirectional in the open mode and will allow reverse flow in the energized (closed) mode.

The normally closed valve will allow reverse flow in the closed mode and is unidirectional in the energized (open) mode.

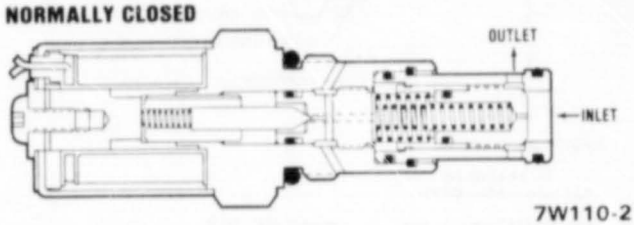


NORMALLY OPEN



7W110-1

NORMALLY CLOSED



7W110-2

FEATURES

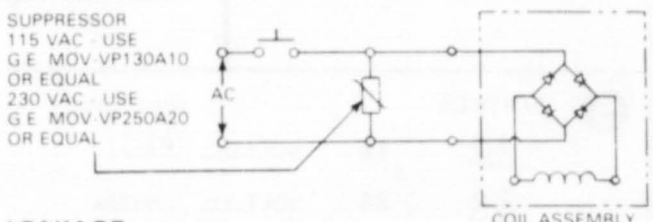
Reliable, excellent performance.
Cartridge construction for use in your own cavity or complete in body.
Hardened steel working parts.
Replaceable weather resistant coil.

SPECIFICATIONS

WORKING PRESSURE: Rated to 3000 P.S.I. (210 bar)

VOLTAGE:
12, 24, 36 VDC, 12 Watts
115 VAC (±10%)
50-60 hz. .12 amps.
230 VAC (±10%)
50-60 hz. .07 amps.
All coils rated for continuous operation.
AC coils use an internal AC/DC rectifier.

PLEASE NOTE:
Coils contain a full wave bridge rectifier rated for reverse voltage peaks of 1000 Volts Maximum. This is adequate for most systems. If voltage transients in your system are greater than 1000 Volts P.I.V., voltage transient suppressors such as metal oxide varistors should be added in parallel with the coil.



LEAKAGE:
In closed position — Inlet to Outlet @ 3000 psi. 15 drops per minute maximum with 135 s.s.u. oil @ 100°F.

MATERIALS: Cartridge housing, steel.
Valve body, hi strength wrought aluminum.
Internal parts, hardened steel, stainless steel.

PART NUMBER EXAMPLE: HOW TO ORDER

7W111 - 14 - L 12 S

❶ ❷ ❸ ❹ ❺ ❻

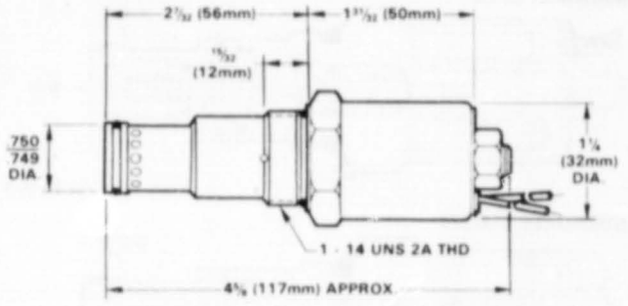
SOLENOID CARTRIDGE

PILOT OPERATED, POPPET STYLE, TWO WAY VALVE
NORMALLY OPEN, NORMALLY CLOSED
FOR OIL - TO 20 G.P.M. (75 L/MIN), 3000 P.S.I. (210 bar)

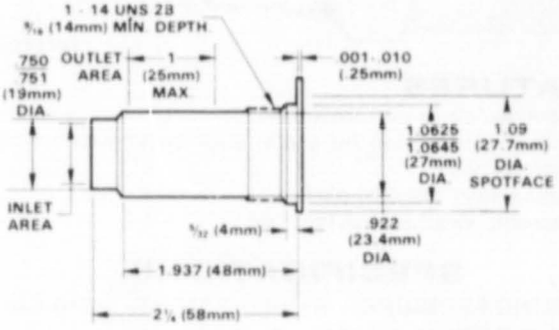
Fluid Controls, Inc.

8341 TYLER BLVD.
MENTOR, OH 44060
Phone 216-255-9711

❶ 7W110 Cartridge Only

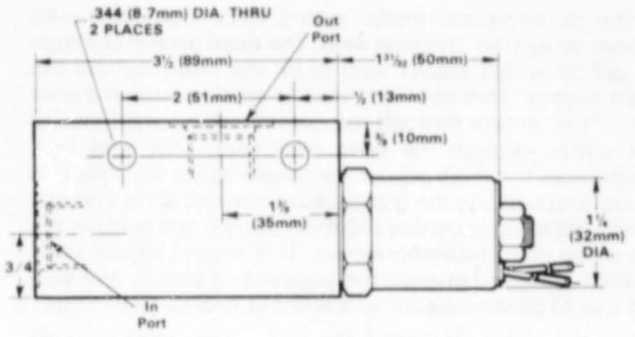


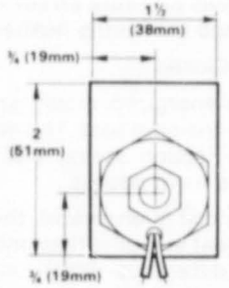
CAVITY DIMENSIONS



Note: Please obtain certified cavity and tool drawings before machining.

❶ 7W111 Complete valve





Refer to coil catalog page for dimensions of available coils.

❷ VALVE CONFIGURATION

1	Normally Open
2	Normally Closed

❸ PORT SIZE

4	½" NPTF	**12T**	¾" SAE
6	¾" NPTF	**4W**	½" BSPPL
8T	½" SAE	**6W**	¾" BSPPL

❹ COIL TERMINATIONS

Refer to coil catalog page for dimensions of available coils

—	Pigtails		
C	Conduit	**D**	Double Screw
H	DIN	**S**	Double Spade
B	Heavy Cord	**L**	Heavy Lead
G	Single Screw	**M**	Military Standard

❺ VOLTAGE

			WIRE COLOR
12	12	VOLT D.C.	Black
24	24	VOLT D.C.	Yellow
36	36	VOLT D.C.	Red
115	115	VOLT A.C.	White
230	230	VOLT A.C.	Blue

❻ SEALS

S	Buna N
SV	Viton A

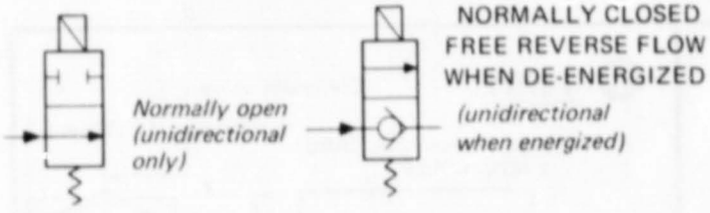
Consult factory for absolute seal compatibility.

SOLENOID CARTRIDGE

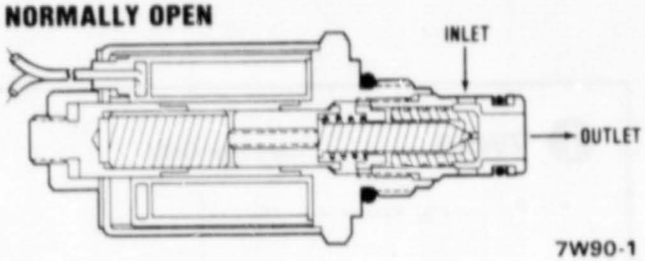
PILOT OPERATED, POPPET STYLE, TWO WAY VALVE
NORMALLY OPEN, NORMALLY CLOSED
FOR OIL - TO 5 G.P.M. (19 L/MIN), 3000 P.S.I. (210 bar)

Fluid Controls, Inc.

8341 TYLER BLVD.
MENTOR, OH 44060
Phone 216-255-9711

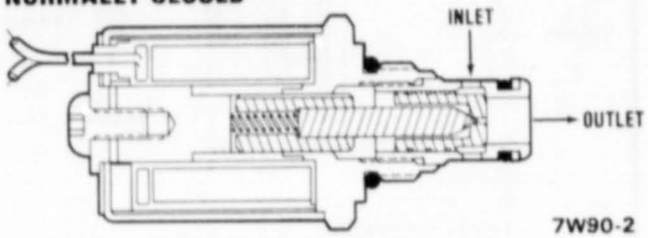


NORMALLY OPEN



7W90-1

NORMALLY CLOSED



7W90-2

USE

To be used as a two-way directional control in any hydraulic system with up to 5 GPM flow. Also can be used to remotely operate or pilot large pilot operated valves requiring up to 5 GPM pilot flow.

OPERATION

Normally Open.

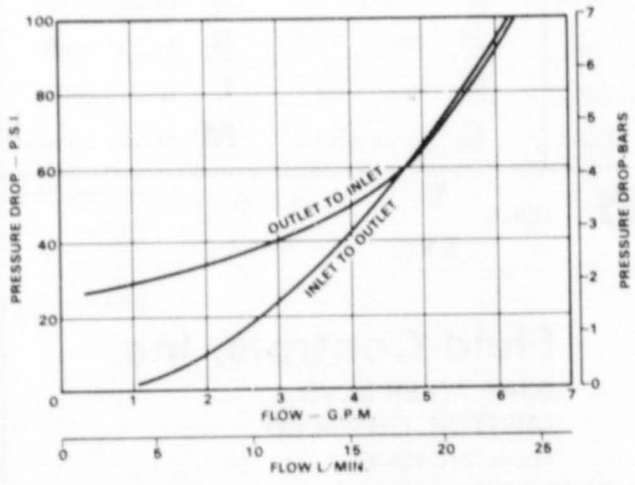
Spring tension holds the pilot poppet away from the orifice seat on the main poppet. An axial groove on the O.D. of the main poppet allows pilot flow to pass through the poppet nose. This flow pattern creates a pressure imbalance on the main poppet and causes the poppet to shift open allowing complete flow to pass through the outlet port. When the solenoid coil is energized, the armature is magnetically forced to slide the push pin and pilot poppet forward. The poppet blocks pilot flow and the main poppet shifts to a completely closed position.

Normally Closed.

Spring tension holds the pilot poppet against the main poppet and both pilot and main flow through the valve is blocked. When the solenoid coil is energized the armature is magnetically forced to pull the pilot poppet from the orifice seat and pilot flow occurs. The pilot flow creates a pressure imbalance on the main poppet and the valve shifts open.

Optional Application.

The normally closed valve will allow reverse flow in the closed mode and is unidirectional in the energized (open) mode.



FEATURES

Reliable, excelient performance.
Cartridge construction for use in your own cavity or complete in body.
Hardened steel working parts.
Replaceable weather resistant coil.

SPECIFICATIONS

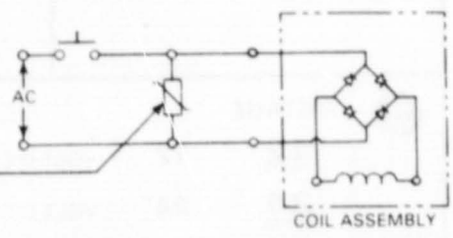
WORKING PRESSURE: Rated to 3000 P.S.I. (210 bar)

VOLTAGE:
12, 24, 36 VDC, 12 Watts
115 VAC (±10%)
50-60 hz. .12 amps.
230 VAC (±10%)
50-60 hz. .07 amps.

All coils rated for continuous operation.
AC coils use an internal AC/DC rectifier.

PLEASE NOTE:
Coils contain a full wave bridge rectifier rated for reverse voltage peaks of 1000 Volts Maximum. This is adequate for most systems. If voltage transients in your system are greater than 1000 Volts P.I.V., voltage transient suppressors such as metal oxide varistors should be added in parallel with the coil.

SUPPRESSOR
115 VAC - USE
G.E. MOV-VP130A10
OR EQUAL
230 VAC - USE
G.E. MOV-VP250A20
OR EQUAL



LEAKAGE:
In closed position – Inlet to Outlet @ 3000 psi. 5 drops per minute maximum with 135 s.s.u. oil @ 100°F.

MATERIALS: Cartridge housing, steel.
Valve body, hi strength wrought aluminum.
Internal parts, hardened steel, stainless steel.

PART NUMBER EXAMPLE: HOW TO ORDER

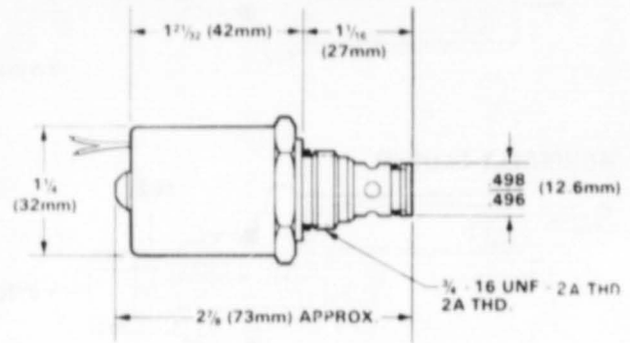
7W91 - 12 - L 12 S

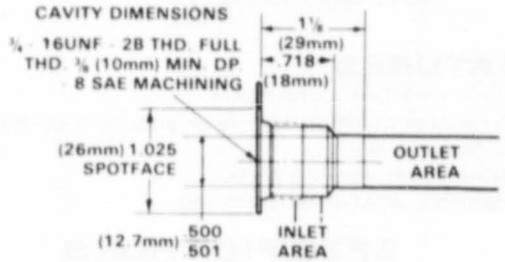
❶ ❷ ❸ ❹ ❺ ❻

SOLENOID CARTRIDGE

PILOT OPERATED, POPPET STYLE, TWO WAY VALVE
NORMALLY OPEN, NORMALLY CLOSED
FOR OIL - TO 5 G.P.M. (19 L/MIN), 3000 P.S.I. (210 bar)

❶ 7W90 Cartridge Only

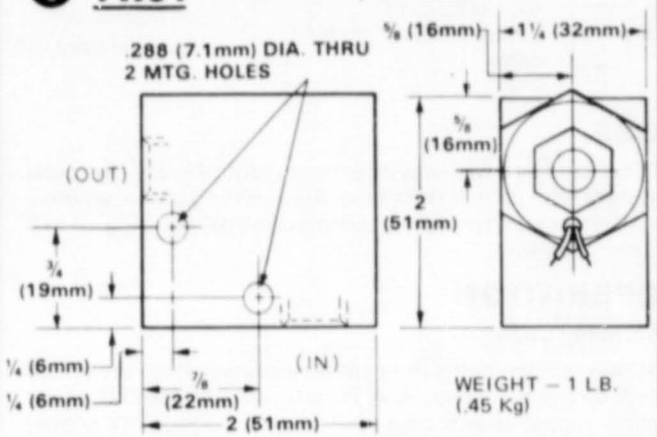


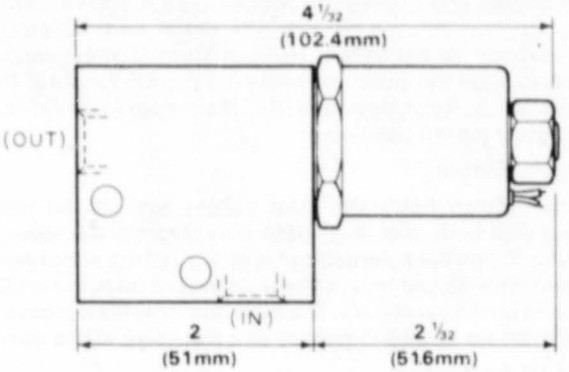


Refer to coil catalog page for dimensions of available coils.

Note: Please obtain certified cavity and tool drawings before machining.

❶ 7W91 Complete valve





❷ VALVE CONFIGURATION

1	Normally Open
2	Normally Closed

❸ PORT SIZE

2	1/4" NPTF
3	3/8" NPTF
6T	3/8" SAE
3W	3/8" BSPPL
2W	1/4" BSPPL

❹ COIL TERMINATIONS

—	Pigtails		
C	Conduit	**D**	Double Screw
H	DIN	**S**	Double Spade
B	Heavy Cord	**L**	Heavy Lead
G	Single Screw	**M**	Military Standard

❺ VOLTAGE

			WIRE COLOR
12	12	VOLT D.C.	Black
24	24	VOLT D.C.	Yellow
36	36	VOLT D.C.	Red
115	115	VOLT A.C.	White
230	230	VOLT A.C.	Blue

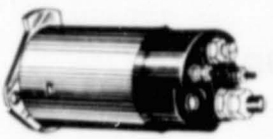
❻ SEALS

S	Buna N
SV	Viton A

Consult factory for absolute seal compatibility.

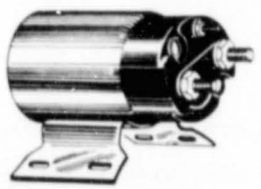
Fluid Controls, Inc.
8341 TYLER BLVD.
MENTOR, OH 44060
Phone 216-255-9711

STARTER SOLENOIDS



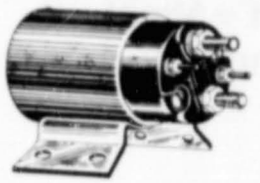
STS-1
(AL:SWG-235; DR:1114251, 52, 53, 55, 56, 57, 62, 63, 66, 71, 72, 73, 76, 78, 99, 1114304, 30, 56, 80, 88, 95, 96, 99, 1114458, 87, 96, 1118810, 11, 16, 21, 1119781, 98, 1119910, 19, 23, 36, 46, 67, 74, 86, 98, D-930, D-931, D-932, D-933, D-934, D-942, D-943, D-948, D-952, D-956, D-958, D-960, D-965, D-966, D-967, D-969, D-981, D-982) 12 Volt

American Motors 68-59
Buick Division 80-57
Cadillac Division 79-56
Chevrolet Division 80-57
GMC Truck 75-67
IHC 77-57
Jeep Corp. 71-66
Oldsmobile Division 80-57
Pontiac Division 80-56
and **Industrial, Marine, Tractors & Trucks**



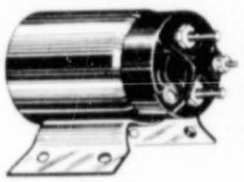
STS-2
(DR: 1114310, 12, 1118140, 48, D-936, D-938, D-939, D-961, D-964) 6 Volt

Buick Division 52-51
Cadillac Division 52-50
Chevrolet Division 54-49
Diamond T 58-55
GMC Truck 56-49
IHC 55-53
Pontiac Division 54-49
Reo Truck 60-54
and **Marine & Trucks**



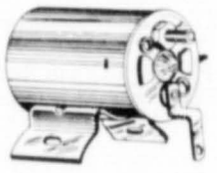
STS-3
(DR: 1118806, 1119760, 61, 67, 74, 77, 80, 89, 93, D-941, D-944, D-945, D-946, D-947, D-950, D-951) 12 Volt

American Motors 58-56
Buick Division 56-54
Cadillac Division 56-54
Chevrolet Division 62-55
GMC Truck 55
John Deere Tractor 60-58
Massey-Ferguson Tractor 61-59
Oldsmobile Division 56-54
Pontiac Division 55
Reo Truck 60-54
and **Industrial, Tractors & Trucks**



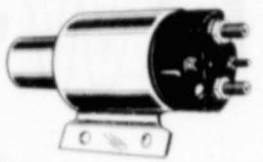
STS-5
(AL: SAD-4301, 03, 4401, SAD-4501, 3, 15-61, 15-62, 15-64; Chrys: 1889799, 2275217) 12 Volt

Chrysler Division 59-56
DeSoto 60-56
Dodge Truck 66-57
and **Industrial, Marine, Tractors & Trucks**



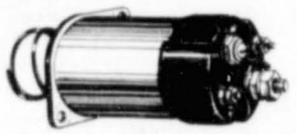
STS-8
(Chrys: 1889146, 2642222, 884, 961, 64, CH-2346; CH-2352, CH-2355, CH-2358) 12 Volt

Chrysler Division 71-57
Dodge Division 71-61
Plymouth Division 65-61



STS-9
(Chrys: 2525288, 2325288; DR: 1115501, 8, 10, 29, 40, 1119778, 833, 882, 85, 90, D-954, D-959, D-970, D-971, D-980; FR: C6TZ-11390A, SW-825) 12 Volt

Allis-Chalmers Tractors 62-57
Case Tractors 60-59
Cockshutt Tractors 61-60
IHC Truck 69-58
John Deere Tractors 60-58
Mack Truck 66-57
Massey-Ferguson Tractors 62-56
Oliver Tractors 64-57



STS-10
(DR: 1114370, 86, 473; FR: C8VF, C8VY-11390A, D3AZ-11390A, B, D3VY-11390A, SW-675)

Ford Division 75-69
Lincoln-Mercury Division 75-68



STS-11
(FR: D3TZ, D4VY, D5AZ-11390A, D6VZ-11390A, SW-1219,B, SW-1310)

Ford Division 77-73
Lincoln-Mercury Division 77-75

TEL: 315-568-5844

GP Guaranteed Parts Company - Seneca Falls, New York 13148

Gulf + Western Manufacturing Company

Electric Vehicle Components

Bohn Heat Transfer Division

1625 East Voorhees Street
Danville, Illinois 61832
Telephone: 217/446-3710

Heat Exchangers	Air to air, liquid to air and liquid to liquid designs. Custom manufacture.

Michigan Plating & Stamping Division

1860 Alpine Avenue, N.W.
Grand Rapids, Michigan 49504
Telephone: 616/363-4847

Fuel Tanks	Supplier to automotive industry of terneplate stamped and welded tanks.

Automotive Marketing and Engineering Center

Detroit Sales and Engineering Office
24114 Research Drive
Farmington Hills, Michigan 48024
Telephone: 313/478-8140

Relays	Miniaturized 12VDC to control circuits to 20 amperes.
Solenoids	Build to customer requirements.
Switches	Build to customer requirements.
Transducers	Current, Position, Pressure, Speed, Temperature, Torque, Voltage - Build to customer requirements.
Voltage Regulators	12VDC Solid State

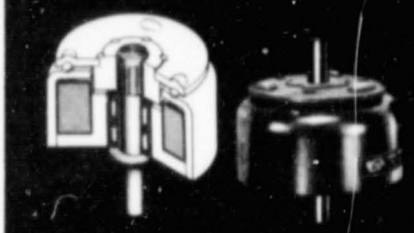
Collyer Insulated Wire Division

100 Higginson Ave.
Lincoln, RI 02865
Telephone: 401/723-7800

Apparatus Cables	**Single conductor, Type A.I.A.** IPCEA S-28-357, NEMA WC-1; Underwriters' Lab. Sizes #4 AWG and larger. Asb. covered, 300V and 600V.
Appliance Wires	**Single conductor** Collyer P-400 THHN/THWN PVC/NYLON in those sizes which are 19W uncompressed. U.L. Listed Rate AWM 105°C Dry and 80°C in oil.
Control Cables	**Single and multi conductor** THERMOPLASTIC: Collyer C-141 — PZR — PE/NYLON condrs. PVC Jacket 600V, 1000V, 75°C. Collyer C-140 — PVC insulated and jacketed 600V. Collyer C-143 — PE/PVC conductors, PVC jacket 600V, 1000V. Collyer C-153 — PE/NYLON, PZR 90°C, PVC jacket 600V, 1000V. Collyer C-154 — THHN/THWN conductors Type T.C. U.L. Listed.

LEDEX Design Engineering Aids

Rotary Solenoids



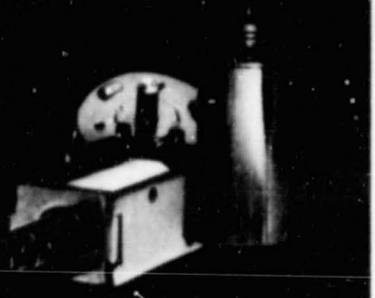
Step – turn – index – lock – punch – lift –

for millisecond fast torque and endurance decide on a *Ledex® rotary solenoid*. Simple to use, requires only a square wave input, no polarity to worry about and our endurance engineered version will give you over 100,000,000 cycles.

Torque up to 117 lb. in. with right hand or left hand strokes up to 110°. Send in attached postcard for information and breadboard with one of our 250 stock models.

OVER 100,000,000 CYCLES LIFE TESTED

Linear Solenoids



Short – medium – long strokes –

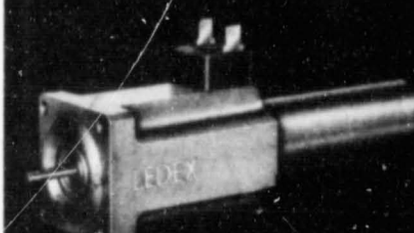
are all available from one source – Ledex. Choose our low profile flat face *push/pull* for high force/short stroke; our low profile conical face push/pull for medium force/stroke and our *tubular* solenoids for long strokes.

Repeatability and ruggedness will still be there after long usage. Our tubulars have built-in impact cushions to absorb energy at the end of the stroke and electroless nickle plated plungers for long life.

For cost awareness use our *D-Frame* solenoids available in AC or DC.

RUGGED REPEATABILITY

Servo Solenoid



Open loop – closed loop –

variable position sensing is now possible by using the Ledex Servo Solenoid with the Ledex controller for smooth, accurate response.

Hydraulic systems can use our *wet plunger* type which requires no dynamic seals and provides up to 50 pounds force. The linear force is proportional to the current input and is a force sensing system. Do away with pilot stages and expensive servo-valves.

HYDRAULIC OR DRY POSITIONING

Stepping Motors



Step 10-15-20-30 degrees –

with the highest torque stepping motor made – the *Ledex Series 50-L*. Exotic wave forms are passé, a simple square wave pulse drives either the unidirectional or bidirectional motor for 10,000,000 steps with a non-accumulative accuracy of ± 1°.

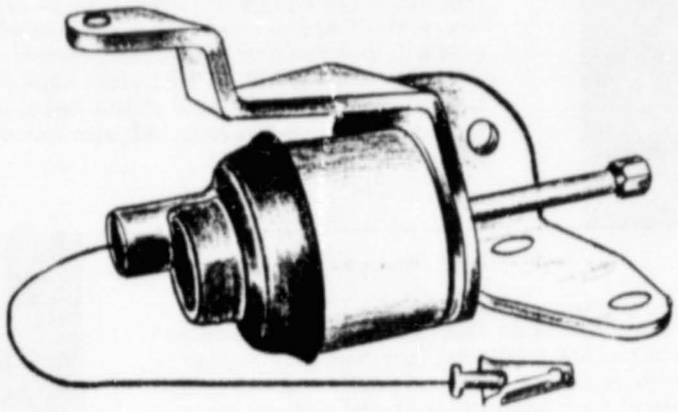
Direct couple for mechanical ease and avoid linkages. Can be manually over-ridden in case of power failure.

HIGHEST TORQUE

LEDEX

Ledex, Inc.
801 Scholz Drive, P. O. Box 427
Vandalia, Ohio 45377 U.S.A.
Phone: 513/898-3621

HOLDING SOLENOID WITH BRACKET



This is a constant duty, 12-volt, holding solenoid. It is actuated by the ignition circuit and is used to hold the throttle at a fast idle position. Initial actuation sequence is completed by turning or ignition switch and manually opening throttle once. Fast idle RPM is adjusted by rotating the hexagon end of the (10-32 SAE) threaded stem, while the engine is idling and the solenoid is actuated. When the ignition is turned off, the solenoid returns to the de-energized position and the throttle fly returns to the low idle position to prevent an engine after run condition. The unit is internally grounded and has lead wire for customer electrical connection.

Unit is available as bushing mount, optional bracket mount and adjustable bushing mount.

OTHER USES: Air conditioner, and decel throttle control, or other actuator controls.

CONTACT ENGINEER - CLARENCE FOX

BORG WARNER Transportation Equipment

Marvel-Schebler/Tillotson Division

Borg-Warner Corporation
2195 South Elwin Road, Decatur, Illinois 62525
Phone 217/428-4631

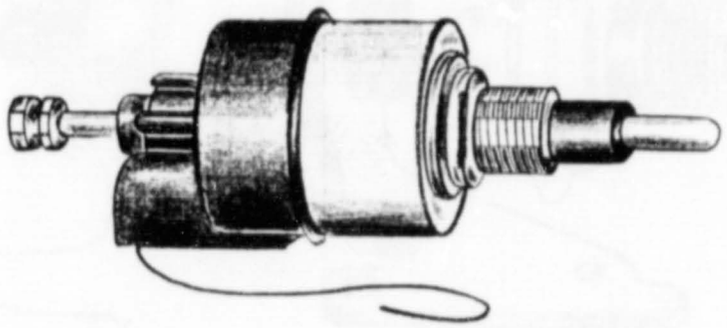
DRAWN

CHECKED

APPROVED

SKETCH NUMBER 103

THROUGH ADJUST SOLENOID



This is a constant duty, 12-volt, holding solenoid. It is actuated through the ignition circuit and is used to hold the throttle at a fast idle condition. Initial actuation sequence is completed by turning on the ignition switch and manually opening the throttle once. Approximate fast idle RPM is controlled by rotating the engine solenoid on its threaded bushing with the engine idling and the solenoid actuated. Precise fast idle RPM is controlled by adjusting the Hex nut at the rear of the solenoid. When ignition is turned off, the solenoid returns to the de-energized position to prevent an engine after run condition. The unit is internally grounded and has lead wire for customer electrical connection.

OTHER SUGGESTED APPLICATIONS: Permits accurate idle adjustments without removing engine air cleaner during production emission checks.

Fast curb idle for air conditioning, or decel control.

CONTACT ENGINEER - CLARENCE FOX

BORG WARNER Transportation Equipment

Marvel-Schebler/Tillotson Division
Borg-Warner Corporation
2195 South Elwin Road, Decatur, Illinois 62525
Phone 217/428-4631

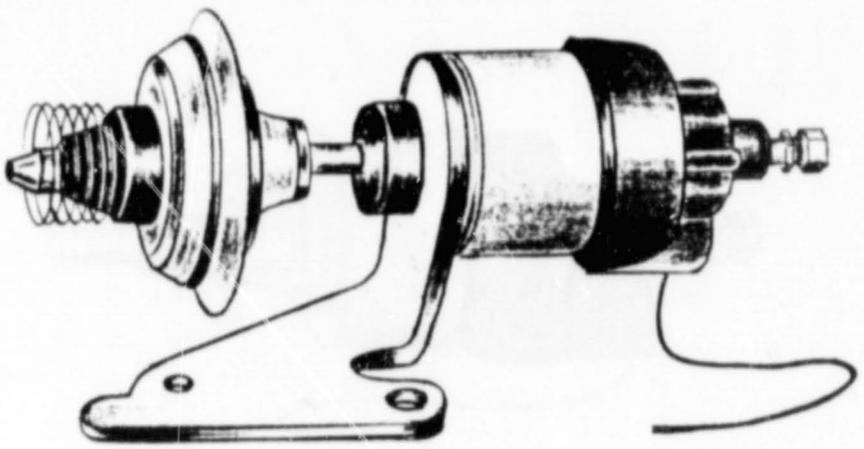
DRAWN

CHECKED

APPROVED

SKETCH NUMBER 104

DASH POT AND HOLDING SOLENOID



This is a constant duty, 12 volt, holding solenoid with combined dashpot. The solenoid portion is operated through the ignition circuit and holds the throttle at a fast idle position. Initial actuation sequence is completed by turning on ignition switch and manually opening the throttle once. Fast idle RPM is adjusted by rotating the hex nut at the rear of the solenoid while the engine idling and the solenoid is actuated. The dashpot portion is used to provide a slow closing throttle during the normal driving cycle. When the ignition is turned off, the nudger dashpot solenoid returns to the de-energized position and the throttle fly returns to the slow idle position to prevent an engine after run condition. The solenoid has sufficient travel to permit complete throttle closing without collapsing the dashpot. Unit is internally grounded and has lead wire for customer electrical connection. The rear adjustment feature permits setting idle without air cleaner removal.

OTHER SUGGESTED APPLICATIONS: Anti-dieseling solenoid, to reduce hydrocarbons on deceleration, driveline shock reduction.

CONTACT ENGINEER - CLARENCE FOX

BORG WARNER Transportation Equipment

Marvel-Schebler/Tillotson Division

Borg-Warner Corporation
2195 South Elwin Road, Decatur, Illinois 62525
Phone 217/428-4631

DRAWN

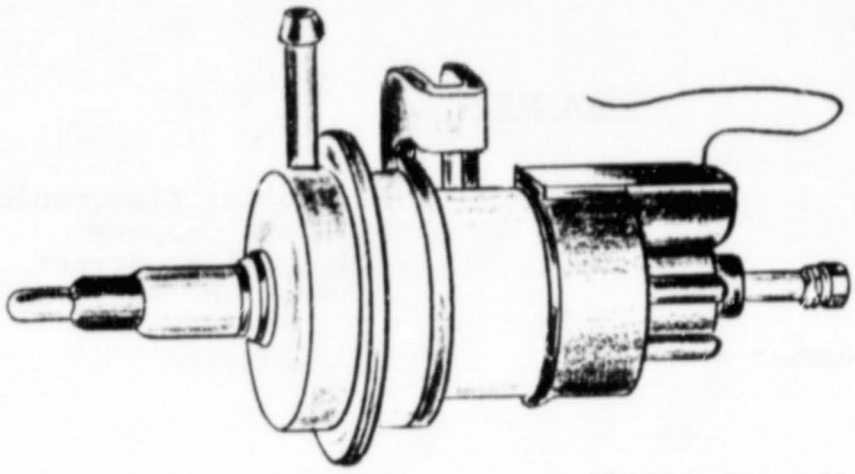
CHECKED

C. Fox
APPROVED

SKETCH NUMBER

105

3-POSITION HOLDING SOLENOID



This is a constant duty 12 volt holding solenoid combined with a vacuum motor, mounted on an adjustable bracket pad. The unit is adjustable by repositioning the bracket pad and the through-adjust stem for fast idle and curb idle. When the solenoid is energized with the throttle manually opened, it will move from the anti-run-on position to the curb idle position. When high manifold vacuum is applied the unit will push out, against the throttle, to the fast idle position.

The unit is internally grounded and has a lead wire for customer electrical connection.

SUGGESTED APPLICATIONS: Hydrocarbon reduction during deceleration.
Catalytic converter protection during deceleration.
Low temperature warm-up control.
Air conditioning speed up at idle.

CONTACT ENGINEER - CLARENCE FOX

BORG WARNER Transportation Equipment

Marvel-Schebler/Tillotson Division
Borg-Warner Corporation
2195 South Elwin Road, Decatur, Illinois 62525
Phone 217/428-4631

DRAWN
CHECKED
APPROVED

SKETCH NUMBER
106

The Prestolite Company

DATA SHEET

Company Name -	Prestolite Electronics Div. an Eltra Company 511 Hamilton Street Toledo, OH 43694
Company Phone Number -	419/255-4068
Name of Items -	
DC - DC Converters (on board)	Low Power (Instrument lighting only)
Relays, AC & DC (up to 300V, AC & DC)	Low Voltage, only i.e. 6 to 24 volt (horn relays, etc.)
Solenoids	Up to 72 Volt; SAZ, SBC, SAW, SAS, etc.
Switches (6-3000V, 1-20 Amp, AD&DC)	High Current low voltage push type switches
Transducers, Control Current	Brush Wear Indicators
Voltage Regulators	Generator & Alternator Voltage Regulators for 6 to 36 volt applications Solid state and Electro Mechanical types, i.e. VSH, VBC, VCA, etc.
Production Status of Above Items -	All are currently in production

SWITCHES

6-300V, 1-20 AMP, AC & DC

(CODE **SW**)

Alto International, Ltd. 11062 · 118th Place Northeast Kirkland, WA 98033 □ 206 · 827-9606

HEAVY-DUTY 16 AMP SWITCHES
AND SWITCH ACCESSORIES

	NUMBER	NAME/COLOR	DESCRIPTION
TOGGLES			
NON-ILLUMINATED	01001	On/Off	Multi-use application: Driving Lights, Backup Lights, Fans, Defoggers, etc. Easy installation.
	01002	Momentary/Off/Momentary	
	01004	On/On	
	01005	Momentary On	
	01008	On/Off/On	
GLOW TOGGLES			
	01007R	On/Off — Red	Switch handles GLOW in "ON" position. Popular in Europe - Fast becoming a hot item in U.S.
	01007G	On/Off — Green	
	01007A	On/Off — Amber	
	01007B	On/Off — Blue	
ROCKERS			
ROUND HOLE	01010	On/Off — non-illuminated	Easy installation. Rockers on certain models illuminate in "ON" position. May also be mounted in Victory Mounting Panels under dash.
	01011R	On/Off — Red	
	01011G	On/Off — Green	
	01011A	On/Off — Amber	
	01011W	On/Off — White	
RECTANGULAR HOLE	01070	On/Off — non-illuminated	Rockers on certain models illuminate in "ON" position. Especially easy installation when used with Victory Rectangular Hole Mounting Panel.
	01071R	On/Off — Red	
	01071G	On/Off — Green	
	01071A	On/Off — Amber	
	01071B	On/Off — Blue	
PUSH / PULL			
	01013	non-illuminated	Multi-use application. Illuminated models GLOW in "ON" position. Pulled out: "ON" Pushed in: "OFF"
	01014B	Blue	
	01014G	Green	
SWITCH / PANEL KITS			
TOGGLES	01022	(1) On/Off	Each kit includes: H-D 16A – 12V switch(es), mounting panel, fuse holder, terminals & screws
	01023	(1) On/Off "GLOW"	
(01025 shown)	01024	(1)1 On/Off/On	
	01025	(1) On/Off & (1) Warning Light	
	01026	(2) On/Off "GLOW"	
	01027	(1) On/Off/On & (1) Warning Light	
	01031	(2) On/Off & (2) Warning Lights	
	01032	(4) On/Off "GLOW"	
	01033	(4) On/Off	
ROCKERS	01056	(1) On/Off	
	01057	(1) Illuminating On/Off	
(01056 shown)	01058	(1) On/Off & (1) Warning Light	
	01059	(2) Illuminating On/Off	
	01065	(2) On/Off & (2) Warning Lights	
	01066	(4) Illuminating On/Off	

4000 SERIES POWER UNITS

This is the thyristor power switch that chops the battery power to the motor in a series of pulses.

MOUNTING

The heatsinks should preferably be vertical. The body of the unit is part of the electrical circuit and must be clear of the vehicle chassis. Insulating mounting brackets are supplied in the positions shown in full line on the installation drawing, but may be rotated through 90° as shown dotted.

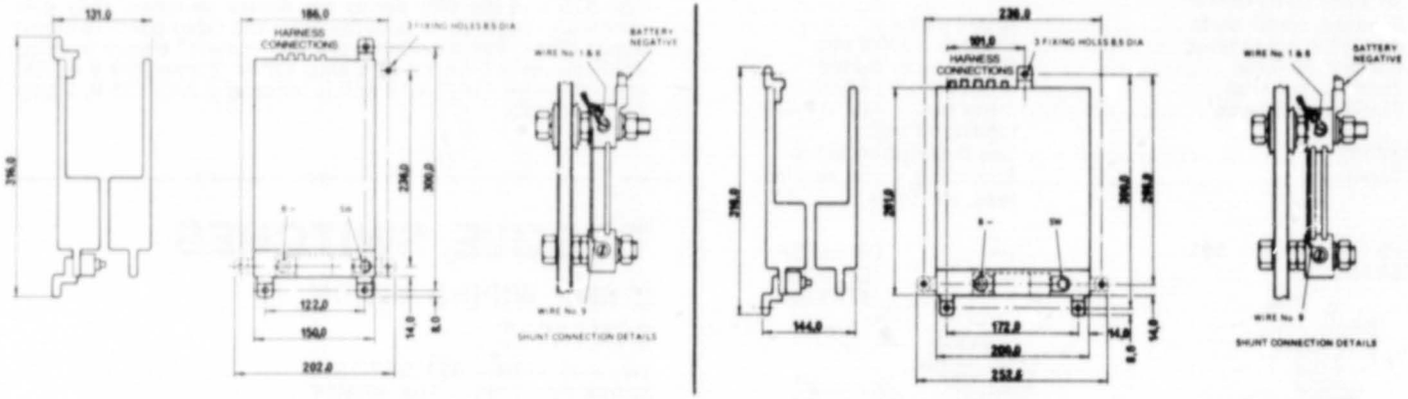
CONNECTIONS

Power connections are by M8 studs marked "B–" and "SW".
Control wiring connections are by 6.35mm faston type colour coded terminals.
Mating faston connector required for vehicle harness is Cableform Part No. 10188 fitted with coloured shroud Part No. 10189-2 (red), 10189-4 (yellow), 10189-5 (green), 10189-6 (blue) or 10189-9 (white).

MODEL 4021, 4022, 4023 OR 4024

INSTALLATION

MODEL 4011, 4012, 4013 OR 4014



PERFORMANCE SPECIFICATION

TEMPERATURE: –40°C to +50°C
HUMIDITY: 95% R.H.

CURRENT RATINGS AND MODEL SPECIFICATION

The appropriate unit for the application may be selected by equating the continuous current rating of the traction motor with the one hour current rating of the power unit and ensuring that the running current on the steepest specified gradient when fully laden is below the maximum 100% conduction figure.

CURRENT IN AMPS				VOLTAGE RANGE			
Ratings			Maximum 100% Conduction	24V	36 – 80V	84 – 140V	160 – 220V
Time	Ambient Temperature						
	20°C	40°C					
1 Hour	160	140	360	4021	4022	4023	4024
5 Mins.	320	270					
3 Mins.	385	330					
1 Hour	205	180	600	4011	4012	4013	4014
5 Mins.	475	400					
3 Mins.	530	450					

N.B. The power units listed above are representative of mid-range ratings only. Customer requiring ratings not included in the above table are requested to consult Cableform.

OPTION

Thermal protection for the main Thyristor–
Please specify the following
Not required –1
Required –2

Cableform Inc.
ZION CROSS ROADS
TROY, Va 22974 U.S.A.
Tel:(804) 589-8224

EXAMPLE OF ORDER WRITING INFORMATION

Power Unit including thermal protection, for use with a motor having a continuous current rating of 120 amps and a gradient requirement of 350 amps, and operated at 72 Volts:–
Order MODEL 4022-2

SERVICING AND SPARES

Please refer to the Pulsomatic Mk 10 instruction manual.

Specialty Switches

ARROW HART DIVISION

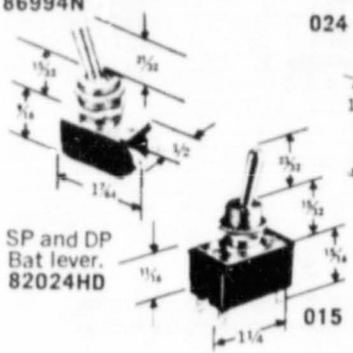
6 AMP WIPING-ACTION CONTACTS

TWO-POSITION — 591 SERIES, 015 SERIES
THREE-POSITION — 024 SERIES

SPECIFICATIONS

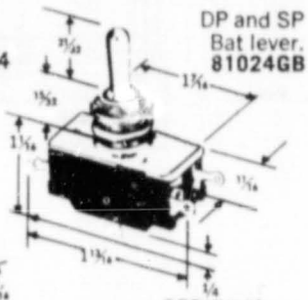
Exposed metal parts	Bright nickel
Dielectric breakdown	Exceeds 1000 V rms
Contact material	Bronze silver plated
Terminal material	Bronze silver plated
Standard hardware	1 hex nut, 1 knurled nut (unassembled)
Rating	See description below
Terminals	Solder lug, screw, or wire lead, see Table

SPST Solder lug. **591**
86994N



024

DP and SP Bat lever.
81024GB



SP and DP Bat lever.
82024HD

015

OPTIONAL LEVER



.968"

(591 & 015 Series)

591 SERIES
The 591 Series offers a selection of medium current (6 amps) switches in a small molded base. Quick-make quick-break wiping mechanism. UL Listed at 6 amp 125 V, 3 amp 250 V AC/DC.

015 AND 024 SERIES
The 015 and the 024 Series are deluxe switches. They give maximum reliability in both low-level and rated power (6 amps) applications. These switches are the "classic" choice in many applications. UL Listed at 6 amp 125 V, 3 amp 250 V AC/DC (except model 81021AV which is listed at 6 amp 125 V, 1 amp 250 V AC/DC).

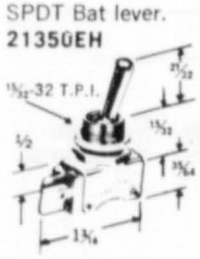
3 AMP ROLLER-BUTT CONTACTS

TWO-POSITION — CANOPY SERIES

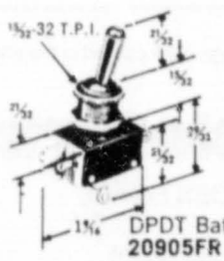
SPECIFICATIONS

Exposed metal parts	Bright nickel
Dielectric breakdown	Exceeds 1000 V rms
Contact material	Bronze silver plated
Solder lug terminal material	Bronze silver plated
Standard hardware	1 hex nut, 1 knurled nut (unassembled)
Rating	See description

SPDT Bat lever.
21350EH



DPDT Bat lever.
20905FR



OPTIONAL LEVER



BALL

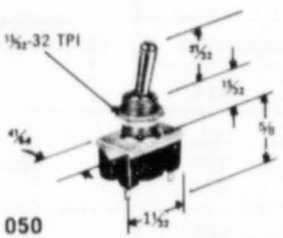
TOGGLE SWITCHES

3 AMP WIPING-ACTION CONTACTS

TWO-POSITION — 050 SERIES
THREE-POSITION — 104 SERIES

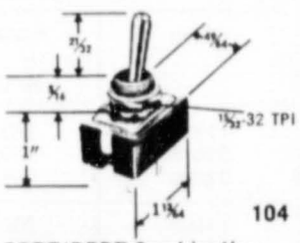
SPECIFICATIONS

Exposed metal parts	Bright nickel
Dielectric breakdown	Exceeds 1000 V rms
Contact material	Bronze silver plated
Terminal material	Bronze silver plated
Standard hardware	1 hex nut, 1 knurled nut (unassembled)
Rating	UL Listed 3 amp 125 V AC/DC, 1 amp 250 V AC/DC
Terminals	Solder lug 050 Series. Quick-connect/solder lug 104 Series.



050

SP and DP Bat lever.
Shown **83050.**



104

SPDT/DPDT Combination Solder lug, Quick Connect.
Shown **84104.**

OPTIONAL LEVERS



.968"

COLORED BATON

MOLDED TAPER

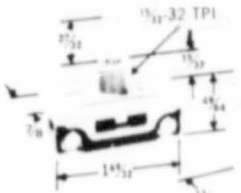
METAL PADDLE

16 AMP

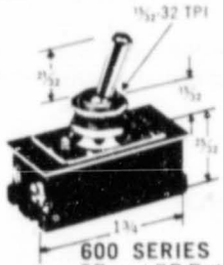
TWO-POSITION — 800 SERIES (For double insulation use)
TWO-POSITION — 600 SERIES

SPECIFICATIONS

Exposed metal parts ..... Bright nickel
Dielectric breakdown .... Exceeds 1000 V rms
Contact material ..... Bronze silver plated
Terminal material ..... Bronze silver plated
Rating 800 Series ..... UL Listed 16 amp, 1 HP, 125 V AC/DC; 8 amp, 1 HP, 250 V AC/DC
Rating 600 Series ..... SPST models UL Listed 12 amp, 125 V AC/DC, 6 amp, 250 V AC/DC DPST models UL Listed 16 amp, 1 HP, 125 V AC/DC, 8 amp, 1 HP, 250 V AC/DC.
Termination ..... Screw
Standard hardware ..... 1 hex nut, 1 knurled nut (unassembled)

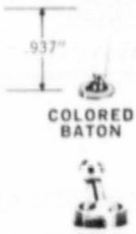


800 SERIES
DPST
All molded construction.
83800D



600 SERIES
SP and BP Bat lever
80600BJ.

OPTIONAL LEVERS

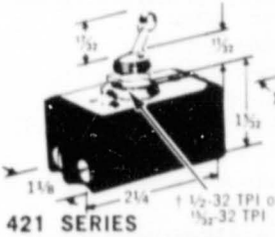


COLORED BATON

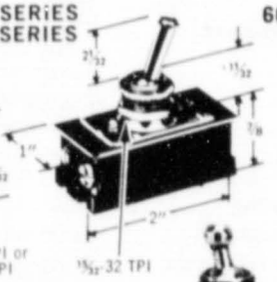
BALL

20 AMP WIPING-ACTION CONTACTS

TWO-POSITION — 602 SERIES
TWO-POSITION — 421 SERIES



421 SERIES
DPST Ball lever. **80602CA**



602 SERIES
SP and DP Bat lever.
80421

OPTIONAL LEVERS



COLORED BATON

BALL

421 SERIES
The 421 Series of quick-make quick-break AC/DC switches are built to handle rugged applications up to 20 amp and 2 HP at 250 V. Widely used in industrial power tools and floor cleaning and polishing equipment. Screw termination.

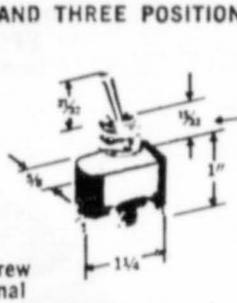
602 SERIES
The 602 Series of heavy duty switches are designed for higher power applications than the 600 Series, above. Screw termination.

DOUBLE INSULATION — 800 SERIES
The all-molded construction of the 800 Series of medium duty switches allows them to be applied where double insulation is desirable — or mandatory. Screw termination.

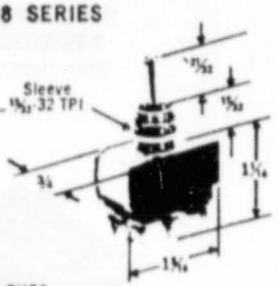
600 SERIES
The 600 Series of medium duty switches are primarily designed for small motor applications, both AC and DC. Screw termination.

15 AMP AC ONLY

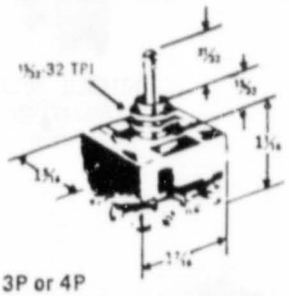
TWO AND THREE POSITION — 608 SERIES



SP Screw Terminal
Depth with QC termination is 1³⁄₃₂", with solder lug is 1⁵⁄₁₆



DP Bat Lever
Depth with QC termination is 1¾", with solder lug is 1"



3P or 4P
Depth with QC termination is 1¾" with solder lug is 1"

OPTIONAL LEVER



COLORED BATON

SPECIFICATIONS

Exposed metal parts ..... Bright nickel
Dielectric breakdown .... Exceeds 1000 V rms
Contact material ..... Silver Cadmium Oxide
Rating ..... UL Listed 15 amp, ¾ HP, 125 V AC; 10 amp, ¾ HP, 250 V AC
Terminals ..... Screw, solder lug, quick connect, see Table
Standard hardware ..... 1 hex nut, 1 knurled nut (unassembled)

The 608 Series is designed to offer high capacity (AC only) on a small size phenolic base butt type (silver cad-oxide buttons) contacts and ball-joint lever construction for long life expectancy. Available in 2- or 3-position and momentary contact at one or both sides of the center position. Rated at 15 amp, ¾ HP, 125 V AC, 10 amp, ¾ HP, 250 V AC.

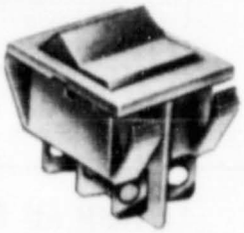
Specialty Switches

ARROW HART DIVISION

SNAP-IN ROCKER SWITCHES LIGHTED AND NON-LIGHTED



SINGLE POLE 2-POSITION
(non-lighted)



DOUBLE POLE 2-POSITION
(non-lighted)



SINGLE POLE 2-POSITION
(lighted)



DOUBLE POLE 2-POSITION
(lighted)



INDICATOR

- **Economical**
- **Compact design with popular snap-in mounting**
- **Choice of color**
- **Matching indicator lights**
- **Slow, make and break action**
- **Choice of single pole 1600 Series or double pole 2600 Series**
- **Complete European approvals**

Compact design with popular snap-in mounting. UL, CSA, UTE, BS, VDE, SEMKO, SF and DEMKO listed at 16 amp 250 Vac.

Specified in electronic instrumentation and on medical, data processing, telecommunications and duplicating equipment — the same switch can be used for both domestic and foreign markets.

Offered in a choice of colors. A wide circuit variety for designers and engineers. Lighted and unlighted styles.

SPECIFICATIONS

Operation	Rocker lever action, slow make-break, 2 and 3 position maintained 2 position momentary, with and without illumination
Function	1600 Series single pole, single throw (SPST) and single pole double throw (SPDT). 2600 Series double pole, single throw (DPST) and double pole, double throw (DPDT)
Mounting method	Through rectangular aperture by fixing legs on switch which gives a "snap-in" feature
Base	High grade Nylon 66
Actuator	High grade Nylon 66
Weight	1600 Series — 6 grams approx. 2600 Series — 12 grams approx.
Contact rating	16A, 250 Vac
Dielectric voltage	1000 volts R.M.S. (across contacts)
Insulation resistance	50 megohms
Electrical life	10,000 cycles minimum at maximum rated voltage and current
Mechanical life	50,000 cycles minimum
Lamp specification	Average life — 25,000 hours for neons (110 volts) and 50,000 hours for filament (6 volts). Wattage: 6 Volts, 0.9 Watts
Temperature range	−40°C to +85°C
Angular movement	2 position 36°, 3 position 18° each side of center
Maximum Panel Thickness	.118 for both 1600 and 2600

SPECIAL OPTIONS — CONTACT FACTORY

- **Special voltage bulbs**
- **Hot stamp legends**
- **Special color bezel and actuators**
- **Wire leads**
- **Solder lugs**

Introduction




Environmentally Sealed Switches

- Meets MIL-S-3950 requirements
- Standard lever and lever lock configurations
- 1 pole, 2 pole and 4 pole circuits available
- Ratings at 28 Vdc and 115 Vac, 60/400 Hz
- Self-extinguishing base material
- Molded-in screw terminal inserts




Environmentally Sealed Switches Integrated Wire Termination System (IWTS)

- Meets MIL-S-3950 requirements
- Standard lever and lever lock configurations
- 1 pole, 2 pole and 4 pole circuits available
- Ratings at 28 Vdc and 115 Vac, 60/400 Hz
- Self-extinguishing base material




Environmentally Sealed Positive Action Switches

- Meets MIL-S-8834 requirements
- Standard lever and lever lock configurations
- 1 pole, 2 pole and 4 pole circuits available
- Ratings at 28 Vdc and 115 Vac, 60/400 Hz
- High reliability—Mechanical and electrical
- Screw or solder lug termination




Flush Mounted Switches

- High capacity switch
- Ratings at 28 Vdc and 115 Vac, 60/400 Hz
- 1 pole and 3 pole circuits available
- Screw termination




Switches With Lever Seal

- Meets MIL-S-83731 requirements
- Standard lever and lever lock configurations
- Ratings at 28 Vdc and 115 Vac, 60/400 Hz
- 1 pole, 2 pole and 4 pole circuits available
- Screw and solder lug termination





Integral Toggle Switches

- Ratings up to 20 amperes
- One and two pole configurations
- Choice of terminals
- Maintained contacts
- One hole mounting




Multi-Circuit Toggle Switches

- Ratings up to 7 amperes
- Two, four, six and eight pole configurations
- Lever lock or standard levers
- Double turret terminals
- One hole mounting

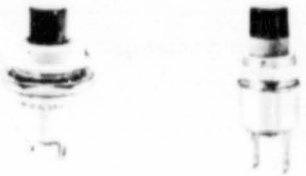
CUTLER · HAMMER
4201 N. 27TH STREET
MILWAUKEE, WIS. 53216
PHONE 414-442-7800

Introduction



Standard Pushbutton Switches

- Momentary and alternate action types
- Ratings up to 40 amperes
- One and two pole configurations
- One hole mounting
- Decorative actuators in different colors
- Two moisture proof series



UPA (Uniform Panel Appearance) Pushbutton Switches

- Ratings up to 10 amperes
- One, two and four pole configurations
- Solder lug or quick connect terminals
- Momentary snap or push-pull action
- One hole mounting



Illuminated Switches

- Momentary, alternate, and push on,-push off actions available
- Ratings up to 10 amperes
- Two pole and two circuit configurations
- One hole mounting
- Variety of cap styles in different colors
- Most designed to use MS25237 type lamps



Special Designed Pushbuttons and Rotary Sw.

- Pushbutton designed for limit or indicating applications
- Pushbutton designed for microphone applications
- Pushbutton switch with holding coil
- Pushbutton switch with holding coil and light
- Rotary switch with positive snap action mechanism

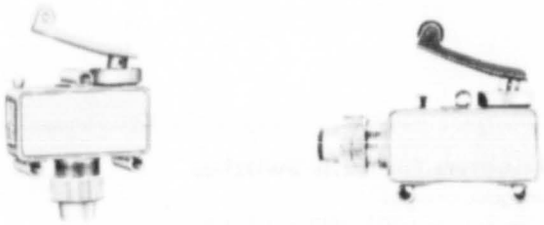
CUTLER • HAMMER
4201 N. 27TH STREET
MILWAUKEE, WIS. 53216
PHONE: 414-442-7800

Introduction



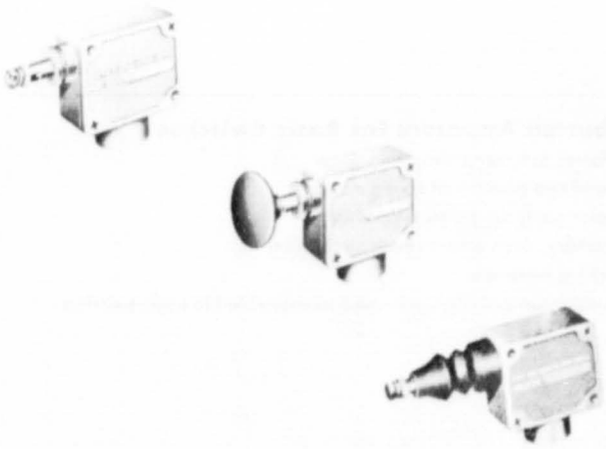
H11 Series

- Ratings up to 7 amperes
- Two and four pole configurations
- Wire leads (6 foot length)
- One hole mounting
- MIL-S-8805 approved
- Available with rotary roller arm actuator
- Available with pushbutton actuator
- Available with rotary link arm actuator
- Available with roller plunger actuator
- Available with glass-to-metal seal or phenolic disc header



HERMETIC SWITCHES

- Inert gas filled and sealed
- Roller-lever actuated
- Side mounted
- Features wire solder cup terminals
- Momentary contact
- One and two pole configurations
- All metal parts treated for corrosion resistance



Limit Switches

- Switches specifically designed for industrial use
- Available in standard or one way impulse action
- Rugged plunger type spring return action
- All metals are corrosion resistant
- Case is die cast aluminum with silver hammer finish
- Available with standard plunger actuator
- Available with large 1¾" button actuator
- Available with a splash proof neoprene boot.

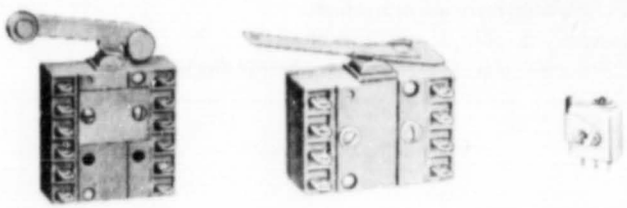
CUTLER · HAMMER
4201 N. 27TH STREET
MILWAUKEE, WI 53216
PHONE 414-442-7800

Introduction



Basic Switches

- Ratings up to 40 amperes
- One, two and three pole configurations
- Choice of terminals
- Maintained and momentary circuits
- Snap action contact mechanism
- Dry circuit capabilities
- Diallyphthalate case



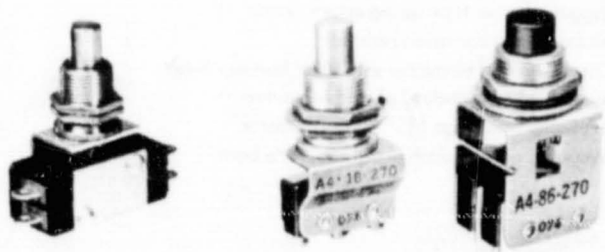
Roller, Straight, and Leaf Actuators For Basic Switches

- Variety of actuator styles
- Consistent reliable performance
- Actuator metal parts are stainless passivate
- All parts are treated for corrosion resistance
- Adaptable to D, K, and EF series switches
- All actuators are supplied assembled to basic switches



Toggle Actuators For Basic Switches

- 10 different actuator styles
- Basic switches conform to MS25085 or MS25351
- Standard bat or decorative flat lever styles
- Ambient temperature range − 65 to + 160°F
- All parts are treated for corrosion resistance
- All toggle actuators are supplied assembled to basic switches



Pushbutton Actuators For Basic Switches

- 7 different actuator styles
- One and two pole circuit configurations
- Actuator parts are stainless passivate
- Momentary, snap action switch mechanism
- Solder lug terminals
- All pushbutton actuators are supplied assembled to basic switches

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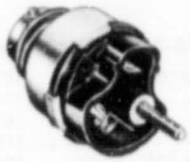
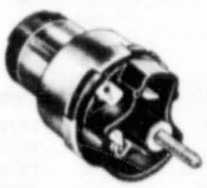
WA-0376-7 Wire Feed Assembly

To be used with **68-0310-2** ignition switch. Replaces damaged harness often resulting from original switch overload.



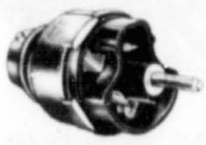
41905-1 Ignition Switch

Bronco	1966
Comet	1965-60
Edsel	1960
Fairlane	1965-62
Falcon	1965-60
Ford	1964-60
Ford Truck	1968-61
Lincoln	1964-61
Mercury	1964-60
Mustang	1966-65
Thunderbird	1964-60



41910-5 Ignition Switch

Comet	1967-66
Cougar	1967-66
Fairlane	1967-66
Falcon	1967-66
Ford	1967-65
Ford Truck	1967
Lincoln	1967-66
Mercury & Meteor	1967-65
Mustang	1967
Thunderbird	1967-65



66-0300-2 Ignition Switch

Bronco	1977-67
Ford Truck	1977-67



68-0310-2 Ignition Switch

Comet, Montego	1969-68
Cougar	1969-68
Fairlane, Torino	1969-68
Falcon	1970-68
Ford	1969-68
Ford Truck	1972-68
Lincoln	1969-68
Mark III	1969
Maverick	1970
Mercury & Meteor	1969-68
Mustang	1969-68
Thunderbird	1969-68



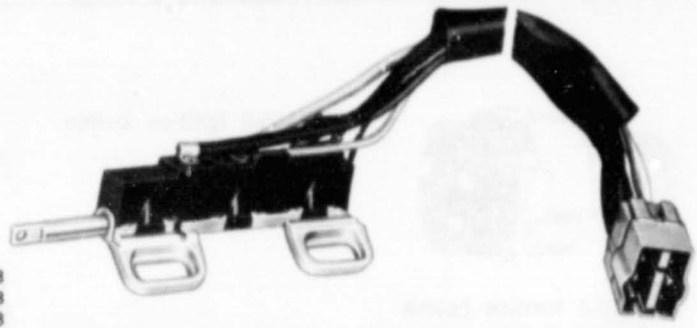
68-0350-3 Ignition Switch

Barracuda	1968-65
Chrysler	1968-60
Dart	1968-63
DeSoto	1961-60
Dodge	1968-60
Dodge Truck	1976-61
Imperial	1968-60
Plymouth	1968-60
Valiant	1968-60



69-0350-4 Ignition Switch

Barracuda	1969
Chrysler	1969
Dart	1969
Dodge	1969
Imperial	1969
Plymouth	1969
Valiant	1969

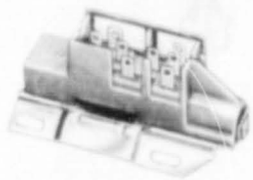


70-0330-3 Ignition Switch

Cougar	1970
Maverick	1970
Mustang	1970

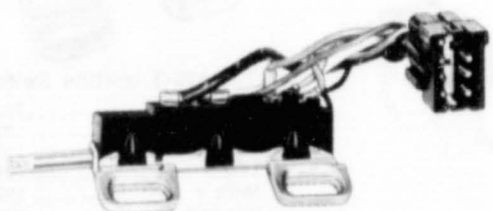
70-0330-4 Ignition Switch

Fairlane, Torino	1970
Ford	1970
Lincoln & Mark IV	1970
Maverick	1970
Mercury & Meteor	1970
Montego	1970
Thunderbird	1970



70-0370-2 Ignition Switch

American Motors	1978-70
Buick	1977-69
Buick Special, Skylark	1977-69
Cadillac	1977-69
Chevrolet	1977-69
Chevy II & Nova	1977-69
Corvette	1977-69
Firebird	1977-70
F-85 & Cutlass	1977-69
Jeep	1978-74
Oldsmobile & Toronado	1977-69
Omega	1977-73
Pontiac	1977-71
Skyhawk	1977-75
Starfire	1977-75
Sunbird	1977-76
Tempest/LeMans	1977-71
Vega & Monza	1977-71
Ventura II	1977-71



71-0330-5 Ignition Switch

Comet	1977-71
Cougar	1972-71
Lincoln	1978-71
Mark III, IV	1971
Maverick	1977-71
Montego	1972-71
Mustang	1972-71
Pinto	1974-73
Thunderbird	1971
Torino	1971

71-0330-7 Ignition Switch

Cougar	1973
Ford	1972-71
Mercury & Meteor	1972-71
Mustang	1973

71-0330-8 Ignition Switch

Bobcat	1974
Pinto	1973-71

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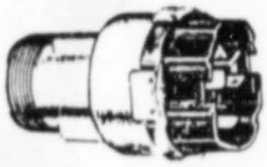
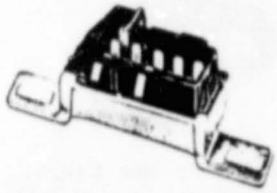


72-0310-2 Ignition Switch

Ford Truck 1976-70

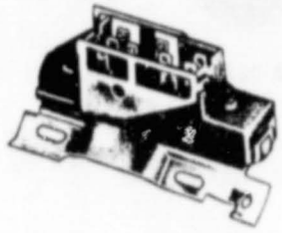
75-0355-6 Ignition Switch

Use 76-0355-6



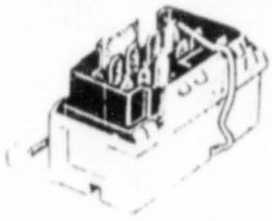
77-0335-4 Ignition Switch

LTD 1978-77
Marquis 1978-77



78-0370-3 Ignition Switch

American Motors 1978
Buick 1978
Cadillac 1978
Chevrolet 1978
Chevy & GMC Truck 1978
Oldsmobile 1978
Pontiac 1978
(All models w/o tilt wheel)



72-0335-2 Ignition Switch

Bobcat 1976-75
Cougar 1976-74
Granada 1976-75
Mark IV 1976-72
Monarch 1976-75
Montego 1976-72
Mustang 1976-74
Pinto 1976-75
Thunderbird 1976-72
Torino 1976-72



76-0355-6 Ignition Switch

Aspen 1976
Coronet/Charger 1976-70
Cordoba 1976-75
Chrysler 1976-72
Dodge 1976-70
Plymouth 1976-70
Grand Fury 1976
Monaco 1976-70
Volare 1976
Dodge Truck 1976-72



77-0360-2 Ignition Switch

Chrysler 1978-77
Dodge 1978-77
Dodge Truck 1978-77
Plymouth 1978-77
(All models w/o tilt wheel)



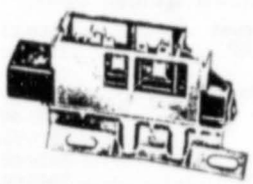
78-0370-4 Ignition Switch

American Motors 1978
Buick 1978
Cadillac 1978
Chevrolet 1978
Chevy & GMC Truck 1978
Oldsmobile 1978
Pontiac 1978
(All models w/Tilt wheel)



77-0335-3 Ignition Switch

Bobcat 1978-77
Cougar 1978-77
Granada 1978-77
LTD II 1978-77
Mark V 1978-77
Monarch 1978-77
Mustang II 1978-77
Pinto 1978-77
Thunderbird 1978-77



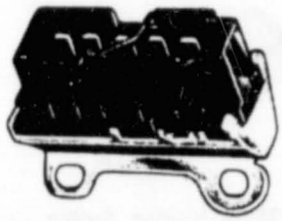
77-0370-2 Ignition Switch

Chrysler 1978-77
Dodge 1978-77
Plymouth 1978-77
(All models w/Tilt wheel)



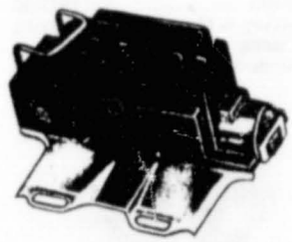
73-0335-2 Ignition Switch

Ford 1976-73
Mercury & Meteor 1976-73



78-0325-2 Ignition Switch

Capri 1979
Fairmont 1979-78
Ford 1979
Mercury 1979
Mustang 1979
Zephyr 1979-78



78-6300-2 Ignition Switch

Dodge Omni 1978
Plymouth Horizon 1978

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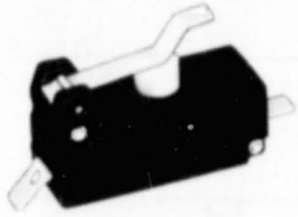
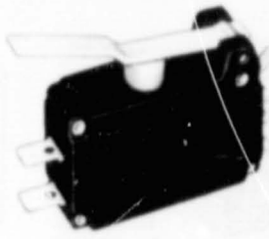
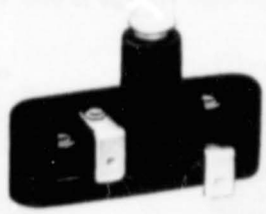
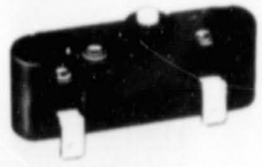
ESSEX CONTROLS DIVISION 131 GODFREY STREET, LOGANSPORT, INDIANA 46947 219/753-7521

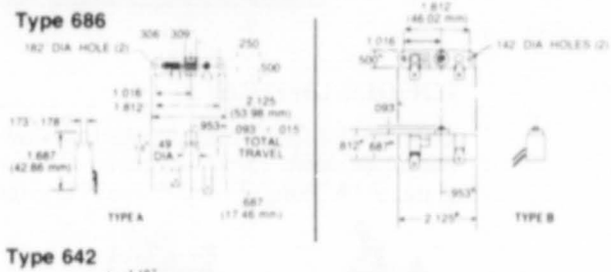
Switches

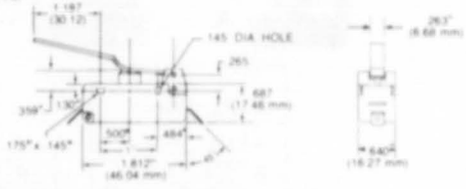
TYPE 642, 643, and 686 Snap-Action Switches

OUTLINE DIMENSIONS

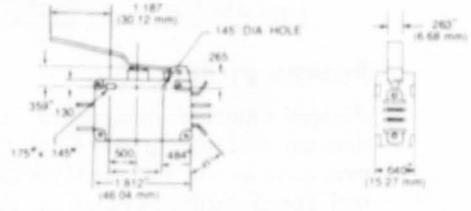
Type 686



Type 642



Type 643



NOTE: Dimensions are approximate — consult factory for exact dimensions.

APPLICATION DATA

Designed and built for low cost, dependable operation, Essex Snap-Action Type 686 and Type 642 series are available in both single and double throw versions, with mounting brackets and operating arms which can be furnished to your mounting specifications. The Type 643 features DPDT capability. It is ideal for special applications such as controlling both sides of a power line.

Features: Molded phenolic case has a positive over-center action to make and break the circuit. These switches are electrically rated up to 25 amps, U.L. and C.S.A. listed, have large fine-silver contacts and NEMA standard termination.

ENGINEERING DATA

Series	Maximum Circuitry	UL Rating	Pretravel Maximum	Trip Force Oz. Maximum	Termination	Differential Maximum
686	S.P.D.T.	12 Amp ½ HP 125/250 VAC	5/64"	20	250 x .032 Male	.032
642	S.P.D.T.	15 Amp* 125/250 VAC ½ HP 125 VAC 1 HP 250 VAC	5/64"	20	250 x .032 Male	.032
643	D.P.D.T.	16 Amp* 125/250 VAC 1 HP 125 VAC 2 HP 250 VAC	1/8"	40	250 x .032 Male	.032

* 25 Amp Available on Request.

MICRO SWITCHES

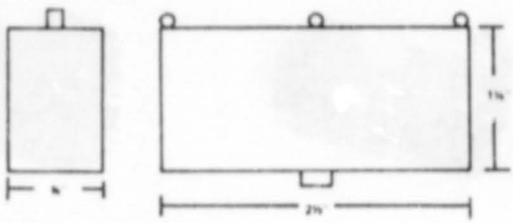
These quality microswitches can be used in an unlimited number of applications. Possibilities demonstrated in this catalog include accelerators and contactor interlocks. Available in two styles, roller actuated or push button. Order appropriate style based on desired application. Rated at 3 amps at 115 VDC. Maximum voltage is 600 VDC.



•Push Button



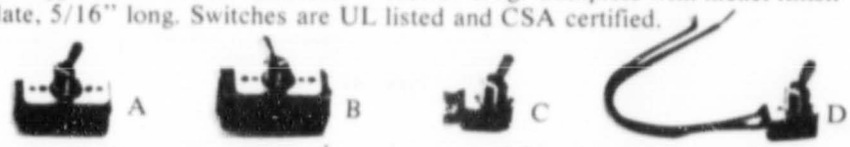
Roller Actuated



Part No.	Description
31-3MN-410	Push Button Microswitch
31-6MN-410	Roller Actuated Microswitch

TOGGLE SWITCHES

Quick-make, quick-break contact mechanism in bakelite housing. 11/16" long bat toggle, stem 15/32" diameter × 15/32" long. Complete with nickel finish plate, 5/16" long. Switches are UL listed and CSA certified.



#	Part No.	Elec. Action	Charact. Type	Amperes at 125/250 VDC	Terminals
A	700-2A488	on-off	DPST	16/8	Screw
B	700-2B488	on-off	DPST	20/10	Screw
C	700-1C878	on-off	SPST	6/3	Screw
D	700-1D878	on-off	SPST	6/3	6" Leads

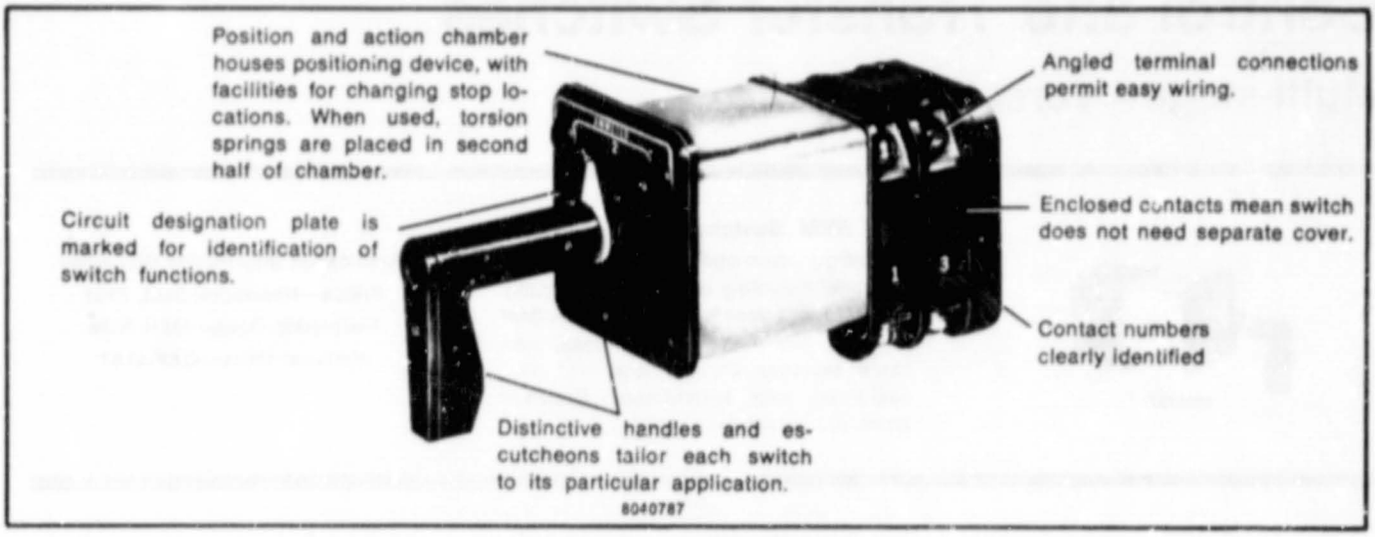
POWER FUSES

Protect valuable components from damage with these power fuses. Connect them in line with the EV's motor and speed control system to guard against damage from overload.



Part No.	Description
26-5383-260	200 Amp Fuse
26-2816-260	400 Amp Fuse
26-2900-260	600 Amp Fuse
26-2800-260	800 Amp Fuse

ELECTRIC VEHICLE COMPONENTS
FLIGHT SYSTEMS
HEADQUARTERS
P.O. BOX 25, MECHANICSBURG, PA 17055
PHONE (717) 697-0333



The SBM Compact Cam-operated

- Control and transfer
- For control panels and switchboards
- Up to 600 volts

The SBM is a compact, positive acting switch for control and transfer service on panels and switchboards, 600 volts and under. Up to 10 stages, 2 contacts per stage can be provided, with independent action, both electrically and mechanically, through eight positions.

Ideal For Switchboards—

—The SBM switch is especially adaptable for switchboard applications where space is at a premium. When a control switch is required for use in an explosion-proof or watertight enclosure, space is normally not a controlling factor, and the SB-1 switch, which is somewhat larger, is used.

The SBM switch is normally supplied for mounting on panels up to ¼ inch thick. If requested, it can also be supplied for mounting on panels of one and one and a half inches.

Compact design of the SBM switch permits close center-to-center line mounting distances and, at the same time, easy access to the terminals for wiring. Also, since the switch is enclosed, there is no need for clearance at the back of the panel to remove a separate cover. This further reduces space requirements.

Ratings

The SBM switch is rated for a mechanical life of 500,000 operations. The electrical ratings are 600 volts ac or dc, 20 amps continuous or 250 amps for three seconds. The interrupting rating depends upon the voltage and character of the circuit. The table below illustrates the interrupting duty of a single contact and contacts in series when various conditions exist on a circuit.

SBM is recognized under the component program of Underwriters' Laboratories, Inc.

Interrupting Rating (amperes)

Circuit Volts	Non-inductive		Inductive	
	Number of Contacts			
	1	2 in series	1	2 in series
24 dc	10	30	8	25
48 dc	8	25	6	18
125 dc	5	15	4	10
250 dc	1	3	1	2.5
600 dc	0.4	0.8	0.3	0.7
115 ac	40	75	24	50
230 ac	25	50	12	25
460 ac	20	30	10	20
600 ac	15	25	8	12

GENERAL ELECTRIC COMPANY . . . . . .6901 ELMWOOD AVENUE
PHILADELPHIA, PENNSYLVANIA 19142. Phone (215) 726-2626

Control and Transfer Switches

Multi-stage—versatile—reliable

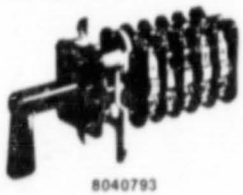


8040787

The SBM Switch

—rotary, cam-operated, compact—for panel mounting only. Two electrically separate and mechanically independent contacts per stage. These small, versatile switches mount close and wire easily on your switchboard. Common types are warehouse stock.

Application Information GET-6169
Prices—Handbook Sect. 7151
Instruction Book—GEH-2038
Renewal Parts—GEF-4167

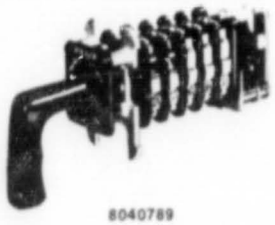


8040793

The SB-1 Switch

—rotary, cam-operated, slightly larger than the SBM switch and capable of more design flexibility. Can be independently mounted and housed—Navy approved in relevant applications. Many common types warehoused.

Application Information GET-6169
Prices—Handbook Sect. 7151
Instruction Book—GEH-908
Renewal Parts—GEF-2357

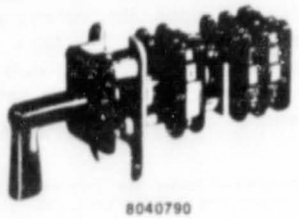


8040789

The SB-9 Switch

—a heavier-duty switch than the SB-1—for applications requiring unusually high numbers of repetitive operations, but otherwise similar in optional features and design capability.

Application Information GET-6169
Prices—Handbook Sect. 7151
Instruction Book—GEH-908
Renewal Parts—GEF-3481



8040790

The SB-10 Switch

—in addition to the rotary operation like the SB-1 switch, the SB-10 is capable of opening and closing contacts with a lateral push or pull of the handle.

Application Information GET-6169
Prices—Handbook Sect. 7151
Instruction Book—GEH-908
Renewal Parts—GEF-3482

How to Select and Order

This booklet describes the General Electric control and transfer switches in functional terms . . . how they operate, what they look like, and what they can do.

For application information see GET-6169, where contact and connection diagrams are given for 160 switches. Pricing information is carried in the Apparatus Handbook, Section 7151.

Maintenance and overhaul directions are contained in the instruction book. For renewal parts see the renewal parts bulletin.

GENERAL ELECTRIC COMPANY . . . . . 6901 ELMWOOD AVENUE
PHILADELPHIA, PENNSYLVANIA 19142, Phone (215) 726-2626



P6A65912

Positioning

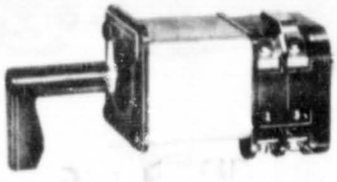
Contacts of the SBM switch are positively positioned by a detent wheel mounted on a square shaft and acted upon by a spring-loaded roller arm. If the shaft of the 45° switch is not rotated more than one-half the distance between positions, it will snap back to its prior position. If rotated more than half the distance between positions, it will snap to the next position. The 90° switch has this same positive detent action when in position, but the snapping action is not as prominent. Up to eight positions are available with 45° or 90° between positions.

Terminal Connections

Terminal connections are brought to the corners of each stage, allowing screw connections to be made over a large angle. This angular displacement of connection points allows the switches to be mounted on three-inch centers or less.

Jumpers

Jumpers are furnished assembled, where required, on all standard listed switches. For special switches or unlisted switches, separate jumpers can be ordered.



8040784

Jumper 307V515 (Same Stage)

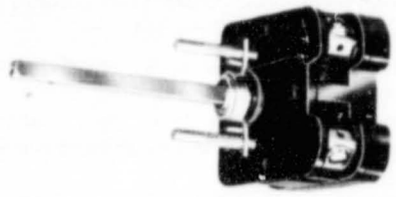
Jumper 307V512 (Adjacent Stage)

Contacts Handle End.	Positions			
		3	2	1
	1			X
o-|-o o-|-o	2		X	
o-|-o	3	X	X	

Break-Before-Make Contacts

Contacts on SBM switches are normally non-overlapping (break-before-make). This sequence is illustrated above, which shows that contact No. 1 opens before contact No. 2 closes.

Another normal function is illustrated by contact No. 3, which is shown closed in two adjacent positions. When switching between these positions, this contact will always remain closed.



8040797

Spring Action

Torsion springs return the switch handle to or towards the 12 o'clock or No. 3 position. The travel of the handle is limited to 90° to either side of this position. The switches may be furnished with spring return both ways, or only one way, with maintaining action in the opposite direction. You can also have spring return from position No. 1 (9 o'clock) to position No. 2 (10 o'clock) and/or spring return from position No. 5 (3 o'clock) to position No. 4 (2 o'clock) with maintained action in the other positions. Torsion springs are housed in the rear half of the positioning chamber. There is no need to modify the chamber to accommodate the springs.

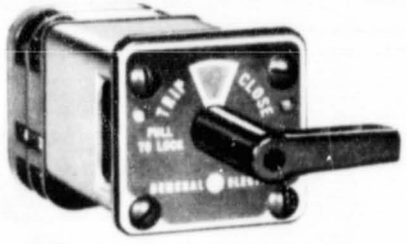
Contacts Handle End										
Odd	Even		*	3	*	2	*	1	*	Off
o-|-o		1	X	X	X	X	X		X	X
	o-|-o	2					X	X	X	
o-|-o	o-|-o	3	X	X	X		X	X	X	X
		4			X	X	X			
o-|-o	o-|-o	5	X		X	X	X	X	X	X
		6	X	X	X					

10AA009

Overlapping Contacts

Overlapping contacts (make-before-break) contribute to the versatility of the SBM switch.

Typical overlapping contacts are shown on model switch 10AA009. The asterisk (*) indicates an intermediate (non-feel) position and shows the contacts overlapping. In the 10AA009 when turning from the OFF position to reading position "1" (Phase 1), contact 2 closes at the intermediate position and before contact 1 which remained closed through the intermediate position, opens.



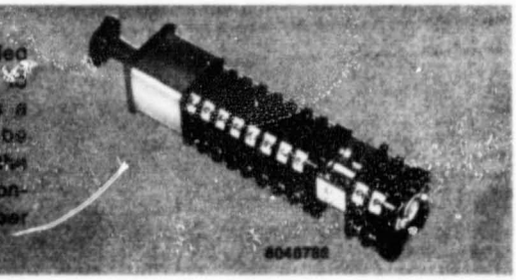
8040796

Pull-To-Lock

A pull-to-lock mechanism is designed for spring-return switches. When the handle is turned to the 9 o'clock position, it can be pulled out and locked in that position. When the handle is pushed in, the handle spring returns to the normal position. This pull-to-lock feature does not actuate contacts, but merely prevents the spring return of the handle.

Add-A-Stage

A one-half inch extension is provided on the rear of all switches with one to eight stages. This extension enables a maximum of two additional stages to be easily and economically coupled to the existing switch in the event more contacts are required. Maximum number of stages is 10 (20 contacts).



8040788

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Construction Features



STANDARD TARGET KEYED

8040785

Escutcheons

Two basic types of escutcheons are available: the standard and the target. The standard type shown on the left is a molded black phenolic material with white lettering for clear reading of the positions. A target type escutcheon, shown in the middle, is normally furnished on breaker control switches. An aluminum front plate houses the target mechanism with a window in the center to show green for the trip position, red for the closed position, and black for the pull-to-lock position. The target has a slip action so that it will remain green when the handle returns to NORMAL from the TRIP position, and red when it returns from the CLOSE position. This shows the operator the last operation of the switch.

On the right a modified standard is shown with keyways for use with a removable type handle.

Aluminum circuit designation plates are available for all three types.

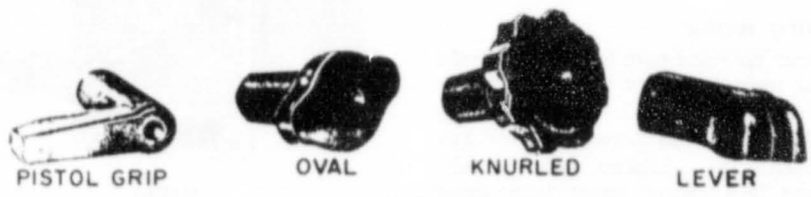
The standard and keyed escutcheons can be furnished in painted colors of red, green, yellow, blue, gray, orange, brown, and white, but must be specified on each order.



8040798

Keyed Escutcheons and Removable Handles

The removable handle commonly used in synchronizing switches can be made to be removed in any one of the eight positions. There are three keys set in front of the handle, so that they fit the designated keyways in the escutcheon in a desired position. The escutcheon can be keyed so that a handle is interchangeable or non-interchangeable with another switch. If this is desired, the catalogue number of the other switch and the position in which the handle is to be removed must be given. The removable handle is not furnished with the switch, but as a separate item.



PISTOL GRIP OVAL KNURLED LEVER

8040783

Handles

Four types of molded black phenolic handles shaped for easy gripping are available with the SBM switch: pistol grip, oval, knurled, and lever. Any of the standard handles except the lever, may be adapted for removable handle keying. A fixed handle may be easily removed for replacement by a screw in the front of the handle. A white pointer, furnished with the handles (except the lever) and mounted near the escutcheon, give a clear identification of the position that the handle is in. For match and line up with SB-1 switches, type SB-1 pistol grip, oval, knurled, and round handles can be furnished for use with SBM switches. The same colors are available for the handles as were listed for the escutcheons.



8040794

Cams and Contacts

The silver to silver contacts of the SBM switch are of double-break design, as seen at left, which reduces arcing and subsequent pitting of contacts. Each contact is operated by a double surface cam, one surface for closing, the other surface for opening. This construction provides opening and closing action not dependent on springs.



8026989

Slip Cams

The slip cam is basically used on breaker control switches. The slip action enables a contact to remain closed or open after returning to the normal (12 o'clock) position from either the CW or CCW positions.

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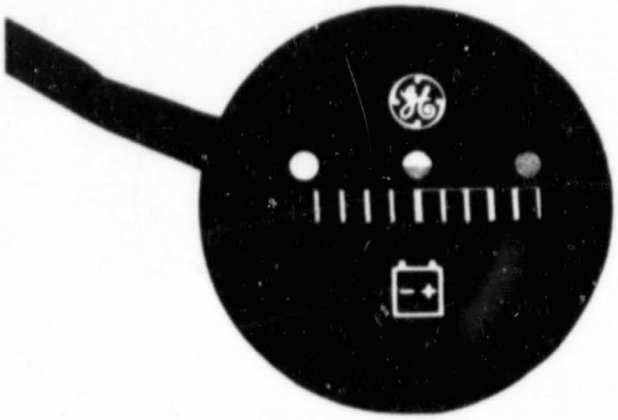


Battery Condition Indicator

The Battery Condition Indicator displays battery condition very clearly and accurately, and maximizes battery life by protecting the battery from the damaging effects of deep discharge.

This microprocessor device actually *measures* energy consumed and displays battery condition on an eight-position LED readout with green, amber, and red zones. If the battery discharges to the red zone condition, the indicator begins flashing and several minutes later, it will render the truck inoperable by disconnecting the hydraulic pump motor (forward contactor disconnect is optional).

The device cannot be fooled by disconnecting the battery or by temporarily connecting a charged battery.



Accelerator Switch

Solid state electronics provide at least 100 times longer life for this new accelerator, and eliminates the potentiometer.

- Only one principal moving part
- Small size
- Rugged, gasketed enclosure
- Short stroke assures positive shaft return
- Reliable solid-state by-pass switch

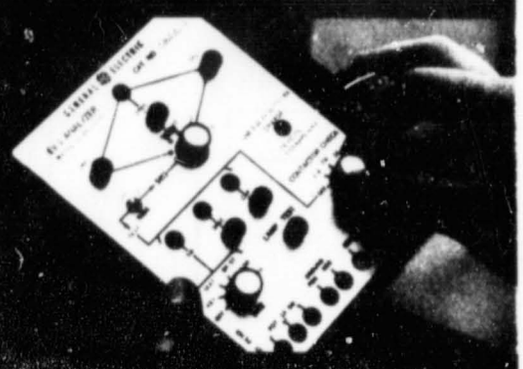
GENERAL ELECTRIC

INDUSTRIAL CONTROL DEPARTMENT

P.O.Box 8106, Charlottesville, VA 22906

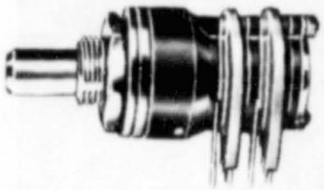
TEL: 804-973-1851

You get... outstanding backup and support

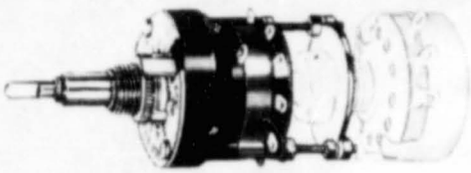


System Analyzer for easy troubleshooting

Using the EV-1 Analyzer, one service person can check out the control and all vital truck electrical components in less than 10 minutes. With the flick of a switch, the analyzer can test a key switch, seat switch, brake switch, accelerator switch, directional selector switch, capacitor, SCRs, diodes, thermal protector, motor and wiring.







Switch Rating

This factor becomes a matter of interpretation. Ratings which assure a different life are possible—Contact GRAYHILL.

Amp Rating @ 115 VAC Resistive	Life Cycles	Series No.
50 Milliamps	25,000	50 or 51
100 Milliamps	10,000	75
200 Milliamps	10,000	50 or 51
¼ Amp	25,000	71
¼ Amp	25,000	8, 9, 53, 57 and 59
½ Amp	10,000	8, 9, 53, 57 and 59
1 Amp	25,000	24, 42, 44 and 5000
3 Amp	25,000	42 and 44
5 Amp	10,000	42 and 44
5 Amp	25,000	44 (45°, 60°, and 90°)
15 Amps	6,000	19 UL Listed

Series	Approx. Dia. Behind Panel	Approximate Length Behind Panel In Inches	
		Single Deck	Additional Decks
75	.298	.500	N.A.
50	.500	.698	N.A.
51	.561	.698	N.A.
8	.687	.960	.268
71	.750	.760	.218
9	.750	.960	.268
5000 Single Deck	1.015	.470	N.A.
24 Single Deck	1.015	.580	N.A.
42	1.015	1.025	.346
44	1.170	1.025	.346
57 and 59	1.190	.916	.326
53	1.350	.916	.329
19	2.280	.950	N.A.

Circuitry

Series	Angle of Throw	No. of Decks(1)	Poles per Deck(2)	Position per Pole(3)	Shorting or Non-Shorting	P.C. or Solder Lug Terminals
53	15°	1-12	1-12	2-24	Both	Solder
59	18°	1-12	1-10	2-20	Both	Solder
57	22½°	1-12	1-8	2-16	Both	Solder
51	22½°	1	1 or 2	2-16	Both	Both
51	30°	1	1-4	2-12	Both	Both
9	30°	1-12	1-6	2-12	Both	Both
44	30°	1-12	1-6	2-12	Both	Solder
19	30°	1	1	2-11	N	"Faston" or Solder
71	30°	1-12	1-6	2-12	Both	Both
71	36°	1-12	1 or 2	2-10	Both	Both
75	36°	1	1 or 2	2-10	N	P.C.
50	36°	1	1 or 2	2-10	Both	Both
8	36°	1-12	1 or 2	2-10	Both	Both
5000	36°	1	1	2-10	Both	Solder
24	36°	1	1	2-10	Both	Both
42	36°	1-12	1 or 2	2-10	Both	Both
50	45°	1	1 or 2	2-8	N	Both
9	45°	1-12	1-4	2-8	Both	Solder
44	45°	1-12	1-4	2-8	Both	Solder
50	60°	1	1 or 2	2-6	N	Both
9	60°	1-6	1-3	2-6	N	Both
44	60°	1-12	1-3	2-6	N	Solder
9	90°	1-6	1 or 2	2-4	N	Both
44	90°	1-12	1 or 2	2-4	N	Solder

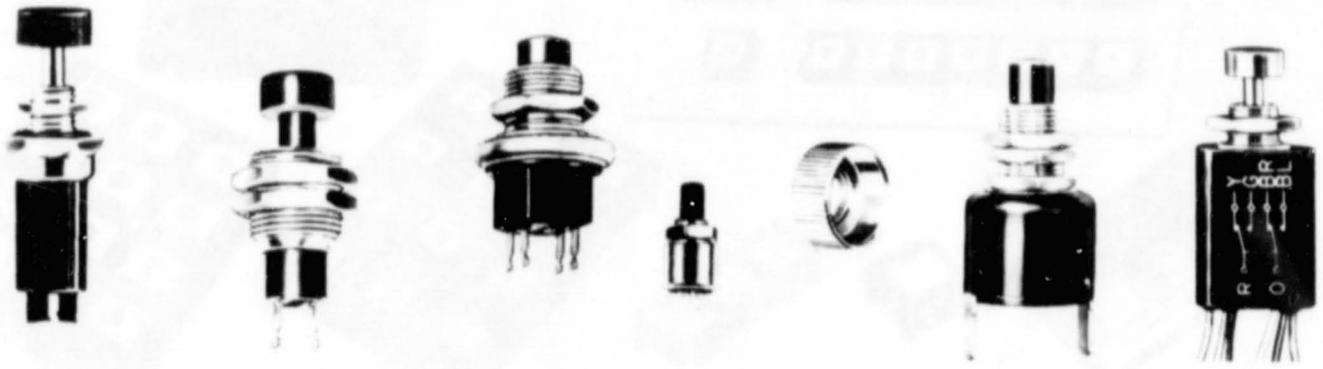
(1) Information shown based on 1 pole per deck. Maximum number of decks is also limited by the total number of poles.
(2) Limited by total number of poles for entire switch.
(3) Maximum positions per pole dependent on number of poles per deck.

Features Available

Features
Adjustable Stops Coded Output Concentric Add-A-Pot Concentric—Two Switches
Homing Rotor Isolated Position Keylock
Military Qualified PC Mount Progressively Shorting
Screwdriver Slotted Shaft Sealed Spring Return Standard Commercial

Contact GRAYHILL for part numbers and other information.

Grayhill, Inc. / 617 Hillgrove Ave. / La Grange, Illinois 60525 / (312) 354-1040



	Circuitry		Contacts: Maintained	Contacts: Momentary	Amps Rating @ 115 VAC Resistive	Operations at Rated Load	Largest Diameter Behind Panels (Approx.)	Pertinent Features	Grayhill Series No.
Wiping Contacts	SPST	N.O. or N.C.		X	3	6,000	13/16"	U.L. Listed	4000/10
		N.O. or N.C.		X	1	100,000	13/16"	Positive Feel	4000/10
		N.O.		X	1/4	100,000	1/2"		23
	SPDT	BBM or MBB		X	1/4	250,000	7/16"		46
		BBM or MBB		X	1/4	100,000	11/16"	Sealed	46
		BBM	X	X	1/4	250,000	11/16" sq	Square Bezel Mounting	46
		BBM	X	X	1/4	250,000	11/16"	Round Bezel Mounting	46
	DPST	N.O.		X	1/2	100,000	13/16"		35
	DPDT	BBM or MBB		X	1/4	250,000	5/8" x 1/2"		46
		BBM		X	1/4	250,000	13/16" x 11/16"	Environmentally Sealed—Wires	46
		BBM or MBB		X	1/4	100,000	11/16"	Sealed	46
		BBM	X	X	1/4	250,000	11/16" sq	Square Bezel Mounting	46
		BBM	X	X	1/4	250,000	13/16"	Round Bezel Mounting	46
Butt Contacts	SPST	N.O. or N.C.		X	5	6,000	3/8"	U.L. Listed	30
		N.O. or N.C.		X	1	1,000,000	3/8"		30
		N.O.		X	1	500,000	3/8"	Overtravel	30
		N.O.		X	1	200,000	11/16"	Positive Feel	30
		Push or Pull	X		1	100,000	11/16"		30
		N.O. or N.C.		X	1	100,000	1/2"	Sealed	30
		N.O.		X	1	1,000,000	11/16"	Round Bezel Mounting	30
		N.O.		X	1	200,000	11/16"	Positive Feel, Round Bezel Mtg.	30
		N.O.		X	1	1,000,000	11/16" sq	Square Bezel Mounting	30
		N.O.		X	1	200,000	11/16" sq	Positive Feel, Square Bezel Mtg.	30
		N.O.		X	1/2	1,000,000	1/4"	Smallest Pushbutton Switch	39
		N.O.		X	1/2	500,000	5/8"	Overtravel, Limit Switch	39
		N.O.		X	1/2	100,000	1/4"	Overtravel	39
		N.O.		X	1/2	250,000	5/16"	Sealed	39
		N.C.		X	1/4	250,000	1/4"		39
		N.C.		X	1/4	100,000	5/16"	Sealed	39
	Lighted	N.O. or N.C.		X	1	500,000	7/16"	Neon Incandescent, or LED	40
	SPDT	BBM		X	1/4	500,000	5" x 4"	P.C. Terminals, 2 Circuits	39
Snap Action	SPST	N.O. or N.C.		X	10	25,000	7/8"	Faston Terminals, Audible Click	2000/7
	SPDT	BBM		X	10	25,000	7/8"	Audible Click	2000/7

***BBM-Break Before Make**
MBB-Make Before Break

Also available are pushbutton accessories such as button caps, button guards, pendant housing, recessed caps and decorative mounting hardware.

Contact GRAYHILL for more information on part numbers and dimensions.

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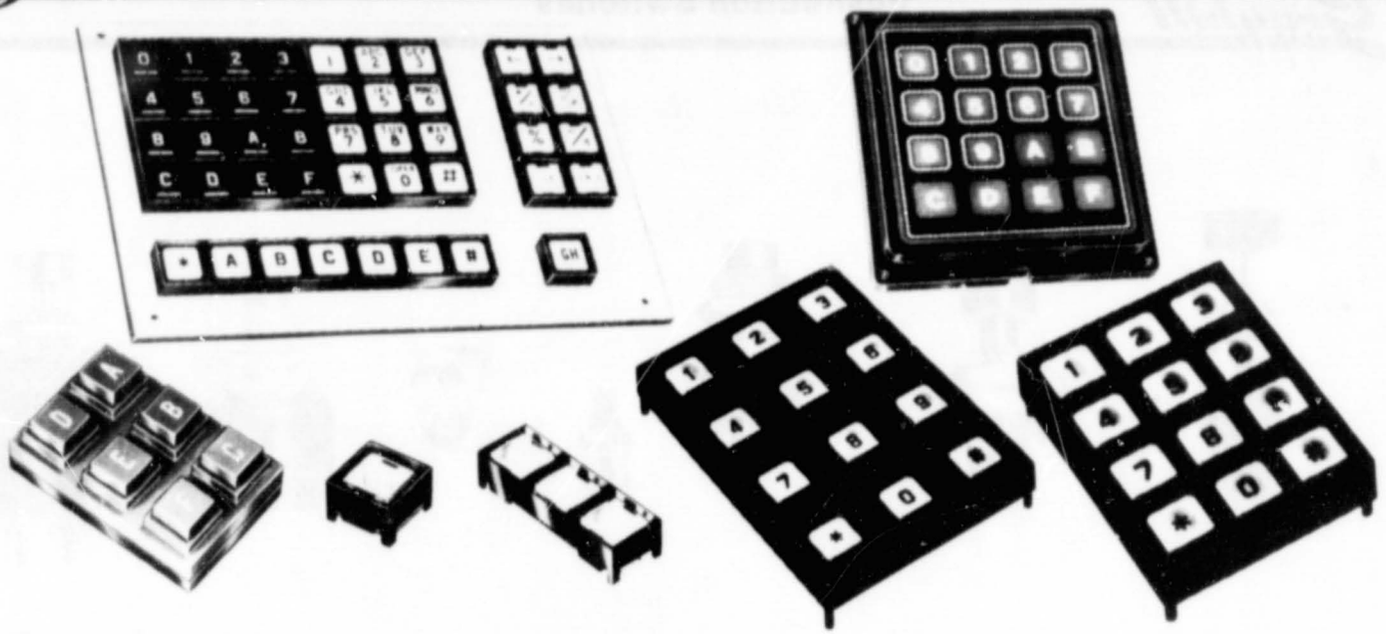

Choices:

- 12 and 16 Button Keypads or Stackable Modules
- Button Center Distances of .50, .750, and .682
- Low Profile or Long Stroke
- Snap Feedback or Soft Stroke
- Sealed or Unsealed
- Insertable, Stamped, Molded, or Graphic Legend
- Matrix, SP/Common Bus, 2 out of 7(8) Codes, and Custom Circuitry

Note: All choices not available in each series.

Contact GRAYHILL for part numbers, specifications, additional information and dimensions.

Selector Chart	Circuitry	Amps Rating @ 115 VAC Resistive	Operations at Rated Load	Type of Contact	Pertinent Features	Grayhill Series No.
Keyboards	N.O. Coded	N.A.	3,000,000	Snap	1/2" Button Centers Post Mounted	83
	N.O. Coded	N.A.	3,000,000	Snap	3/4" Button Centers Post Mounted	84
	N.O. Coded	N.A.	3,000,000	Snap	1/2" Button Centers	86
	Legend Sheet	N.A.	N.A.	N.A.	Legend Sheet	
	SEALED KEYBOARDS					
	N.O. Coded	N.A.	3,000,000	Snap	1/2" Button Centers Sealed, Colorful	88
	STACKABLE KEYBOARDS					
	N.O.	N.A.	3,000,000	Snap	1,2,3,4,5,6,12, and 16 Button Stackable Keyboard Modules	87
	Legend Sheet		N.A.	N.A.		
Pushbutton Modules	SPST-N.O.	100mA @ 5VDC	1,000,000	Wiping	1,2,3 or 6 Button Module	82
	4PST-N.O.		1,000,000	Wiping	Slip-in Legends	82
	SPST-N.O.		1,000,000	Wiping	6 Button Modules	82
	2PST-N.O.		1,000,000	Wiping	Two-Shot Molded	82
	3PST-N.O.		1,000,000	Wiping	Standard Telephone	82
	4PST-N.O.		1,000,000	Wiping	Legend	82
	Legend Sheet	N.A.	N.A.	N.A.	Legend Sheet	82

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STARTER SWITCH SPECIFICATION CHART

Part Number	No. of Terminals	Base	Bracket	Volt
SS-43	3	Insulated	Flat	6
SS-44	3	Grounded	Curved	6
SS-46	3	Grounded	Flat	6
SS-47	3	Grounded	Curved	12
SS-49	3	Insulated	Flat	12
SS-50	3	Insulated	Special Base	6
SS-55	3	Grounded	Flat	6
SS-56	3	Grounded	Flat	12
SS-57	4	Grounded	Flat	12
SS-58	3	Grounded	Flat	12
SS-59	4	Insulated	Flat	12
SS-61	4	Insulated	Flat	12
SS-62	4	Insulated	Flat	6
SS-72	4	Insulated	Curved	12
SS-73	4	Grounded	Flat	12

TOGGLE SWITCH SPECIFICATION CHART

Part No.	No. of Positions	Mounting Dia.	Mounting Length	No. of Terminals	Amps.	Voltage	Handle & Length
SP-1	2	1½"	....	2	10	12V	Bat
SP-2	2/Switch	2½"	....	2/Switch	10	12V	Bat
SP-3	2	2½"	....	2	....	12V	Bat
SP-4	2/Switch	4"	....	2/Switch	....	12V	Bat
TS-1	2	3/8"	3/8"	2	20 10	6V 12V	Bat 7/16"
TS-2	2	7/16"	3/8"	2	35 20	6V 12V	Bat ¾"
TS-2M	2	7/16"	3/8"	2 Screw	25 15	6V 12V 24V	Bat ¾"
TS-3	3	7/16"	3/8"	3	20 10	6V 12V	Ball ½"
TS-4	2	15/32"	15/32"	2 Screw	6 3	125V-A.C. 250V-A.C.	Ball 7/16"
TS-5	3	15/32"	15/32"	3 Screw	15 10	125V-A.C. 250V-A.C. ¾ HP 120- 240V-A.C.	Bat 9/16"
TS-6	2	15/32"	15/32"	2 Screw	35 35	6V 12V	Bat 1⅛"
TS-7	2	½"	....	2	10	12V	Bat

PUSH & PULL SWITCH SPECIFICATION CHART

Part No.	Positions	Mounting Dia.	Mounting Length	No. of Terminals	Voltage & Amps.	Switch Length Shaft & Body	Knob
PBS-9M	2	5/8"	1¼"	2 Screw	25 Amp-6V 15 Amp-12V	2⅞"	Brass Chrome Plated
PS-10	2	9/16"	½"	2 Screw	15 Amp-6V	1½"	Metal
PS-11	2	9/16"	1"	2 Screw	15 Amp-6V	1½"	Metal
PS-12	2	7/16"	1"	2 Screw	25 Amp-6V 15 Amp-12V	3 1/16"	Ivory Plastic
PS-15	2	7/16"	½"	2 Screw	25 Amp-6V 15 Amp-12V	1⅝"	Ivory Plastic
PS-16	2	7/16"	1"	2 Screw	25 Amp-6V 15 Amp-12V	2¾"	Ivory Plastic
PS-17	2	7/16"	1"	3 Screw	25 Amp-6V 15 Amp-12V	3½"	Ivory Plastic
PS-19M	2	3/8"	1¼"	2 Screw	25 Amp-6V 15 Amp-12V	3⅛"	Ivory Plastic
PS-20M	2	3/8"	1¼"	2 Screw	25 Amp-6V 15 Amp-12V	3⅛"	Chrome Plated Plastic
PS-23M	3	3/8"	1¼"	3 Screw	25 Amp-6V 15 Amp-12V	3⅞"	Chrome Plated
PS-24	2	½"	5/8"	2 Screw	35 Amp-6V 20 Amp-12V	2 7/16"	Chrome
PS-25	2	15/32"	5/8"	2 Screw	65 Amp-6-28V	4 1/16"	Chrome
PS-26M	3	3/8"	1¼"	4 Screw	25 Amp-6V 15 Amp-12V	3 1/16"	Chrome Plated

GP Guaranteed Parts Company - Seneca Falls, New York 13148

TEL: 315-568-5844

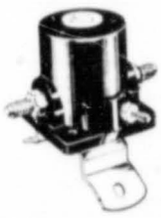
STARTER SWITCHES



SS-47
(AL: SS-4003, 4301, 15-8, 15-18; DR: 1450, 4, 7, 67, 85, D-928) 12 Volt, Grounded Base, Curved Bracket
Jeep Corp. 71-55
Studebaker 58-56
and **Industrial, Marine, Tractors & Trucks**



SS-49
(FR: 59B-11450) 12 Volt, Insulated Base, Flat Bracket
Ford Motor Coach 38-37
Ford Truck 47-46



SS-50
(FR: 8N-11450) 6 Volt, Insulated Base, Special Bracket
Ford Tractor 52-48



SS-52
(AL: SW-4012, 15-49; DR: 1996478)
American Motors 51



SS-55
(AL: SS-4007, A, 30, 15-10, 15-17; DR: 1453, 64, 1549, D-925; FR: FAB-11450B, 1A, B5A, FDA, FDH-11450A) 6 Volt, Grounded Base, Flat Bracket
Ford Division 55-51
Lincoln Division 55-52
Mack Truck 50-44
Mercury Division 55-52
Studebaker 55
and **Industrial, Marine, Tractors & Trucks**



SS-56
(AL: SS-4008, 11, 23, 15-11 15-16; Amer. Mtrs: 3225629; DR: 1456, 66, 1544, D-927; FR: 2C-11450A, D2OZ-11450A, D2SF-11450-AB, SW-1080, SWY-118) 12 Volt, Grounded Base, Flat Bracket
American Motors 77-75
Ford Division 79-72
Jeep Corp. 78-75
Mercury Division 79-72
and **Industrial, Marine & Trucks**



SS-57
(Am. Mtrs.: 3180465; FR: B6A, B6AZ, C7AF, D2DZ, FDR-11450A, D2AF-11450-AA, 2701966) 12 Volt, Grounded Base, Flat Bracket
American Motors 74-73, 69-67
Ford Division 78-56
Jeep Corp. 79-72
Lincoln-Mercury Division 78-56
and **Industrial, Tractors & Trucks**



SS-58
(AL: SAE-4001, 15-5; Chrys: 1658880, 2, 1692658, CH-2326) 12 Volt, Grounded Base, Flat Bracket
DeSoto 59-57
Dodge Division 66-55
Fargo Truck 66-56
Plymouth Division 60-56
and **Marine & Trucks**



SS-59
(AL: SAE-4002, 15-6, Chrys: 1658881, 3, 1692659, CH-2327) 12 Volt, Flat Bracket
DeSoto 59-57
Dodge Division 66-56
Fargo Truck 66-56
Plymouth Division 60-56



SS-61
(Amer. Mtrs: 3227812; FR: 311006) 12 Volt, Flat Bracket
American Motors 77-75
Ford Tractor (Diesel) 63-58



SS-62
(FR: 311007) 6 Volt, Flat Bracket
Ford Tractor (Gas) 64-58



SS-72
(Amer. Mtrs: 3215394)
American Motors 78-72



SS-73
(Amer. Mtrs: 3230406)
American Motors 78-77

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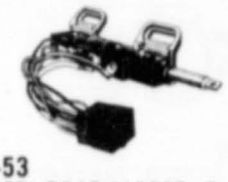
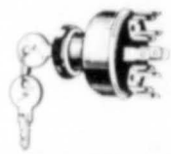
IGNITION SWITCHES



S-53
(FR: D0AZ-11572B, D, SW-926) Used w/LC-21 lock cyl. & keys.
Ford Division 70
Lincoln Division 70
Mercury Division 70



S-55
(DR: 1116683, 95, 704, 709, 712, D-1403A, D-1480, A, D-1498A) w/ Through Dash Mounting. Used w/LC-15 lock cyl. & keys.
Chevrolet Division 75-67
GMC Trucks 75-67



S-56
(IHC: 167-603-R91, 344-688-C91) (w/Dash Mounted Switch)
IHC Truck 73-56



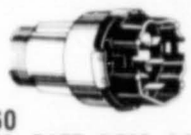
S-57
(FR: D1AZ, D4DZ-11572A, D4DW-11572AA, SW-992, A) Used w/LC-23 & LC-25 lock cyl. & keys.
Ford Division 78-71
Lincoln 78-71
Mercury Division 76-71



S-58
(FR: D2OZ-11572A, SW-1079) Used w/LC-21 & LC-23 lock cyl. & keys
Ford Division 76-72
Lincoln 76-72
Mercury Division 76-72



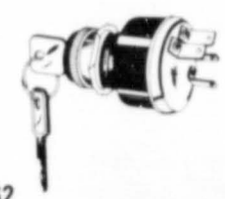
S-59
(FR: D3AB-11572AA D3AZ-11572A, SW-1149). Used w/LC-21 & LC-23 lock cyl. & keys.
Ford Division 76-73
Mercury Division 76-73



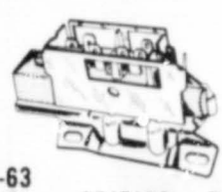
S-60
(FR: D0TZ, D3TZ, D6TZ-11572A, D20B-11572-AB, D2TB, D3TB-11572-AA, SW-944, SW-1317). Used w/LC-14 lock cyl. & keys.
Ford Truck 76-70



S-61
(Chrys: 2947719, CH-2553) w/Tilt & Tele. Steering. Used w/LC-26 lock cyl. & keys.
Chrysler Division 76-70
Dodge Division 76-70
Plymouth Division 76-70



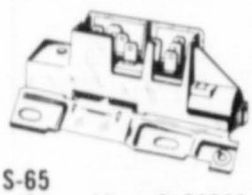
S-62
(DR: 1116553, 628; Cole Hersee: 9564137, 138)
Mack Truck 78-68



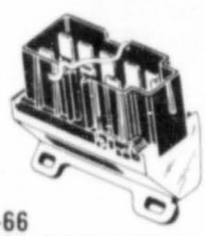
S-63
(Chrys: 3747199) w/Tilt & Tele. steering. Used w/ LC-26 lock cyl. & keys.
Chrysler Division 79-77
Dodge Division 79-77
Plymouth Division 77



S-64
(Amer. Mtrs: 8128890; DR: 1990106, D-1412A) w/Tilt Wheel
American Motors 79-78
Buick Division 80-78
Cadillac Division 79-78
Chevrolet Division 80-78
Jeep Corp. 79-78
Oldsmobile Division 80-78
Pontiac Division 80-78



S-65
(Amer. Mtrs: 8128889; DR: 1990105, D-1407A) w/o Tilt wheel.
American Motors 79-78
Buick Division 80-78
Cadillac Division 79-78
Chevrolet Division 80-78
Jeep Corp. 79-78
Oldsmobile Division 80-78
Pontiac Division 80-78



S-66
(FR: D8BC-11572AC, D8BZ-11572A, SW-1471) Used w/LC-25 lock cyl. & keys.
Ford Division 79-78
Mercury Division 79-78



S-101
Magneto Switch Three Position Four Screw Terminals
Position 1-"Off"-Magneto to Ground
Position 2-"Run"-No Continuity between Terminals
Position 3-"Run & Lights"-Battery to Lights, Mounting Stem 7/16" long, 3/4" diameter with 1 1/8" mounting nut. (6, 12 and 24 volts)



S-102
Magneto Switch Four Position-Five Screw Terminals
Position 1-"Off"-Magneto to Ground
Position 2-"Run & Lights"-Battery to Lights
Position 3-"Run"-No Continuity between Terminals
Position 4-"Start"-Battery to Starter Solenoid, Screw Type Terminals, Mounting Stem 7/16" long, 3/4" diameter with 1 1/8" mounting nut. (6, 12 and 24 volts)



S-104
Magneto Switch Three Position-Four Screw Terminals
Position 1-"Off"-Magneto to Ground
Position 2-"Run"-No Continuity Between Terminals
Position 3-"Start"-Battery to Starter Solenoid, Mounting Stem 7/16" long, 3/4" diameter with 1 1/8" mounting nut. (6, 12 and 24 volts)

OIL PRESSURE SWITCHES



EP-137
(Honda: 37600-611-154, 54823)
Honda Civic 77-73



EP-138
(GM: 94021127)
Chevrolet Luv 79-72
Opel 79-76



EP-139
(Honda: 37240-657-033, 57842)
Honda 78-75



EP-140
(Datsun: 25240-09400, 25240-89900, 1, 2, 10)
Datsun 78-65



OPS-1
(DR: 389966, 1508286, 753, 2815936, 3751700, 3815936, 3915936, 5653197, 6460242, 391, 6462514)
Buick Division 79-68
Cadillac Division 79-76
Chevrolet Division 79-56
Oldsmobile Division 79-56
Pontiac Division 79-59



OPS-2
(FR: B6A, B6AZ-9278B, FDA, FDH, FDR-9278A)
Edsel 60-58
Ford Division 68-54
Lincoln Division 63-56
Mercury Division 69-57



OPS-3
(AL: 13608A, 14206A, 14272A, 938092; Chrys: 1594936, 1704239, 1818830, 2256807, 2580445, 2822179, 3004106, 3488617, CH-2468, CH-2481)
Chrysler Division 78-53
DeSoto 61-57
Dodge Division 78-57
Plymouth Division 78-54



OPS-6
(DR: 1508754, 3751611, 3815935)
Chevrolet Division 65-57



OPS-7
(DR: 534598, 1194214, 1359289, 1508319, 668, 3818783, 5653397; Am. Mtrs: 3142826, 3200422; Stude: 1539898, 475175)
American Motors 79-54
Buick Division 65-60
Chevrolet Division 69-60
Jeep Corp. 74-62
Oldsmobile Division 75, 65-64
Pontiac Division 74-61
Studebaker 62-56



OPS-8
(Cadillac: 1469790, 1508648, 767, 5653462)
Cadillac Division 75-73, 62-56



OPS-10
(Amer. Mtrs: 439278, 3134704, 3138847; FR: DORY-9278A; IHC: 149-132-R91; K.S: 47170, 47185; Willys: 805874, 913120)
American Motors 53-51
Capri 73-71
Ford (English) 58-53
Ford (German) 61-52
IHC 61-56
Jeep Corp. 65-52
Reo Trucks 58-57
Vauxhall 61-57



OPS-20
(Chrys: 2256800, 2585110, 3004105)
Chrysler Division 78
Dodge Division 78-62
Plymouth Division 78-62



OPS-21
(Cadillac: 1480667)
Cadillac Division 72-63



OPS-24
(GM: 1350116, 1359288)
Buick Division 64-61
Oldsmobile Division 65-64



OPS-25
(GM: 551458, 1370748)
Buick Division 79-65
Cadillac Division 79-75
Jeep Corp. 71-68
Oldsmobile Division 78-76
Pontiac Division 79-75



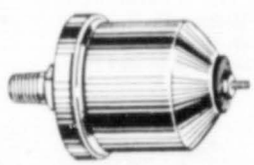
OPS-26
(FR: B5AF, B5AZ-9278A, C5AF-9278B, C5AZ-9278A, B)
Ford Division 66-65
Lincoln Division 66



OPS-27
(Amer. Mtrs: 3182952)
American Motors 66



OPS-29
(Chrys: 1972241)
(with Dial Type Gauge)
Chrysler Division 63-60
Dodge Division 63



OPS-30
(FR: B7T, B7TZ, C6SZ, C9ZZ-9278A, SW-586, SW-587, SW-666, SW-668, SW-852) (with Dial Type Gauge)
Ford Division 79-64
Lincoln-Mercury Division 74-64

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Guaranteed Parts Company - Seneca Falls, New York 13148

Gulf + Western Manufacturing Company

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Heat Exchangers	Air to air, liquid to air and liquid to liquid designs. Custom manufacture.

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Control Cables	**Single and multi conductor** THERMOPLASTIC: Collyer C-141 — PZR — PE/NYLON condrs. PVC Jacket 600V, 1000V, 75°C. Collyer C-140 — PVC insulated and jacketed 600V. Collyer C-143 — PE/PVC conductors, PVC jacket 600V, 1000V. Collyer C-153 — PE/NYLON, PZR 90°C, PVC jacket 600V, 1000V. Collyer C-154 — THHN/THWN conductors Type T.C. U.L. Listed.

Gulf+Western Manufacturing Company

Eagle Signal Industrial Controls Division

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Davenport, IA 52803
Telephone: 319/326-8111

Interval (Reset) Time Delay Relays	**Push Button**	191	8 Sec. to 16 Hrs.	1½% of Full Scale	Push Button	120, 240V 50/60 Hz	10 Amp 120, 240VAC
	Push Button Pneumatic	86	0.5 Sec. to 60 Sec.	±15%	Push Button	120, 240V	1 SPDT Switch, 15 Amp ½ HP 120V

	DESCRIPTION	SERIES
Control Unit Non-Illuminated	Round Momentary Pushbuttons	AF, AE, AH, AS
	Square Momentary Pushbuttons	BF, BE
	Special Pushbuttons	AP, AL, AK, BT
	Mushroom Momentary Operators	AM, AD, AB, AR, AJ
	Maintained Operators	WV, WG, WC, WT, WW
	Single Rod Selectors	SK, SL, SY
	Twin Rod Selectors	TK, TL
Control Unit Illuminated	Pushbuttons	LO, SO, MO
	Maintained Operators	LB
	Pilot Lights	PA, PB, PJ, PK
		PF, PG

CONTACT BLOCKS
N.C. 3BT N.O. Early Make 3BM
N.C. 3BC N.C. Early Break 3BL

TRANSFORMER WITH 6V LAMP
120V 3LT-A
240V 3LT-C
480V 3LT-F

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Red White Gray
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ALUMINUM LEGEND PLATES
Natural Legend on Black Anodized
46 Standard Legends
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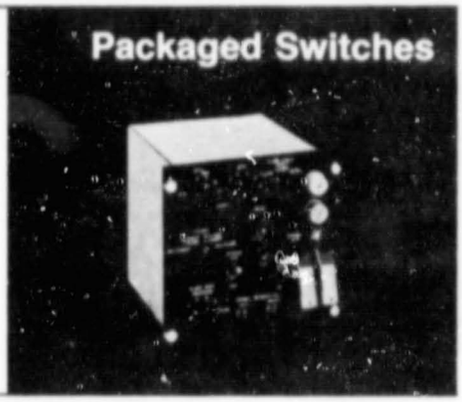
2 Piece Metal to Metal Connectors
- 3 to 5 amperes rating

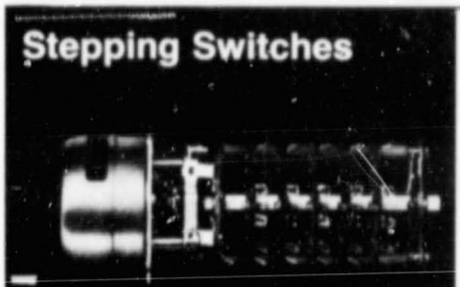
Rack and Panel Connectors
High Density Metal to Metal PC Connectors
Military Weather and Moisture Proof Pin Connectors
Transistor PC Sockets

LEDEX Design Engineering Aids

RELIABLE WITH MEMORY

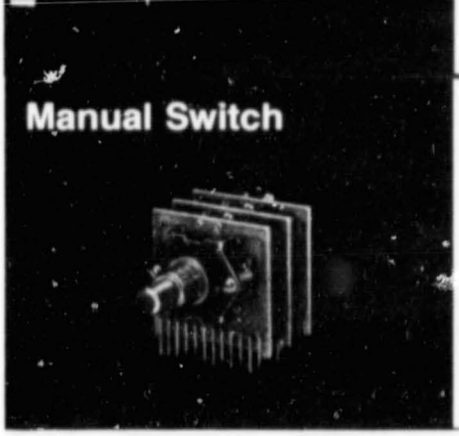
When both timing and switching
are required Ledex can combine the best characteristics of solid state and electro-mechanical features in a *packaged switch* to meet your requirements from a deep space environment to industrial application. Available closed or hermetically sealed with a dry nitrogen atmosphere – immune to adverse environments. Our engineers delight in solving your problems.





PROGRAMMED RELAY CONTROL

Do your own programmed switching –
or let us design it for you with this *solenoid driven selector.* Used instead of relays or to control relays it is also used for transfer switching and multiple switching functions. Used over a wide range of voltage and temperatures world-wide it can solve your remote switching problems.



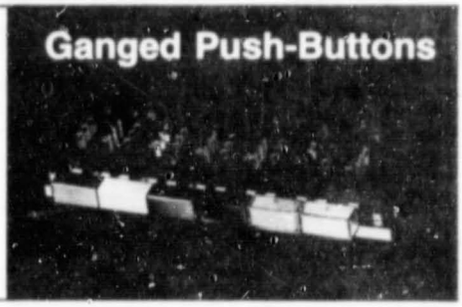
RELIABLE OVER THE YEARS

1 to 24 positions –
are available in a variety of sizes and poles in our *rotary manual switches.* BCD output, spring returns, panel seal, PCB mounting, snap switch mounted, push-to-turn safety device, grounding spring, non-metallic knob end shafts for OSHA requirements are some of the custom features available.

Custom wired switches and engineering know-how are specialties.

GOOD APPEARANCE TOO

A variety of interrelated functions –
make our *Series 1400* ganged switch the most versatile switch you can get. We can mount up to 20 stations, either vertically or horizontally with push/push, reciprocal release, master release, lockout, momentary and maintain functions illuminated or not. U/L and overseas rated to switch 2 amps/250 VAC.*



LEDEX

Ledex, Inc.
801 Scholz Drive, P. O. Box 427
Vandalia, Ohio 45377 U.S.A.
Phone: 513/898-3621

LEDEX Design Engineering Aids

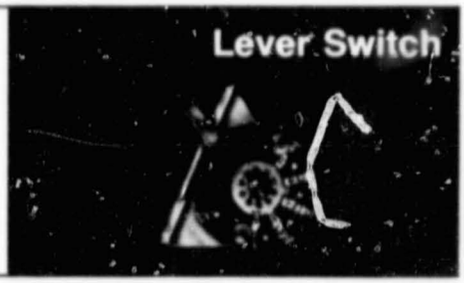


This power switch –
has a U/L and overseas rating of 16 amps/250 VAC. Use this *Series 1500* switch ganged up to 15 stations with lockout, reciprocal release and master release or as a single switch for internal electrical (fail/safe) lockout. Get up to 3 N. O. 2 N. C. functions on one individual switch module.*

SWITCH 16 AMPS

POSITIVE DETENT FEEL

When available space is critical
this Ledex miniature *lever switch* is the answer by providing positive switching in 2, 3, or 4 positions and up to 6 pole 4 throw by using 2 wafers. Combining its self-cleaning wiping action, a smooth tactile movement and a positive detent feel you have a worry free switch.





The most versatile switch ever made
is our *Series 1800* which is U/L and overseas rated to switch either a dry logic level of 10mA/5VDC or a high 6A/250VAC. Single or dual bulb illumination, PC pins or solder lug terminals. Gang up to 20 modules with momentary, maintain, push/push, reciprocal release and master release all on one assembly either 2 pole 2 throw or 4 pole 2 throw per module.*

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At last a true electronic joystick utilizing
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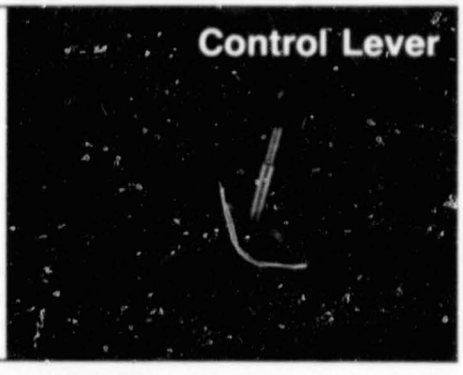

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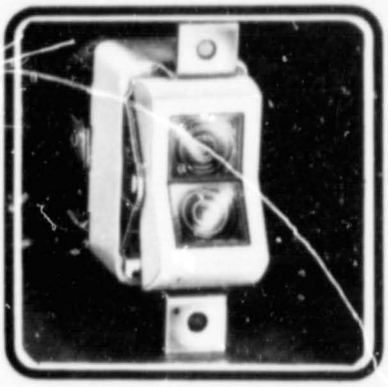
Phone: 513/898-3621

Switches



No. 15751

Lighted rocker switch

15A-125VAC 10A-250VAC
¾HP-120/240VAC
Also available with rating of
20A-6V to 30V, AC or DC

AC switch mechanism completely contained in molded phenolic housing. Choice of mountings: bracket or snap-in, with or without decorative bezel. Choice of terminations: solder lugs, screw terminals or quick-connect tabs.



No. 2591

Fully-insulated momentary push switch, normally OFF. 3A-125VAC.UL Listed. Molded plastic body, bushing and pushbutton. Aluminum knurl nut, plain or brass finish. Standard leads are No. 18 AWG 105° C plastic, 6" long, stripped ½".

Call on Leviton's Custom Design Capability Team for personal attention to your requirements.

Whatever you need—be it a consultation with the engineering-wise Marketing Manager of our Appliance Products Division, or a full-scale meeting between your staff and ours, including the Chief Engineer of our Design Capability Team—you'll find that the session is more like a think-tank experience than the usual cut-and-dried "what-do-we-have-that-we-can-sell-you?" Not that we don't have a vast product line to show you. We do. We offer a complete line of wiring devices, power supply cords, wire and specialty cable, which is what we mean by "Total Capability from a Single Source".

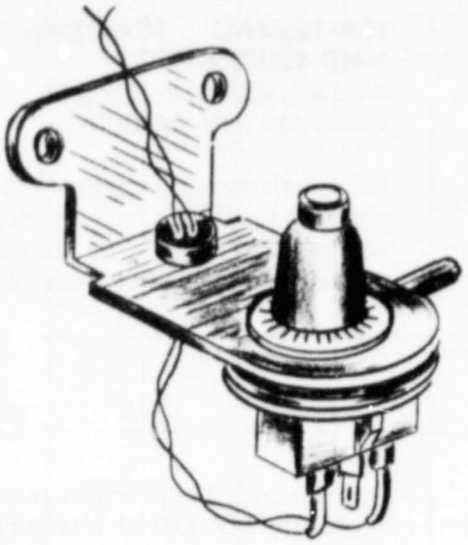
Phone us at 212-229-4040, ext. 532. Or write Mr. Lou Vlismas, Marketing Manager, Leviton, 59-25 Little Neck Parkway, Little Neck, N.Y. 11362.

LEVITON

Affiliates:
AMERICAN INSULATED WIRE • PACIFIC ELECTRICORD

C - 9

VACUUM OPERATED ELECTRIC SWITCH



The universal vacuum switch is designed to provide an electrical switching function in response to a given vacuum signal. It can be supplied as either a normally open, normally closed or 3 terminal switch. The switch actuation is accomplished through a spring loaded diaphragm arrangement. The signal level required to actuate the switch is adjustable and it has a built-in cushion effect to prevent switch oscillation at the switch point.

Various calibrations to obtain switch points of 2 to 25" Hg are available.

Alternate design can include mounting bracket variations, soldered lead wires.

OTHER SUGGESTED APPLICATIONS:

To convert any vacuum signal to electrical on-off; to switch automatic transmission with an EGR vacuum signal or other vacuum signal; to signal when EGR is on.

CONTACT ENGINEER - CLARENCE FOX

BORG WARNER Transportation Equipment

Marvel-Schebler/Tillotson Division
Borg-Warner Corporation
2195 South Elwin Road, Decatur, Illinois 62525
Phone 217/428-4631

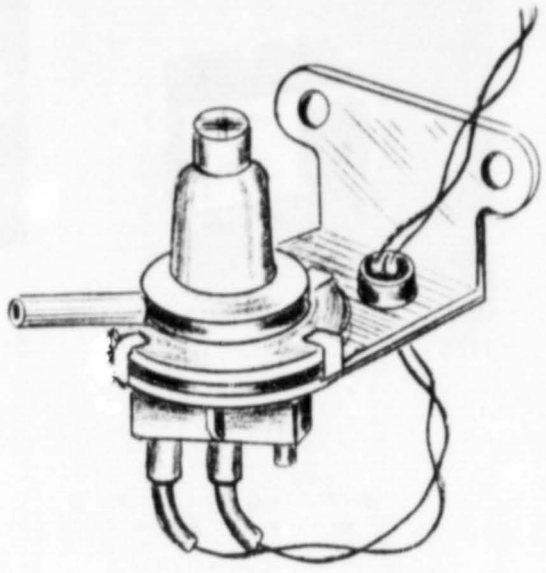
DRAWN

CHECKED

APPROVED

SKETCH NUMBER 101

PRESSURE OPERATED ELECTRIC SWITCH



The universal pressure switch is designed to provide an electrical switching function in response to a given pressure signal. It can be supplied as either a normally open, normally closed or 3 terminal switch. The switch actuation is accomplished through a spring loaded diaphragm arrangement. The signal level required to actuate the switch is adjustable and it has a built-in cushion effect to prevent switch oscillation at the switch point.

Various calibrations to obtain switch points of 2 to 25" Hg are available.

Alternate design can include mounting bracket variations, soldered lead wires.

OTHER SUGGESTED APPLICATIONS:

To convert any pressure signal to electrical on-off to monitor turbo charger operations, to monitor air pump output.

CONTACT ENGINEER - CLARENCE FOX

BORG WARNER Transportation Equipment

Marvel-Schebler/Tillotson Division

Borg-Warner Corporation
2195 South Elwin Road, Decatur, Illinois 62525
Phone 217/428-4631

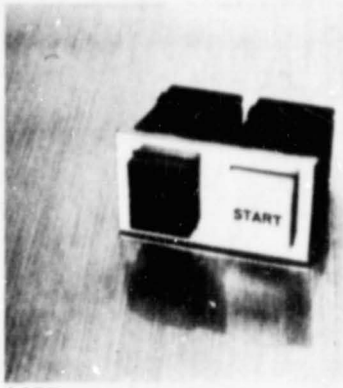
DRAWN	SKETCH NUMBER
CHECKED	102
APPROVED	

Lighted Pushbutton Switches

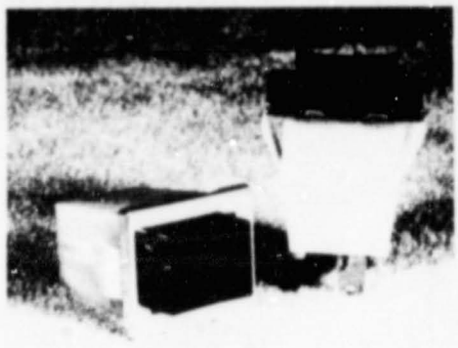
1175

General Features:

- SPST
- 2 or 8.5 amps.
- UL & CSA rated
- 1, 2 or 3 switch configurations
- 7 button colors
- Hot stamping
- 25,000 cycles
- Incandescent or neon bulbs
- Lead wire option

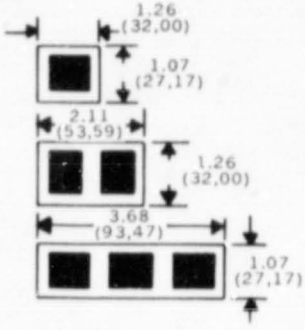


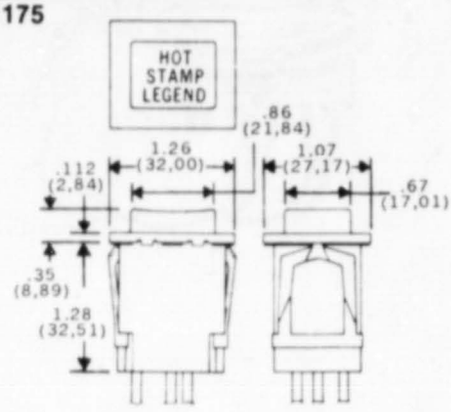
1175

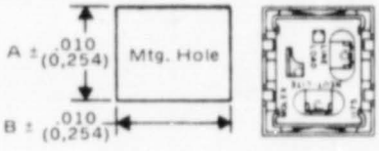


2146

Dimensions:





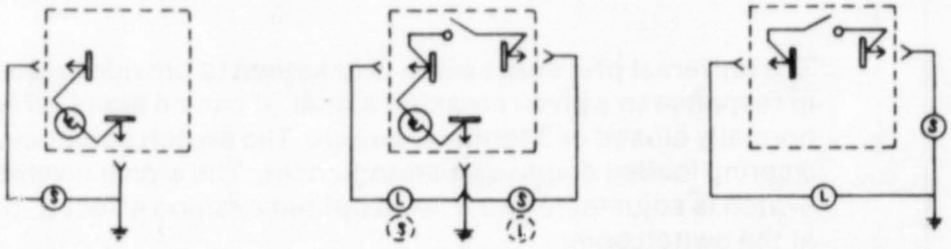


BEZEL	A	B
Single	.915 (23,24)	1.115 (28,32)
Double	1.115 (28,32)	1.955 (49,65)
Triple	.915 (23,24)	3.540 (89,91)

2146

General Features:

- SPST
- 2 or 8.5 amps.
- UL & CSA rated
- Molded mounting ears
- 7 button colors
- Hot stamping
- 25,000 cycles
- Incandescent or neon bulbs



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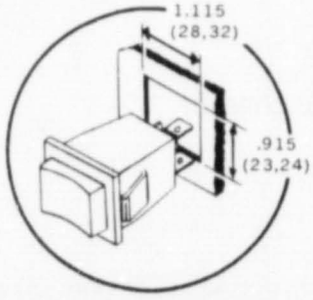
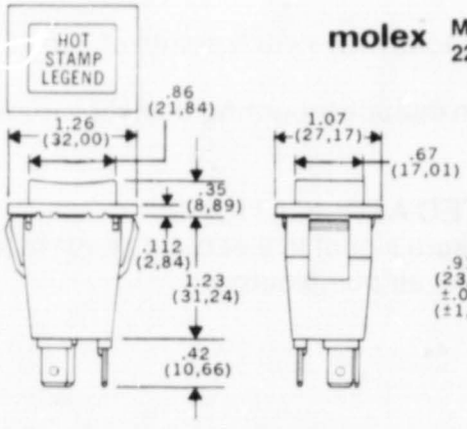
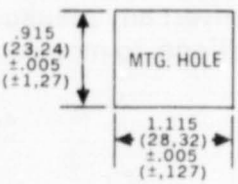
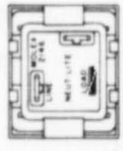








molex Molex Incorporated • Switch Division
2222 Wellington Court • Lisle, IL 60532
Phone: (312) 969-4550

TECHNICAL SPECIFICATIONS

ELECTRICAL

UNDERWRITER LISTINGS		
Card Numbers		
Switch with or without pilot light	UL E33149	CSA 29661
Pilot light only	UL E40888	CSA 29653

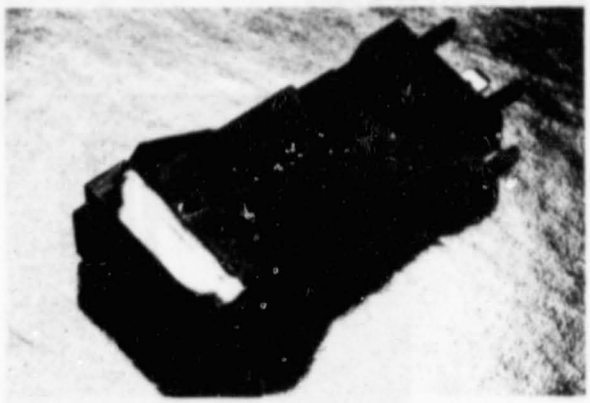
SWITCH RATING			
Amperes (AC)	2	4.25	8.5
Voltage (AC)	125	250	125
Dielectric (Volts, RMS)	900	900	900
Amperes at 150% overload for 50 cycles	3	6.4	12.8
Type of test load		INDUCTIVE	
Power factor for test load		75-80%	
Endurance test at rated amperes		6000 cycles	

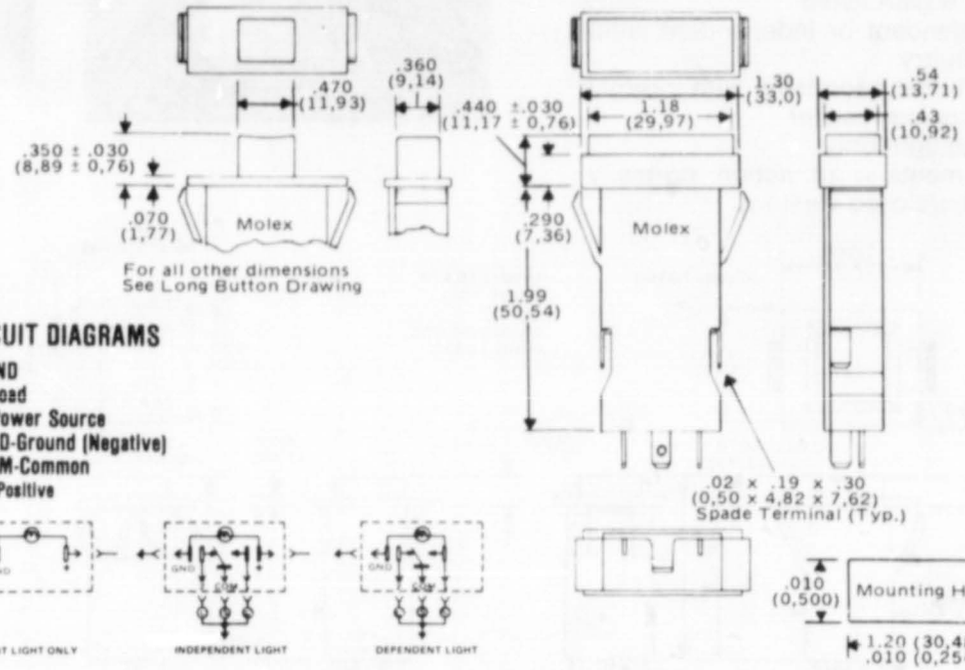
Lighted Push Button Switches

1820 RL

General Features:

- Replaceable bulb
- SPST & SPDT
- 2, 6 & 9 amps.
- UL rated
- 7 button colors
- Hot stamping
- 25,000 cycles
- Neon lamp option
- Stacking versatility





1820

General Features:

- Long or short button
- SPST & SPDT
- 2, 6, & 9 amps.
- UL & CSA listed
- 7 button colors
- Hot stamping
- 25,000 cycles
- Neon lamp option
- Stacking versatility

CIRCUIT DIAGRAMS

LEGEND
L-Load
S-Power Source
GND-Ground (Negative)
COM-Common
+ -Positive

TECHNICAL SPECIFICATIONS

ELECTRICAL

UNDERWRITER LISTINGS

Card Numbers		
Switch with or without pilot light	UL E33149	CSA 29661
Pilot light only	UL E40888	CSA 29653

SWITCH RATING

Ampers (AC)	2	4.5	6	9
Voltage (AC)	125	250	125	125
Dielectric (Volts, RMS)	900	900	900	900
Ampers at 150% overload for 50 cycles	3	6.75	9	13.5
Type of test load		INDUCTIVE		
Power factor for test load		75-80%		
Endurance test at rated amperes		6000 cycles		

BULBS (Incandescent) 1820 RL ONLY

Volts	Mean Spherical Candle Power	Rated Avg. Lab life hrs.	Size	Amps	Commercial Designation
6.0	.32	70,000	1¾	.19	379
12.0	.28	6,000	1¾	.07	336
14.0	.30	50,000	1¾	.08	386
28.0	.30	25,000	1¾	.04	388

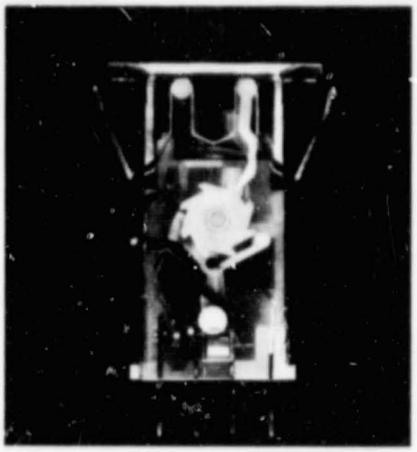
BULBS 1820 ONLY

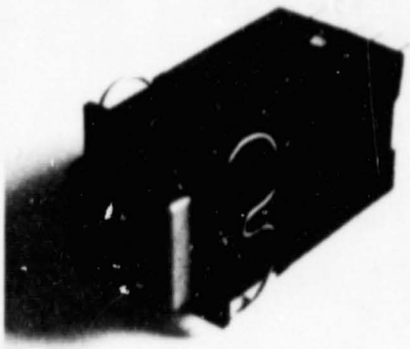
Type	Volts	Mean Spherical Candle Power	Rated Avg. Lab life hrs.	Size	Amps	Commercial Designation
Independent	6.0	.46	5,500	1¾	.19	2112
Dependent	6.0	.016	92,000	1¾	.038	2180
Independent	12.0	.10	10,000	1¾	.04	2174
Dependent	12.0	.12	10,000	1¾	.04	2174
Independent	14.0	.50	10,000	1¾	.10	2164
Dependent and Independent	14.0	.30	50,000	1¾	.08	2182
Dependent	28.0	.20	50,000	1¾	.04	2185
Independent	28.0	.30	7,000	1¾	.04	2187
Neon with 39K series resistor	125.0	.02	25,000	NE2H	.002	ASA Type C2A
Neon with 100K series resistor	250.0	.02	25,000	NE2H	.002	ASA Type C2A

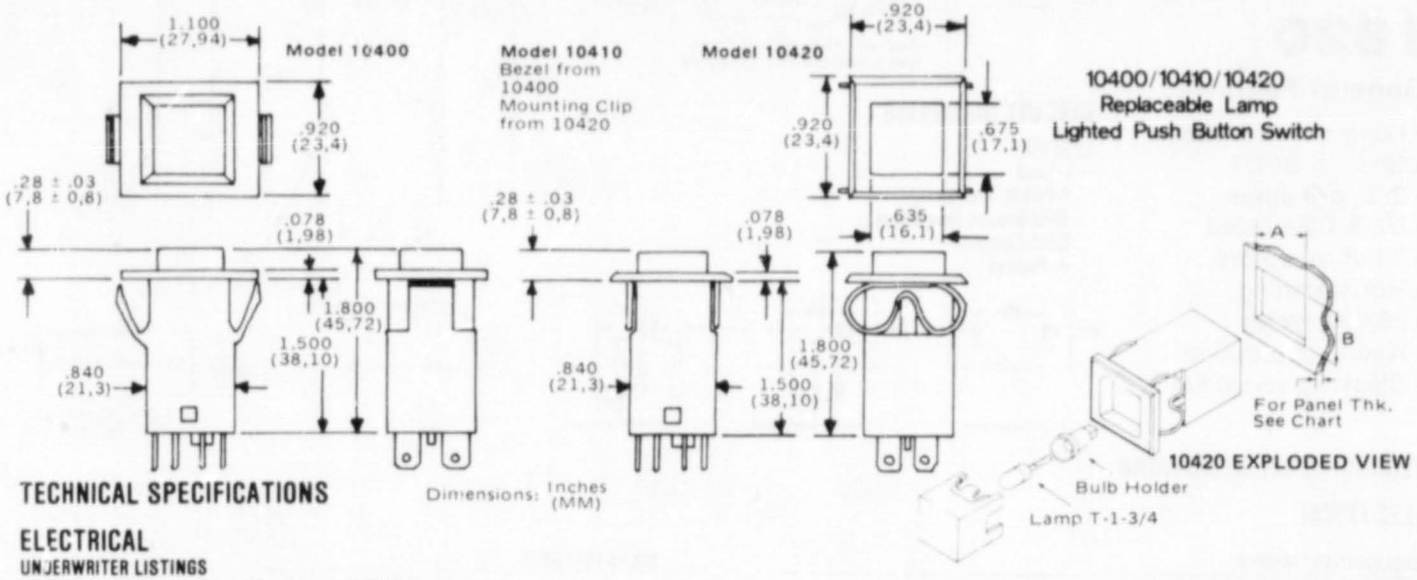
Lighted Push Button Switch
Model 10400/10410/10420

General Features:

- SPST, SPDT, DPST & DPDT
- Replaceable Lamp
- Front panel snap mounting
- 50,000 cycle mean life
- Wide selection of lenses, bezels and legends
- Contact resistance less than 10 milliohms (Initial)
- Contact ratings of 100 milliamps, 10.1 and 15 amps
- UL & CSA listed
- Dependent or independent lamp circuitry
- Optional neon lamp with internal dropping resistor
- Pilot light only
- Momentary, alt. action, normally open/closed versions







TECHNICAL SPECIFICATIONS

Dimensions: Inches (MM)

ELECTRICAL

UNJERWRITER LISTINGS

UL Card Number E33149 — CSA Approval 29661

SWITCH RATING	10400 UL-CSA	UL-CSA
Ampers (AC)	10.1	15
Voltage (AC)	125/250	125/250
Dielectric (Volts, RMS)	900	900
Amperers at overload for 50 cycles	12.625	18.75
Type of test load	INDUCTIVE	
Power Factor for test load	75-80%	
Endurance test at rated ampers	6000 Cycles	

BULBS (Incandescent)

Volts	Mean Spherical Candle Power	Rated Avg. Lab life hrs.	Size	Amps	Commercial Designation
6.0 Max.	.32	70,000	1¾	.19	2181
12.0 Max.	.12	10,000	1¾	.04	2174
14.0 Max.	.30	50,000	1¾	.08	2181
28.0 Max.	.30	25,000	1¾	.04	2187

NOTE: Any voltage T1¾ lamp with wire leads will function.

Switch is also available with a 125VAC / 250VAC Neon Lamp. The Neon Lamp is NOT replaceable.

Switch Type	Dim. A	Dim. B	Panel Thickness
10400	1.050	.875	.030 to .109
10410	.875	.875	.030 to .125
10420	.875	.875	.030 to .125

MECHANICAL

SWITCH ACTION

Alternate Action: Push-on - Push-off SPST
Alternate Action: Push - Push SPDT (Transfer Circuit)
Momentary Normally Open SPST
Momentary Normally Closed SPST
Alternate Action: Push-on - Push-off DPST
Alternate Action: Push - Push DPDT (Transfer Circuit)
Momentary Normally Open DPST
Momentary Normally Closed DPST
Momentary DPDT
Momentary SPDT

MOLEX INCORPORATED • 2222 WELLINGTON COURT • LISLE, IL 60532 • PHONE: (312) 969-4550

The Prestolite Company

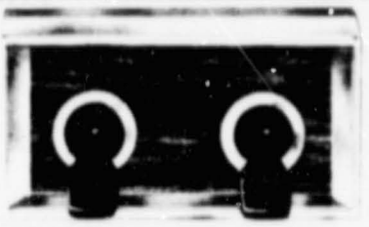
DATA SHEET

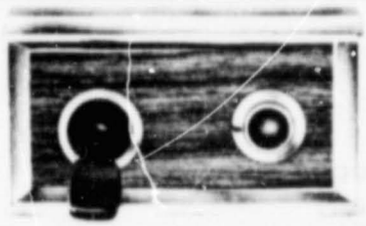
Company Name -	Prestolite Electronics Div. an Eltra Company 511 Hamilton Street Toledo, OH 43694
Company Phone Number -	419/255-4068
Name of Items -	
DC - DC Converters (on board)	Low Power (Instrument lighting only)
Relays, AC & DC (up to 300V, AC & DC)	Low Voltage, only i.e. 6 to 24 volt (horn relays, etc.)
Solenoids	Up to 72 Volt; SAZ, SBC, SAW, SAS, etc.
Switches (6-3000V, 1-20 Amp, AD&DC)	High Current low voltage push type switches
Transducers, Control Current	Brush Wear Indicators
Voltage Regulators	Generator & Alternator Voltage Regulators for 6 to 36 volt applications Solid state and Electro Mechanical types, i.e. VSH, VBC, VCA, etc.
Production Status of Above Items -	All are currently in production

RITE AUTOTRONICS CORP. 3485 S. LA CIENEGA BLVD., LOS ANGELES, CALIFORNIA 90016
TEL: 213-836-7900

SWITCH PANEL, DUAL, WITH 2 SINGLE POSITION SWITCHES – Walnut inlay • Additional black leatherette inlay included • Pack: 12 to a carton, carton weight: 3 lbs.

3121





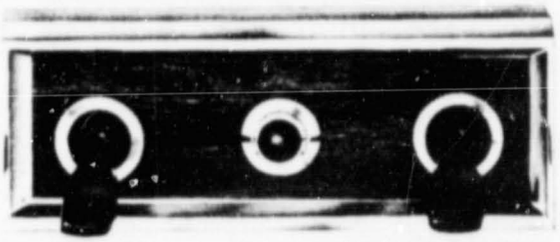
3125

SWITCH PANEL, DUAL, WITH 1 RED INDICATOR LIGHT AND 1 SINGLE POSITION SWITCH – Walnut inlay • Additional black leatherette inlay included • Pack: 12 to a carton, carton weight: 3 lbs.



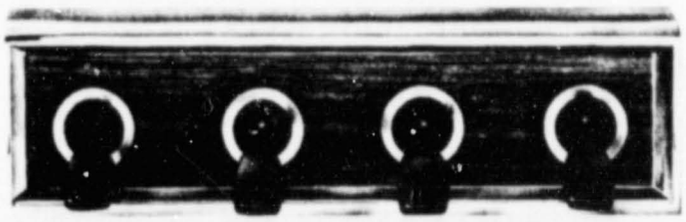
3131

SWITCH PANEL, TRIO, WITH 3 SINGLE POSITION SWITCHES – Walnut inlay •. Additional black leatherette inlay included • Pack: 12 to a carton, carton weight: 3 lbs.



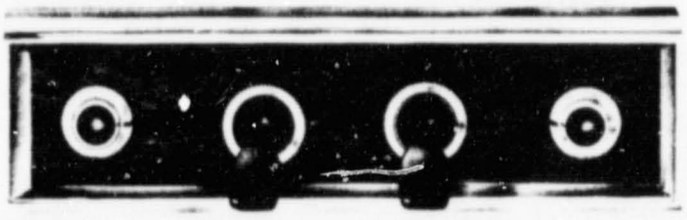
3135

SWITCH PANEL, TRIO, WITH 1 RED INDICATOR LIGHT AND 2 SINGLE POSITION SWITCHES – Walnut inlay • Additional black leatherette inlay included • Pack: 12 to a carton, carton weight: 3 lbs.



3141

SWITCH PANEL, QUAD, WITH 4 SINGLE POSITION SWITCHES – Walnut inlay • Additional black leatherette inlay included • Pack: 6 to a carton, carton weight: 4 lbs



3145

SWITCH PANEL, QUAD, WITH 2 RED INDICATOR LIGHTS AND 2 SINGLE POSITION SWITCHES – Walnut inlay • Additional black leatherette inlay included • Pack: 6 to a carton, carton weight: 4 lbs.



3151

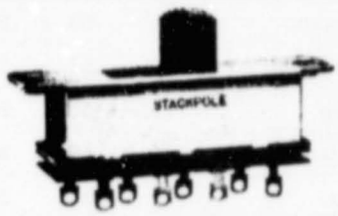
SWITCH PANEL, PENTA "5", WITH 5 SINGLE POSITION SWITCHES – Walnut inlay • Additional black leatherette inlay included • Pack: 6 to a carton, carton weight: 4 lbs.

STACKPOLE SLIDE AND ROCKER SWITCHES



Basic, single-pole switches — Series 20

Rugged, dependable and durable. Movable contact is a heavy slug of silver-plated copper alloy which eliminates distortion through light and heavy loads. Coil-spring loading assures positive detent action and low contact resistance. Available in ratings to 15 amps, 125 V ac inductive in a variety of terminal styles and actuators in models up to 4 positions.



Large-case, multi-pole switches — Series 10

Same features and rugged durability as the Series 20, but offering more complex switching. Available in ratings to 8 amps, 125 V ac inductive.



Basic, double-pole switches — Series 50

Unique design features include a swaging process that firmly anchors the terminals to the base, plus a special long-lasting lubricant. Ratings up to 11 amps, 125 V ac inductive, in models up to 4 positions.



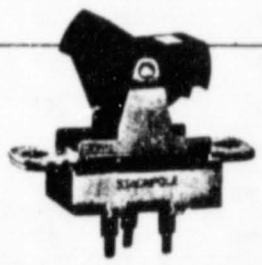
Double-wipe contact switches — Series 70

Double-wipe contacts provide either "break-before-make" (non-shorting) contact or "make-before-break" (shorting) contact. Wide selection suits a variety of electronic applications.



Miniature switches — Series 90

Scaled to match the miniaturization of modern electronic equipment, with Stackpole quality construction to meet today's precise standards.



Rocker switches

Most of the Stackpole slide switches shown here are available in rocker variations, with either flat (sub-panel mounting) or offset (flush-panel mounting) brackets.

Options

- Actuator heights and colors
- Special terminals
- Glamour caps
- Welded leads and components
- Terminal shields
- Jumper strips
- Solder guards
- Special mounting holes
- Snap-in mounting
- Twist-tab mounting
- Special mounting
- Push-latch adaptor
- Heavy detents

STACKPOLE COMPONENTS COMPANY
Dept. EM, PO. Box M, Farmville, VA 23901
Phone (804) 392-4111



STACKPOLE
Get to know us. We can help.

SPECIFICATIONS

	Type*	Rating (125 V AC)	Size (inches) Length	Width	Height[1]
Series P-20	Single-pole, push	3 amp	1.375	.53	.28
Series S-20	Single-pole, single- and double-throw[2]	4 to 7 amp	1.375	.53	.28
Series S-25	Single-pole, single- and double-throw (push-in leads)[2]	4 and 6 amp	1.375	.53	.28
Series S-22	Single-pole, single- and double-throw[2]	10 amp	1.375	.53	.28
Series S-21	Single-pole, single- and double-throw (push-on connectors)[2]	3 to 10 amp	1.375	.53	.45
Series S-20	Single-pole, three-position[2]	6 amp	1.375	.53	.28
Series S-21	Single-pole, three-position (push-on connectors)	6 amp	1.375	.53	.45
Series S-25	Single-pole, three-position (push-in leads)	5 amp	1.375	.53	.28
Series S-20	Single-pole, four-position	6 amp	1.656	.53	.28
Series S-10	Double-pole, double-throw[2]	6 amp	1.890	.53	.49
Series S-11	Triple-pole, double-throw[2]	6 amp	1.890	.53	.49
Series S-10	Double-pole, three-position[2]	6 amp	1.890	.53	.49
Series S-12	Double-pole, three-position[2] (with isolated switching)	3 and 8 amp	1.890	.53	.49
Series S-10	Double-pole, four-position	6 amp	1.890	.53	.49
Series S-50	Double-pole, double-throw	3 and 4 amp	1.375	.52	.35
Series S-55	Double-pole, double-throw (push-in leads)	non-rated	1.375	.52	.35
Series S-51	Double-pole, three-position (isolated poles)	1 and 3 amp	1.656	.52	.37
Series S-52	Double-pole, four-position	11 amp	1.968	.56	.32
Series S-70	Double- and single-pole[3]	1 amp	1.375	.52	.35
Series S-71	Double- and single-pole, three-position[3]	non-rated	1.656	.52	.37
Series S-72	Double- and three-pole, two-position[3]	non-rated	1.656	.80	.27
Series S-72	Triple-pole, three-position[3]	non-rated	1.656	.80	.27
Series S-73	Double- and single-pole, four position[3]	non-rated	1.938	.52	.35
Series P-90	Single-pole, push	non-rated	1.000	.43	.26
Series S-90	Single-pole, single- and double-throw	1 and 3 amp	1.000	.43	.26
Series S-90	Double-pole, double-throw	1 and 3 amp	1.000	.43	.26
Series S-91	Single-pole, three-position	1 and 3 amp	1.190	.43	.26
Series S-91	Double-pole, three-position	1 and 3 amp	1.190	.43	.26
Series S-98	Single-pole, single- and double-throw	—	1.000	.35	.25

[1]Height from top of case to bottom of base, not including actuator or terminals
[2]Available in either maintained action or spring return
[3]Available in either shorting or non-shorting contacts

STACKPOLE COMPONENTS COMPANY
Dept. EM, P.O. Box M, Farmville, VA 23901
Phone (804) 392-4111

*Commonly used configurations. Consult with factory for other ratings and circuit types.

Tech Labs

SINCE 1935

SWITCHES

TECH LABORATORIES, INC.
DEPT. EM
BERGEN AND EDSALL BOULEVARDS
PALISADES PARK, N.J. 07650
TEL: (201) 944-2221

SWITCHES

SQUARE ROTARY SWITCHES



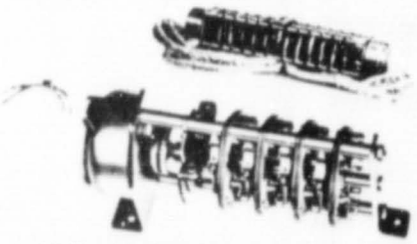
- 13 models available
- 1⅛" sq. to 8" sq. x 15 decks (max.)
- 1 to 12 poles
- Up to 150 positions/pole
- Fixed stops or continuous rotation
- 3 amps at 120 VAC
  to 15 amps at 120 VAC
- Precious metal contacts

THUMBWHEEL SWITCHES



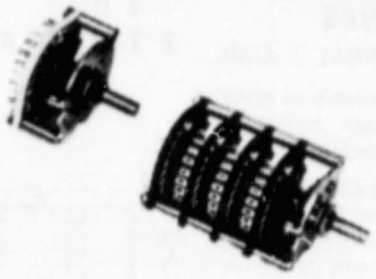
- Modular construction
- Compact
- Wide range of logic codes
- Positive detent
- Simple installation
- Two models available —
  Panelmite and Thumbmite

REMOTELY CONTROLLED ROTARY SWITCHES



- All Tech Lab Switches can be supplied as stepping switches or continuous motor driven
- Solenoid drives
- Motor and Geneva drives
- Enercon AC incremental motor drive
- Available with interrupters or homing decks
- Completely pre-wired ready to install
- Hermetic sealing available
- May be remotely controlled by: Master-slave arrangement; Computer or other; External pulse
- Either AC or DC operation

TYPE 2 ROTARY SWITCH

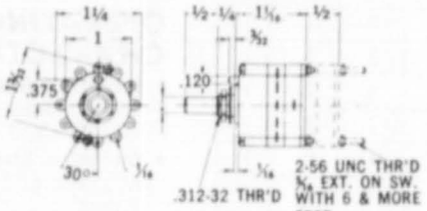


- Four insulation materials available
- 1 to 4 poles/deck
- Up to 24 positions/pole
- 2¼" x 1¾" x 24 decks (max.)
- Adjustable stops
- 5 amps, 120 VAC max.
- Precious metal contacts

TYPE 3 ROTARY SWITCH



DIMENSIONS

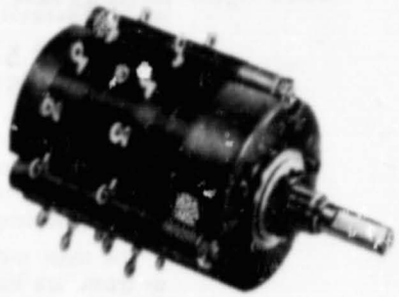


- Enclosed molding in diallyl phthalate
- Molded in terminals
- 1 or 2 poles/deck
- Up to 12 positions/pole
- 1¼" OD up to 8 decks (max.)
- Adjustable stops
- 12 amps, 28 VDC
- Precious metal contacts
- Mixed decks of shorting and non-shorting
- Mixed shorting and non-shorting contacts on each deck
- Choice of either ⅜-32 or ⅛-32 mounting bushing

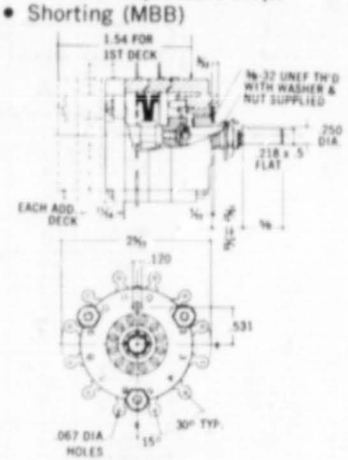
SPECIALS

Tech Labs can customize your Switch and Attenuator requirements, completely pre-wire your switches ready for installation. We can also undertake prototype design and manufacturing. Contact our factory for quotations.

ROTARY INSTRUMENT SWITCH SERIES 2000



- Extremely low contact resistance — <1 milliohm
- Extremely high insulation resistance — more than one million megohms
- Totally enclosed -- dust tight
- Long life — > one million
- 12 position/1-6 pole/deck max.
- Solid silver contacts
- External adjustable stops
- Shorting (MBB)



SPECIAL DESIGN VARIATIONS

SIX AND ELEVEN POSITION DETENTS
The six position detent is 60° throw, skipping every other contact. The eleven position detent is 30° throw with the eleventh position omitted so that the detent goes 60° from position ten to position zero.

OFFSET WIPERS
30° and 180° offset wipers are available for use in special circuits.

CAPACITANCE
Less than 1 micromicrofarad between contacts or to ground.

CURRENT CAPACITY
5 amps maximum continuous duty.

THERMAL EMF
Extremely low. Silver contacts & brushes.

VOLTAGE BREAKDOWN
Withstands 1500V RMS between contacts and to ground.

LOSSES
Low electrical losses at frequencies up to several megacycles.

Tech Labs

SINCE 1935

TECH LABORATORIES, INC.
DEPT. EM
BERGEN AND EDSALL BOULEVARDS
PALISADES PARK, N.J. 07650
TEL: (201) 944-2221

TEC LAB 5 AMP 50 VDC TOGGLE SWITCHES

EQUIVALENT TO TORBAL 5 AMP

Tec Lab switches are available in many **combinations** of bushings, terminals, handles, housings and electrical styles.

The most widely used **combinations**, or **types**, are listed in the table below. These are coded with the outline drawings on this page so you can determine construction details and dimensions of the various parts of the switch.

The SP-1, for example, has short bushing, solder terminals, long stem handle, single-pole housing and double-throw electrical style.

Model Designation	Bushing A	Terminal B	Handle C	Housing D	Elec. E
SP-1	1	1	1	1	1
SP-3	2	1	1	1	1
SP-4	1	1	1	1	2
SP-5	1	2	1	1	1
SP-6	1	1	4	1	1
SP-7	1	1	2	1	1
SP-10	2	1	3	1	1
SP-11	1	1	3	1	1
SP-14	2	1	4	1	1
DP-1	1	1	1	2	1
DP-3	2	1	1	2	1
DP-6	1	1	4	2	1
DP-7	1	1	2	2	1
DP-10	2	1	3	2	1
DP-11	1	1	3	2	1

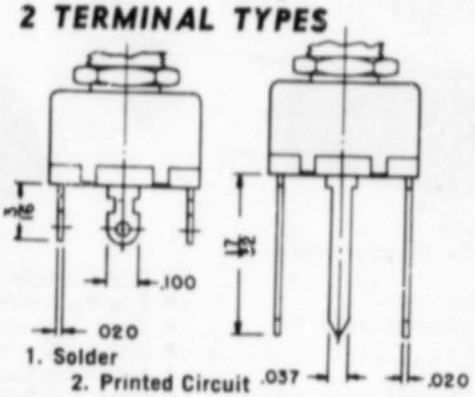
Generally, switch types not listed in this table can be made available. To specify the type desired in your inquiry, list the numerical style desired for each switch feature. Example, to specify switch having the following styles:

	Block Letter	Style No.
Bushing, long	A	2
Terminal, printed circuit	B	2
Handle, ball end, long	C	4
Housing, single-pole	D	1
Electrical, double-throw	E	1

Specify A2 — B2 — C4 — D1 — E1



2 TERMINAL TYPES



1. **Solder**
2. **Printed Circuit**

APPLICABLE MIL SPEC

MIL-S-3950 MS-75028 MS-75029

MATERIAL SPEC

- **Base**
  Rogers RX-600
  Phenolic Glass Fiber
- **Housing and Mounting Bushing**
  One-piece casting of Duronze III — corrosion proof
  Conforms to QQ-M-151 & AN-QQ-S-91
- **Contacts**
  Fine silver-gold plated

OPERATING CHARACTERISTICS

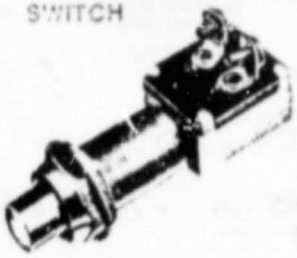
- **Insulation Resistance**
  Greater than 100,000 megohms at 100 VDC and 70°F
- **Dielectric Strength**
  At sea level 1,000V rms at 60 cps for 1 min.
- **Contact Resistance**
  Initial — less than .010 ohms
- **Contact Rating**

DC Load Inductive	AC Load Inductive
28V	**125V**
5 amp	5 amp

- **Temperature Range**
  −55°C to 85°C
- **Vibration Endurance**
  10 to 2,000 cps per MIL-R-25018
- **Shock Endurance**
  75G
- **Contact Chatter**
  10 microseconds or less MIL-R-5757
- **Corrosion Resistance**
  of complete assembly 50 hrs per QQ-M-151
- **Mechanical Endurance**
  100,000 cycles switching 10 amp. 50 VDC resistive load

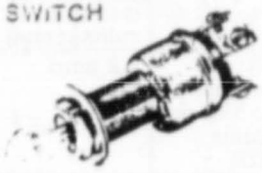
SWITCHES

PUSH BUTTON SWITCH



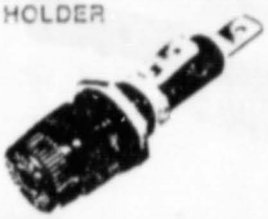
Momentary contact for use as horn button, choke or starter button.
Chrome-plated. Fits panels up to 1" thick.
Requires ⅝" diameter mounting hole.
5800474

HEAVY-DUTY IGNITION/STARTER SWITCH



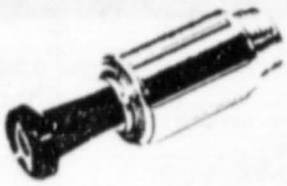
Three positions: off—ignition—start. Returns automatically from start to ignition. Includes two keys. Fits panels up to 1" thick, $^{13}/_{16}$" diameter, 3¼" long.
5800277

PANEL MOUNT FUSE HOLDER



Requires ½" panel hole.
5909272

CIGARETTE LIGHTER



6531874

OIL PRESSURE WARNING LIGHT



Combination light and buzzer indicates low oil pressure. Must be used in conjunction with an oil pressure switch, as recommended by engine manufacturers. Fits panels up to ½" thick. Requires a ¾" mounting hole.
6283378

LIGHT KIT



Includes socket and 12 volt bulb.
1827871 for 2" gauges
1827975 for 3" gauges

WARNING INDICATOR LIGHT



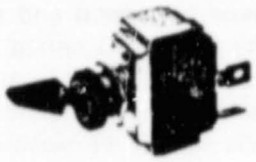
Indicator lamps have black bezel rings, $^{3}/_{16}$" blade terminals. Requires ½" mounting hole.
7301275 flush green lens
7301379 raised red lens
7301472 raised blue lens
6287670 flush green lens with turn signal arrow
7301472 raised blue lens with high beam symbol

SQUARE BEZELS



Practical, attractive addition to individual gauge installations. Fits all 2" or 3" gauges, and enhances dash appearance.
6545472 for 2" gauges
6545576 for 3" gauges

TOGGLE SWITCHES



Feature black plastic paddle and locking ring. Sealed to resist water penetration. Fit panels up to ¼" thick. Require $^{15}/_{32}$" mounting hole.
TWO POSITION:
On/off switch.
5804776
THREE POSITION:
5804776
MOMENTARY ON/OFF:
5804973

TOGGLE SWITCH IDENTIFICATION PLATES



Add a finishing touch to your dash area or instrument panel with these beautifully styled 1" diameter aluminum identification plates. Black with ⅛" high silver lettering. Most toggle switches fit $^{15}/_{32}$" hole. Smaller diameter plate allows for more compact mounting of switches.
6523473 Accessories
6523774 Lights
6523878 Wiper
6523971 Panel
6524071 Auxiliary
6524372 Blank
6524570 Horn
6532670 Off
6534571 Ignition
6536172 Heater
6537372 Washer-Wiper

Teleflex INCORPORATED
industrial

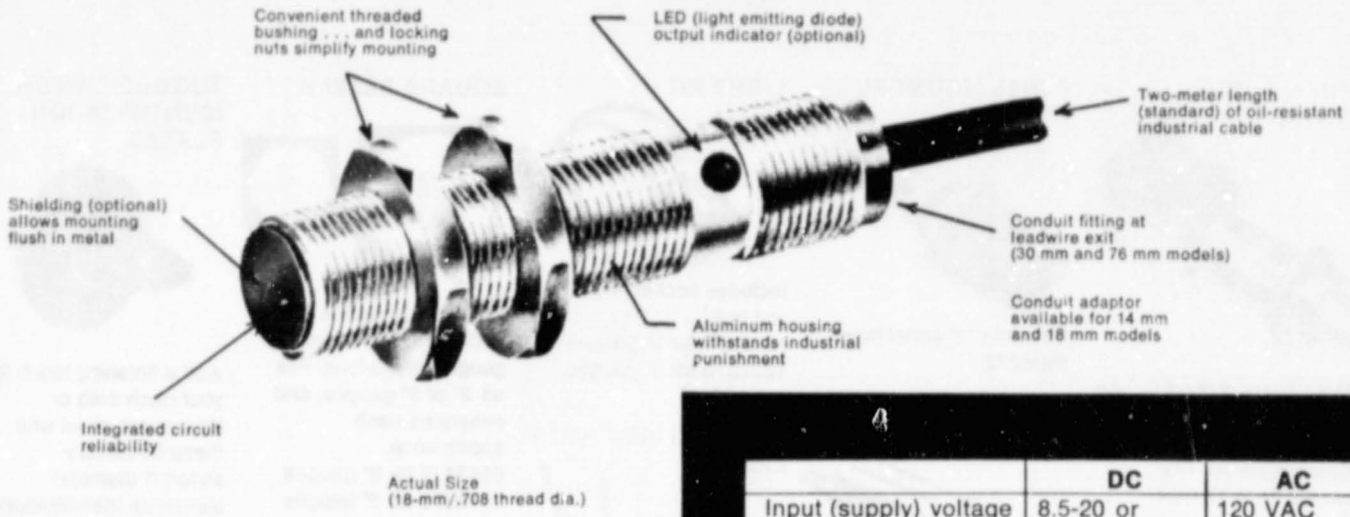
Electrical systems:
1816 57th Street, Sarasota, Florida 33580
Telephone (813) 355-7721

Mechanical systems:
640 North Lewis Road, Limerick, Pennsylvania 19468
Telephone (215) 495-7011

TSI

ELECTRONIC PROXIMITY SWITCHES

BULLETIN PS-1000A



Answering the need for speed and reliability in industrial switching, the TSI series XPS self contained, solid state, electronic proximity switches, do just that, at very economical prices. The XPS series units detect all types of metal. They do not require the presence of a magnet. The XPS series units are RF (radio frequency) inductive units, operating on the Eddy current principle, whereby a solid state (transistor) oscillator circuit creates an RF field whose output (amplitude) changes due to Eddy currents established on any metal surface entering the RF field. This amplified change causes a change in switch output.

These non-contact solid state switches are vastly superior to mechanical or electro-mechanical switching switches. Since actuation is accomplished without physical contact, units have an extensive electrical life; are extremely rugged and are hermetically sealed to meet NEMA 1, 2, 3, 3R, 3S 12 and 13 requirements. Units are oil, dust and water tight. XPS series units interface directly with industrial logic and programmable controllers (DC version) and with 120 volt pilot circuits and relay loads (AC version). XPS series proximity switches operate over temperature range from −22° to +160° F. (−30° to +70° C.)

	DC	AC
Input (supply) voltage	8.5-20 or 19-30 VDC	120 VAC (+10%, −15%)
Max. supply voltage ripple	10%	— —
Burden current (exclusive of load)	33 milliamps	15 milliamps
Max. load current		
Inrush	— —	7.5 amps (for less than 1 millisecond)
Steady state	20 mA (switches w/o LED); 170 mA (switches w/LED)	1.2 amp
Output leakage current (OFF state)	1 microamp	4.5 milliamps (typical) 6 mA max.
Output saturation voltage (at max. rated load)	1 VDC (20 mA versions) .5 VDC (170 mM versions)	1.4 VAC max.
Repetition rate	4,000/minute (min.)	2400/min. (76mm) 3300/min. (30mm)

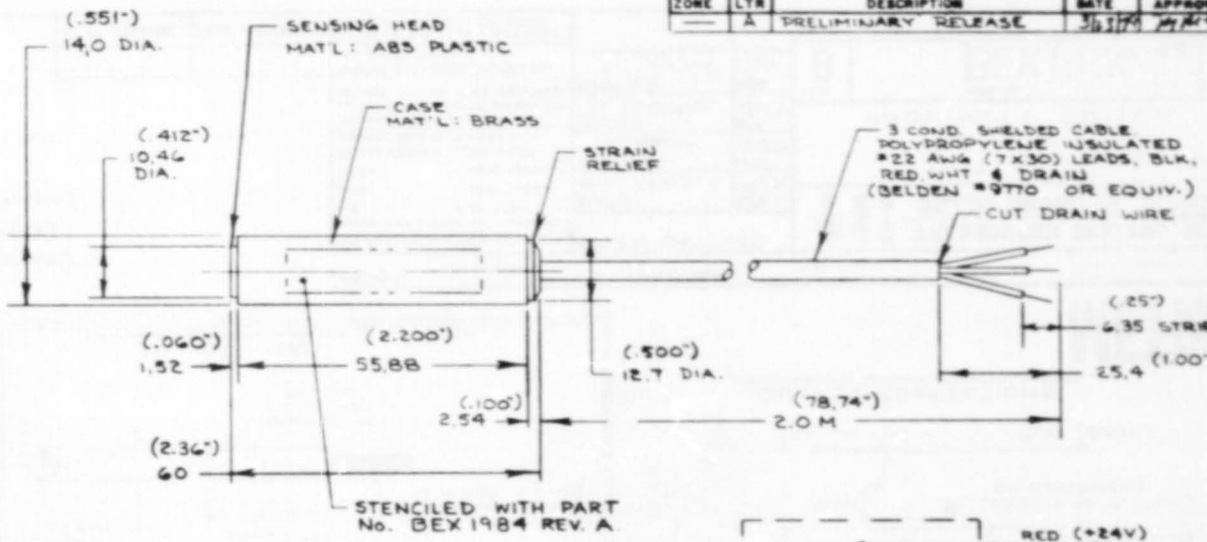
	DC and AC
Temperature range	−22° to +185°F (−30° to +85°C)
Drift in operating point over rated temperature	(See page 9.)
Differential travel (from operate point to release point)	4% typical (at 75°F), 8% max.* of O.P. dist.
Operating point tolerance at 75°F	+15%; −5% of rated sensing distance**

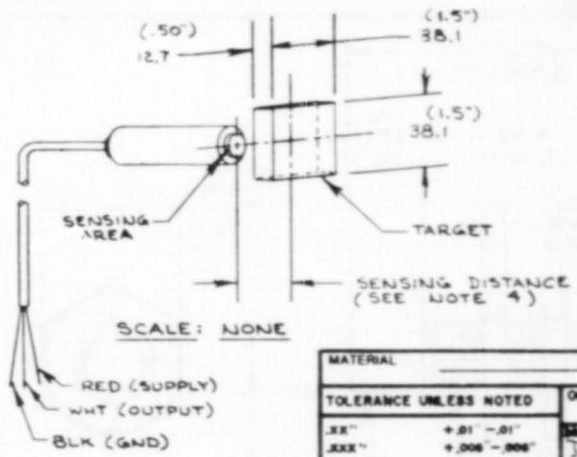
TRANSDUCER SYSTEMS, INC.
710 DAVISVILLE ROAD · WILLOW GROVE, PA. 19090 · AC/215-657-0800

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
—	A	PRELIMINARY RELEASE	3/23/79	[illegible]

SPECIFICATIONS

1. OUTPUT: 150 MA MAX.
2. INPUT: 24 VOLTS
3. OUTPUT SATURATION VOLTAGE:
   @ MAX. RATED LOAD: ≤ 2.0 V.
4. SENSING DISTANCE:
   STEEL: 3.76 mm (.148")
   BRASS: 1.96 mm (.077")
   ALUMINUM: 1.68 mm (.066")
5. NORMALLY OPEN SWITCH.
6. OPERATING TEMPERATURE:
   0° C. TO 80° C.
   (32° F. TO 176° F.)
7. HYSTERESIS (MIN.): 3% OF THE SENSING DISTANCE.
8. SHORT CIRCUIT PROTECTION TO CASE.
9. REVERSE POLARITY PROTECTION.
10. CONTACT OF THE SENSING HEAD WITH AROMATICS, KETONES, ESTERS, TRI. M.FL SHOULD BE AVOIDED.





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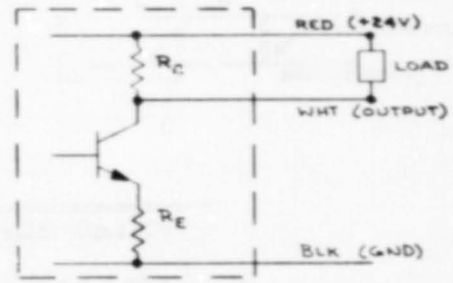


OUTPUT STAGE
SCHEMATIC

NOTE:
UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN mm.

METRIC

MATERIAL	HEAT TREAT	FINISH

TOLERANCE UNLESS NOTED		ORDER NO. 0279-43		TSI TRANSDUCER SYSTEMS, INC. WILLOW GROVE, PA. 19090
.XX"	+.01" −.01"	DRAWN BY D.M. Broadwater	DATE 3/20/79	OUTLINE XPS 3A1-UX PROXIMITY SWITCH
.XXX"	+.005" −.005"	CHECKED [signature]	DATE 3/23/79	
.XXXX"	+.0005" −.0005"	APPROVED [signature]	DATE 3/23/79	
DRILLED HOLES	+.005" −.000"	APPROVED M. Godwall	DATE 3/23/79	SIZE B — DWG NO. BEX1984 — REV. A
FORMED ANGLES	+1/2° −1/2°			SCALE 1:1 — SHEET 1 of 1

UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS ARE IN INCHES AND INCLUDE PLATING WHEN SPECIFIED.
REMOVE ALL BURRS AND BREAK ALL SHARP EDGES.
ALL DIAMETERS TO BE CONCENTRIC WITHIN .005" T.I.R. UNLESS NOTED

NEXT ASSEMBLY	FINAL ASSEMBLY

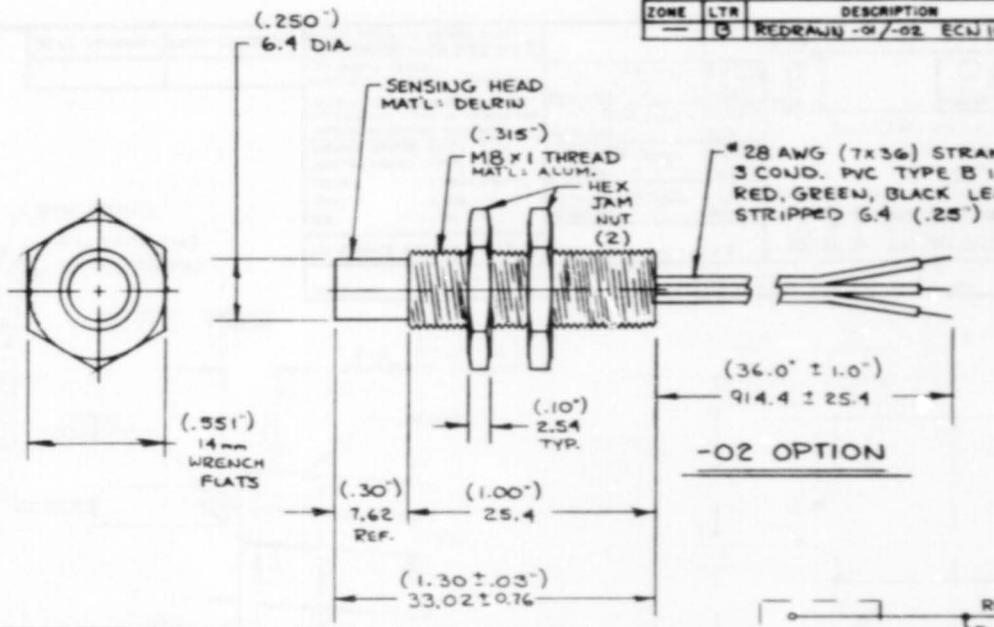
REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
—	B	REDRAWN -01/-02 ECN 1042	5/4/79	

SPECIFICATIONS

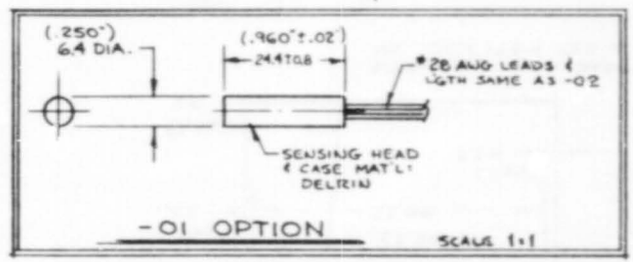
1. OUTPUT: 20mA MAX.
2. INPUT: 8.5 TO 20 VOLTS.
3. OUTPUT SATURATION VOLTAGE:
   @ MAX. RATED LOAD: ≤ 1.0 V.
4. SENSING DISTANCE:

STEEL:	2.34mm (.092")
BRASS:	0.97mm (.038")
ALUM:	0.79mm (.031")

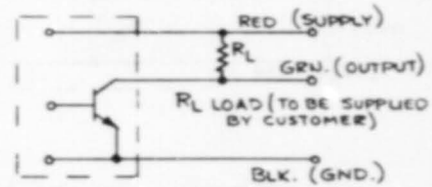
5. OPEN COLLECTOR OUTPUT, WITH NORMALLY OPEN SWITCH.
6. OPERATING TEMPERATURE:
   0° - 80° C. (32° - 176° F.)
7. HYSTERESIS (MIN.): 3 % OF THE SENSING DISTANCE.
8. CONTACT OF THE SENSING HEAD WITH AROMATICS, KETONES, ESTERS, TRI.M.FL SHOULD BE AVOIDED.



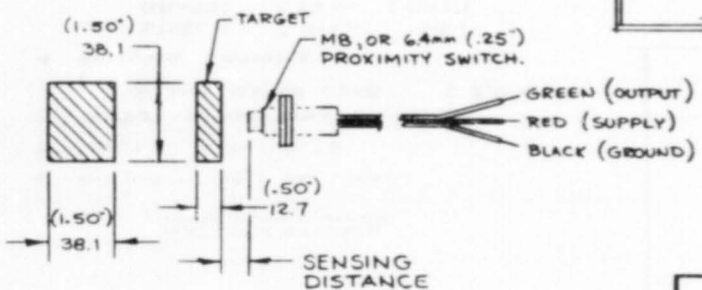
-02 OPTION



-01 OPTION SCALE 1:1



OUTPUT CONNECTIONS



SCALE: NONE

METRIC

MATERIAL	HEAT TREAT	FINISH

TOLERANCE UNLESS NOTED		ORDER NO. 0479-45		TSI TRANSDUCER SYSTEMS, INC. WILLOW GROVE, PA. 19090		
.XX	+.01 −.01	DRAWN BY R.W. HINDLE	DATE 5/4/79	OUTLINE XPSIAI-U-01/02 PROXIMITY SWITCH		
.XXX	+.005 −.005	CHECKED	DATE 5/4/79			
.XXXX	+.0005 −.0005	APPROVED	DATE 5/4/79			
DRILLED HOLES	+.005 −.000	APPROVED	DATE 5/4/79	SIZE B	DWG NO. BEX1996-01 02	REV. B
FORMED ANGLES	+1/2° −1/2°			SCALE 2:1	SHEET 1 of 1	

UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS ARE IN INCHES AND INCLUDE PLATING WHEN SPECIFIED.

REMOVE ALL BURRS AND BREAK ALL SHARP EDGES.

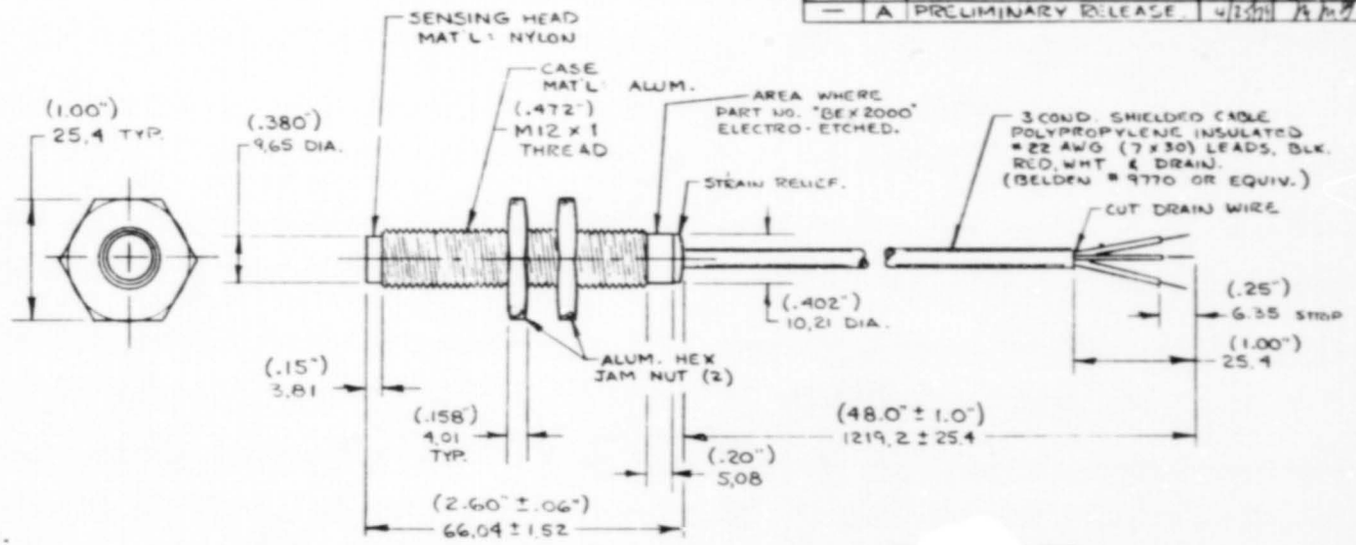
ALL DIAMETERS TO BE CONCENTRIC WITHIN .005 T.I.R. UNLESS NOTED

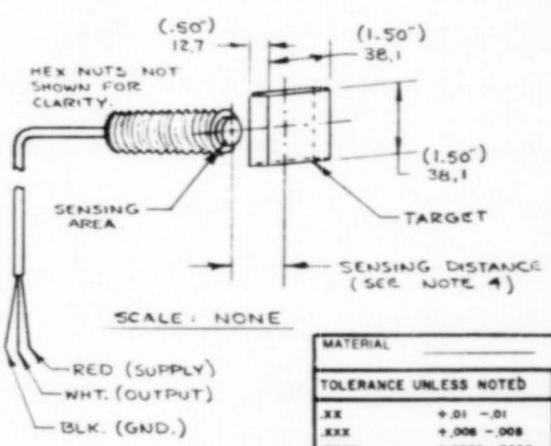
NEXT ASSEMBLY	FINAL ASSEMBLY

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
—	A	PRELIMINARY RELEASE	4/25/74	

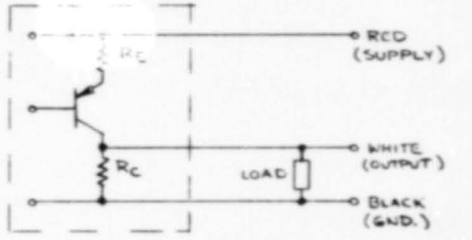
SPECIFICATIONS

1. OUTPUT: 100 mA. MAX.
2. INPUT: 7 TO 16 VOLTS.
3. OUTPUT SATURATION VOLTAGE: @ MAX. RATED LOAD: ≦ 2.0 V.
4. SENSING DISTANCE: STEEL: 1.0mm (.039")
5. NORMALLY CLOSED SWITCH.
6. OPERATING TEMP. RANGE: 0° TO 80° C (32° TO 176° F)
7. HYSTERESIS (MIN.): 3% OF THE SENSING DISTANCE.
8. SHORT CIRCUIT PROTECTION TO CASE.
9. REVERSE POLARITY PROTECTION.
10. CONTACT OF THE SENSING HEAD WITH AROMATICS, KETONES, ESTERS, TRI. M. FL. SHOULD BE AVOIDED.





SCALE: NONE



OUTPUT STAGE SCHEMATIC

METRIC

MATERIAL	HEAT TREAT	FINISH

TOLERANCE UNLESS NOTED

.XX	+.01 −.01
.XXX	+.005 −.005
.XXXX	+.0005 −.0005
DRILLED HOLES	+.003 −.000
FORMED ANGLES	+1/2° − 1/2°

UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS ARE IN INCHES AND INCLUDE PLATING WHEN SPECIFIED.

REMOVE ALL BURRS AND BREAK ALL SHARP EDGES.

ALL DIAMETERS TO BE CONCENTRIC WITHIN .005 T.I.R. UNLESS NOTED

NEXT ASSEMBLY	FINAL ASSEMBLY

ORDER NO. 0279-41

DRAWN BY	R. W. HINDLE	DATE 4/24/74
CHECKED	[illegible]	DATE 4/24/74
APPROVED	[illegible]	DATE 4/24/74
APPROVED	[illegible]	DATE 4/24/74

TSI TRANSDUCER SYSTEMS, INC.
WILLOW GROVE, PA. 19090

OUTLINE
XPS 1A1 - SX
PROXIMITY SWITCH

SIZE	DWG NO.	REV.
B	BEX2000	A

SCALE 1:1 SHEET 1 of 1

SW-47

TRANSMISSIONS, AUTOMATIC

(CODE **TA**)

American Motors Corporation
Engine and Component Sales Department
27777 Franklin Road
Southfield, Michigan 48034
(313) 827-3817

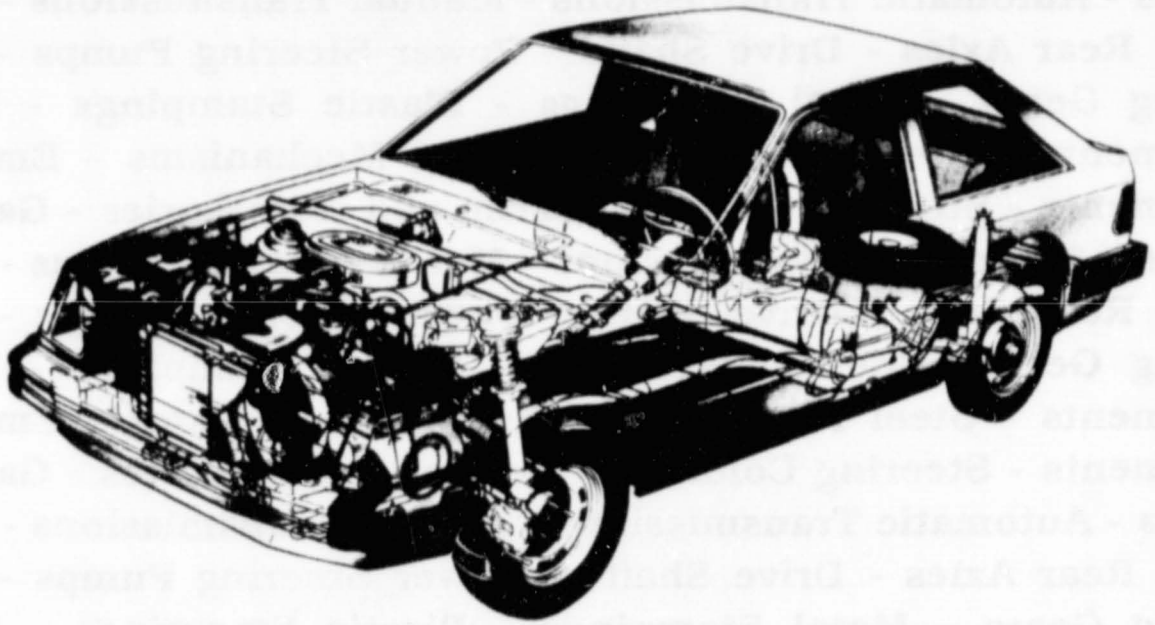
American Motors' products which have potential applications for electric and hybrid vehicles include components used in the manufacture of AMC/Jeep vehicles, such as:

- Alternators
- Axle Assemblies
- Brake Assemblies
- Differentials
- Manual Transmissions
- Automatic Transmissions

For additional information please contact:

American Motors Corporation
Engine and Component Sales Department
27777 Franklin Road
Southfield, Michigan 48034
(313) 827-3817

Automotive Components



Ford

Power Products

New Accounts and Contract Sales
300 Renaissance Center
P.O. Box 43338, Suite 1800
Detroit, Michigan 48243
Telephone 313.568-7435

Avoid Unnecessary Design and Tooling Expense . . . Take Advantage of Proven Ford Automotive Components

Gasoline Engines - Automatic Transmissions - Manual Transmissions - Front Axles - Rear Axles - Drive Shafts - Power Steering Pumps -Power Steering Gears - Metal Stampings - Plastic Stampings - Frame Components - Steel Forgings - Latching Mechanisms - Emission Components - Steering Columns - Trim and Accessories - Gasoline Engines - Automatic Transmissions - Manual Transmissions - Front Axles - Rear Axles - Drive Shafts - Power Steering Pumps -Power Steering Gears - Metal Stampings - Plastic Stampings - Frame Components - Steel Forgings - Latching Mechanisms - Emission Components - Steering Columns - Trim and Accessories - Gasoline Engines - Automatic Transmissions - Manual Transmissions - Front Axles - Rear Axles - Drive Shafts - Power Steering Pumps -Power Steering Gears - Metal Stampings - Plastic Stampings - Frame Components - Steel Forgings - Latching Mechanisms - Emission Components - Steering Columns - Trim and Accessories - Gasoline Engines - Automatic Transmissions - Manual Transmissions - Front Axles - Rear Axles - Drive Shafts - Power Steering Pumps -Power Steering Gears - Metal Stampings - Plastic Stampings - Frame Components - Steel Forgings - Latching Mechanisms - Emission Components - Steering Columns - Trim and Accessories - Gasoline

Industrial Engine Operations
Ford Parts and Service Division
300 Renaissance Center, Suite 1800
P.O. Box 43338
Detroit, Michigan 48243
Telephone 313/568-7435

Ford
Power Products

TRANSDUCERS, CONTROL

PRESSURE, BRAKE

(CODE **TB**)

Gulf + Western Manufacturing Company

Electric Vehicle Components

Bohn Heat Transfer Division
1625 East Voorhees Street
Danville, Illinois 61832
Telephone: 217/446-3710

Heat Exchangers	Air to air, liquid to air and liquid to liquid designs. Custom manufacture.

Michigan Plating & Stamping Division
1860 Alpine Avenue, N.W.
Grand Rapids, Michigan 49504
Telephone: 616/363-4847

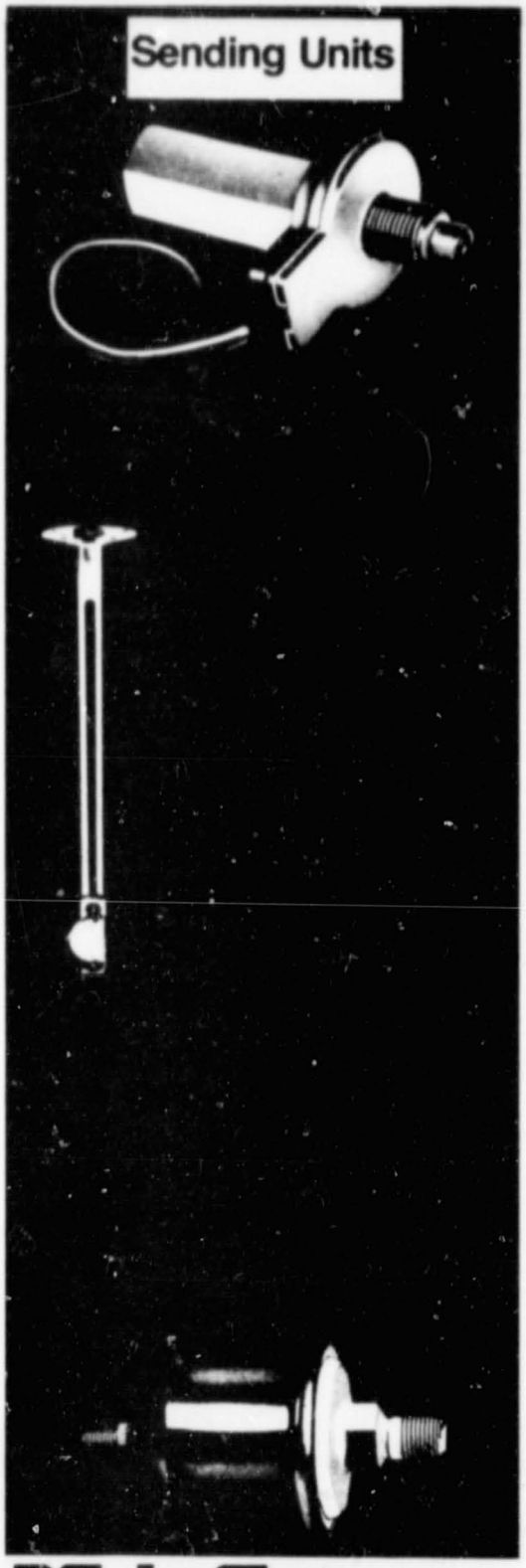
Fuel Tanks	Supplier to automotive industry of terneplate stamped and welded tanks.

Automotive Marketing and Engineering Center
Detroit Sales and Engineering Office
24114 Research Drive
Farmington Hills, Michigan 48024
Telephone: 313/478-8140

Relays	Miniaturized 12VDC to control circuits to 20 amperes.
Solenoids	Build to customer requirements.
Switches	Build to customer requirements.
Transducers	Current, Position, Pressure, Speed, Temperature, Torque, Voltage - Build to customer requirements.
Voltage Regulators	12VDC Solid State

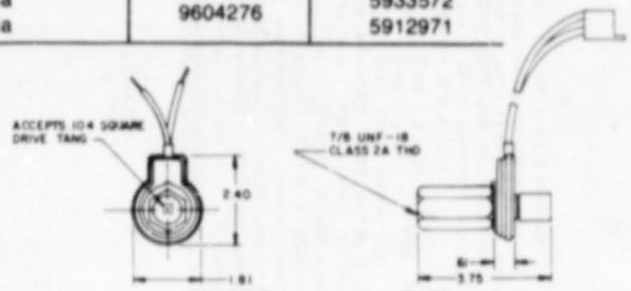
Collyer Insulated Wire Division
100 Higginson Ave.
Lincoln, RI 02865
Telephone: 401/723-7800

Apparatus Cables	**Single conductor, Type A.I.A.** IPCEA S-28-357, NEMA WC-1; Underwriters' Lab. Sizes #4 AWG and larger. Asb. covered, 300V and 600V.
Appliance Wires	**Single conductor** Collyer P-400 THHN/THWN PVC/NYLON in those sizes which are 19W uncompressed. U.L. Listed Rate AWM 105°C Dry and 80°C in oil.
Control Cables	**Single and multi conductor** THERMOPLASTIC: Collyer C-141 — PZR — PE/NYLON condrs. PVC Jacket 600V, 1000V, 75°C. Collyer C-140 — PVC insulated and jacketed 600V. Collyer C-143 — PE/PVC conductors, PVC jacket 600V, 1000V. Collyer C-153 — PE/NYLON, PZR 90°C, PVC jacket 600V, 1000V. Collyer C-154 — THHN/THWN conductors Type T.C. U.L. Listed.

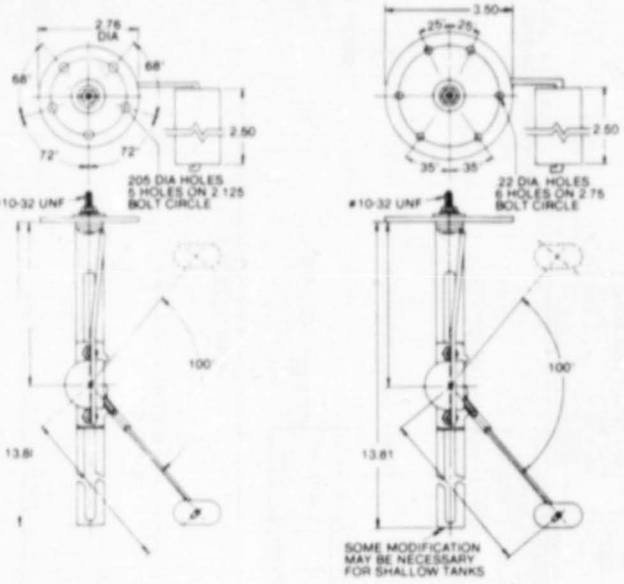


SIGNA-FLEX TACHOMETER

DRIVE TANGS	SENDER PART NUMBER	PART NUMBER
.187 dia .152 dia	9604276	5933572 5912971

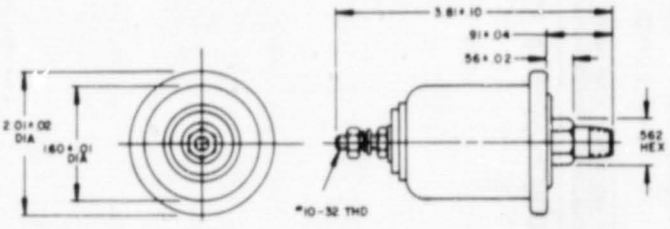


FUEL	SENDER TYPE	PART NUMBER
6" to 24" tank 5 hole flange	Introl Stewart Warner	1507170 1501775
6" to 24" tank 6 hole flange	Introl	1507273



OIL PRESSURE

PRESSURE RANGES	SIZE NPT	SENDER TYPE	PART NUMBER
80 psi 100 psi 120 psi	1/8" 1/8" 1/8"	Stewart Warner	1500171 1501671 1506177
80 psi 100 psi	1/8" 1/8"	Introl	9600171 9605476

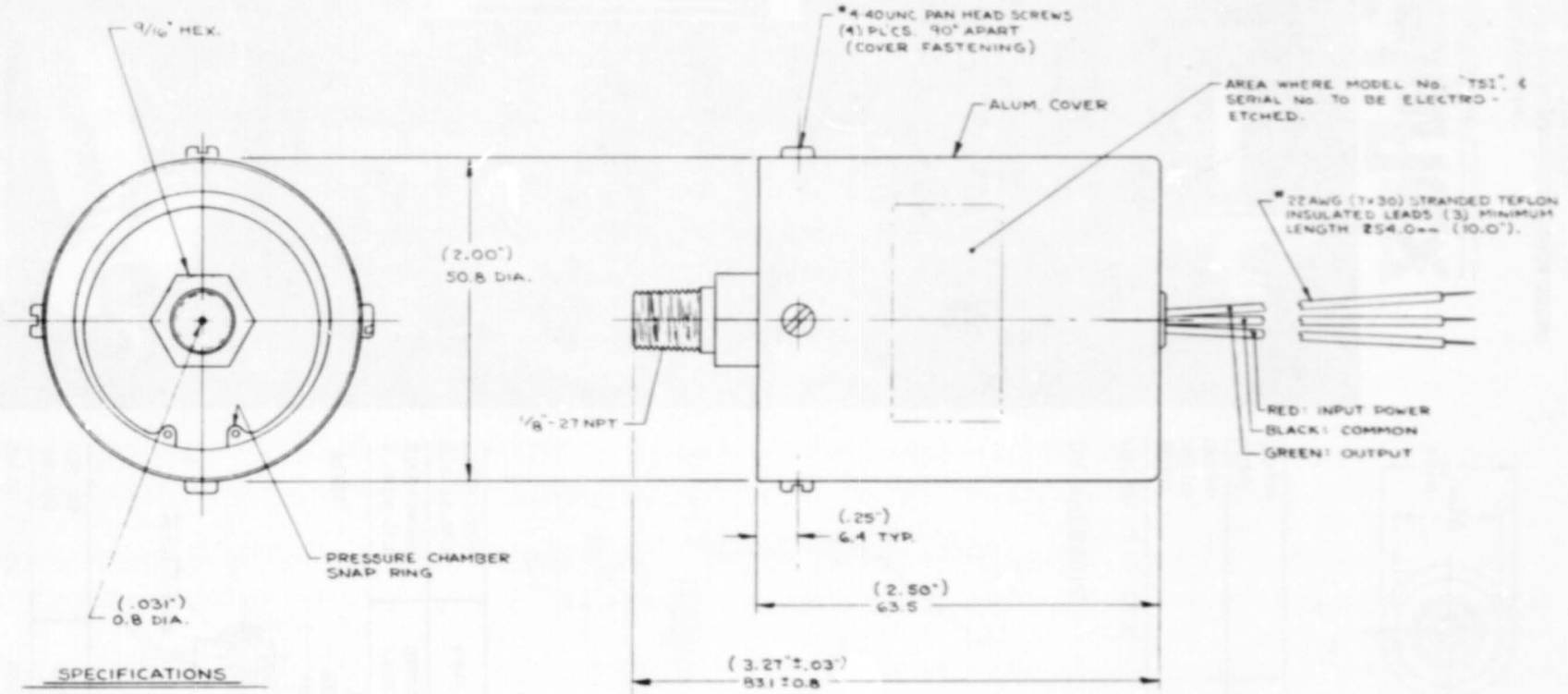


Teleflex INCORPORATED
industrial

Electrical systems:
1816 57th Street, Sarasota, Florida 33580
Telephone (813) 355-7721

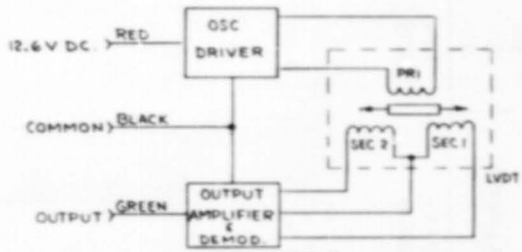
Mechanical systems:
640 North Lewis Road, Limerick, Pennsylvania 19468
Telephone (215) 495-7011 • Telex 84-6335

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
—	A	PRELIMINARY		
—	B	ECN 0995		



SPECIFICATIONS

INPUT POWER: 10-20 VDC (CALIBRATED @ 12.6 VDC .010 A.)
PRESSURE RANGE: 0-100 PSIG.
OVER PRESSURE: (LESS THAN .2% CAL. SHIFT) 125 PSI.
BURST PRESSURE: THREE TIMES RATED TOP PRESSURE.
OUTPUT: { ZERO - .050 V ± .050 VDC. / FULL SCALE - 5.000 VDC ± .1 VDC } R_L 5K OHM TO ∞.
OUTPUT IMP: LESS THAN 10 OHM.
OUTPUT RIPPLE: LESS THAN 2 % F.S. RMS.
REPEATABILITY: LESS THAN .2 %.
LINEARITY: { .01 ± 2.0 % / .02 ± 5.0 % } BST F.S.
HYSTERESIS: 0.5 % F.S.
OPERATING TEMP. RANGE: -40° TO 125° C.
CAUTION: THE (+) INPUT LEAD IS PROTECTED FROM REVERSE VOLTAGE. THE OUTPUT LEAD MUST BE PROTECTED FROM THE INPUT VOLTAGE. PERMANENT DAMAGE CAN BE DONE TO THE UNIT.
WEIGHT: (9 oz.) 255 GRAMS.



SCHEMATIC

TEL: 215-657-0800

TOLERANCE UNLESS NOTED		
.XX	+.01	-.01
.XXX	+.005	-.005
.XXXX	+.0005	-.0005
DRILLED HOLES	+.005	-.000
FORMED ANGLES	+1/2°	-1/2°

UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS ARE IN INCHES AND INCLUDE PLATING WHEN SPECIFIED.

REMOVE ALL BURRS AND BREAK ALL SHARP EDGES.

ALL DIAMETERS TO BE CONCENTRIC WITHIN .005 T.I.R. UNLESS NOTED.

NEXT ASSEMBLY | FINAL ASSEMBLY

ORDER NO. 0179-13, 1078-33

DRAWN BY	(K.W.) HINDLE	DATE 7/19/79
CHECKED	TSA	DATE 11/6/79
APPROVED	TSA	DATE 11/6/79
APPROVED		DATE

TSI — TRANSDUCER SYSTEMS, INC.
WILLOW GROVE, PENNSYLVANIA 19090

OUTLINE
CDP 0-100G DC/DC 12.6-.050-5.0 B
PRESSURE TRANSDUCER

SIZE	DRAWING NO.	REVISION
C	CEX 1921- 01 02	B

SCALE 2:1 SHEET 1 of 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
—	A	DWG. # WAS BEX 2001 REL. FOR PROD. ECN 1135	10/2/79	JEA

SPECIFICATIONS

INPUT POWER: 10 TO 20 VDC @ .010 A.

REGULATION GAIN: $\frac{\Delta E \text{ INPUT } \%}{\Delta E \text{ OUTPUT F.S. } 300 \text{ MIN.}} \times 1000$ TYP.

PRESSURE PORT: SEE NOTES

PRESSURE RANGE: 0-100 PSIG.

OVER PRESS.: (LESS THAN .1% CALIBRATION SHIFT), 125 PSIG.

BURST PRESS.: THREE TIMES RATED TOP PRESSURE.

OUTPUT: 1-5 VDC R_L 5K TO ∞

OUTPUT IMPEDANCE: LESS THAN 1 OHM.

OUTPUT RIPPLE: LESS THAN 1% F.S. R.M.S.

REPEATABILITY: LESS THAN .1%.

LINEARITY: ± 1.5% F.S., B.S.L.

HYSTERESIS: .4% F.S.

OPERATING TEMP. RANGE: 0° TO 85° C.

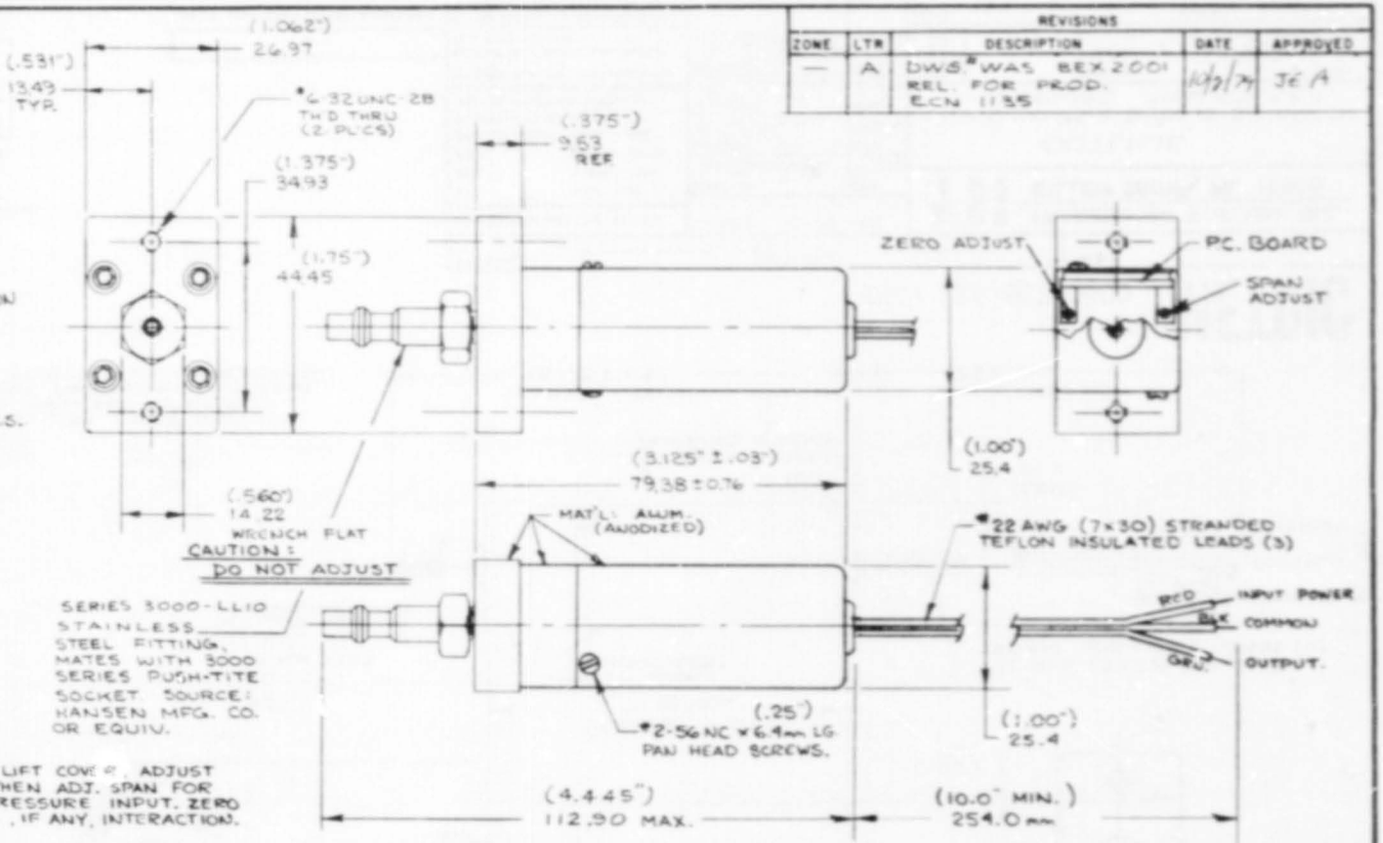
STORAGE TEMP. RANGE: -40° TO 125° C.

EFFECTS OF TEMP.:
ZERO SHIFT: .04% /°C TYP.
.1% /°C MAX.
SPAN SHIFT: .02% /°C TYP.
.05% /°C MAX.

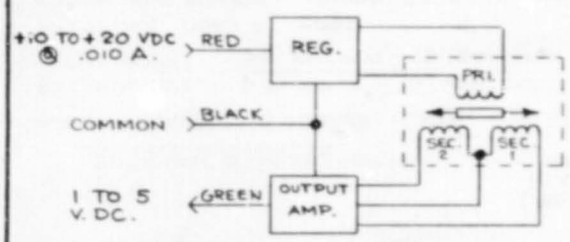
ZERO ADJ. RANGE: ± 5% NOMINAL.

SPAN ADJ. RANGE: ± 5% NOMINAL.

CALIBRATE:
REMOVE SCREWS (2) FROM COVER. LIFT COVER, ADJUST ZERO ADJ. AT LOWEST PRESSURE THEN ADJ. SPAN FOR FULL SCALE OUTPUT AT HIGHEST PRESSURE INPUT. ZERO AND SPAN ADJUST HAS VERY LITTLE, IF ANY, INTERACTION.



UNIT WILL BE CALIBRATED WITH +15 VOLTS INPUT UNLESS SPECIFIED



SCHEMATIC

TEL: 215-657-0800 **METRIC**

NEXT ASSEMBLY	D103-01006
FINAL ASSEMBLY	

MATERIAL — HEAT TREAT — FINISH

TOLERANCE UNLESS NOTED
.XX +.01 -.01
.XXX +.005 -.005
.XXXX +.0005 -.0005
DRILLED HOLES +.005 -.000
FORMED ANGLES +1/2° -1/2°

UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS ARE IN INCHES AND INCLUDE PLATING WHEN SPECIFIED.

REMOVE ALL BURRS AND BREAK ALL SHARP EDGES.

ALL DIAMETERS TO BE CONCENTRIC WITHIN .005 T.I.R. UNLESS NOTED

ORDER NO. 0379-42, 0779-14

DRAWN BY: R.W. Hindus — DATE 5/1/79
CHECKED: JFA — DATE 5/1/79
APPROVED: JEA — DATE 5/1/79
APPROVED: M. Goldstein — DATE 5/1/79

TSI TRANSDUCER SYSTEMS, INC.
WILLOW GROVE, PA. 19090

OUTLINE
CCDP 0-100 PSIG DC/DC 10 TO 20 1 TO 5 M
PRESSURE TRANSDUCER

SIZE: B — DWG NO.: B103-40027 — REV.: A
SCALE: 1:1 — BEX2001 — SHEET: 1 of 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
—	B	REDRAWN W/ NO CHANGE	[illegible]	[illegible]
—	C	ECN 1071	[illegible]	[illegible]

SPECIFICATIONS

INPUT POWER: 15 VDC @ .010 A.

REGULATION GAIN: $\frac{\Delta E \text{ INPUT } \% \times 1000 \text{ TYP}}{\Delta E \text{ OUTPUT F.S. } 300 \text{ MIN.}}$

PRESSURE PORT: HOSE.

PRESSURE RANGE: 0-100 PSIA

OVER PRESS.: (LESS THAN .1% CALIBRATION SHIFT), 100 PSIA.

BURST PRESS.: THREE TIMES RATED TOP PRESSURE.

OUTPUT: 2.5 TO 12.5 V

OUTPUT IMPEDANCE: LESS THAN 1 OHM.

OUTPUT RIPPLE: LESS THAN 1% F.S. R.M.S.

REPEATABILITY: LESS THAN .1%.

LINEARITY: ± 1.5% F.S., B.S.L.

HYSTERESIS: .6% F.S.

OPERATING TEMP. RANGE: 0° TO 85° C.

STORAGE TEMP. RANGE: -40° TO 125° C.

EFFECTS OF TEMP.:

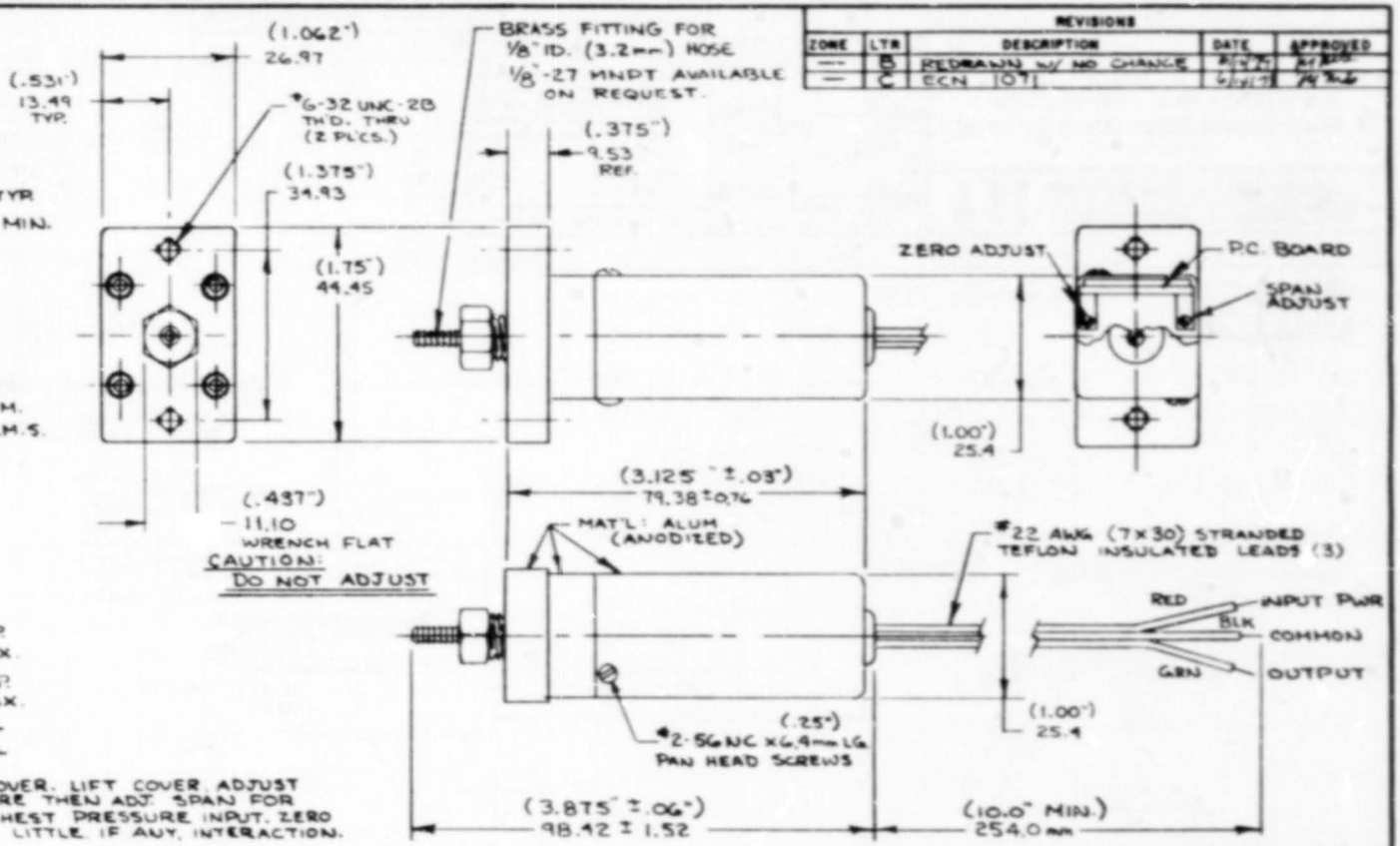
ZERO SHIFT: .02% / °C. TYP.
.05% / °C. MAX.

SPAN SHIFT: .02% / °C. TYP.
.05% / °C. MAX.

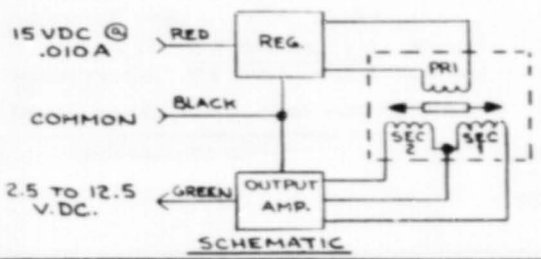
ZERO ADJ. RANGE: ± 5% NOMINAL

SPAN ADJ. RANGE: ± 5% NOMINAL

CALIBRATE:
REMOVE SCREWS (2) FROM COVER. LIFT COVER. ADJUST ZERO ADJ. AT LOWEST PRESSURE THEN ADJ. SPAN FOR FULL SCALE OUTPUT AT HIGHEST PRESSURE INPUT. ZERO AND SPAN ADJUST HAS VERY LITTLE IF ANY, INTERACTION.



TEL: 215-657-0800 **METRIC**

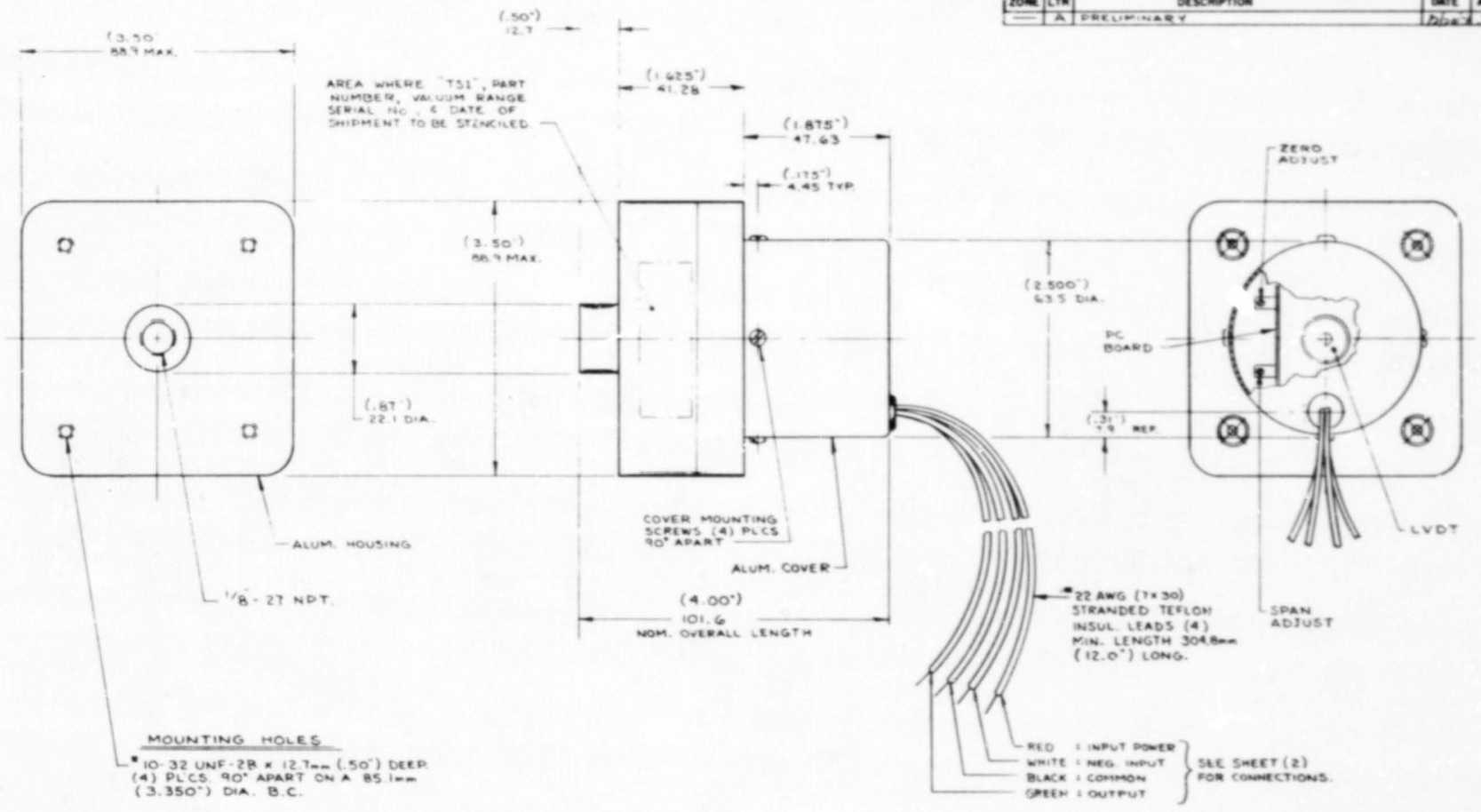


SCHEMATIC

ORIGINAL PAGE IS
OF POOR QUALITY

MATERIAL	HEAT TREAT	FINISH	
TOLERANCE UNLESS NOTED .XX +.01 -.01 .XXX +.005 -.005 .XXXX +.0005 -.0005 DRILLED HOLES +.005 -.000 FORMED ANGLES +1/2° -1/2° UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS ARE IN INCHES AND INCLUDE PLATING WHEN SPECIFIED. REMOVE ALL BURRS AND BREAK ALL SHARP EDGES. ALL DIAMETERS TO BE CONCENTRIC WITHIN .005 T.I.R. UNLESS NOTED	ORDER NO. 2179-49 DRAWN BY D.H. Bandwater DATE 6/11/79 CHECKED R.W. Hinkle DATE 6/12/79 APPROVED J.E. Armstrong DATE 6/12/79 APPROVED [illegible] DATE 6/12/79	TSI TRANSDUCER SYSTEMS, INC. WILLOW GROVE, PA. 19090 OUTLINE CDP 0-100 PSIA DC/DC 15 2.5 TO 12.5M PRESSURE TRANSDUCER	
NEXT ASSEMBLY	FINAL ASSEMBLY	SIZE B	DWG NO. BEX1998 REV. C
		SCALE 1:1	SHEET 1 of 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
—	A	PRELIMINARY	[illegible]	[illegible]



TEL: 215-657-0800

DASH No.	MODEL No.	CUSTOMER PART No.
-02	CDP 0-45 in H_2O VAC ±5V 0 to 4.05 V.	7409182
-01	CDP 0-42 in H_2O VAC ±5V -2.1 to +2.1 V	7409191

METRIC

TOLERANCE UNLESS NOTED	
.XX	+.01 -.01
.XXX	+.005 -.005
.XXXX	+.0005 -.0005
DRILLED HOLES	+.003 -.000
FORMED ANGLES	+ 1/2° - 1/2°

UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS ARE IN INCHES AND INCLUDE PLATING WHEN SPECIFIED.

REMOVE ALL BURRS AND BREAK ALL SHARP EDGES.

ALL DIAMETERS TO BE CONCENTRIC WITHIN .005 T.I.R. UNLESS NOTED

ORDER NO. 1078-34

DRAWN BY R. W. HINDLE — DATE 12/18/78

CHECKED J. F. A. — DATE 12/20/78

APPROVED J. F. A. — DATE 12/27

APPROVED — DATE

NEXT ASSEMBLY | FINAL ASSEMBLY

TSI TRANSDUCER SYSTEMS, INC.
WILLOW GROVE, PENNSYLVANIA 19090

OUTLINE
CDP 0-42 in H_2O VAC ±5V -2.1 to +2.1V.
CDP 0-45 in H_2O VAC ±5V 0 to 4.05V.
PRESSURE TRANSDUCER

SIZE C | DRAWING NO. CEX1913-01/02 | REVISION A

SCALE 1:1 | SHEET 1 of 3

TRANSDUCERS, CONTROL

CURRENT

(CODE **TC**)

Subsidiary of
ESSEX GROUP UNITED TECHNOLOGIES.
ESSEX CONTROLS DIVISION 131 GODFREY STREET, LOGANSPORT, INDIANA 46947 219/753-7521

TYPE 296 Current Sensing Control

GENERAL DATA (cont'd.)

Logic and Timing Circuits (2).

Signals from the current pickup are processed in the logic and timing circuits of the control.

This portion of the control can be tailored to specific application needs. It can be very simple, or more complex.

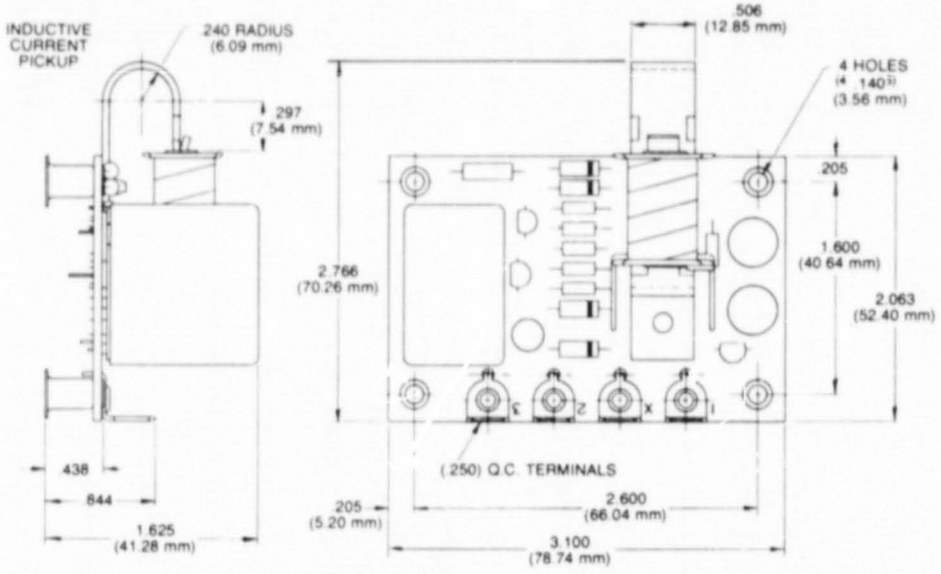
External control signals can be used to alter the control logic, timing sequence, sensing levels, etc.

Output Devices (3).

Solid-State or electromechanical output devices are available to interface with the control system in the equipment in which the Type 296 is used, or control loads directly.

Electromechanical output shown in FIGURE 1.

OUTLINE DIMENSIONS



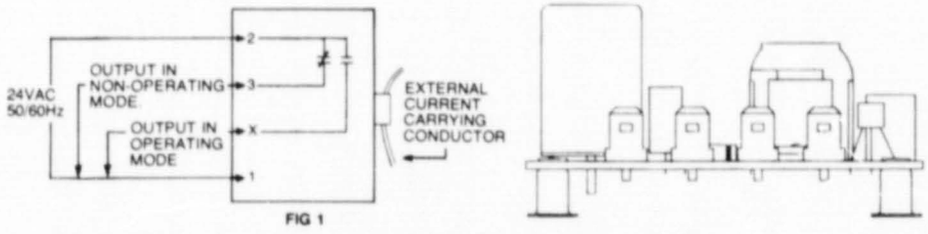


FIG 1

Gulf + Western
Manufacturing Company

Electric Vehicle Components

Bohn Heat Transfer Division
1625 East Voorhees Street
Danville, Illinois 61832
Telephone: 217/446-3710

Heat Exchangers	Air to air, liquid to air and liquid to liquid designs. Custom manufacture.

Michigan Plating & Stamping Division
1860 Alpine Avenue, N.W.
Grand Rapids, Michigan 49504
Telephone: 616/363-4847

Fuel Tanks	Supplier to automotive industry of terneplate stamped and welded tanks.

Automotive Marketing and Engineering Center
Detroit Sales and Engineering Office
24114 Research Drive
Farmington Hills, Michigan 48024
Telephone: 313/478-8140

Relays	Miniaturized 12VDC to control circuits to 20 amperes.
Solenoids	Build to customer requirements.
Switches	Build to customer requirements.
Transducers	Current, Position, Pressure, Speed, Temperature, Torque, Voltage - Build to customer requirements.
Voltage Regulators	12VDC Solid State

Collyer Insulated Wire Division
100 Higginson Ave.
Lincoln, RI 02865
Telephone: 401/723-7800

Apparatus Cables	**Single conductor, Type A.I.A.** IPCEA S-28-357, NEMA WC-1, Underwriters' Lab. Sizes #4 AWG and larger. Asb. covered, 300V and 600V.
Appliance Wires	**Single conductor** Collyer P-400 THHN/THWN PVC/NYLON in those sizes which are 19W uncompressed. U.L. Listed Rate AWM 105°C Dry and 80°C in oil.
Control Cables	**Single and multi conductor** THERMOPLASTIC: Collyer C-141 — PZR — PE/NYLON condrs. PVC Jacket 600V, 1000V, 75°C. Collyer C-140 — PVC insulated and jacketed 600V. Collyer C-143 — PE/PVC conductors, PVC jacket 600V, 1000V. Collyer C-153 — PE/NYLON, PZR 90°C, PVC jacket 600V, 1000V. Collyer C-154 — THHN/THWN conductors Type T.C. U.L. Listed.

TRANSDUCERS, WATT, CURRENT, VOLTAGE,

WATT TRANSDUCERS



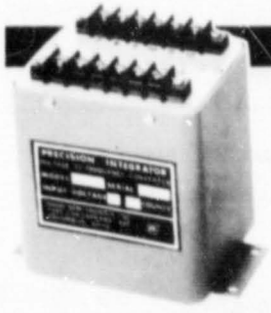
OSI Watt Transducers provide an isolated d.c. output proportional to the true power (EI x Cos θ) consumed in single or three phase circuits. Their fast response makes them very useful on non-sinusoidal as well as sinusoidal waveforms. Outputs of millivolts, milliamperes or volts are available, offering flexibility to the designer in interfacing to control or metering systems.

Over 100 standard units with current ranges of 1 through 1000 Amperes available. Contact O.S.I. for detailed specifications. Bulletin PC76-1

APPLICATION	MODEL	FULL SCALE INPUTS VOLTS	FULL SCALE INPUTS AMPS	OUTPUT CALIBRATION
SINGLE PHASE	PC5-1	120	5	500W
	PC5-2	240	5	1KW
	PC5-3	480	5	2KW
	PC5-58	120	100	10KW
	PC5-59	240	100	20KW
	PC5-60	480	100	40KW
	PC5-94	120	1000	100KW
	PC5-95	240	1000	200KW
	PC5-96	480	1000	400KW
3 PHASE 3 WIRE	PC5-4	120	5	1KW
	PC5-5	240	5	2KW
	PC5-6	480	5	4KW
	PC5-14	240	10	4KW
	PC5-62	240	100	40KW
	PC5-98	240	1000	400KW
3 PHASE 4 WIRE	PC5-7	120	5	1.5KW
	PC5-8	240	5	3KW
	PC5-9	480	5	6KW
	PC5-64	120	100	30KW
	PC5-65	240	100	60KW
	PC5-66	480	100	120KW

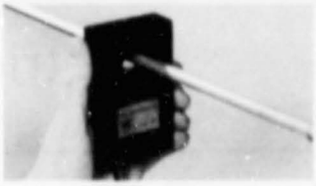
ACCURACY: PC5-1 thru PC5-14 ±0.5% f.s.
PC5-58 thru PC5-98 ±0.75% f.s.
POWER FACTOR RANGE: 0 lead to 0 lag
FREQUENCY RANGE: 50 to 70Hz
OUTPUT: Single Phase: 0 to 50mv
3 Phase, 3 wire: 0 to 100mv
3 Phase, 4 wire: 0 to 150mv
NOTE: Output options of 0 to 1ma and 0 to ±10 volts are available.

PRECISION INTEGRATOR

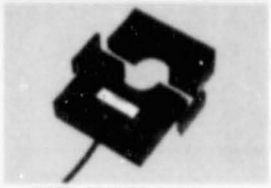


The VFC series of Precision Integrators works from analog signals of 50, 100 and 150 millivolts supplied from watt transducers, current transducers or shunts. The output is a pulse with a rate proportional to the input. Pulse rates of 1,500 to 10,000 per hour are available in 21 standard models. The output pulse is derived from relay contacts with 1 ampere capacity, so it is ideal for operating electromechanical counters and data acquisition systems.

CURRENT TRANSDUCERS – d.c. to KILOHERTZ



MODEL CT200LT



MODEL CT1KLTS (Split Version)

These current transducers provide flat d.c. to Kilohertz response which allows accurate waveform monitoring and measurements of d.c., sinusoidal or distorted waveform currents with high accuracy. Since no physical or electrical connection is necessary to the circuit being monitored, they are especially useful where high voltages are present by providing an output which is electrically isolated from the current source.

Standard models are available in full scale currents of 50 to 8000 Amperes, extended temperature ranges and split versions. Signal conditioners for 10 volt outputs, true rms measurements, and interfacing to other equipment are available. (See "Signal Conditioners" below).

Transducers with response from d.c. to megahertz are available. Ask for Bulletin HE7-4 covering the CT-W Series.

SPECIFICATIONS COMMON TO ALL CT-LT SERIES TRANSDUCERS

Linearity: ±0.5% Full Scale
Temperature Effect (−40°C to +65): ±1% Reading
Response: d.c. to 5KHz
Rise Time For Step Input: 100 Microseconds
Isolation from Line to Output: >5000 volts

MODEL	ENCLOSED CURRENT rms	OUTPUT FULL SCALE mv
CT100LT	100A	50
CT200LT	200A	50
CT400LT	400A	50
CT1KLT	1000A	50
	Request Bulletin CT4-1 listing 30 models.	

SIGNAL CONDITIONER



These signal conditioners provide excitation current for the CT-L current transducers and other Hall Effect devices requiring a low drift, constant current. They also provide amplification for the outputs of current transducers and other Hall Effect devices. Output of CTA113 and CTA114 is proportional to the true rms of the input.

SPECIFICATIONS COMMON TO ALL CTA SIGNAL CONDITIONERS

Amplifier Section (Output)
Drift: 2mv
Response: d.c. to 5KHz
Linearity: 0.1%
Control Current
Adjustment: ±30%
Drift: <0.005%/°C
Operating Power: 115vac, 60Hz

MODEL	INPUT	CONTROL CURRENT OUTPUT	OUTPUT FROM AMPLIFIER
CTA101	±50mv	100ma	±10V
CTA201	±50mv	200ma	±10V
CTA113	50mv (AC)	100ma	+10Vdc
CTA114	50mv (AC)	100ma	+1ma (0 to 7K ohm load)

OHIO SEMITRONICS, INC.
PHONE 614/486-9561 TWX 810/482-1630
1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212

The Prestolite Company

DATA SHEET

Company Name -	Prestolite Electronics Div. an Eltra Company 511 Hamilton Street Toledo, OH 43694
Company Phone Number -	419/255-4068
Name of Items -	
DC - DC Converters (on board)	Low Power (Instrument lighting only)
Relays, AC & DC (up to 300V, AC & DC)	Low Voltage, only i.e. 6 to 24 volt (horn relays, etc.)
Solenoids	Up to 72 Volt; SAZ, SBC, SAW, SAS, etc.
Switches (6-3000V, 1-20 Amp, AD&DC)	High Current low voltage push type switches
Transducers, Control Current	Brush Wear Indicators
Voltage Regulators	Generator & Alternator Voltage Regulators for 6 to 36 volt applications Solid state and Electro Mechanical types, i.e. VSH, VBC, VCA, etc.
Production Status of Above Items -	All are currently in production

TERMINATIONS,

ELECTRICAL

(CODE **TE**)

Beau® Barrier Terminal Strips: consider the advantages of thermoplastics.

In the past several years, Vernitron has made significant additions to its line of barrier terminal strips. The most obvious advance is the introduction of thermoplastic, the material that solves the primary fault of phenolic strips: barrier breakage. And it also attained UL's highest flame retardant rating, 94V-0.

But Vernitron didn't stop there. When we designed our new thermoplastic series, we incorporated a number of other significant improvements. We've ultrasonically welded the terminals in the thermoplastic insulator, so that you can't pull them out. At the same time, this design eliminates solder joint fatigue from twisting the tail when torqueing the screws. And we've enclosed the contact tails to give you the greatest circuit isolation and the least possibility of trapping foreign material.

With all this, we've also designed a 20-amp double-row strip (76000 Series) that actually fits in the same panel space as 15-amp units. And we have a high-barrier style (72000 Series) with an advantage over all the others – lower overall height.

Still, there's more to be said. The principal advantages are fully described on the next three pages. And there are other differences. Like the quality of our hardware.

Terminals with clean, smooth edges, and bright uniform, highly solderable plating. Insulators that exceed all the electrical/mechanical performance standards. These differences are the result of maintaining constant control over the manufacturing processes. And constant attention to tool maintenance. We have a fetish for quality. So, when you buy from Vernitron, you can expect the finest barrier terminal strips available – anywhere.

The basics:
when to use barrier terminal strips

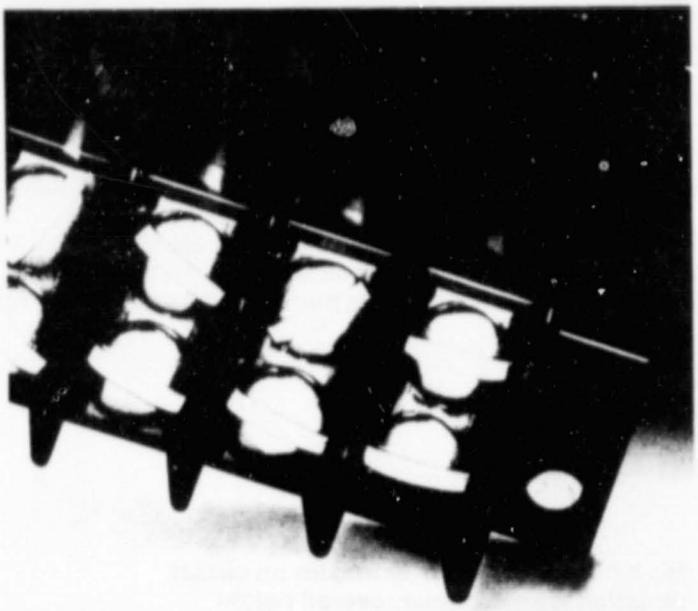
Barrier terminal strips are one of the most widely used and accepted devices for terminating wires. They have achieved this status because of their versatility and cost effectiveness – both initial cost and installed cost.

They provide increased insulation to stop leaks and short circuits. Wiring work is simplified because time-consuming splicing is eliminated. They offer the easiest and most convenient method for field wiring – only a screwdriver is needed. Usually, a higher density of circuitry can be attained, saving panel space. The end result is a professional looking termination rather than a jumble of wires. A great variety of top and bottom termination styles add to their versatility.

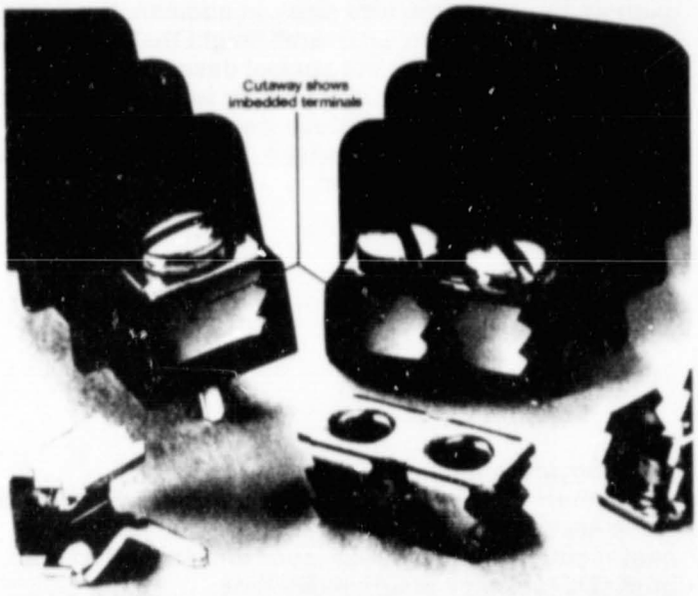
Barrier terminal strips also allow for convenient future changes. Circuit changes can usually be made just by rearranging wires. The barrier terminal strips also offer a good test point area for troubleshooting. Circuit tracing is especially easy when the strips are imprinted with circuit designations.

Beau Products
DIVISION OF VERNITRON CORPORATION

BOX 10, LACONIA, NEW HAMPSHIRE 03246
TEL. (603) 524-5101



The barriers you can bend without breaking
Vernitron's flexible barrier terminal strips reduce breakage dramatically because they are made of a highly resilient glass-filled thermoplastic. Its impact strength is many times greater than phenolic materials. Because the barriers can actually bend without breaking, production line and in-field damage is virtually eliminated. Time-consuming component replacement and re-wiring, and its high cost, is no longer a problem.



Screw terminals that won't pull out
All our thermoplastic barrier strips feature screw terminal plates that are ultrasonically imbedded into the walls of the terminal blocks. The result: a dramatic improvement in pull-out strength.

Single-row types have the terminals imbedded into the walls of the insulator on both sides (photo). This provides a pull-out strength over twice as great as competitive designs, which retain the terminal only by twisting the terminal tail.

Double-row styles eliminate the problem of insecure terminal retention commonly found in closed back styles. The eyelets and nails have been eliminated. Instead, terminal plates (photo) are ultrasonically welded (imbedded) into the barrier strip – making it virtually impossible to pull them out.



Solder joint fatigue eliminated
Because our barrier strips have the terminals welded in both sides, you get this additional advantage: solder joint fatigue from twisting the tail while torqueing the screws or laying the wire bundle is eliminated. This design also resists fatigue under vibration conditions.

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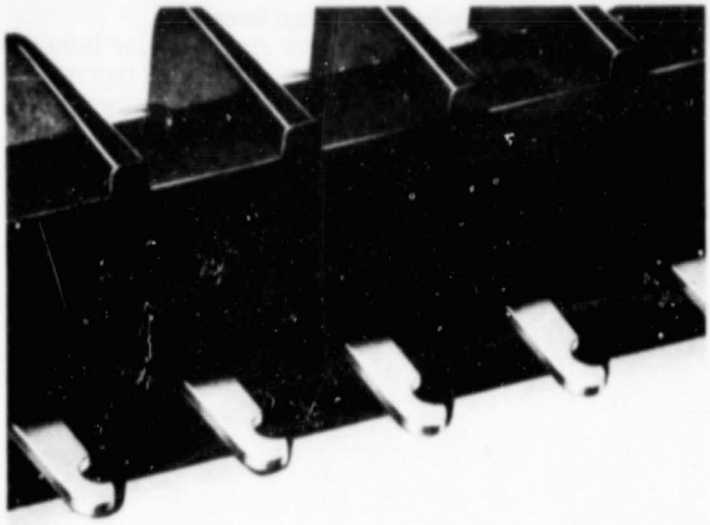
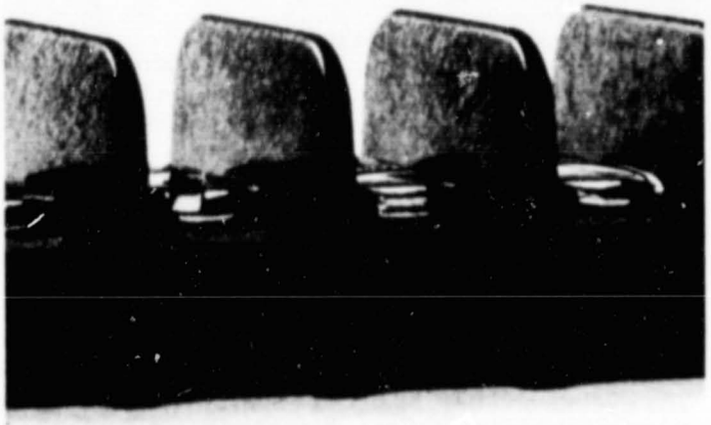
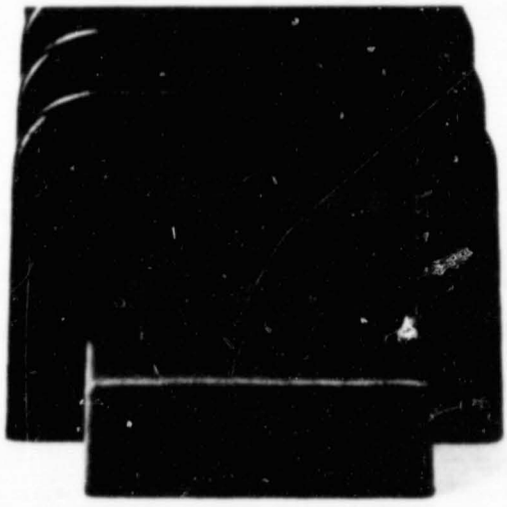
ORIGINAL PAGE IS
OF POOR QUALITY



Contact tails enclosed for maximum circuit isolation
Take a look at the bottom side of our thermoplastic barrier terminal strips (photo). You'll notice the absence of a large size hole required to allow for the twisting action needed to retain ordinary terminals. In Vernitron's design, the terminals are welded in, so the hole can be virtually the same size as the contact tail. With the cavities around dip solder contact tails eliminated, the terminal strip can be mounted directly against a PC board without affecting circuit isolation. This also eliminates entrapment of foreign matter – and reduces solder wicking.



High barrier styles offer maximum circuit isolation with minimum overall height
Our high barrier styles provide maximum circuit isolation – even when using large wire sizes. In addition, the 72000 high-barrier strip offers an overall height that is less than any others. The reason: our special design does not require twisting of the contact tail for terminal retention, and makes it possible to reduce the height of the base – thus saving valuable space. The shorter terminal also reduces heat generation.



Neat, accurate mounting ends
All our thermoplastic terminal strips are molded to length. None are cut down from longer strips. The result is a neater strip without ugly saw cuts, and strips that are precisely the same length every time.

Beau Products
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BOX 10, LACONIA, NEW HAMPSHIRE 03246
TEL: (603) 524-5101

No insulating strips needed
Because all our thermoplastic series have closed backs, you can get the electrical rating you want – without the expense of buying and installing insulating strips.

A 20-amp double-row strip in the same space as 15
Our Series 76000 and 77000 are 20-amp strips that have been designed to take the same panel space as any double-row 15-amp barrier terminal strip. They are 7/8" wide and have screw terminals 3/8" on centers – just like the strips they are designed to replace.



Standoffs reduce cleaning time

The bottom of our single-row barrier terminal strips can be molded with .070" diameter standoffs (option -P). They provide a space of .040" between the bottom and the mounting surface. This further reduces entrapment of foreign materials during soldering and reduces cleaning time to a minimum.

Highest UL flame retardant rating

The thermoplastic material attains the highest flame retardant rating (self extinguishing) assigned by Underwriters Laboratories, 94V-0. It also offers negligible water absorption, high dielectric strength and low heat transfer.

How to convert phenolics to thermoplastics

You can obtain all the advantages of bendable thermoplastic barrier terminal strips by converting from fragile phenolic types. The Vernitron thermoplastic styles shown in the right hand column are designed to replace the styles listed in the center column.



Quick-connect terminals save assembly time, cut costs

Beau quick-connect terminals speed your assembly time, cut costs, and improve your connections. Cold solder joints are also eliminated. Quick-connect terminals offer one of the fastest ways to make circuitry changes. A variety of single and two sided styles are available for top-side terminations. As many as three can be stacked in a single section—to attain up to six terminations. In addition, Series 72000 is available with an insulated quick connect on the bottom.

Manufacturer	Convert from these phenolic styles . . .	. . . to these thermoplastic styles from Vernitron
Cinch	173	71000, 72000
	174	71000, 72000
	140	76000, 77000
	164	76000, 77000
	240	76000, 77000
	141	78000
	241	78000
	341	78000
Curtis	E	71000, 72000
ETC	14000	71000, 72000
	34000	71000, 72000
	27000	76000, 77000
	37000	76000, 77000
	57000	76000, 77000
	67000	76000, 77000
	28000	78000
	38000	78000
General Electric	CR151–Type D1	76000, 77000
	CR151–Type D7	76000, 77000
	CR151–Type D2	78000
Kulka	599	71000, 72000
	1590	71000, 72000
	600	76000, 77000
	600A	76000, 77000
	620A	76000
	670	76000, 77000
	670A	76000, 77000
	601	78000
	671	78000
Marathon	100	76000, 77000
	200	78000
Vernitron (Beau)	12000	71000, 72000
	14000	76000, 77000
	15000	76000, 77000
	16000	76000, 77000
	17000	76000, 77000
	18000	78000
	19000	78000

Beau Products
DIVISION OF VERNITRON CORPORATION

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TEL. (603) 524-5101

MORE BILFRO HEAVY DUTY BATTERY TERMINALS



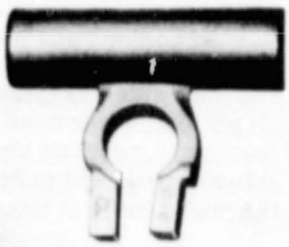


Un-retouched photo showing fusion of wire with terminal.

1. ONE PIECE CONSTRUCTION.
2. CRIMPS OR SOLDERS ON – YOUR CHOICE.
3. EXTRA DEEP FERRULE FOR BETTER CRIMP.
4. EXTREMELY HIGH CONDUCTIVITY – 95% COPPER, LESS THAN 1% LEAD.
5. DELIVERS MORE ELECTRICITY UNDER LOAD.
6. REASONABLY PRICED.
7. PROMPT DELIVERY.
8. FURNISHED WITH NUT & BOLT.
9. RESISTS UP TO 1800 POUNDS PULL-OUT WHEN CRIMPED WITH FRO-1040 TOOL.

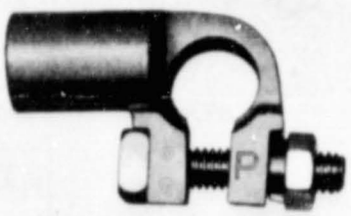


New Longer Barrel



FOR ALL HEAVY DUTY APPLICATIONS
– Trucks – Busses – Lift Trucks – Maintenance – Marine –
– Stationary Engines – OFF Road Equipment – etc. –

TWELVE SIZES	WIRE SIZE	POST TYPE
HDBT – 6U	6 universal	
HDBT – 4U	4 universal	
HDGT – 1 & 2/P	1 and 2	Positive
HDBT – 1 & 2/N	1 and 2	Negative
HDBT – 1/OP	1/O	Positive
HDBT – 1/ON	1/O	Negative
HDBT – 2/OP	2/O	Positive
HDBT – 2/ON	2/O	Negative
HDBT – 3/OP	3/O	Positive
HDBT – 3/ON	3/O	Negative
HDBT – 4/OP	4/O	Positive
HDBT – 4/ON	4/O	Negative



Closed End Elbow Terminals For Series Batteries

EL–1/OP	Positive
EL–1/ON	Negative
EL–2/OP	Positive
EL–2/ON	Negative

90° RIGHT ANGLE TYPE

RA – 1/OP Positive
RA – 1/ON Negative
RA – 2/OP Positive
RA – 2/ON Negative
RA – 3/OP Positive
RA – 3/ON Negative

FRO-1040 Crimping Tool



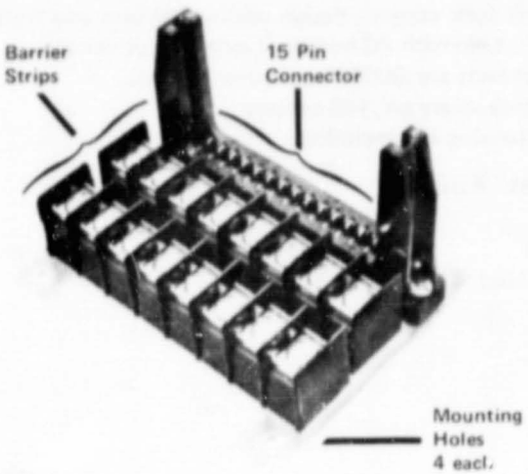
A BILFRO, CORP. PRODUCT
P. O. Box 39265
Solon, Ohio 44139
Phone: 216/248-0729

MODEL 2005 INTERFACE MOUNTING KIT

CALEX

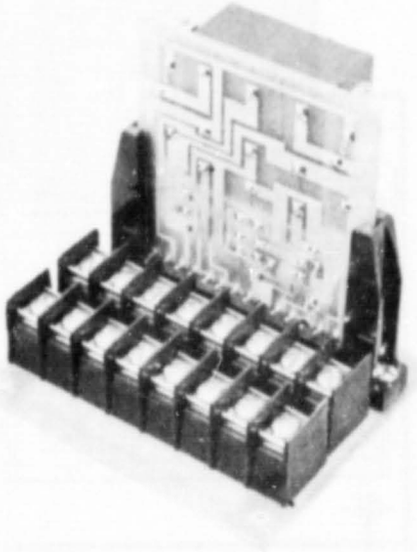
FEATURES

- The Model 2005 is constructed on 1/16" printed circuit material.
- The barrier strip terminals are of the "clamp" type. This type of terminal offers the advantage of applying a clamping pressure to the wires, terminals or quick connect fittings rather than a twisting motion usually found in most standard strips.
- Standoffs can be easily swaged into PC board.
- 15 pin connector provides card guides for extra stability.



DESCRIPTION

The Model 2005 INTERFACE has been designed to provide quick, easy connection between printed circuit cards and wired electrical circuits. Circuit boards or card mounted modules slide into the 15 pin connector. Wiring is done via the barrier terminal strips. Connector pins and barrier strip terminals are connected via paths on the printed circuit boards.



APPLICATIONS

- Use where "plug-in" convenience of p.c. card mounted electronic circuits or modules are to be combined with semi-permanent electrical wiring.
- Use to add small control elements to existing installations. e.g. Add an amplifier to industrial recorder by mounting 2005 directly in the recorder case.
- Use to easily combine several p.c. card circuits or modules, power supply etc., into a compact system without requiring racks etc.
- Use in industrial plants where interchange of several modules is required for rapid change of calibration in a test or control circuit.

CALEX MFG. CO., INC., 3355 Vincent Road, Pleasant Hill, CA 94523 Telephone (415) 932-3911

MODEL 2005 INTERFACE MOUNTING KIT

SPECIFICATIONS

Printed Circuit card:
1/16" fiberglass epoxy G-10

15 Pin Connector:
Tuning fork contact design assures uniform and firm contact action, even with PC boards at extremes of thickness.
Contacts are .00002" gold over copper.
Contacts are on .156 centers.
Polarizing key included.

Weight: 4 oz.

Price: each (attractive quantity and OEM discount available.) F.O.B. Factory.

Barrier terminal strips (2):
Eight terminals per strip. Terminals on 3/8" centers.

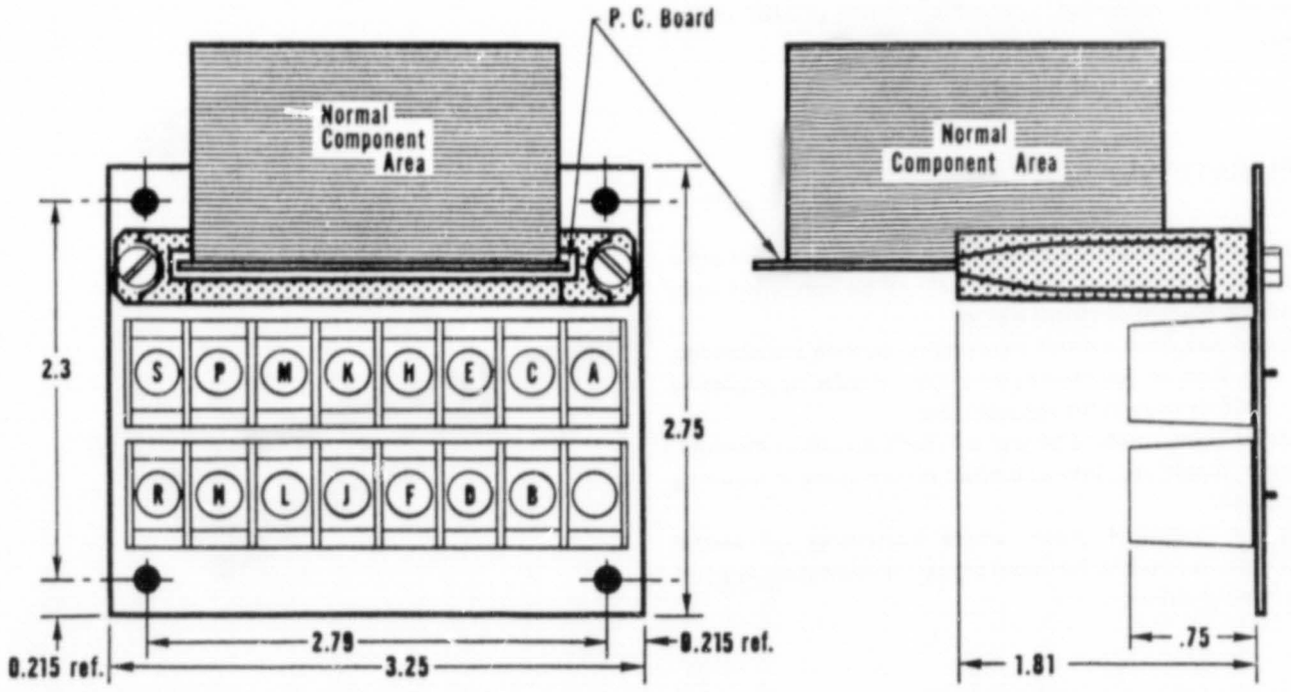
Extra high barriers with No. 6 screws for 20 amp 300 volt ratings normally associated with larger strips.

Loads of room for ring or spade wire lugs to 5/16" wide—no need for special lugs for barrier use.

Screw and clamp plate for retaining uninsulated wire can eliminate need for wire lugs.

Shatterproof polypropylene.

MODULE DIMENSIONS



CALEX MFG. CO., INC., 3355 Vincent Road, Pleasant Hill, CA 94523 Telephone (415) 932-3911

CABLE TERMINALS

Heavy duty copper cable terminals provide convenient connections and excellent conductivity. All will fit a 5/16" stud or bolt.



Part No.	Description	Gauge
22-024-200	Cable Term	4, 2
22-100-200	Cable Term	1
22-200-200	Cable Term	2/0

BATTERY TERMINALS



Quality universal battery terminals fit both positive and negative posts. In addition, they will fit any cable size from 4 Ga to 2/0. Manufactured from lead alloy with steel thread inserts to prevent stripping.

21-888-200 Universal Battery Terminal

ELECTRIC VEHICLE COMPONENTS
FLIGHT SYSTEMS
HEADQUARTERS
P.O. BOX 25, MECHANICSBURG, PA 17055
PHONE (717) 697-0333

Type PK-2 Test Blocks and Plugs

APPLICATION

For mounting on switchboard panels for use in conjunction with proper test equipment to facilitate the testing of a-c instruments, meters, and relays.

FEATURES

Type PK-2 test blocks are essentially 4-pole and 6-pole jacks, provided with molded Textolite covers that have internal plug contacts, which make a through connection when the cover is in place. The contacts in the blocks are of the line-pressure type and provide positive contact with minimum contact resistance. For all current circuits auxiliary contacts are used which automatically short circuit the current transformer when the cover, or plug, is removed.

The test plugs, provided with studs and links, can be permanently connected to the testing equipment for any of the various test methods in use.

Routine testing can be accomplished simply by removing the cover and substituting the properly connected test plug; normal connections are restored by replacing the cover.



(Photo 851894)
Fig. 1. 4-pole block with cover



(Photo 851891)
Fig. 2. 4-pole test plug

Contact rating is 250 volts, 10 amperes continuously.

EXPLANATION OF LISTING

The Cat. No. for each form of block includes the PK-2 block and cover, with a set of **unmounted** auxiliary contacts, jumpers, and screws in sufficient variety and quantity to provide the combinations to suit a variety of applications.

PRICES

Type PK-2 Test Blocks with Covers

FOUR-POLE				SIX-POLE			
Catalog No. *†		Net Price Each *	Net Wt in Lb	Catalog No. *		Net Price Each *	Net Wt in Lb
Surface Mounting on 1-, 1½-, 2-in. Panels (Fig. 3 and 5)	Semiflush Mounting on ⅛-in. Panels or Surface Mounting on ⅛- to ½-in. Panels (Fig. 3 and 6 or 7)			Surface Mounting on 1-, 1½-, 2-in. Panels (Fig. 4 and 5)	Semiflush Mounting on ⅛-in. Panels or Surface Mounting on ⅛- to ½-in. Panels (Fig. 4 and 6 or 7)		
6422120G1	6422120G3	Refer to nearest General Electric Sales Office	2	6422120G2	6422120G4	Refer to nearest General Electric Sales Office	3

* Auxiliary contacts, jumpers, screws, mounting screws, and bushings, as required, included in Cat. No. and price.
† Stock in the Philadelphia Works warehouse.

Test Plugs (Fig. 2 and 8)

FOUR-POLE			SIX-POLE		
Catalog No.	Net Price	Net Wt in Lb	Catalog No.	Net Price	Net Wt in Lb
6129533G1	Refer to nearest General Electric Sales Office	1¼	6129533G2	Refer to nearest General Electric Sales Office	1¼

DIMENSIONS (subject to change and not to be used for construction without approval.)

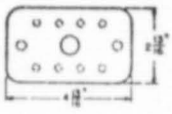


Fig. 3. 4 Pole

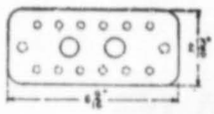


Fig. 4. 6 Pole

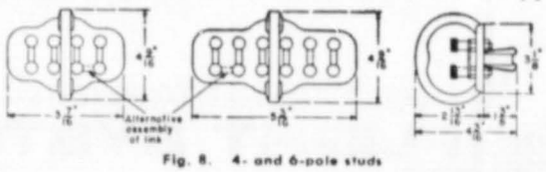


Fig. 8. 4- and 6-pole studs



Fig. 9. Semi-flush mounting, steel panel only

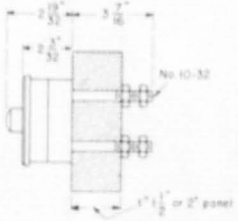


Fig. 5. 4- or 6-pole surface mounted on 1- to 2-in. panel

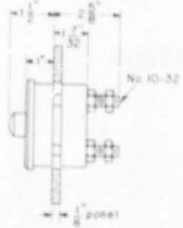


Fig. 6. Semiflush mounted on ⅛-in. panel

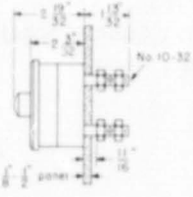


Fig. 7. Surface mounted on ⅛- to ½-in. Panel

GENERAL ELECTRIC COMPANY
POWER SYSTEMS MANAGEMENT PRODUCTS DEPARTMENT
PHILADELPHIA, PENNA. 19142

Type EB-5 and EB-6 Fabricated Terminal Boards

Rating: 30 amperes continuous, 600 volts

APPLICATION

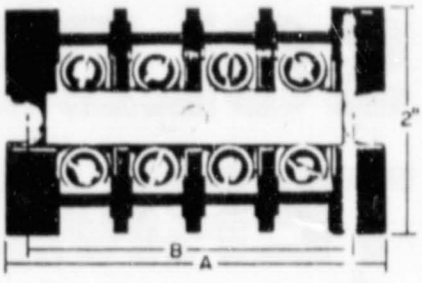
Where leads are brought to any part for permanent or temporary connection, especially if many wires are involved.

DESCRIPTION

The Type EB-5 are fabricated terminal boards. Each is equipped with the necessary washer head binding screws for circuit wire connections, and also a white marking strip for circuit identification (see notes a and b below). To mount, drill for No. 10 screw. Board will accommodate wires size No. 18 to No. 10 inclusive.

The Type EB-6 are fabricated terminal boards of the same construction and dimensions as the Type EB-5, except that clamp type connectors are furnished for circuit wire connections. Boards will accommodate wires No. 18 to No. 10 inclusive.

Boards with short-circuit strips are available with 2 to 12 points; without short-circuit strips from 2 to 18 points.



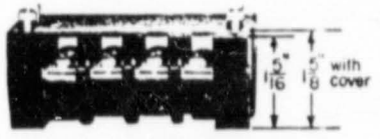
(Photo 8020488)

Fig. 1. 4-pole board Type EB-5 without short-circuit strips, Cat. 6422482G4



(Photo 8010542)

Fig. 2. 4-pole board Type EB-5 with 4 short-circuit strips, Cat. 0165A6145G2



(Photo 8010380)

Fig. 3. 4-pole terminal board, Type EB-6, with hinged cover in place, Cat. 6422494G104

PRICING INFORMATION

No. of Circuits	Board Without Cover: Catalog No.	Marking Strip: W	B	B&W	Net Price $ea.	50 or More	Board With Cover: Catalog No.	Marking Strip: W	B	B&W	Net Price $ea.	50 or More	Approx Ship. Wt in Lb Each	Dimensions in Inches Fig. 1, 2 and 3: A	B
EB-5 WITH WASHER-HEAD SCREWS (FIG. 1)															
2	6422482G2	G202	G402				6422494G2	G202	G402				¾	2	1 5/8
3	6422482G3	G203	G403				6422494G3	G203	G403				¾	2 5/8	2 ¼
4	6422482G4✚	G204	G404				6422494G4✚	G204	G404				¾	3 ¼	2 5/8
5	6422482G5	G205	G405				6422494G5	G205	G405				¾	3 5/8	3 ½
6	6422482G6✚	G206	G406				6422494G6✚	G206	G406				1	4 ½	4 1/8
7	6422482G7	G207	G407				6422494G7	G207	G407				1	5 1/8	4 ¾
8	6422482G8✚	G208	G408	Refer to			6422494G8✚	G208	G408	Refer to			1	5 ¾	5 5/8
9	6422482G9	G209	G409	nearest			6422494G9	G209	G509	nearest			1½	6 5/8	6
10	6422482G10	G210	G410	General			6422494G10	G210	G410	General			1½	7	6 5/8
11	6422482G11	G211	G411	Electric			6422494G11	G211	G411	Electric			1½	7 5/8	7 ¼
12	6422482G12✚	G212	G412	Sales			6422494G12✚	G212	G412	Sales			2	8 ¼	7 5/8
13	6422482G13	G213	G413	Office			6422494G13	G213	G413	Office			2	8 5/8	8 ½
14	6422482G14	G214	G414				6422494G14	G214	G414				2½	9 ½	9 1/8
15	6422482G15	G215	G415				6422494G15	G215	G415				2½	10 1/8	9 ¾
16	6422482G16	G216	G416				6422494G16	G216	G416				2½	10 ¾	10 5/8
17	6422482G17	G217	G417				6422494G17	G217	G417				3	11 5/8	11
18	6422482G18	G218	G418				6422494G18	G218	G418				3	12	11 5/8
EB-6 WITH PRESSURE TYPE CONNECTORS (FIG. 3)															
2	6422482G102	G302	G502				6422494G102	G302	G502				¾	2	1 5/8
3	6422482G103	G303	G503				6422494G103	G303	G503				¾	2 5/8	2 ¼
4	6422482G104✚	G304	G504				6422494G104✚	G304	G504				¾	3 ¼	2 5/8
5	6422482G105	G305	G505				6422494G105	G305	G505				¾	3 5/8	3 ½
6	6422482G106✚	G306	G506				6422494G106✚	G306	G506				1	4 ½	4 1/8
7	6422482G107	G307	G507				6422494G107	G307	G507				1	5 1/8	4 ¾
8	6422482G108✚	G308	G508	Refer to			6422494G108✚	G308	G508	Refer to			1	5 ¾	5 5/8
9	6422482G109	G309	G509	nearest			6422494G109	G309	G509	nearest			1½	6 5/8	6
10	6422482G110	G310	G510	General			6422494G110	G310	G510	General			1½	7	6 5/8
11	6422482G111	G311	G511	Electric			6422494G111	G311	G511	Electric			1½	7 5/8	7 ¼
12	6422482G112✚	G312	G512	Sales			6422494G112✚	G312	G512	Sales			2	8 ¼	7 5/8
13	6422482G113	G313	G513	Office			6422494G113	G313	G513	Office			2	8 5/8	8 ½
14	6422482G114	G314	G514				6422494G114	G314	G514				2½	9 ½	9 1/8
15	6422482G115	G315	G515				6422494G115	G315	G515				2½	10 1/8	9 ¾
16	6422482G116	G316	G516				6422494G116	G316	G516				2½	10 ¾	10 5/8
17	6422482G117	G317	G517				6422494G117	G317	G517				3	11 5/8	11
18	6422482G118	G318	G518				6422494G118	G318	G518				3	12	11 5/8

EB-5 WITH SHORT-CIRCUIT STRIPS (FIG. 2)

	Board Without Cover		Board With Cover					
2	0165A6145G1	Refer to	0165A6145G6	Refer to	¾	2	1 5/8
4	0165A6145G2✚	nearest	0165A6145G7	nearest	¾	3 ¼	2 5/8
6	0165A6145G3✚	General	0165A6145G8	General	1	4 ½	4 1/8
8	0165A6145G4✚	Electric	0165A6145G9	Electric	1	5 ¾	5 5/8
12	0165A6145G5✚	Sales	0165A6145G10	Sales	1½	8 ¼	7 5/8
		Office		Office			

✚ Stock in Philadelphia Works Warehouse and supplied with white marking strip only.

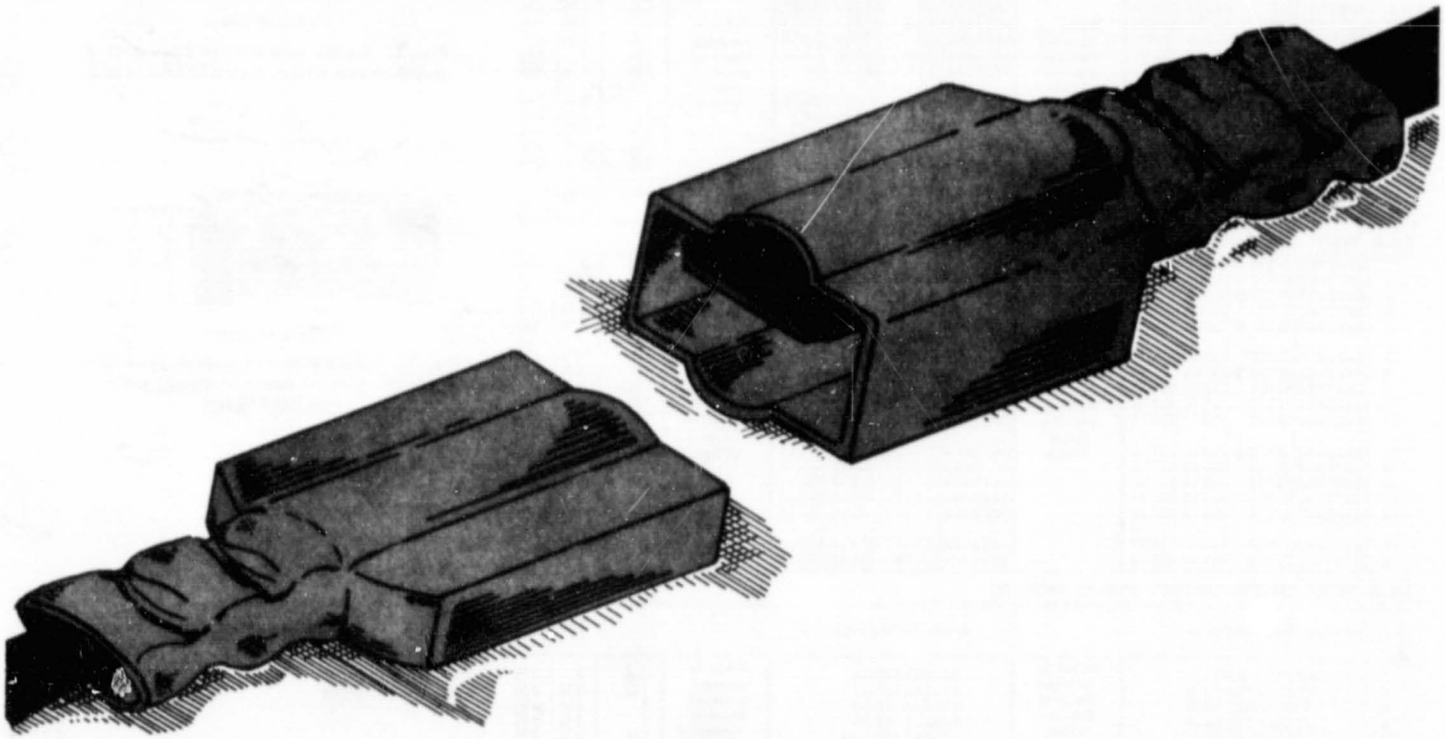
For further information, contact your nearest General Electric Sales Office

GENERAL ELECTRIC COMPANY
POWER SYSTEMS MANAGEMENT PRODUCTS DEPARTMENT
PHILADELPHIA, PENNA. 19142

GVI®

Great Valley Industries, Inc.
4 Pennsylvania Avenue
Malvern, Pennsylvania 19355

SOLDERLESS TERMINALS AND CONNECTORS



215-647-7400

Great Valley Industries, Inc.

BOX 324 • MALVERN, PENNSYLVANIA 19355 • 215-647-7400

GVI TERMINALS FEATURE:



- One piece, burr free construction for economy, mechanical strength and maximum electrical conductivity
- Beveled terminal mouth to facilitate wire insertion on bare terminals
- Funnel barrel to facilitate wire insertion on insulated terminals can be provided (available on nylon insulated terminals with insulation support in mid 1980)
- Multiple "V" grooves for maximum holding power and minimum contact resistance
- Constructed from pure electrolytic copper, annealed to guard against breaking due to vibration and bending
- Uniform electro-tin plating, for maximum corrosion protection
- Full ¼" long barrel provides extra length for fast, easy location when crimping
- Wire ranges clearly marked on all terminals
- UL & CSA listings available where applicable

GVI PART NUMBER BREAKDOWN

C 1614 - 10R

BARREL CODE

BS	Bare Butted Seam
B	Bare Brazed Seam
EB	Bare With Insulation Support
C	Vinyl Insulated
NC	Nylon Insulated
PC	Nylon Insulated With Insulation Support

WIRE RANGE

Sizes of wire that can be used with an individual terminal, in this case both 16 gauge and 14 gauge.

STUD SIZE

(Where applicable) Size of screw that should be used to connect terminal.

END CODE

(Denotes type of terminal)

R	= [illegible]
RS	= [illegible] Small Pattern
RV	= Ring, Mid[illegible]rn
RIS	= [illegible] Ring
S	= [illegible]
SN	= [illegible] Narrow (Block Spade)
SNI	= [illegible] row, Small Pattern
SS	= Snap [illegible]de
F	= Spade with Flange
H	= Hook
SC	= Stop Connector
SCS	= Stop Connector, Seamless
HC	= Horizontal Connector
FF	= Female Quick Connect
FM	= Male Quick Connect
SP	= Male Snap Plug
SL	= Female Snap Plug Receptacle
DEC	= Dead End Connector

This is a list of only the most common terminal types. There are many more listed in this catalog. If you don't see what you want in here, contact the home office or your local GVI representative for assistance.

Basic dimensions in this catalog may vary due to availability or design changes.

GVI®

Great Valley Industries, Inc.

BOX 324 • MALVERN, PENNSYLVANIA 19355 • 215-647-7400

solder lugs



FEATURES:

- Heavy duty lugs flared for easy wire insertion
- Highest grade electrolytic copper
- Fully annealed for easy secure crimping
- Bright dip finish

HEAVY DUTY LUGS FOR CRIMP OR SOLDER APPLICATION

PART NO.	WIRE SIZE	STUD SIZE "A" Inches	LENGTH "B" Inches	WIDTH OF PAD "C" Inches	CLEARANCE "D" Inches	BARREL O.D. "E" Inches	BARREL I.D. "F" Inches	AMP CAPACITY
SL10-8R SL10-10R	10	5/32 (8) 3/16 (10)	.941 .941	.27 .27	.25 .25	.187 .187	.136 .136	25 25
SL8-10R SL8-1/4R	8	3/16 (10) 1/4	1.03 1.03	.38 .38	.28 .28	.250 .250	.186 .186	35 35
SL6-10R SL6-1/4R SL6-5/16	6	3/16 (10) 1/4 5/16	1.218	.438	.344	.312	.232	50
SL4-10R SL4-1/4R SL4-5/16R SL4-3/8R	4	3/16 (10) 1/4 5/16 3/8	1.344	.531	.406	.375	.286	70
SL2-1/4R SL2-5/16R SL2-3/8R SL2-1/2R	2	1/4 5/16 3/8 1/2	1.50	.625	.406	.437	.336	90
SL1-1/4R SL1-5/16R SL1-3/8R SL1-1/2R	1	1/4 5/16 3/8 1/2	1.563	.625	.406	.465	.360	100
SL1/0-1/4R SL1/0-5/16R SL1/0-3/8R SL1/0-1/2R	1/0	1/4 5/16 3/8 1/2	1.750	.703	.406	.515	.407	125
SL2/0-1/4R SL2/0-5/16R SL2/0-3/8R SL2/0-1/2R	2/0	1/4 5/16 3/8 1/2	2	.813	.500	.570	.461	150
SL3/0-1/4R SL3/0-5/16R SL3/0-3/8R SL3/0-1/2R	3/0	1/4 5/16 3/8 1/2	2.125	.906	.500	.630	.511	175
SL4/0-1/4R SL4/0-5/16R SL4/0-3/8R SL4/0-1/2R	4/0	1/4 5/16 3/8 1/2	2.281	1	.531	.690	.559	225
SL250-5/16R SL250-3/8R SL250-1/2R	250 MCM	5/16 3/8 1/2	2.625	1.188	.625	.815	.685	250
SL400-3/8R	400 MCM	3/8	3.375	1.406	.875	.937	.776	400

Great Valley Industries, Inc.

BOX 324 • MALVERN, PENNSYLVANIA 19355 • 215-647-7400

solderless terminals

HEAT RESISTANT TERMINALS

All GVI Heat Resistant Terminals are manufactured from alloy steel and nickel plated to resist corrosion at continuous service at 900°F (480°C).

Wire Range	Stud Size	Width W	Clearance C	Length L	PART NO.
22-18	6	.25	.23	.60	BS2218-6RSHR
22-18	10	.33	.29	.70	BS2218-10RHR
22-18	1/4	.57	.40	.94	BS2218-1/4RHR
22-18	10	.34	.29	.70	BS2218-10SHR
22-18	6	.30	.25	.65	BS2218-6SNHR
16-14	6	.25	.23	.60	BS1614-6RSHR
16-14	10	.33	.29	.70	BS1614-10RHR
16-14	1/4	.57	.40	.94	BS1614-1/4RHR
16-14	10	.34	.29	.70	BS1614-10SHR
16-14	6	.30	.25	.65	BS1614-6SNHR
12-10	6	.38	.29	.73	BS1210-6RHR
12-10	10	.38	.29	.73	BS1210-10RHR
12-10	1/4	.61	.44	.99	BS1210-1/4RHR
12-10	3/8	.61	.44	.99	BS1210-3/8RHR
12-10	10	.38	.29	.73	BS1210-10SHR
8	1/4	.47	.38	.95	BS8-1/4RWHR
6	3/8	.63	.54	1.22	BS6-3/8RHR
4	3/8	.68	.44	1.33	BS4-3/8RHR

RING



SPADE



SPADE NARROW



STOP CONNECTOR



FEMALE QUICK CONNECT



MALE QUICK CONNECT



FEMALE FLAG QUICK CONNECT



STOP CONNECTORS

Wire Range	Length L	PART NO.
22-18	.56	BS2218-SCHR
16-14	.56	BS1614-SCHR
12-10	.56	BS1210-SCHR

QUICK CONNECT TERMINALS

Wire Range	Tab Thickness	Tab Width	Length L	PART NO.
20-14	.030	.250	.81	OB2014-FFHR
18-14	.030	.250	.64	BS1814-FFHR
18-14	.016	.187	.47	BS1814-FFJRHR
20-14	.030	.250	.88	OB2014-FMHR
18-14	.030	.250	.73	BS1814-FMHR
18-14	.016	.187	.50	BS1814-FMJRHR
18-14	.030	.250	.51	BS1814-FLFHR

.250 ADAPTERS



FMA



FMA-P



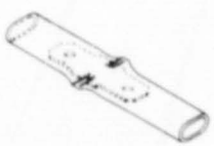
FMA-RA



MFM



FMF-HA



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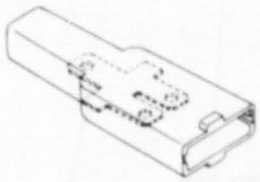

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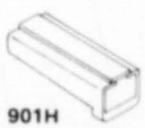
.250 TERMINALS AND HOUSINGS



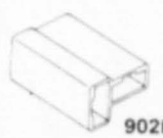
900B



BS1814-FML



901H



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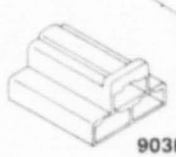
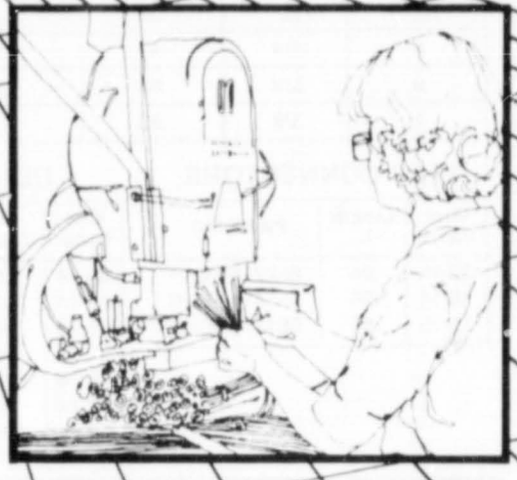


903H

POWER TO MOVE A CHANGING WORLD

When we talk about CUSTOM WIRING, we mean just that. We have machines which automatically cut, strip, solder, terminate and code wire to meet your specs. We can offer you specialized termination for the low volume items, or quantities in the thousands.
During the entire process, quality checks are built into each step of cutting, terminating and assembly, to make sure the product meets IH's tough standards, as well as your own.





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OEM Sales

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K-D TOOLS®
K-D MANUFACTURING COMPANY
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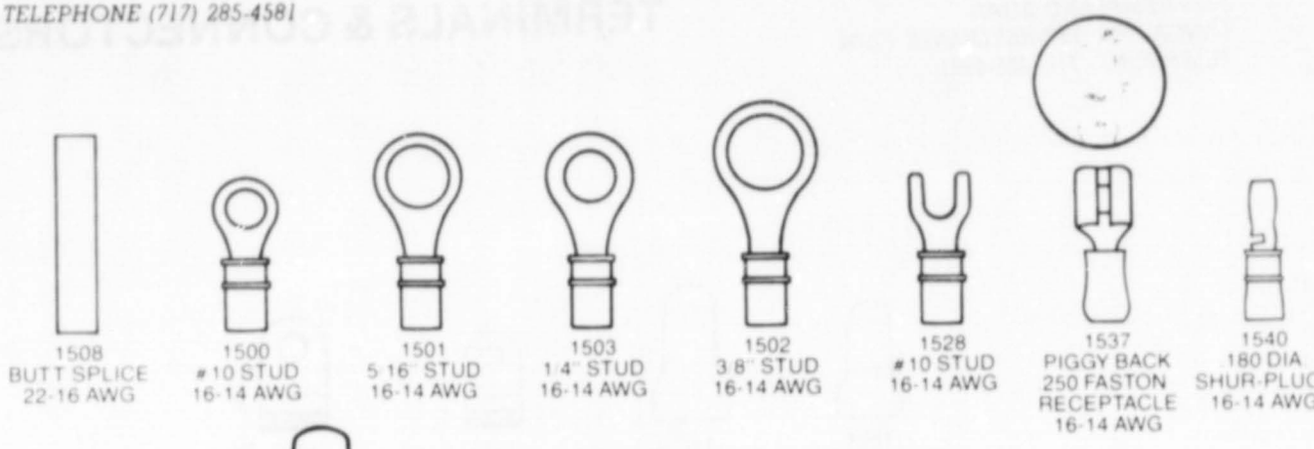
LANCASTER, PENNSYLVANIA 17604
TELEPHONE (717) 285-4581

AUTOMOTIVE ELECTRICAL TERMINALS & CONNECTORS



1508
BUTT SPLICE
22-16 AWG

1500
#10 STUD
16-14 AWG

1501
5/16" STUD
16-14 AWG

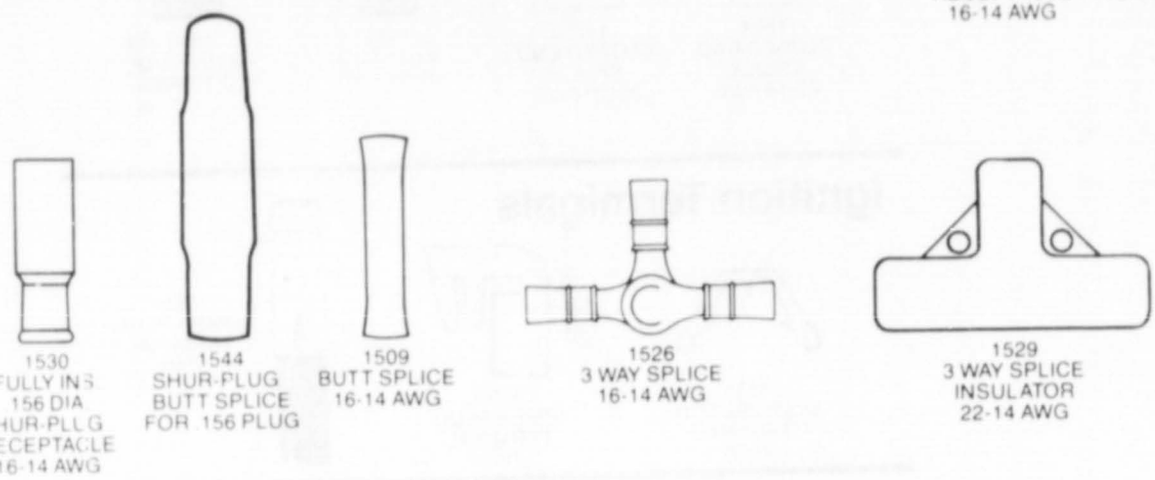
1503
1/4" STUD
16-14 AWG

1502
3/8" STUD
16-14 AWG

1528
#10 STUD
16-14 AWG

1537
PIGGY BACK
250 FASTON
RECEPTACLE
16-14 AWG

1540
.180 DIA
SHUR-PLUG®
16-14 AWG



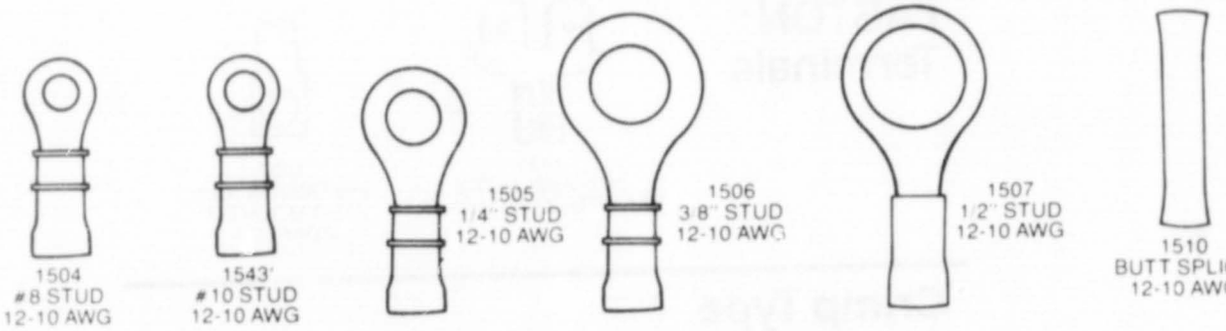
1530
FULLY INS.
.156 DIA
SHUR-PLUG
RECEPTACLE
16-14 AWG

1544
SHUR-PLUG
BUTT SPLICE
FOR .156 PLUG

1509
BUTT SPLICE
16-14 AWG

1526
3 WAY SPLICE
16-14 AWG

1529
3 WAY SPLICE
INSULATOR
22-14 AWG



1504
#8 STUD
12-10 AWG

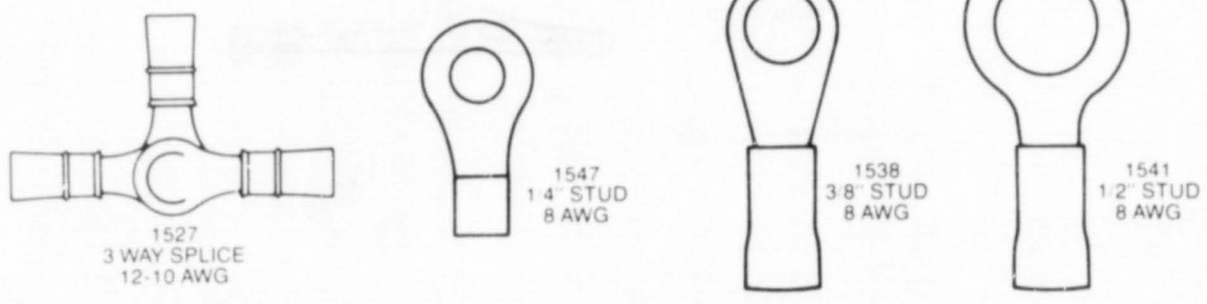
1543
#10 STUD
12-10 AWG

1505
1/4" STUD
12-10 AWG

1506
3/8" STUD
12-10 AWG

1507
1/2" STUD
12-10 AWG

1510
BUTT SPLICE
12-10 AWG



1527
3 WAY SPLICE
12-10 AWG

1547
1/4" STUD
8 AWG

1538
3/8" STUD
8 AWG

1541
1/2" STUD
8 AWG

K-D TOOLS®
K-D MANUFACTURING COMPANY
3575 HEMPLAND ROAD
LANCASTER, PENNSYLVANIA 17604
TELEPHONE (717) 285-4581

AUTOMOTIVE ELECTRICAL TERMINALS & CONNECTORS



1524
CLOSED END
SPLICE
22-14 AWG



1525
CLOSED END
SPLICE
22-10 AWG



1545
#10 STUD
16-14 AWG



1546
#10 STUD
12-10 AWG

Ignition Terminals



1535
DISTRIBUTOR
TERMINAL
7mm



1539
SPARK PLUG
TERMINAL
7mm



1534
SPARK PLUG
TERMINAL
7mm

Uninsulated FASTON* Terminals



1533
250 FASTON TAB
RECEPTACLE ADAPTOR



1532
250 FASTON TAB
STUD MOUNTED
ADAPTOR

Crimp Type Alligator Clips

INSULATED
22-16 AWG
1536

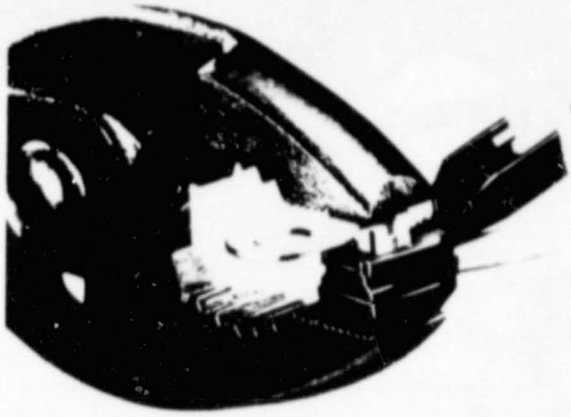


*Trademark of AMP Incorporated

K-D TOOLS®
K-D MANUFACTURING COMPANY
3575 HEMPLAND ROAD
LANCASTER, PENNSYLVANIA 17604
TELEPHONE (717) 285-4581

AUTOMOTIVE ELECTRICAL TERMINALS & CONNECTORS

Plyr-Tap Terminals and Butt Splice

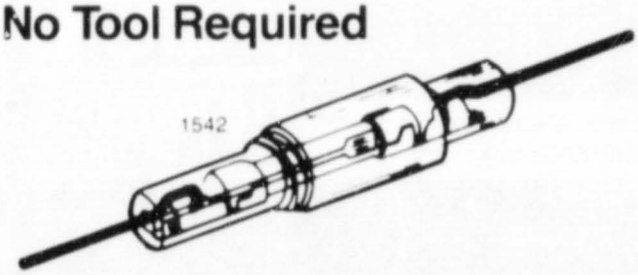


	MULTI-STUD	SPADE	250 FASTON® TAB	187 FASTON® RECEPTACLE	250 FASTON® RECEPTACLE	BUTT SPLICE
PART NO.	1517	1519	1515	1511	1513	1531
WIRE SIZE	22-18	22-18	22-18	22-18	22-18	16-14
STUD SIZE	6-8-10	#10	—	—	—	—
PART NO.	1518	1520	1516	1512	1514	
WIRE SIZE	16-14	16-14	16-14	16-14	16-14	
STUD SIZE	6-8-10	#10	—	—	—	

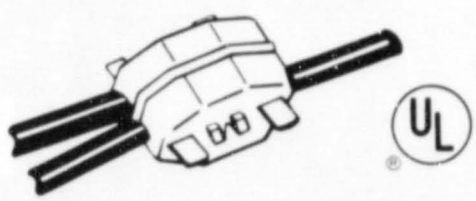
In-Line Fuse Holder

32 VOLT. 24-14 AWG. FOR FUSE .250 DIA. — .625-1.25 L

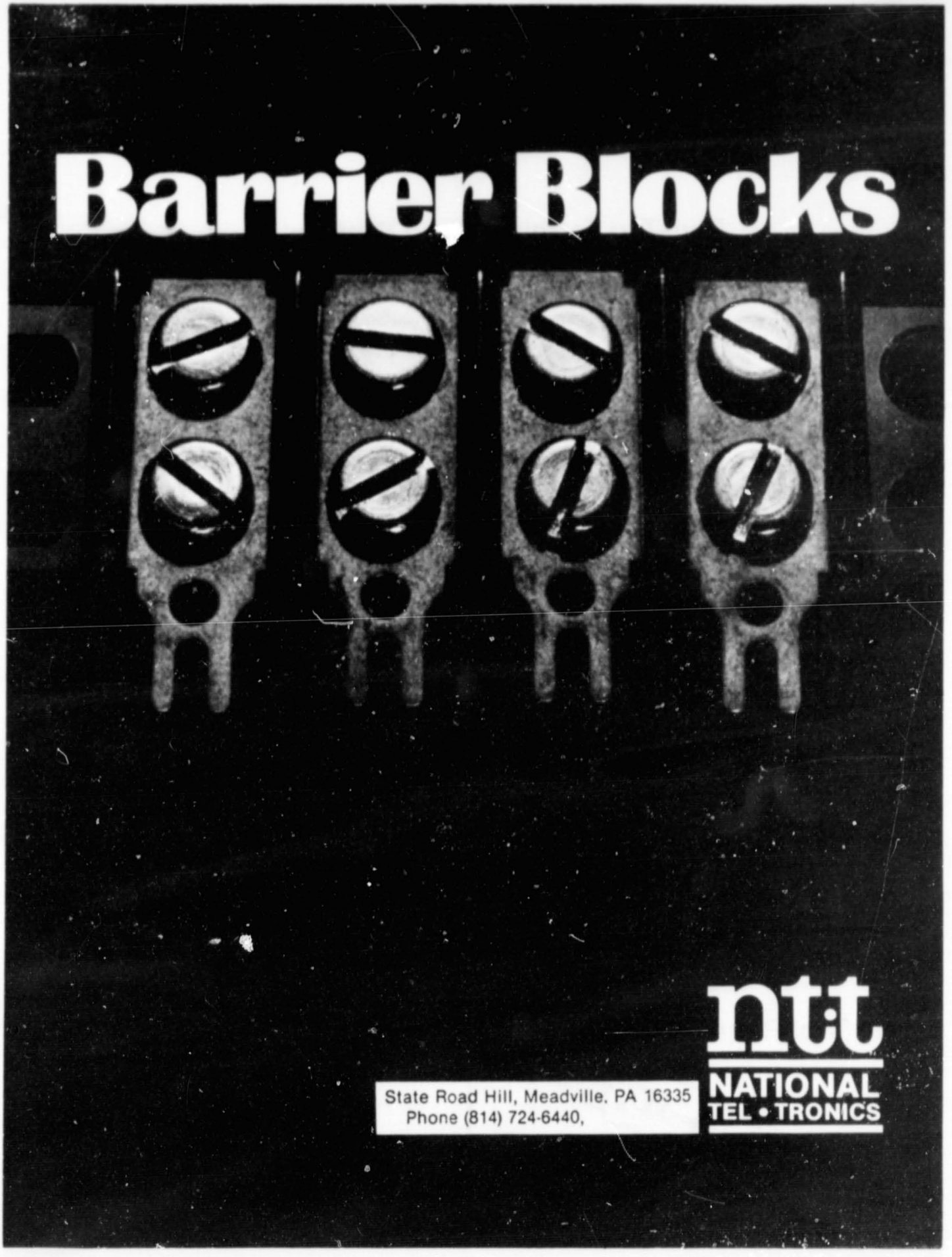
No Tool Required



ELECTRO TAP® Connectors



1522 — 22-18 AWG (RED)
1521 — 18-14 AWG (BLUE)
1523 — 12-10 AWG (YELLOW)


Barrier Blocks
ntt
NATIONAL
TEL • TRONICS
State Road Hill, Meadville, PA 16335
Phone (814) 724-6440,



State Road Hill, Meadville, PA 16335
Phone (814) 724-6440,

ntt
NATIONAL TELTRONICS
Division of EAD

Barrier Blocks

NATIONAL TELTRONICS has designed a complete line of high quality barrier blocks for use by equipment design engineers. These basic double row blocks are available in 3/8" and 7/16" pitch spacing with a variety of terminations to meet your needs.

FEATURES

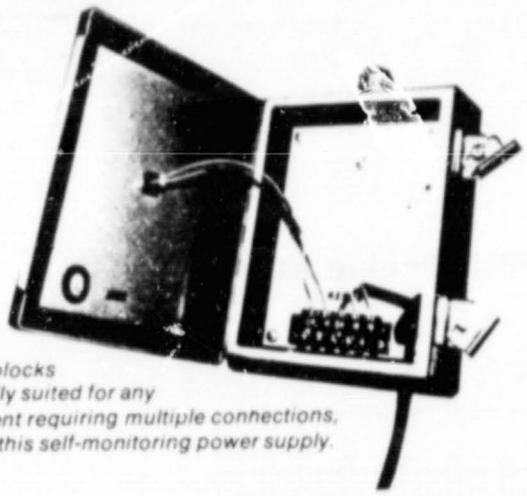
These precision molded blocks feature uniform dimensions with no exposed ends. They are made from a high strength, mineral filled insulating material for added durability. Terminals are tin plated brass or steel and are solder coated for easy soldering. Both eyelet and screw type terminations are available. Eleven terminal variations, 2 block styles and 20 lead positions offer a choice of over 400 standard configurations. Custom designs are easily produced for special applications.

SPECIFICATIONS

	Series 21	Series 22
Pitch:	3/8"	7/16"
Rated Current:	15A	20A
Rated Voltage:	750 Vdc	1000 Vdc
Screw Size:	5-40	6-32
Wire Size:	#22-16	#14-16
Terminals:	Screw type Single or double solder tab Feed thru solder tab Feed thru wire wrap (1/32" x 1/16" and .025 x .025) Quick connect tab (0 degree, 45 degree and 90 degree)	

APPLICATIONS

The applications for barrier blocks are endless and new uses are being discovered every day. Normally, the block is used to connect any circuit where one side or both consists of a flexible wire or conductor. The basic application is joining two stranded wires with a screw terminal. However, if soldering is desired, a solder tab termination provides that option. Where the application requires a feed thru, special terminals provide that capability.

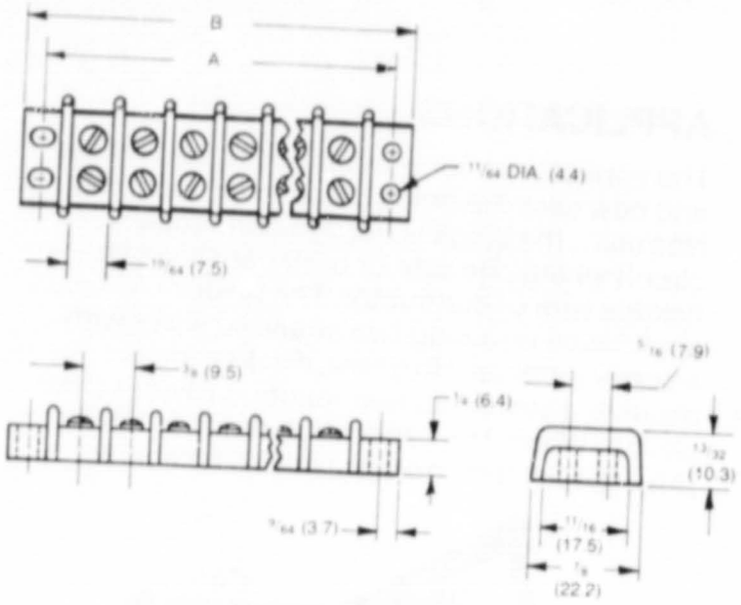


Barrier blocks are ideally suited for any equipment requiring multiple connections, such as this self-monitoring power supply.

If one of the connections needs to be wire wrapped, there are two sizes of wire wrap posts available. In some cases, it may be desirable to mount the block on a printed circuit board. Wave soldering a feed thru terminal will accomplish that connection. A quick connect tab enables you to attach or separate up to six wires per position or, in a 20 position block, a total of 120 wires can be interconnected. In short, whenever there is a requirement for a variety of terminations, we have a barrier block or can produce one to fit the job.

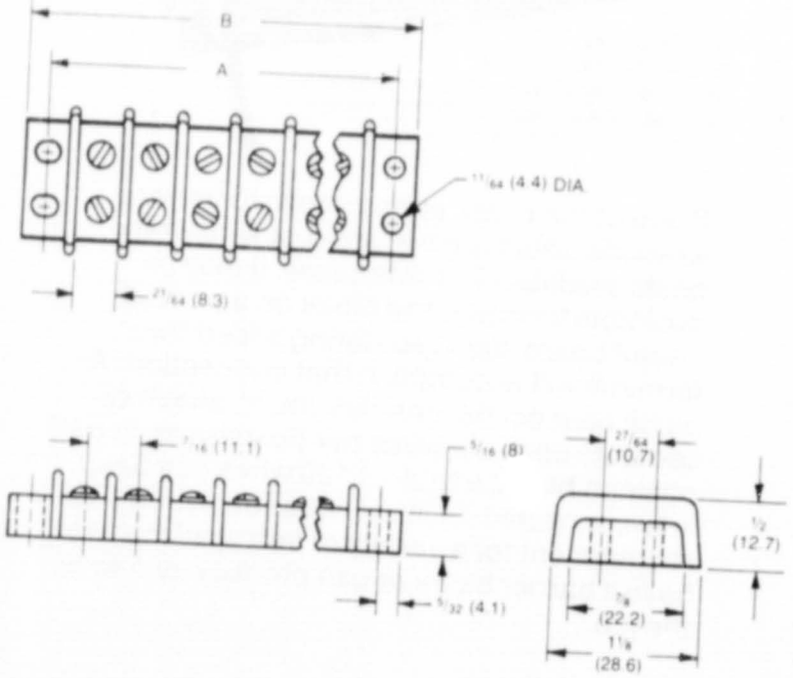
State Road Hill, Meadville, PA 16335
Phone (814) 724-6440,

3/8 Pitch Double Row



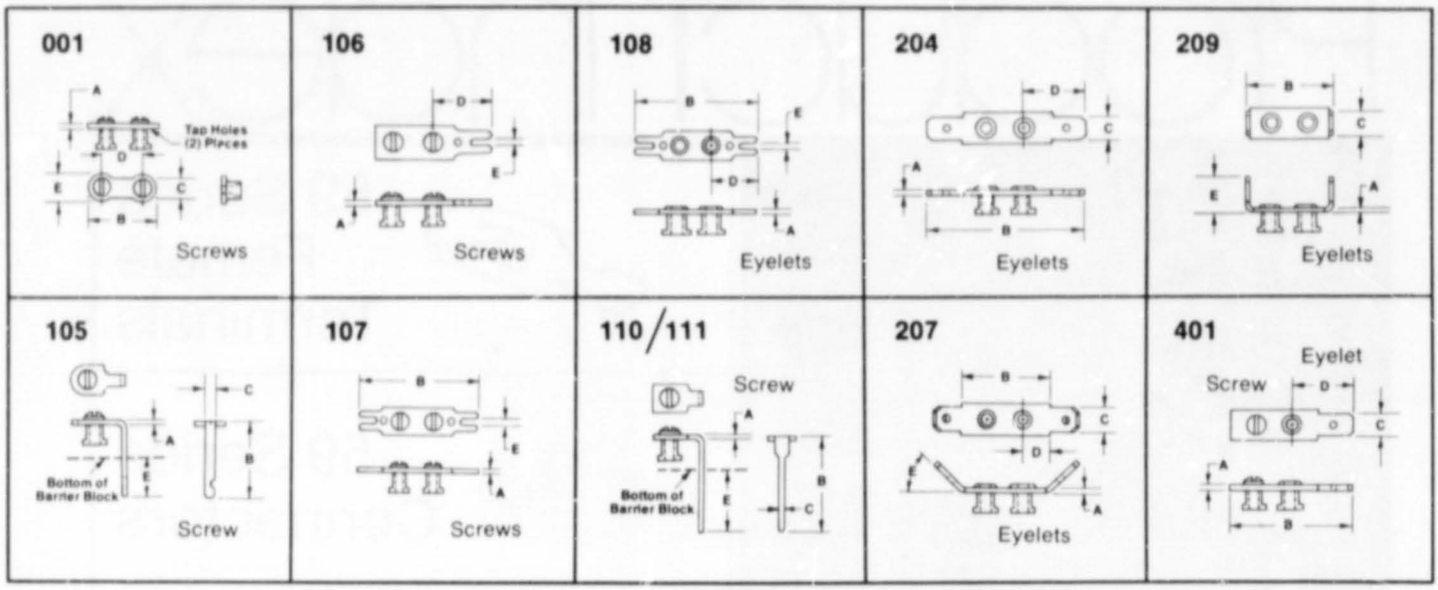
TERM	DIMENSION A FRAC.	MM	DIMENSION B FRAC.	MM
01	3/4	19.0	1 7/64	26.4
02	1 1/8	28.6	1 13/32	36.0
03	1 1/2	38.1	1 27/32	45.0
04	1 7/8	47.6	2 5/32	55.0
05	2 1/4	57.1	2 35/64	64.5
06	2 5/8	66.6	2 29/32	74.0
07	3	76.2	3 19/64	83.6
08	3 3/8	85.7	3 23/64	93.1
09	3 3/4	95.2	4 1/64	102.6
10	4 1/8	104.7	4 13/32	112.1
11	4 1/2	114.2	4 51/64	121.6
12	4 7/8	123.8	5 5/32	131.2
13	5 1/4	133.3	5 35/64	140.7
14	5 5/8	142.8	5 29/32	150.2
15	6	152.3	6 19/64	159.7
16	6 3/8	161.8	6 21/32	169.2
17	6 3/4	171.4	7 1/64	178.8
18	7 1/4	180.9	7 13/32	188.3
19	7 1/2	190.4	7 51/64	197.8
20	7 7/8	199.9	8 5/32	207.3

7/16 Pitch Double Row



TERM	DIMENSION A FRAC	MM	DIMENSION B FRAC.	MM
01	7/8	22.2	1 13/64	30.6
02	1 5/16	33.3	1 5/8	41.7
03	1 3/4	44.4	2 5/64	52.8
04	2 3/16	55.6	2 1/2	64.0
05	2 5/8	66.7	2 13/16	75.1
06	3 1/16	77.8	3 3/8	86.2
07	3 1/2	88.9	3 13/16	97.3
08	3 15/16	100.0	4 17/64	108.4
09	4 3/8	111.1	4 11/16	119.5
10	4 13/16	122.2	5 1/8	130.6
11	5 1/4	133.3	5 9/16	141.7
12	5 11/16	144.4	6 1/64	152.8
13	6 1/8	155.5	6 41/64	163.9
14	6 9/16	166.7	6 7/8	145.1
15	7	177.8	7 5/16	186.2
16	7 7/16	188.9	7 3/4	197.3
17	7 7/8	200.0	8 3/16	208.4
18	8 5/16	211.1	8 5/8	219.5
19	8 3/4	222.2	9 1/64	230.6
20	9 3/16	233.3	9 1/2	241.7

Terminals



HOW TO ORDER

Begin your purchase order with 35, which is the code number for all barrier blocks. Next, list the terminal variations of your choice by using its three digit identifier. Then specify pitch by writing 21 for 3/8" or 22 for 7/16". And finally use two digits to indicate number of terminals. Example: 35-110-22-06 would call for a 7/16" pitch block with six #110 terminals. Although we offer 400 standard configurations, you can have any combination of terminal variations so long as a drawing accompanies the order showing style and position.

Terminal Dimensions

21 Series

3/8	001	105	106	107	108	110	111	204	207	209	401
A	.031	.031	.031	.031	.031	.031	.025	.020	.020	.020	.020
B	.578	.625		1.218	1.218	.843	.843	1.375	.687	.687	1.031
C	.203	.093				.062	.025	.187	.187	.187	.187
D	.312		.453		.453			.531	.156		.531
E	.265	.328	.046	.046	.046	.703	.703		45°	.343	

22 Series

7/16	001	105	106	107	108	110	111	204	207	209	401
A	.031	.031	.031	.031	.031	.031	.025	.031	.031	.031	.031
B	.718	.781		1.578	1.578	.968	.968	1.609	.875	.875	1.250
C	.187	.125				.062	.025	.250	.250	.250	.250
D	.421		.593		.593			.593	.218		.593
E	.296	.406	.062	.062	.062	.625	.625		45°	.375	

when you need it NOW....

call National

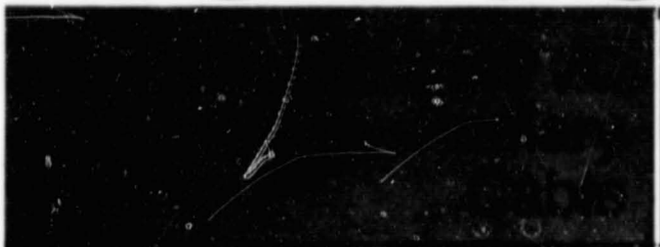
National TelTronics is making a simple promise...to give you the best in products and service. Beginning with service, we are consolidating our distributor sales division with our manufacturing plant to create a shorter supply line and improve our efficiency. We are also expanding our distributor outlets along with our product lines. Whatever it takes to bring our customers the products they need when they need them. And we're going to stake our reputation on it.

State Road Hill, Meadville, PA 16335
Phone (814) 724-6440

Packard Electric

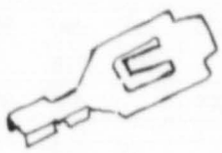
Division of General Motors Corporation
P.O. Box 431 Warren, Ohio 44486
Tel. 216-373-2633

Product Index

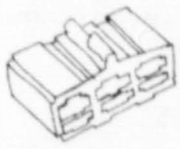




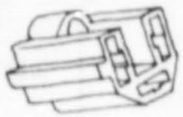



56 Series
Female
Terminals


56 Series
Male
Terminals


56 Series
Connectors


59 Series
Female
Terminals


59 Series
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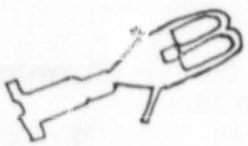
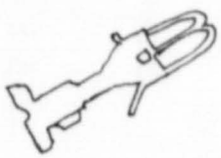
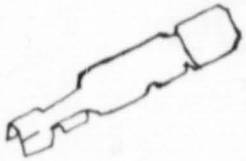
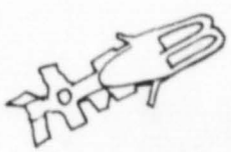

Pack Con
Female
Terminals


Pack Con
Male
Terminals


Pack Con
Female-H.D.
Terminals

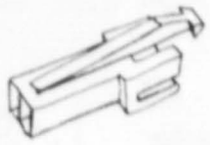
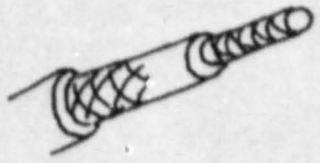
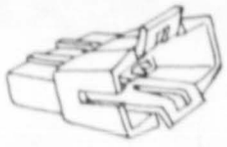
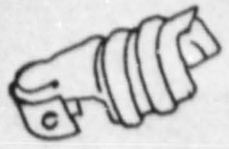
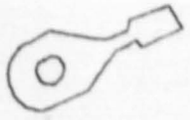
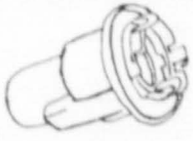

Pack Con
Male-H.D.
Terminals


Pack Con II
Female
Terminals

Packard Electric

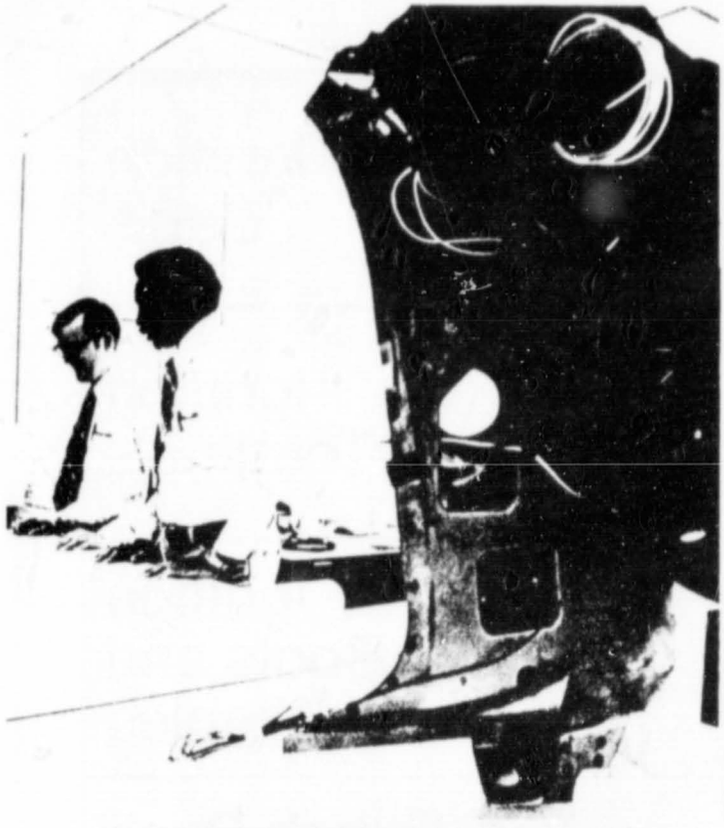
Division of General Motors Corporation
P.O. Box 431 Warren, Ohio 44486
Tel. 216-373-2633

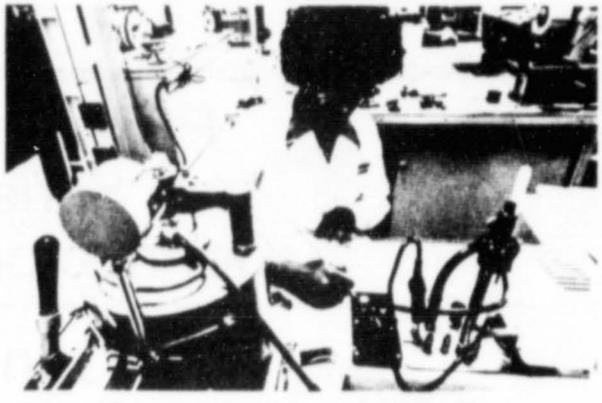
Product Index

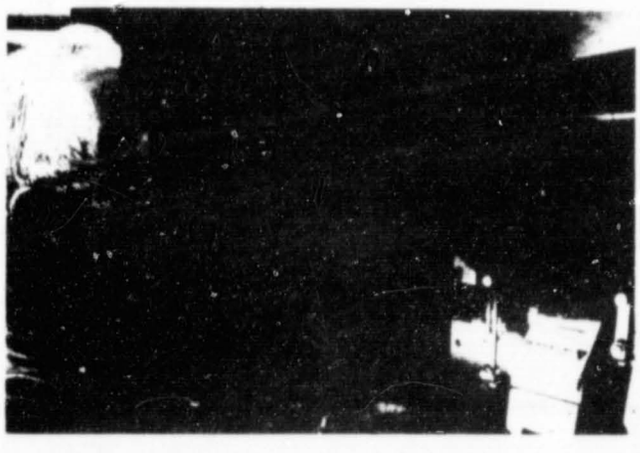
 Pack Con Series Connectors	 Ignition Cable
 Pack Con II Series Connectors	 Ignition Terminals
[redacted]	 Ignition Boots and Nipples
	 Punch-Pack Ring-Spade Terminals
 Twist Lock Lamp Sockets	 Speed-O-Matic Tooling
 Wedge Base Lamp Sockets	 Low Profile Lamp Sockets

PACKARD ELECTRIC...

remarkable capability at your call.







In engineering, in design and in manufacturing capacity, few if any producers of automotive energy distribution systems can match Packard Electric.

Or offer you the servicing, counseling, technical knowledge, and broad experience of the Packard team.

Your own task force

The task force concept gives you the best of both worlds: manufacturing, testing and engineering facilities combined with a responsive, no-red-tape capability usually found only in smaller companies.

A qualified Packard sales engineer is available to answer questions, supply additional data and provide the basis for a relationship that results in substantial savings in time, production and dollars.

Testing Facilities

When you choose Packard, you'll also acquire testing facilities that include engineering labs, a fleet of vehicles that log over a quarter of a million miles per year, and access to all General Motors proving grounds and test facilities.

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ORIGINAL PAGE IS
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PACKARD ELECTRIC...

remarkable capability at your call.









Manufacturing capacity

Judge for yourself—this is what we produce daily: 98,000 miles of drawn wire, 35 million feet of cable extrusion, 16 million metal parts, 5 million molded parts, over a million feet of conduit extrusion and 820,000 rubber parts.

We process more silicone compound than any facility in the world and annually use 58 million fuses, 5 million pounds of steel, 57 million pounds of copper, 9 million pounds of brass, 46 million pounds of plastic compounds and 53 million automotive lamps.

The engineering and manufacturing benefits of Packard Electric are myriad—and can result in substantial savings in time, production and dollars to Packard customers.

Innovation is our tradition.

Our leadership in vehicle wiring is widely acknowledged. Packard was among the first to use plastic insulation, nylon jacketing, cross-linked polyethylene and aluminum core cable in automotive applications.

We pioneered the use of electronic modules in wiring harnesses, the use of special wiring in place of block resistors, and printed circuits on mylar.

Fiber optics, High Energy Ignition wiring, side terminals for batteries, fuse blocks, convoluted conduit, high performance connectors—this is but a small sampling of the innovation, the progressiveness and leadership of Packard and its people.

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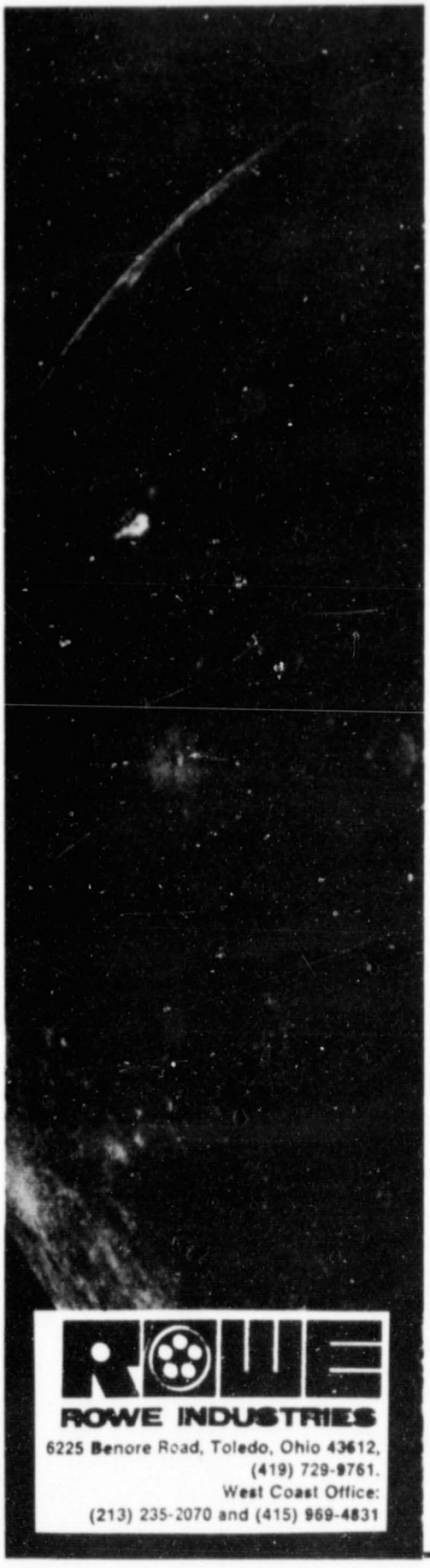
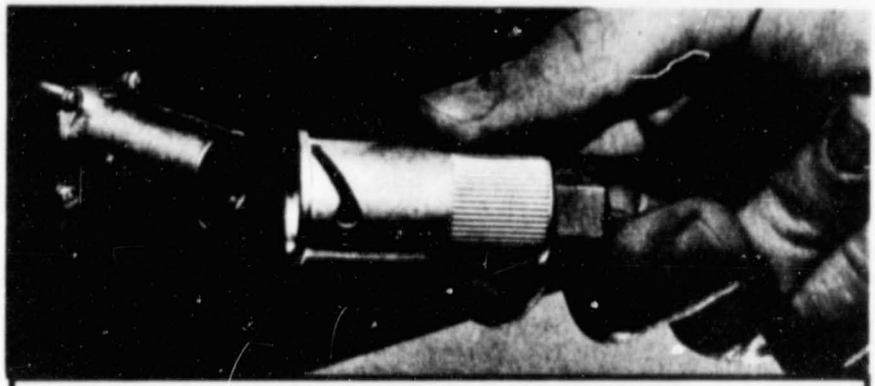


ROWE

CORONA-FREE HIGH VOLTAGE

CONNECTORS AND CABLE ASSEMBLIES



SUITABLE FOR HIGH-VOLTAGE INDUSTRIAL, COMMERCIAL AND MILITARY APPLICATIONS SUCH AS:

- Power supplies
- Radio frequency energy
- Radar installation
- Laser
- X-ray equipment and many others

MINIATURE COAXIAL high-voltage/corona-free CONNECTORS AND CABLE ASSEMBLIES

SPECIFICATIONS:

- One-third turn quick-disconnect, or Screw Coupling Styles
- Handles high voltage in restricted spaces.
- Silicone cable provides flexibility.
- No sustained corona discharge at 30 KV DC, and corona-free operation in excess of 5 KV RMS per MIL-C-17 (up to 50,000 feet in temperature range of -75° C to 175° C). Reduced ratings for field assemblies.
- Recessed contacts.
- Shielded for RFI elimination.
- Silicone dielectric throughout.
- Tapered, air-excluding interfacial seal.
- In military use, exceeds performance of OPN 9136795, 9137089, UG620/U, UG621/U, UG622/U and AF50D13798.

ROWE

ROWE INDUSTRIES

6225 Benore Road, Toledo, Ohio 43612,
(419) 729-9761.
West Coast Office:
(213) 235-2070 and (415) 969-4831

series G

Designed for use in high voltage corona-free applications, series G connectors are improved molded-on versions of UG types 180, 182, 182A/U and 264A/U representing one of the most extensive and versatile connector lines. Series G corona-free high voltage puise connectors are rated at 20 KV-DC, and 8 KV rms. at 10 amperes. They may be used at temperatures from −40° F to +250° F and at altitudes up to 50,000 feet. The G series is completely weatherproof when mated and features quick-disconnect bayonet coupling or standard screw coupling. Both coupling types employ spring contact fingers for a more positive ground circuit and greater reduction of electrical noise.

Rowe corona-free connectors and cable assemblies have been used in high voltage pulse and DC applications in airborne, marine and ground equipment for over a decade. As designers of corona detection equipment, Rowe has continually searched for, and found, better methods of combating corona discharge and its deterioration of dielectric materials in high voltage connectors and cable assemblies.

Series G connectors and cable assemblies, to be corona-free, must be factory assembled where cable ends or wire leads are molded and become an integral part of the connectors. During assembly strict quality control standards are maintained to assure the highest degree of reliability.

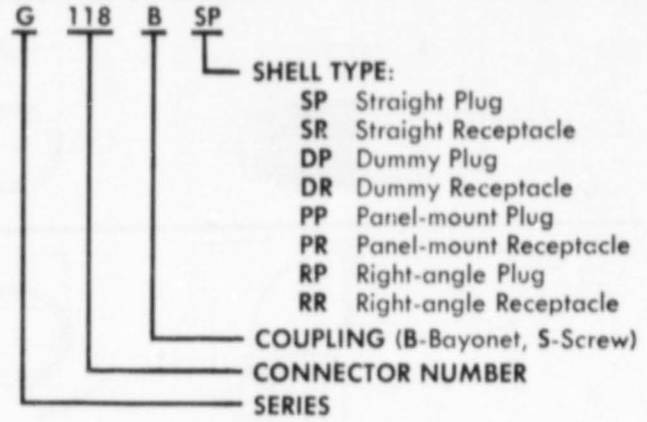
All connectors and cable assemblies shown are currently tooled for off the shelf assembly to your specific cable length requirements. Connectors with stud type terminations are also available. Variations and modifications of the G series are available upon request.

specifications

SHELL:	Brass per FED SPEC QQ-B-626 or Aluminum per FED SPEC QQ-A-268, electro tin plated
INSERT:	Neoprene per MIL-STD 417
CONTACTS:	Male . . . brass, gold plated per MIL-G 45204 Female . . . beryllium copper, gold plated per MIL-G 45204
CABLE TYPES:	RG-64A/U, RG-88/U or Wire Leads

When ordering please specify:
1. Connector types and/or termination
2. Cable type or lead wire
3. Cable or lead wire length (overall length including connectors and/or termination)

catalog number explanation

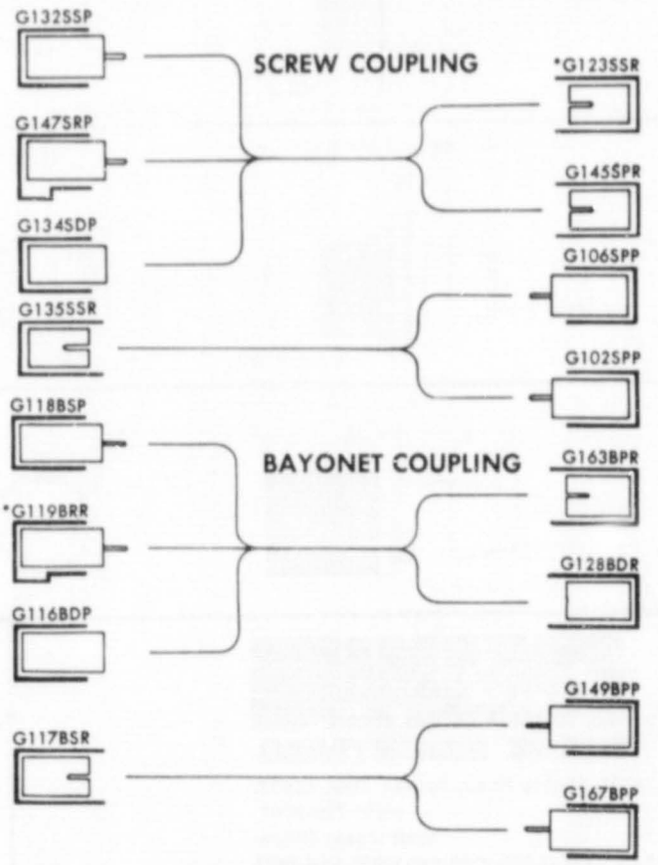


When requesting information, please furnish the following data where applicable:

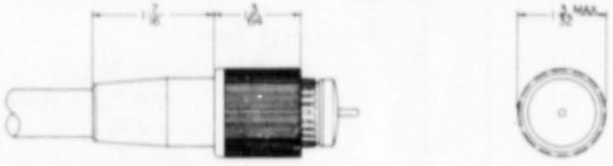
1. Corona level required
2. Environmental conditions
3. Hi-pot requirements
4. Application (AC, DC, or pulse)
5. Pulse repetition rate and duty cycle
6. Pulse risetime
7. Peak current
8. MIL spec

ROWE INDUSTRIES
6225 Benore Road, Toledo, Ohio 43612,
(419) 729-9761.
West Coast Office:
(213) 235-2070 and (415) 969-4831

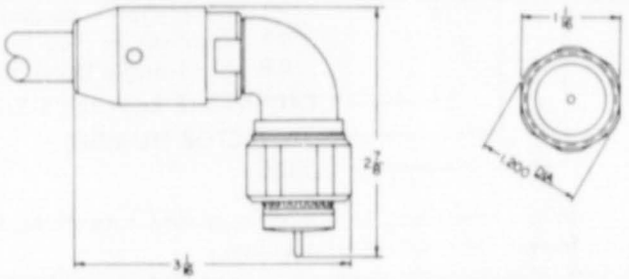
mating diagrams



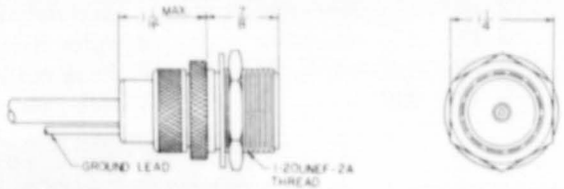
*Connector not illustrated in technical data.



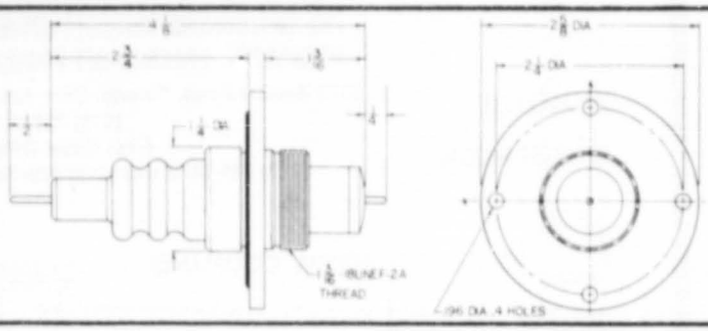
G132SSP
STRAIGHT
PLUG CONNECTOR
8 KV rms *CORONA-FREE*/20 KV-DC



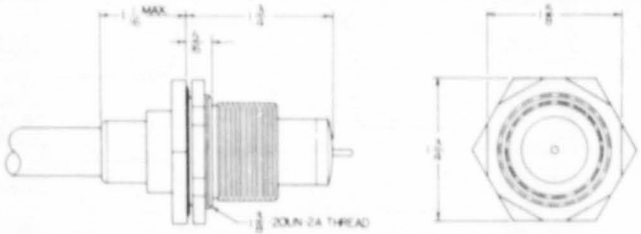
G147SRP
RIGHT ANGLE
PLUG CONNECTOR
8 KV rms *CORONA-FREE*/20 KV-DC



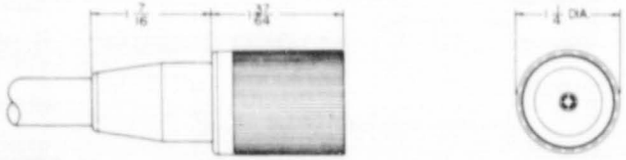
G145SPR
PANEL MOUNTING
RECEPTACLE CONNECTOR
8 KV rms *CORONA-FREE*/20 KV-DC
Also available as G123SSR
STRAIGHT RECEPTACLE version



G106SPP
PANEL MOUNTING
PLUG CONNECTOR
8 KV rms *CORONA-FREE*/20 KV-DC
"O" Ring Bulkhead Seal



G102SPP
PANEL MOUNTING
PLUG CONNECTOR
8 KV rms *CORONA-FREE*/20 KV-DC



G135SSR
STRAIGHT
RECEPTACLE CONNECTOR
8 KV rms *CORONA-FREE*/20 KV-DC

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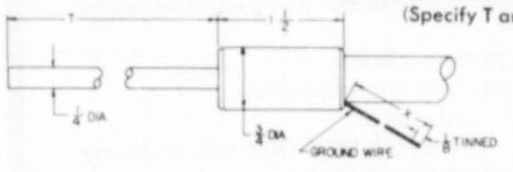
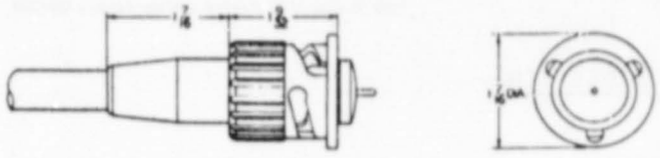
G164T
MOLDED TERMINATION
(Specify T and X lengths)



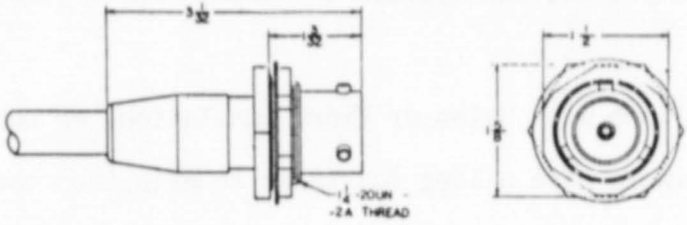
technical data—bayonet coupling

G118BSP
STRAIGHT
PLUG CONNECTOR
8 KV rms CORONA-FREE/20 KV-DC

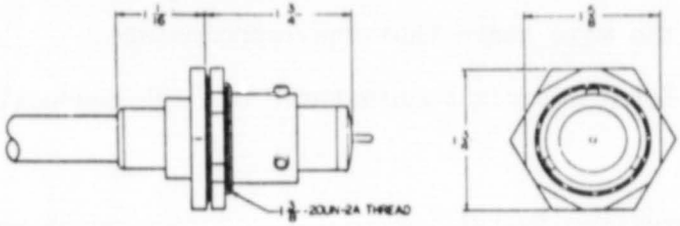
Also available as G119BRR
RIGHT ANGLE version



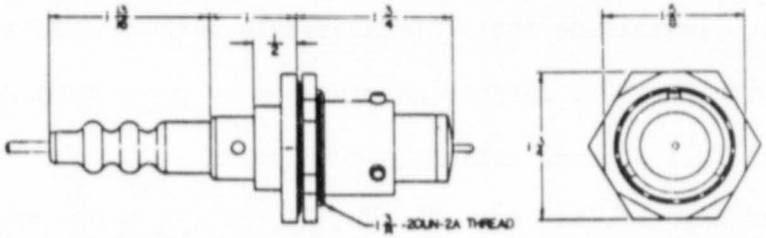
G163BPR
PANEL MOUNTING
RECEPTACLE CONNECTOR
8 KV rms CORONA-FREE/20 KV-DC



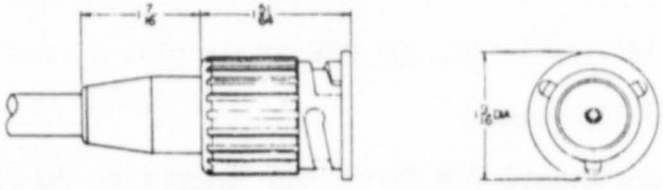
G149BPP
PANEL MOUNTING
PLUG CONNECTOR
8 KV rms CORONA-FREE/20 KV-DC
"O" Ring Bulkhead Seal



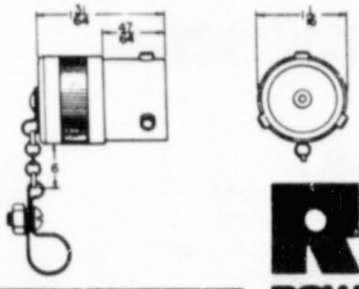
G167BPP
PANEL MOUNTING
PLUG CONNECTOR
8 KV rms CORONA-FREE/20 KV-DC
"O" Ring Bulkhead Seal



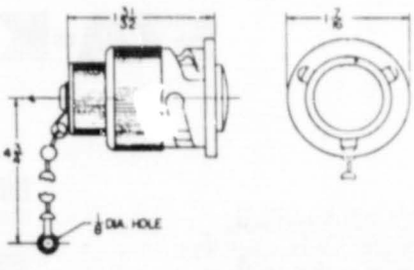
G117BSR
STRAIGHT
RECEPTACLE CONNECTOR
8 KV rms CORONA-FREE/20 KV-DC



G128BDR
DUMMY
RECEPTACLE



G116BDP
DUMMY
PLUG



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(213) 235-2070 and (415) 969-4831

T&B/Thomas & Betts, Division of Thomas & Betts Corporation
920 Route 202 Raritan, New Jersey 08869 (201) 685-1600

Terminations, Electrical

STA-KON® Terminals are supplied in ring tongues, fork tongues, locking fork tongues, wire joints, and splices to accommodate a wire range of 22 AWG to 250 MCM.

They are availabe with Nylon or Vinyl insulation, or non-insulated. The insulated STA-KON terminals have a long insulator to grip the conductor, relieve wire strain, and guard against "Flashover". All insulated Terminals are color-coded to indicate the wire range that they accommodate.

All STA-KON Terminals are manufactured of high conductivity copper with tin plating.

Precise compression installing tools produce a positive contact between wire and terminal. Installing tools are available with the T&B exclusive SHURE STAKE® mechanism which provides correct compression by preventing opening of the tool handles until full staking action is completed.

STA-KON® terminal cat. series: RA, RB, RC, RD, RE Nylon insulated (ring tongues) and wire joints; 18RA, 14RB, 10RC Vinyl insulated ring and fork tongues; D8, E6, F4, G2, H10, J20, K30, L40, and M25 non-insulated ring tongues; 2RA, 2RB, 2RC, 2A, 2B, 2C and 2D splices.

Available at authorized T&B Heavy Duty Automotive Products distributors.

STA-KON® Terminals

These STA-KON® terminals accommodate a wire range from 9 AWG through 250 MCM. Wire range identification is stamped on the tongue of each terminal.

RING
non-insulated



INSTALLING TOOL—
WT115A (D-G)
WT3165 (D-J)

FORK
vinyl self-insulated
insulation support



INSTALLING TOOLS—
WT145C
WT2000

LOCKING SPADE
vinyl self-insulated
insulation support



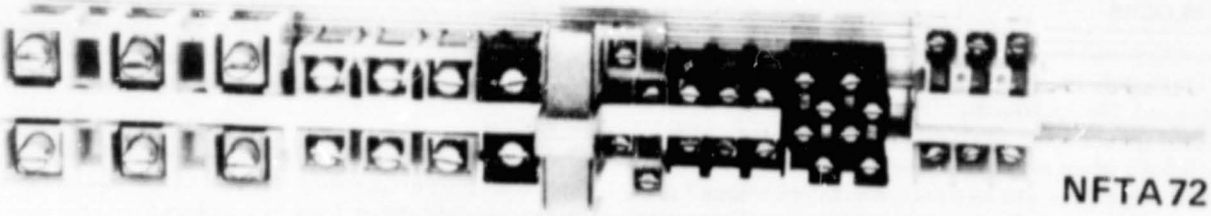
U.S. Pat. 3,590,387

INSTALLING TOOL—
WT2000
WT145C

MODULAR TERMINAL BLOCKS

for control and power circuits

300 VOLT AND 600 VOLT

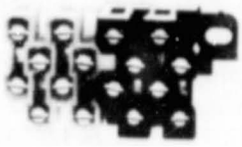


NFTA72

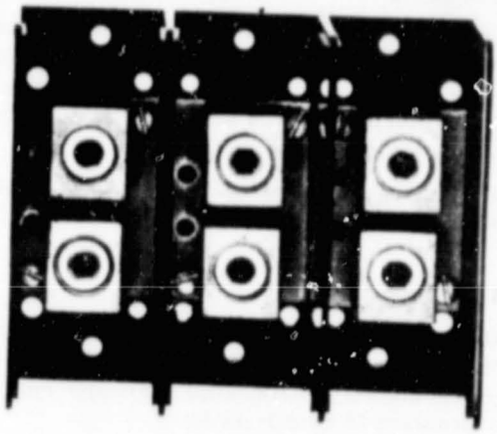
NC3 N111 N1 F1 N2 N3 NT4 PLU3



K 3



KT4



EE3

Ward Leonard

31 South St.
Mt. Vernon NY 10550
Phone (914) 664-1000
Subsidiary of
The Unimax Group Inc.

FEATURES

- Modular design for maximum flexibility
- Base or rail mounting types
- Standard or Miniature blocks
- 300 or 600 Volt spacings
- Up to 50 circuits in 12 1/2 inches
- Up to 4 circuits per block

GENERAL INFORMATION

Ward Leonard's Series 5999B modular terminal blocks are versatile in application and are designed to conserve space while allowing maximum flexibility and ease of installation. Blocks are available with 1, 2, 3 or 4 circuits per block. They offer a choice of either 300 volt or 600 volt spacings.

Some blocks are for base mounting while others are designed for rail mounting. All terminal blocks are shipped ready to use with terminal screws backed out. This construction allows use of portable screw driving equipment resulting in important time savings.

All terminal blocks are constructed of white nylon except for the heavy duty power terminal blocks which are black.

Type NC3 BLOCKS

NC3 three pole terminal blocks are designed for base and stainless steel rail mounting and are suitable for applications requiring 600 volt spacings. They can accommodate copper or aluminum wires from #4 to 2/0.

Type N1, N2, N3 and N111 BLOCKS

These modular terminal blocks are for rail mounting and provide 600 volt spacing.

Type N1 one pole and type N2 two pole blocks are 5/8" modules permitting 20 and 40 circuits respectively in 12 1/2".

Type N3 three pole block is 1 1/4" wide and accommodates 30 circuits in 12 1/2".

Type N111 three pole block is 1 7/8" wide and handles 20 circuits in 12 1/2".

Type N blocks are of the well construction type equipped with hardened stainless steel recessed clamping screws to prevent stripping of threads. The wire clamping lugs are designed to eliminate twisted-off strands of wire.

MODULAR TERMINAL BLOCKS
for control and power circuits

300 VOLT AND 600 VOLT

Ward Leonard
31 South St.
Mt. Vernon NY 10550
Phone (914) 664-1000
Subsidiary of
The Unimax Group Inc.

Type F1 FUSE BLOCKS

Type F1 fuse blocks for rail mounting are 5/8" wide and are for use with 13/32" diameter fuses.

Type K3 BLOCKS

K3 600 volt terminal blocks eliminate the need for a mounting channel. Three pole blocks feature an easy slide snap design to couple adjacent blocks together. Rigid construction reduces the number of mounting screws needed and prevents bowing or lifting of blocks when mounted. Mounting screws are recommended every 5 blocks (15 circuits). Blocks are shipped preassembled in 5 block (15 circuits) sections for immediate mounting.

Type NT4 BLOCKS

NT4 miniature four circuit terminal blocks designed for rail mounting accommodate 48 circuits per foot. Features include: 300 volts spacing, "tang" type collars, large wire openings to allow easy insertion of wires, full size screw heads and backed-off screws ready for tightening.

Special marking tape (Cat. No. 5999BMTC6) for use with these blocks provides a large writing surface and access to all screws.

Type KT4 BLOCKS

These 300 volt miniature 4 circuit terminal blocks feature "lock-twist-snap" assembly for fast, easy installation. KT4 blocks can be quickly preassembled into rigid multi-block assemblies furnishing 48 circuits per foot.

Designed for base mounting, KT4 units are supplied standard as 3-block (12 circuits) assemblies. Terminals are equipped with tang collars to permit blind insertion of wires into connector. KT4 block can be used with 22-10 copper wire and 12-10 aluminum wire. For 6" marking strips specify Cat. No. 5999BMTC6.

Type PLU3 BLOCKS

PLU3 blocks interlock mechanically, providing a unit assembly in which individual units are free to move to permit electrical connection while remaining coupled mechanically to the series. These fully shielded plug-in blocks have three poles, are rated 600 volt and accept up to No. 8 AWG wires.

The connection between the stationary and the plug-in section are made through heat-treated silver plated copper alloy wiping tabs assuring a low resistance coupling (0.0005 ohms cable to cable).

Standard marking strips provide clear identification of stationary and plug-in portions of the block assembly. Standard mounting rails accept Type PLU3 blocks.

Type EE3 BLOCKS

These units are designed for applications on panel boards, motor starters and controllers, switchboards, etc. where 600 volt power terminal blocks are needed. Type EE3 blocks are fully rated with 1" through air and 2" over surface opposite polarity spacing as well as 1" to ground. They are furnished with 300 MCM connectors on both sides of each pole.

MOUNTING RAILS

Mounting rails for modular terminal blocks are available in aluminum in standard 72" lengths and in spring stainless steel in 12 1/2" and 37 1/2" lengths. Refer to Table 2 Accessories for cat. nos.

MARKING STRIPS

Type MTC6 white marking strips in 6" lengths for use with Type NT4 and KT4 miniature blocks are available as shown in Table 2. The strips furnish a large writing surface and do not obstruct terminal screws.

Type K A D End Mounting ADAPTOR

This adaptor must be used when mounting single Type KT3 blocks.

MODULAR TERMINAL BLOCKS — Table 1

Description	Volt Spacing	No. Of Ckts.	Wire Range and Type	Ckts. In 12 1/2 In.	Catalog Number	Price Per Block	Qty. Per Carton
Base Mount Block	600	3	4-2/0 CU & AL	12	5999BNC3		24
Rail Mount Block	600	1	18-4 CU, 12-2 AL	20	5999BN1		100
Rail Mount Block	600	2	22-8 CU, 12-8 AL	40	5999BN2		100
Rail Mount Block	600	3	22-8 CU, 12-8 AL	30	5999BN3		100
Rail Mount Block	600	3	18-2 CU, 12-2 AL	20	5999BN111		24
Rail Mount Fuse Block	600	1	22-8 CU, 12-8 AL	20	5999BF1		20
Base Mount Block	600	3	22-8 CU, 12-8 AL	30	5999BK3		80
Miniature Block Rail Mount	300	4	22-10 CU, 12-10 AL	50	5999BNT4		100
Miniature Block Base Mount	300	4	22-10 CU, 12-10 AL	50	5999BKT4		100
Plug-In Block Rail Mount	600	3	22-8 CU, 12-8 AL	30	5999BPLU3		20
Base Mount Block	600	3	6-300 MCM-Max CU or AL		5999BEE3		1

ACCESSORIES FOR TERMINAL BLOCKS — Table 2

Description	Catalog Number	Price	Qty. Per Carton
Mounting Rail 72" Aluminum Lock	5999BNRTA72		20
Mounting Rail 12 1/2" Stainless Steel	5999BNR125		25
Mounting Rail 37 1/2" Stainless Steel	5999BNR375		25
Marking Strip 12 1/2" White Vinyl	5999BNT125		50
Marking Strip 6" for NT4, KT4	5999BMTC6		50
End Mounting Adaptor for K3	5999BKAD		20

MODULAR TERMINAL BLOCKS

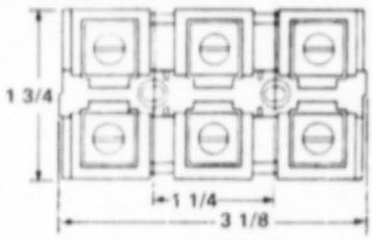
for control and power circuits

300 VOLT AND 600 VOLT

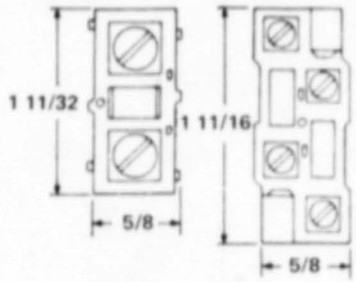
Ward Leonard
31 South St.
Mt. Vernon NY 10550
Phone (914) 664-1000
Subsidiary of
The Unimax Group Inc.

DIMENSIONS – Approximate

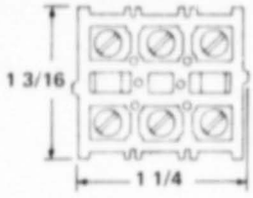
Type NC3



Type N1 Type N2

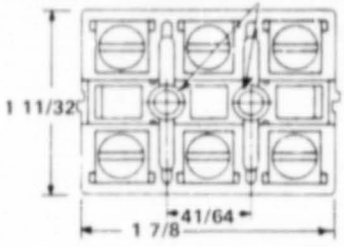


Type N3



Type N111

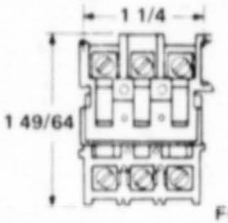
3/16 Dia. (2) Holes 9/32 Dia. C'bores



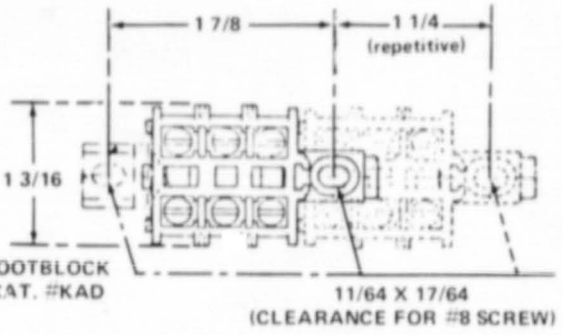
Type F1
Fuse Block



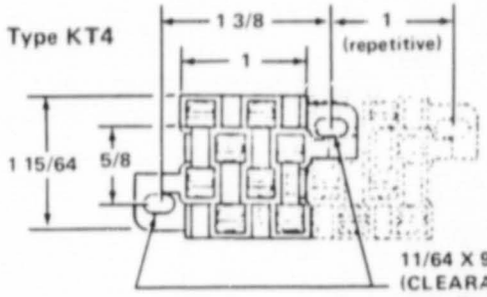
Type PLU3



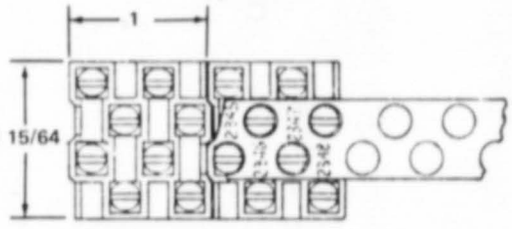
Type K3



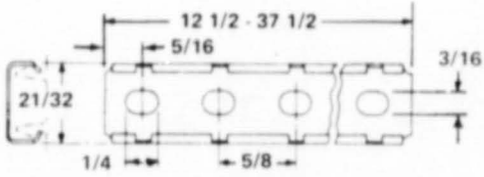
Type KT4



Type NT4

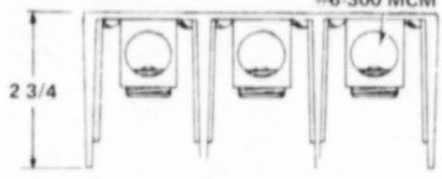


Type NR125 & NR375
Mounting Rails

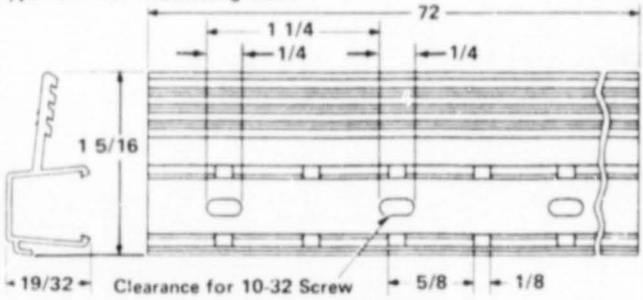


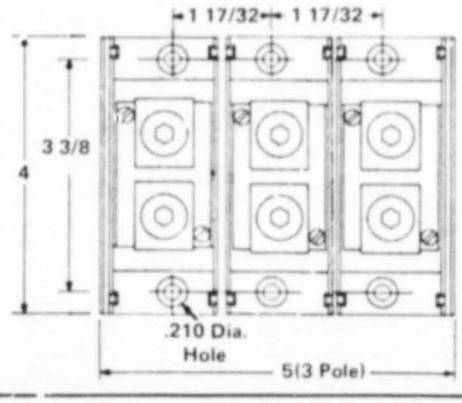
Recommended Distance Between Mounting Rail Fasteners 6 Inches Maximum

Type EE3



Type NFTA7 Mounting Rails





TRANSDUCERS, CONTROL

PRESSURE, HYDRAULIC

(CODE **TH**)

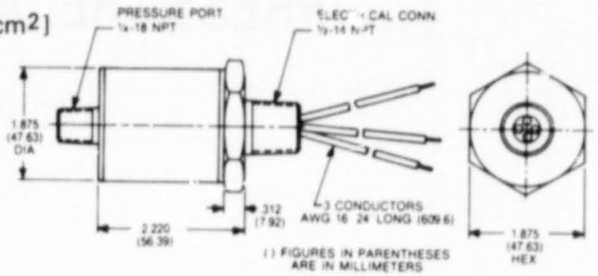
BEC CONTROLS CORP. Box 2510 Northwest Station Davenport, Iowa 52809 319-391-5220

SERIES P63 INDUSTRIAL PRESSURE TRANSDUCERS

SPECIFICATIONS:

GENERAL:

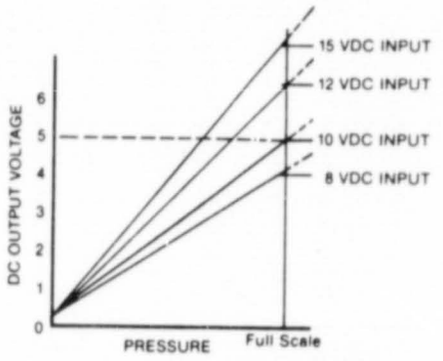
PRESSURE RANGES	0-15 through 0-300 PSI [0-1.1 through 0-21 kg/cm2]
PROOF PRESSURE	150% of full scale
PRESSURE MEDIA	Compatible with most liquids and gases
PRESSURE CONNECTION	¼ NPT male
WEIGHT	0.9 pounds max. [0.41 kg max.]
OPERATING LIFE	Greater than 1 million cycles
CAVITY VOLUME	.41 cu. in [6.6 cm^3]
VOLUMETRIC CHANGE	.07 cu. in [1.2 cm^3]



ELECTRICAL:

INPUT VOLTAGE RANGE	8 to 15 VDC
INPUT CURRENT	30 milliamps max. at 10 Volts input
OUTPUT VOLTAGE	0.100 ± 0.020 VDC to 5 ± 0.050 VDC at 10 volts input (may be shorted without damage)
OUTPUT IMPEDANCE	Less than 10 ohms.
OUTPUT RIPPLE	Less than 1% R.M.S. full scale
RIPPLE FREQUENCY	Greater than 5,000 Hz
OUTPUT CONNECTION	½ NPT — 3-wire free leads, 24" [609.6mm] long
INSULATION RESISTANCE	100 megohms min. at 50 VDC leads to case
POLARITY PROTECTION	Input protected from accidental reverse polarity

TYPICAL CHARACTERISTICS



HOW TO ORDER

MODEL ☐ **P63 -** ☐ **-** ☐

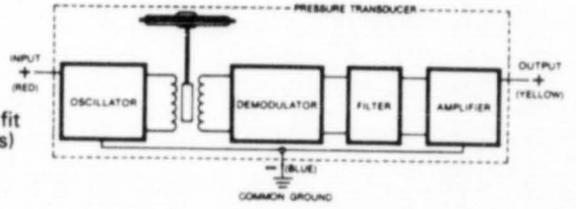
G - Gauge
A - Absolute

Max. PSI Pressure
15, 30, 60, 150, 300
(1.1, 2.1, 4.2, 11.21 kg/cm2)

Sequence No. assigned for variations

PERFORMANCE at nominal input of 10 VDC:

STATIC ERROR BAND	±1% FS maximum at +77°F [+25°] (maximum deviation from best fit straight line through data points)
TEMPERATURE EFFECTS	.015%/°F[.027%/°C] max.
TEMPERATURE RANGE	−40°F to +250°F, [−40°C to + 120°C]



BEC CONTROLS CORP. 2510 NORTHWEST STA. DAVENPORT, IA. 52809 319-391-5220

SERIES P65 OEM PRESSURE TRANSDUCER

SPECIFICATIONS

GENERAL

Pressure Ranges
Standard
0-5, 0-15, 0-30, 0-75, 0-150, 0-300 psi absolute or gage
Custom ranges available

Proof Pressure
150% FS

Burst Pressure
300% FS or 750 psi, whichever is less

Pressure Media
Any media compatible with silicon rubber aluminum die cast and 96% alumina (Buna N or Fluorosilicone, Valox 420 optional)

Cavity Volume
Approx. 0.15 cu. in.

Volumetric Displacement
Less than .001 cu. in.

Pressure Connections
1/8" I.D.hose connection
1/8" MPT pipe thread
(1/4" I.D. hose & 1/4" MPT optional)

Electrical Connection
Integral Molex No. 1653-3 Connector

Weight
4 ounces nominal

Mounting
MPT Pressure Connection or foot mount bracket

ELECTRICAL

Output
2.0 to 6.0 VDC standard @ 9 VDC input
(± 1% FS end point tolerance)

Input Voltage
9.00 VDC, operable from 8-12 VDC
Output ratiometric to input

Input Current
Less than 10 mA

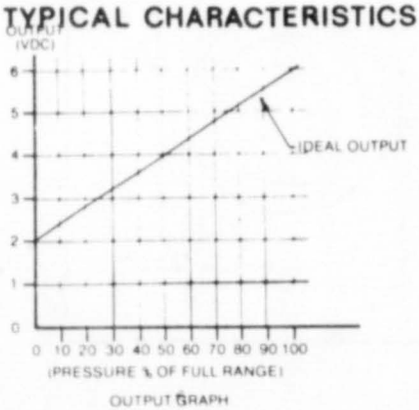
Output Impedance
Less than 100 Ohms

Load Current
2 mA maximum

Output Ripple
Less than 10 mV rms (at approx. 1 KHz)

Polarity Protection
Protected against reverse voltage connection

TYPICAL CHARACTERISTICS



OUTPUT GRAPH

PEFORMANCE

Repeatability
±0.05% FS maximum

Hysteresis
±0.05% FS maximum

Linearity
Better than ±1.6% FS

Operating Life
More than 10 million cycles

Temperature Range
−40°C to +85°C standard
(−55° to +125° optional)

Temperature Stability
Span: ±0.01% FS/°C
Zero: ±0.01% FS/°C

Response Time
15 ms maximum (5 ms available)

MATERIALS

Body
Aluminum die casting

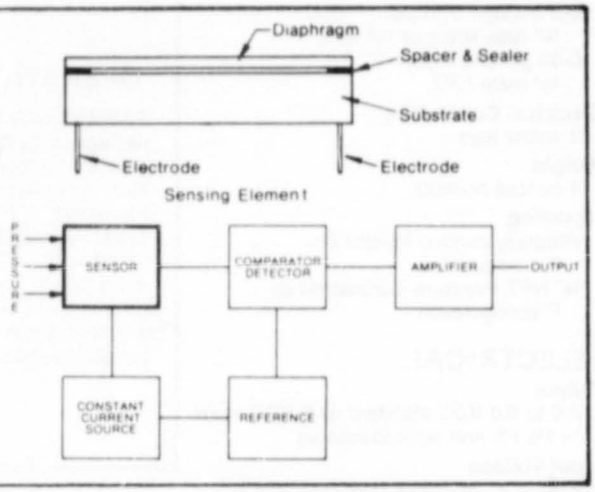
Diaphragm & Substrate
96% alumina

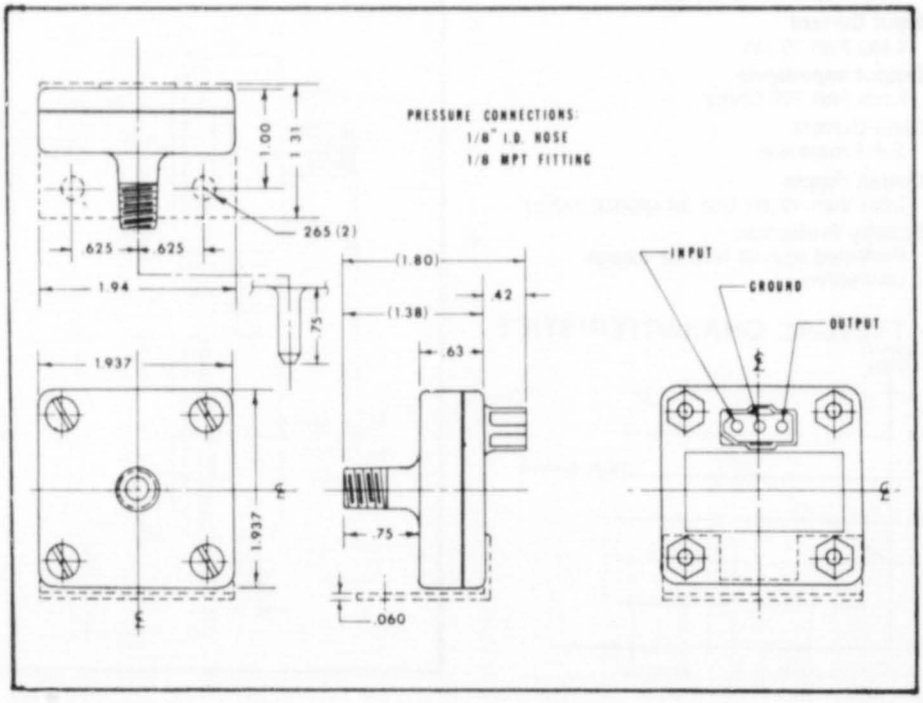
Sensor-to-Housing Seal
Silicone Rubber
(Buna N or Fluorosilicone available)

Electronics
Custom integrated circuit, hybridized, bonded to substrate and shielded.

OPERATION

As pressure is increased, deflection of the alumina diaphragm toward the alumina substrate increases capacitance. This variable capacitance is input to precision laser-trimmed IC circuitry where it is translated to a high level dc signal.





BEC CONTROLS CORP. 2510 NORTHWEST STA. DAVENPORT, IA. 52809 319-391-5220

SERIES P69 OEM PRESSURE TRANSDUCER

SPECIFICATIONS

GENERAL

Pressure Ranges
Standard
0-5, 0-15, 0-30, 0-75, 0-150 psi
absolute or gage
Custom ranges available

Proof Pressure
150% FS

Burst Pressure
300% FS or 300 psi, whichever is less

Pressure Media
Any media compatible with silicon rubber (Buna N or Fluorosilicone available as an option), Valox 420, and 96% alumina

Cavity Volume
Less than 0.15 cu. in.

Volumetric Displacement
Less than .001 cu. in.

Pressure Connection
0-5 through 0-15 psi
¼" tube fitting or ¼" NPT
0-30 psi and higher
¼" male NPT

Electrical Connection
3 solder lugs

Weight
4 ounces nominal

Mounting
Integrally molded flanges on
T configuration
¼" NPT Pressure Connection on
P configuration

ELECTRICAL

Output
2.0 to 6.0 VDC standard @ 9 VDC input
(±1% FS end point tolerance)

Input Voltage
9.00 VDC, operable from 8-12 VDC
Output ratiometric to input

Input Current
Less than 10 mA

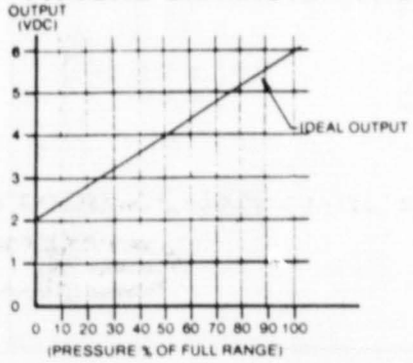
Output Impedance
Less than 100 Ohms

Load Current
2 mA maximum

Output Ripple
Less than 10 mV rms (at approx. 1KHz)

Polarity Protection
Protected against reverse voltage connection

TYPICAL CHARACTERISTICS



OUTPUT GRAPH

PEFORMANCE

Repeatability
±0.05% FS maximum

Hysteresis
±0.05% FS maximum

Linearity
Better than ±1.6% FS

Operating Life
More than 10 million cycles

Temperature Range
-40°C to +85°C standard
(-55° to +125° optional)

Temperature Stability
Span: ±0.01% FS/°C
Zero: ±0.01% FS/°C

Response Time
15 ms maximum (5 ms available)

MATERIALS

Body
Injection molded Valox 420

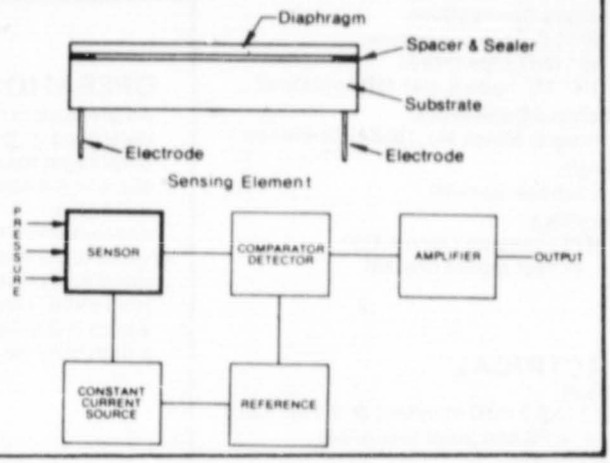
Diaphragm & Substrate
96% alumina

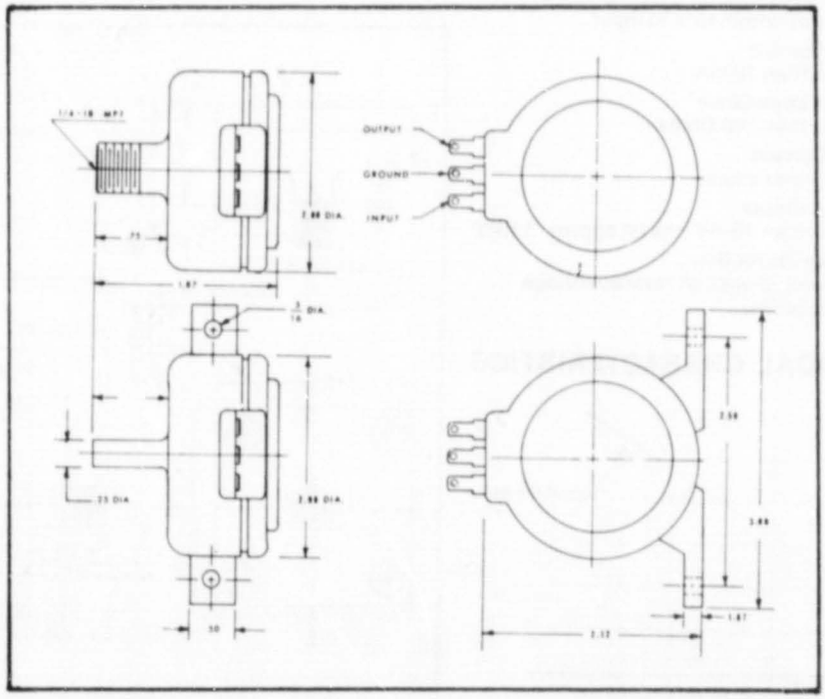
Sensor-to-Housing Seal
Silicone Rubber
(Buna N or Fluorosilicone available)

Electronics
Custom integrated circuit, hybridized, bonded to substrate and shielded.

OPERATION

As pressure is increased, deflection of the alumina diaphragm toward the alumina substrate increases capacitance. This variable capacitance is input to precision laser-trimmed IC circuitry where it is translated to a high level dc signal.



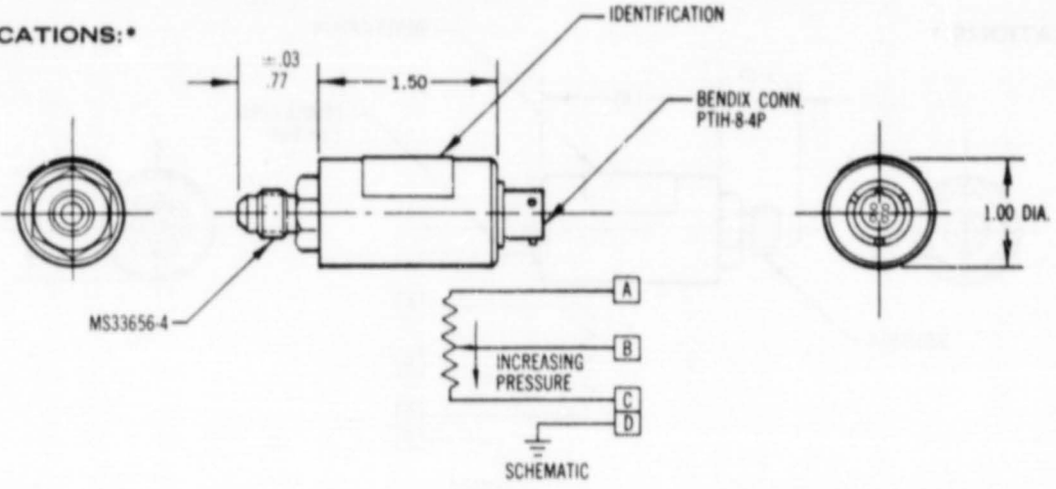


SPECIFICATIONS

MODEL 2 201 LOW PRESSURE POTENTIOMETRIC TRANSDUCERS

EDCLIFF INSTRUMENTS

SPECIFICATIONS:*



CHARACTERISTICS:

Performance:

Range	0 to 5 and 0 to 350 PSIA, PSIG
Pressure Media	Compatible with NiSpan-C or 17-7PH SS
Resolution	0.3% Typ.
End Points	0 to 5% each end
**Static Error Band	±1.2% (See Note 1)
Temperature Error Band	±2.3% (See Note 2)
Temperature	
Operating Range	−65°F to +300°F
Overpressure	150% over normal operating range
Element Burst Pressure	250%
Response Time	7 milliseconds to 63% of pressure step input
Weight	3 oz. Max.

Electrical:

Resistance	500 to 10,000 ohms
Power Rating	0.25 watts at 70°F Nominal
Insulation Resistance	50 megohms min. @ 500 VDC
Equivalent Noise Resistance	100 ohm max.
Resistance Tolerance	±5% Nominal
Life	50,000 full scale cycles 100,000 full scale cycles (5 to 150 PSI) 2,000,000 dither cycles

Environmental:

Vibration Error	±1.5% Maximum
Vibration	10-55 cps — 0.1" D.A. 55-100 cps — 20 G 100-500 cps — 35 G 500-1000 cps — 50 G 1000-2000 cps — 65 G
Acceleration Error	Negligible
Acceleration	100G
Shock	100G for 11ms
Humidity	Salt Spray, Sand & Fungus — per MIL-STD-810

Options:

- Various mounting hole sizes and locations
- Electrical connections by terminals, headers, etc.
- Pressure fitting per MS 33656-2, -3, or -4.
- 17-7PH stainless capsule for corrosive fluids
- Differential pressure models
- Error bands defined in terms of terminal or absolute straight lines
- Segmented switches
- Contact the factory for details on special configurations or modifications to meet your specific requirements.

**1. Static error band is the maximum deviation of any point from the best straight line drawn through all the points of the calibration curve. The tolerance includes the effects of linearity, friction, hysteresis, resolution and repeatability.

2. Temperature error band includes static error band, plus the effects of temperature.

* Contact the factory for details on special configurations or modifications to meet your specific requirements.

EDCLIFF INSTRUMENTS

A Subsidiary of Systron-Donner Corporation

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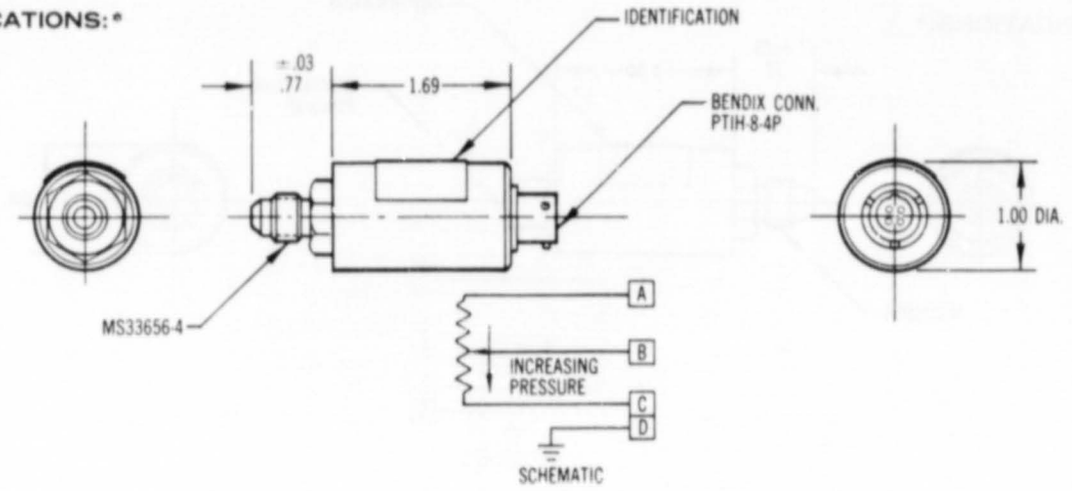
SPECIFICATIONS

MODEL 2-400 HIGH PRESSURE POTENTIOMETRIC TRANSDUCERS

EDCLIFF INSTRUMENTS

SPECIFICATIONS:*



CHARACTERISTICS:

Performance:

Range	0 to 300 and 0 to 5000 PSIA, PSIG
Pressure Media	Compatible with NiSpan-C or 17-7PH SS
Resolution	0.3% Typ.
End Points	0 to 5% each end
**Static Error Band	±1% (See Note 1)
Temperature Error Band	±1% (See Note 2)
Temperature	
Operating Range	−65°F to +300°F
Overpressure	150% over normal operating range
Element Burst Pressure	200%
Response Time	10 milliseconds to 63% of pressure step input
Weight	4 Oz. Max.

Electrical:

Resistance	500 to 10,000 ohms
Power Rating	0.25 watts at 70°F Nominal
Insulation Resistance	50 megohms min. @ 500 VDC
Equivalent Noise Resistance	100 ohm max.
Resistance Tolerance	±5% Nominal
Life	50,000 full scale cycles 100,000 full scale cycles 2,000,000 dither cycles

Environmental:

Vibration Error	Less than ±1% full scale when subjected to .25" D.A. 0 to 55 cps, ±35 G 55 to 2000 cps along any axis
Acceleration	±0.02% per G maximum when subjected to acceleration levels up to 30 G's along any axis
Shock	50 G's for 11.0 millisecond half sine wave.
Humidity	Salt Spray, Sand & Fungus — per MIL-STD-810

Options:

- Various mounting hole sizes and locations
- Electrical connections by terminals, headers, etc.
- Pressure fitting per MS 33656-2, -3, or -4.
- 17-7PH stainless capsule for corrosive fluids
- Differential pressure models
- Error bands defined in terms of terminal or absolute straight lines
- Segmented switches
- Contact the factory for details on special configurations or modifications to meet your specific requirements.

**1. Static error band is the maximum deviation of any point from the best straight line drawn through all the points of the calibration curve. The tolerance includes the effects of linearity, friction, hysteresis, resolution and repeatability.

2. Temperature error band includes static error band, plus the effects of temperature.

* Contact the factory for details on special configurations or modifications to meet your specific requirements.

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EDCLIFF INSTRUMENTS

STRAIN GAGE MODEL 4-901 PRESSURE TRANSDUCER

SPECIFICATIONS

PERFORMANCE

Ranges	0 - 200 through 0 - 5000 PSIA, PSIG
Pressure Media	compatible with 17-7PH SS
Linearity	±0.5%
Hysteresis	±0.2%
Repeatability	±0.05%

ELECTRICAL

Input	28 ±4 VDC @ 35 ma maximum
Output @ 0 PSI	+0.05 ±0.05 VDC
Output @ F.S.	5 VDC ±0.05 VDC
Output Impedance	25 ohms maximum
Insulation Resistance	100 megohms @ 50 VDC

MECHANICAL

Overpressure	2X range
Burst Pressure	5X range
Weight	4 oz. maximum

ENVIRONMENTAL

Temperature Error	±1.0%/100°F
Compensated Temperature Range	0°F to +200°F (-65°F to +250°F available)
Vibration Environment	50 G's peak to 2000 Hz
Shock Environment	100 G's for 11 ms
Acceleration	100 G's

ORIGINAL PAGE IS
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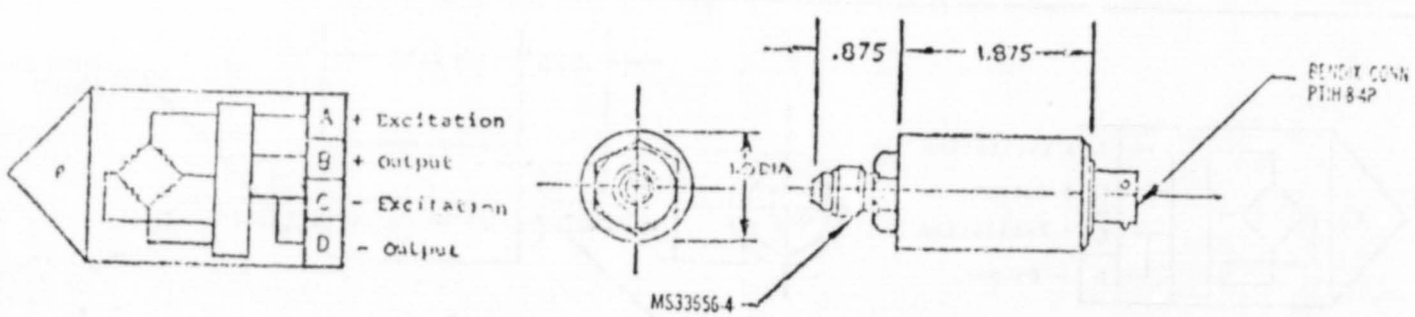
SPECIAL APPLICATIONS

The design described is representative of Edcliff Instruments capabilities. We welcome the opportunity to adapt our designs to meet your specific requirement. Please contact either our sales representative in your area or our applications engineering department.



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EDDLIFF INSTRUMENTS

STRAIN GAGE MODEL 4-910 PRESSURE TRANSDUCER

SPECIFICATIONS

PERFORMANCE

Ranges	0 - 25 through 0 - 5000 PSIA, PSIG
Pressure Media	compatible with 17-7PH SS
Linearity	±0.2%
Hysteresis	±0.2%
Repeatability	±0.05%

ELECTRICAL

Input	28 ±4 VDC @ 35 ma maximum
Output @ 0 PSI	±0.05 ±0.05 VDC
Output @ F.S.	5 VDC ±0.05 VDC
Output Impedance	25 ohms maximum
Insulation Resistance	100 megohms @ 50 VDC

MECHANICAL

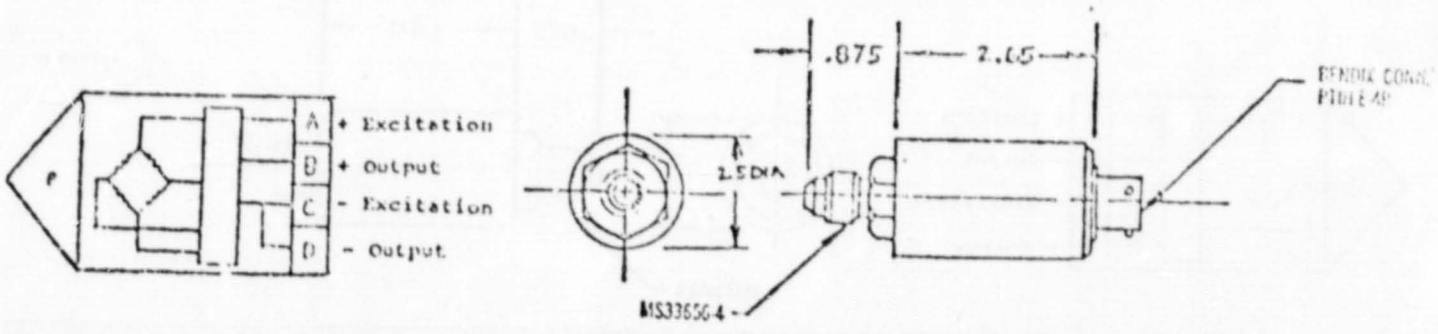
Overpressure	5X range
Burst Pressure	10X range
Weight	12 oz. maximum

ENVIRONMENTAL

Temperature Error	±1.0%/100°F
Compensated Temperature Range	0°F to +200°F (-65°F to +250°F available)
Vibration Environment	50 G's peak to 2000 Hz
Shock Environment	100 G's for 11 ms
Acceleration	100 G's

SPECIAL APPLICATIONS

The design described is representative of Eddliff Instruments capabilities. We welcome the opportunity to adapt our designs to meet your specific requirement. Please contact either our sales representative in your area or our applications engineering department.



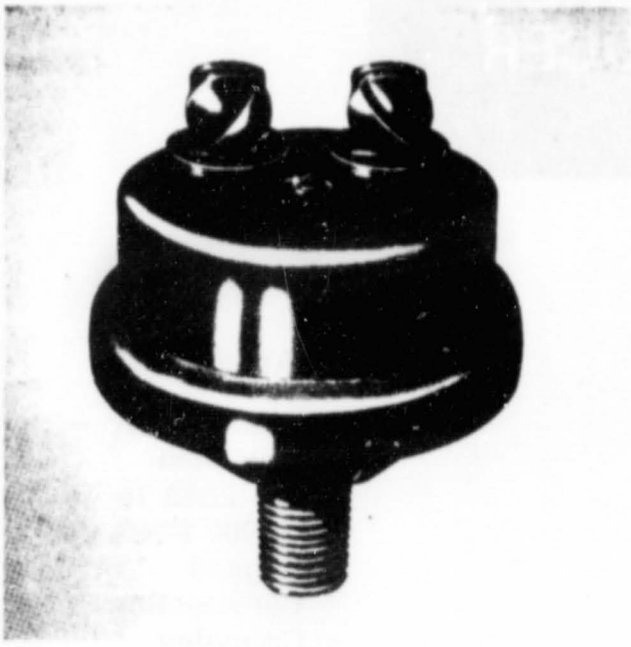
EDDLIFF INSTRUMENTS • 1711 SOUTH MOUNTAIN AVENUE • MONROVIA, CALIFORNIA 91016 • (213) 358-4571

Faria

TECHNICAL DATA SHEET

Series 2900

PRESSURE SWITCH

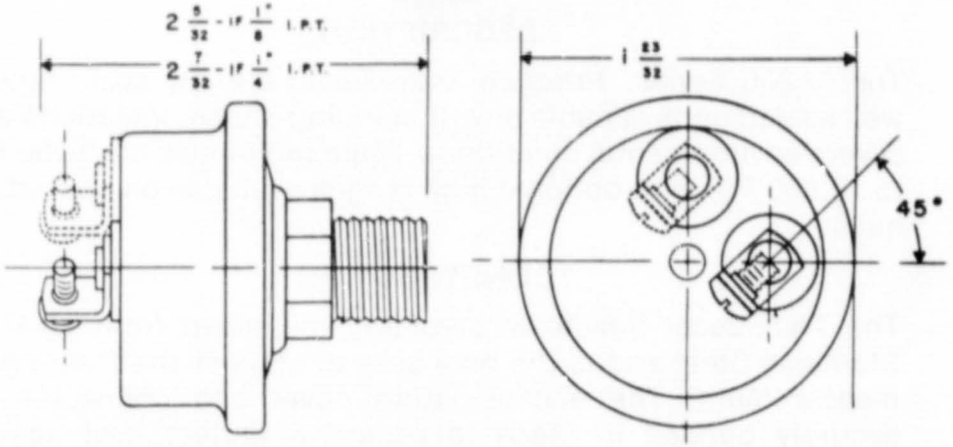


Here's a pressure switch that's designed for both heavy duty application and close calibration features. The Series 2900 Switch will give dependable service in the face of vibration, widely pulsating pressures, and other rugged operating conditions. Available in both single and double terminal models, the FARIA Pressure Switch permits close on and off differentials and consistently maintains precise cut-in and cut-out settings. Has exclusive built-in overload protection and if required, special dampener mechanisms are available.

Typical Uses:

Low air pressure warning switch, activating or deactivating machinery, hydraulic equipment etc. at a preset pressure or vacuum. Used as original equipment by virtually all major truck, farm tractor and off-the-road machinery manufacturers.

- Housed in heavy steel stamping.
- Sealed for all-weather operation.
- Spring loaded synthetic diaphragm for long, trouble-free service.
- Ranges std. to 100 p.s.i.
- Factory set cut-in, cut out settings permanently maintained.
- Rigid mounted pipe fitting with ¼" or ⅛" thread.
- Value priced.



VACUUM	PRESSURE	SPECIFICATIONS		
MODEL	MODEL	AT ZERO PRESSURE	NO. OF TERMINALS	PIPE THREAD
2909	2901	CLOSED	1	1/4" OR 1/8"
2910	2902	CLOSED	2	1/4" OR 1/8"
2911	2903	OPEN	1	1/4" OR 1/8"
2912	2904	OPEN	2	1/4" OR 1/8"

ORDERING INSTRUCTIONS:

1. SPECIFY MODEL NUMBER
2. SPECIFY VACUUM OR PRESSURE AT WHICH SWITCH IS TO SWITCH
3. SPECIFY 1/4" OR 1/8" PIPE THREAD

A DIVERSE STOCK OF PRESSURE SWITCHES IS KEPT ON HAND. TRIAL QUANTITIES CAN BE SUPPLIED ON RELATIVELY SHORT NOTICE.

This product, formerly manufactured by Rochester Gage Corporation and American-Standard Controls Division, is now produced and supplied solely by the Thomas G. Faria Corporation. (Faria Corporation purchased tooling, manufacturing and patent rights in June, 1967.)

THOMAS G. FARIA CORPORATION

UNCASVILLE, CONNECTICUT 06382 • PHONE 203: 848-9271

GSE INC.
TRANSDUCERS • INSTRUMENTS • SYSTEMS

PRESSURE TRANSDUCER



DESCRIPTION

The "7200 Series" Pressure Transducers are low cost, rugged, well sealed units capable of withstanding shock, vibrations and severe environmental conditions. Standard ranges are 0-250 PSI to 10,000 PSI with optional high ranges available on special request.

CONSTRUCTION

The Transducer flexure is precision machined from 17-4 PH Stainless Steel and is the only area to contact the fluid under measurement. The encapsulating cover and connector are securely bonded in place to assure a perfect seal against moisture, dirt and oil. The standard transducer is supplied with a Bendix PT1H-10-6P Receptacle. Pressure connection is 3/8-18 NPT female up to 500 PSI.

OPERATION

The fluid under measurement transmits pressure to a diaphram which is strain gaged in a wheatstone bridge configuration, (4 fully active gages). The Linear deflection of the Diaphram is converted into an electrical signal directly proportional to applied pressure. Each transducer is calibrated traceable to the National Bureau of Standards and supplied with a Calibration certificate and precision shunt resistor.

FEATURES

- **High Quality – Low Cost**
- **250 PSIG to 10,000 PSIG**
- **Rugged Construction**
- **Corrosion Resistant**
- **Accurate**
- **Compact**

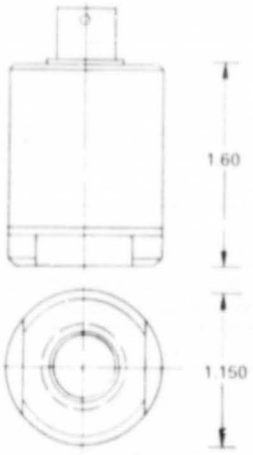
APPLICATIONS

- **Hydraulic Brake Testing**
- **Laboratory Testing**
- **Q. C. Measurements**
- **Safety Testing**
- **On Line Pressure Measurement on Assembly Machines**

—GSE INC.—
23640 RESEARCH DRIVE • FARMINGTON HILLS, MI 48024
(313) 476-7875

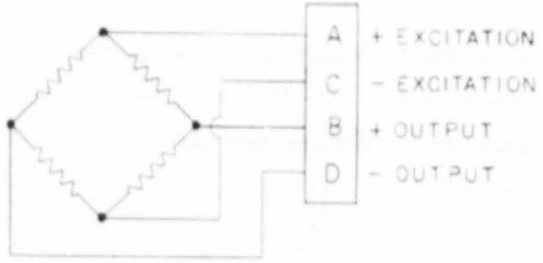
SPECIFICATIONS

Pressure Ranges (PSIG)	
Model 7210 series	250, 500
Model 7220 series	1000, 2000, 3000, 5000
Output	2 mv/v Nominal
Non-Linearity (end Point)	+ 0.25% FS
Hysteresis	+ .15% FS
Resolution	Infinite
Bridge Resistance	350 ohm nominal
Excitation Voltage	10V (15 max.) DC or AC
Proof Pressure	1.5 times rated capacity
Burst Pressure	Greater than 2.5 times capacity 10,000 PSI max.
Operating Temp. Range	-50°F to + 250°F
Compensated Temp. Range	-30°F to + 170°F
Thermal Sensitivity Shift	Less than + 0.02% reading per °F over Compensated Temp. Range
Thermal Zero Shift	Less than + 0.02% full scale per °F over Compensated Temp. Range
Flexure Material	17-4-PH Stainless Steel
Mating Connector	Bendix PT06A-10-6S (SR)
Pressure Cavity Volume	.098 Cubic Inches
Pressure Connection	3/8-18 NPT



* PREMIUM TEMPERATURE COMPENSATION

Compensated Temp. Range	-30°F to + 250°F
Thermal Sensitivity Shift	Less than 0.0025% reading per °F over compensated temp. range
Thermal Zero Shift	Less than 0.0025% full scale per °F over compensated temp. range



ORDERING INFORMATION

FOB – FARMINGTON HILLS, MICH.
TERMS – NET 10 DAYS
DELIVERY – STOCK TO 6 WEEKS ARO

GSE INC.
TRANSDUCERS • INSTRUMENTS • SYSTEMS

GSE INC.
23640 RESEARCH DRIVE
FARMINGTON HILLS, MI 48024
(313) 476-7875

Gulf + Western Manufacturing Company

Electric Vehicle Components

Bohn Heat Transfer Division

1625 East Voorhees Street
Danville, Illinois 61832
Telephone: 217/446-3710

Heat Exchangers	Air to air, liquid to air and liquid to liquid designs. Custom manufacture.

Michigan Plating & Stamping Division

1860 Alpine Avenue, N.W.
Grand Rapids, Michigan 49504
Telephone: 616/363-4847

Fuel Tanks	Supplier to automotive industry of terneplate stamped and welded tanks.

Automotive Marketing and Engineering Center

Detroit Sales and Engineering Office
24114 Research Drive
Farmington Hills, Michigan 48024
Telephone: 313/478-8140

Relays	Miniaturized 12VDC to control circuits to 20 amperes.
Solenoids	Build to customer requirements.
Switches	Build to customer requirements.
Transducers	Current, Position, Pressure, Speed, Temperature, Torque, Voltage - Build to customer requirements.
Voltage Regulators	12VDC Solid State

Collyer Insulated Wire Division

100 Higginson Ave.
Lincoln, RI 02865
Telephone: 401/723-7800

Apparatus Cables	**Single conductor, Type A.I.A.** IPCEA S-28-357, NEMA WC-1; Underwriters' Lab. Sizes #4 AWG and larger. Asb. covered, 300V and 600V.
Appliance Wires	**Single conductor** Collyer P-400 THHN/THWN PVC/NYLON in those sizes which are 19W uncompressed. U.L. Listed Rate AWM 105°C Dry and 80°C in oil.
Control Cables	**Single and multi conductor** THERMOPLASTIC: Collyer C-141 — PZR — PE/NYLON condrs. PVC Jacket 600V, 1000V, 75°C. Collyer C-140 — PVC insulated and jacketed 600V. Collyer C-143 — PE/PVC conductors, PVC jacket 600V, 1000V. Collyer C-153 — PE/NYLON, PZR 90°C, PVC jacket 600V, 1000V. Collyer C-154 — THHN/THWN conductors Type T.C. U.L. Listed.

RITE AUTOTRONICS CORP. 3485 S. LA CIENEGA BLVD., LOS ANGELES, CALIFORNIA 90016
TEL: 213-836-7900

INSTALLATION AND ADAPTER KITS

METRIC ADAPTER KITS for adapting oil pressure gauges, electrical temperature gauges and all dual and trio gauge sets containing either or both of the above instruments, to imported cars and U.S. built vehicles with metric engines. Kits are available for all gauges in this catalog marked with ⊠ symbol.

FOR OIL PRESSURE SINGLE GAUGE AND OIL PRESSURE/AMMETER DUAL GAUGES. Contains: Two tubing fittings with 1/8-28 BSPT and M 14 x 1.5 threads, complete instructions • Pack: 24 to a carton, carton weight: 3 lbs. **734**



FOR ELECTRONIC WATER TEMPERATURE SINGLE GAUGE AND ELECTRONIC WATER TEMPERATURE/AMMETER DUAL GAUGES. Contains: Reducing bushing 1/8 NPT to M 16 x 1.5, temperature sending unit with 1/8-28 BSPT, complete instructions • Pack: 24 to a carton, carton weight: 3 lbs. **735**



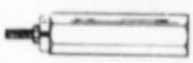
FOR OIL PRESSURE/ELECTRONIC WATER TEMPERATURE DUAL GAUGE AND OIL PRESSURE/ELECTRONIC WATER TEMPERATURE/ AMMETER TRIO GAUGES. Contains: Two tubing fittings with 1/8-28 BSPT and M 14 x 1.5 threads, reducing bushing 1/8 NPT to M 16 x 1.5, temperature sending unit with 1/8-28 BSPT, complete instructions • Pack: 24 to a carton, carton weight: 4 lbs. **736**

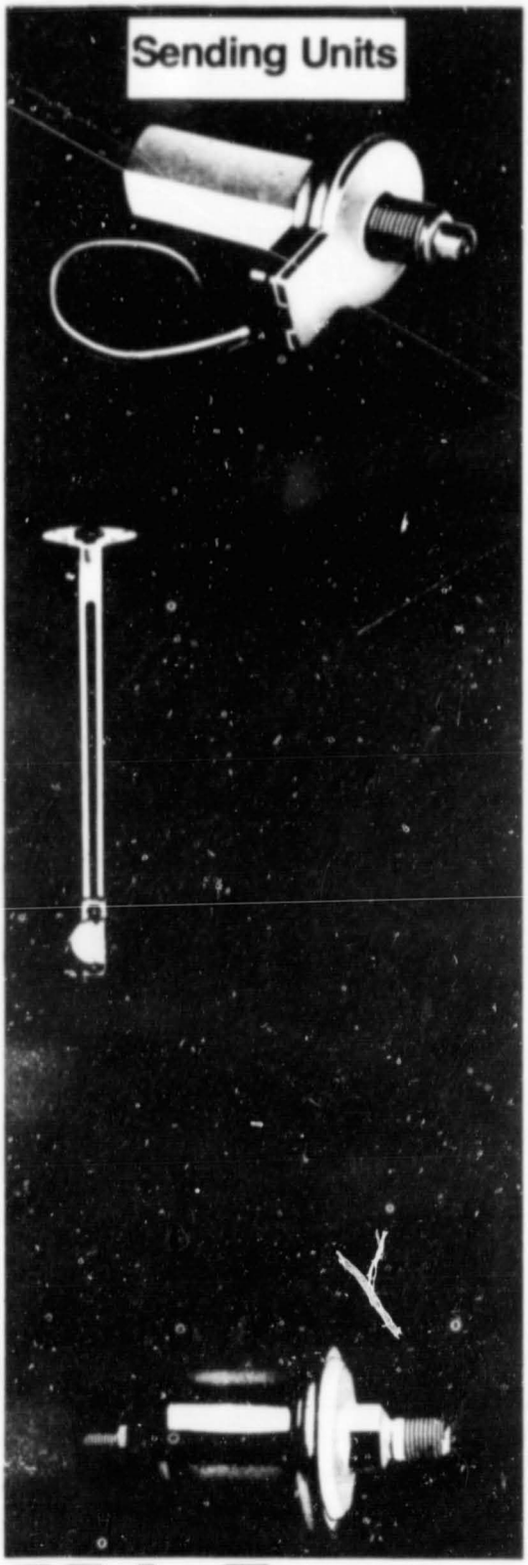


1/8" P.T. SENDING UNIT KIT for U.S. thread engines. For all RAC electronic temperature gauges except head temperature. Includes sender, 1/4", 3/8" and 1/2" P.T. adapters. Specify: 72703 for all 1972 and later gauges, has blue insulator; 72701 for deluxe, custom 1971 and earlier, has white insulator; 72702 for continental, continental 500, 1971 and earlier, has red insulator • Pack: 6 to a carton, carton weight: 2 lbs. **727**



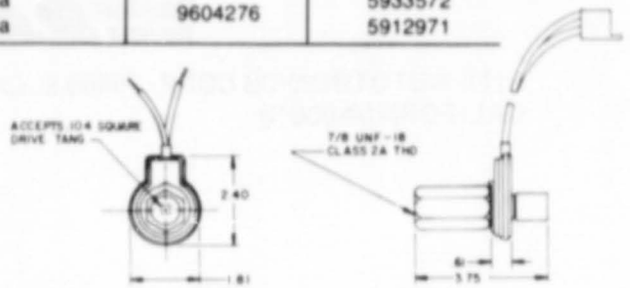
HEAD TEMPERATURE SENDING UNIT fits Corvair, others with 3/8–24 threads. Use with 441, 443 model gauges. Specify: 72801 for 150°–350° meter; 72800 for 130°–300° meter • Pack: 6 to a carton, carton weight: 2 lbs. **728**



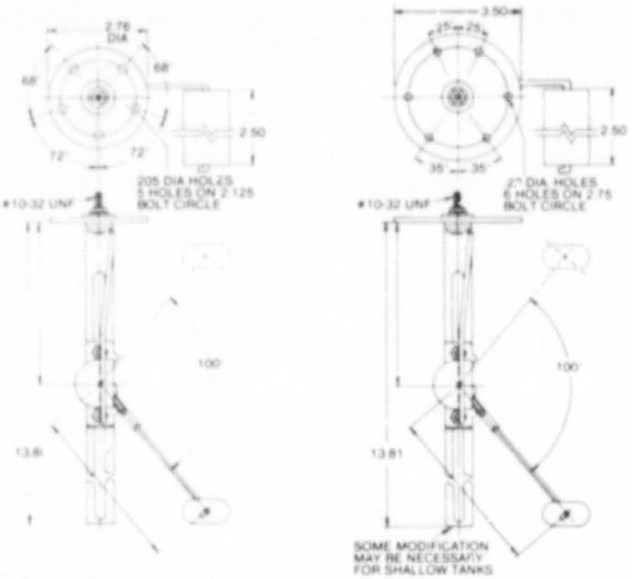


SIGNA-FLEX TACHOMETER

DRIVE TANGS	SENDER PART NUMBER	PART NUMBER
.187 dia .152 dia	9604276	5933572 5912971

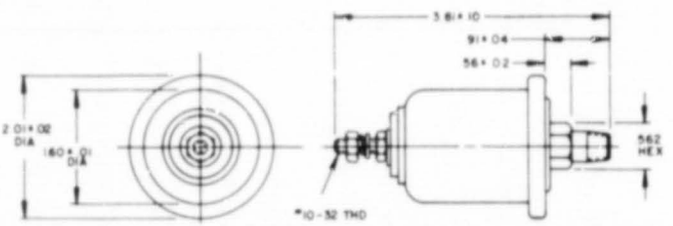


FUEL	SENDER TYPE	PART NUMBER
6" to 24" tank 5 hole flange	Introl Stewart Warner	1507170 1501775
6" to 24" tank 6 hole flange	Introl	1507273



OIL PRESSURE

PRESSURE RANGES	SIZE NPT	SENDER TYPE	PART NUMBER
80 psi 100 psi 120 psi	1/8" 1/8" 1/8"	Stewart Warner	1500171 1501671 1506177
80 psi 100 psi	1/8" 1/8"	Introl	9600171 9605476



Teleflex INCORPORATED
industrial

Electrical systems:
1816 57th Street, Sarasota, Florida 33580
Telephone (813) 355-7721

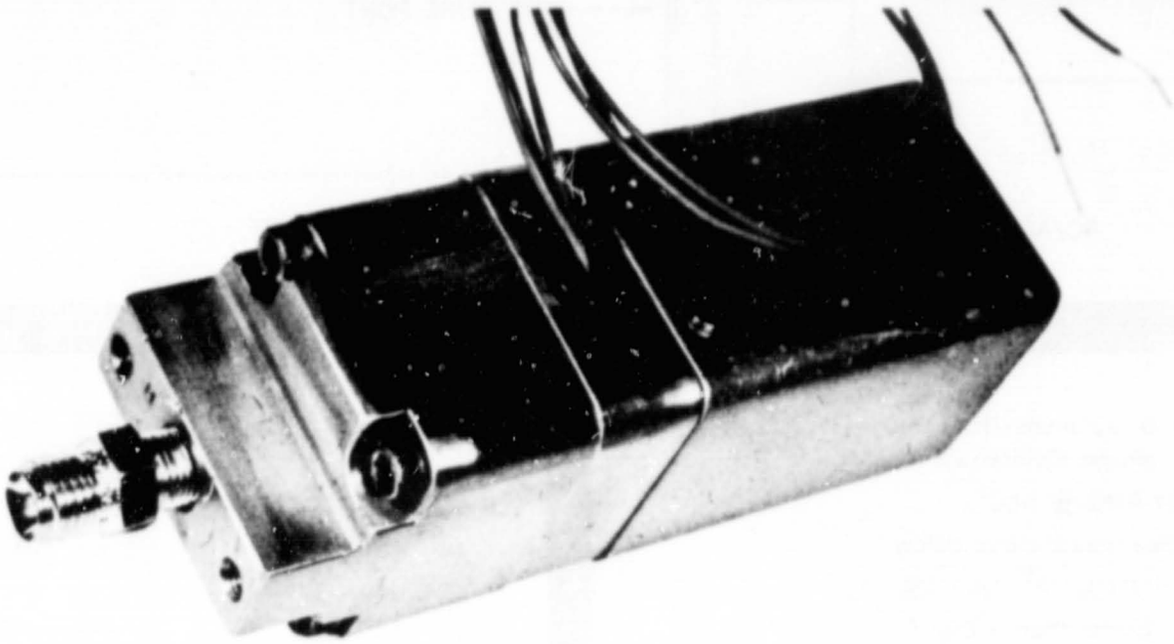
Mechanical systems:
640 North Lewis Road, Limerick, Pennsylvania 19468
Telephone (215) 495-7011 • Telex 84-6335

TSI

PRESSURE TRANSDUCERS

BULLETIN PVT-7000A

TRANSDUCER SYSTEMS, INC.



As a result of extensive research and development, **TSI** has come up with a proprietary* technique for pressure sensing utilizing our new highly accurate and highly sensitive proximity transducer in conjunction with a specially formed and coated alloy diaphragm. By eliminating the use of a mechanical linkage between the pressure sensor and the electrical pickoff unit, we have, to all intents and purposes, eliminated hysteresis error.

The basic characteristics of this unit are described on the reverse side of this sheet, including typical dimensions and sensitivity curves.

While the basic units are AC-input, AC-output devices, **TSI** also produces the same units with DC-input—DC-output. This is accomplished either in one integral unit or with the electronics in a separate package, as preferred by the customer, since the transducer can be designed to withstand higher temperatures than the electronics will normally withstand. This is an added degree of flexibility available in **TSI** transducers. For high temperature applications it is imperative that the electronics be located remote from the transducer. The electronic circuitry in the near future will be located on a single MOS I.C. chip exclusive of capacitors zero adjust and range adjust controls. The zero reference as shown on the typical curve on the reverse side is adjustable to interface into the electronic circuitry and system specifications. The output range (slope of typical curve shown) is also variable to customer requirements. Circuitry schematic is available upon customer request.

TSI pressure transducers can be tailored to meet customer requirements for mounting, size, shape, temperature, sensitivity, accuracy, available excitation voltages, and integration with varying electronic circuit/load configurations.

The pressure transducers, described in this bulletin are available in gauge, differential or absolute configurations.

*Patent 3,638,497

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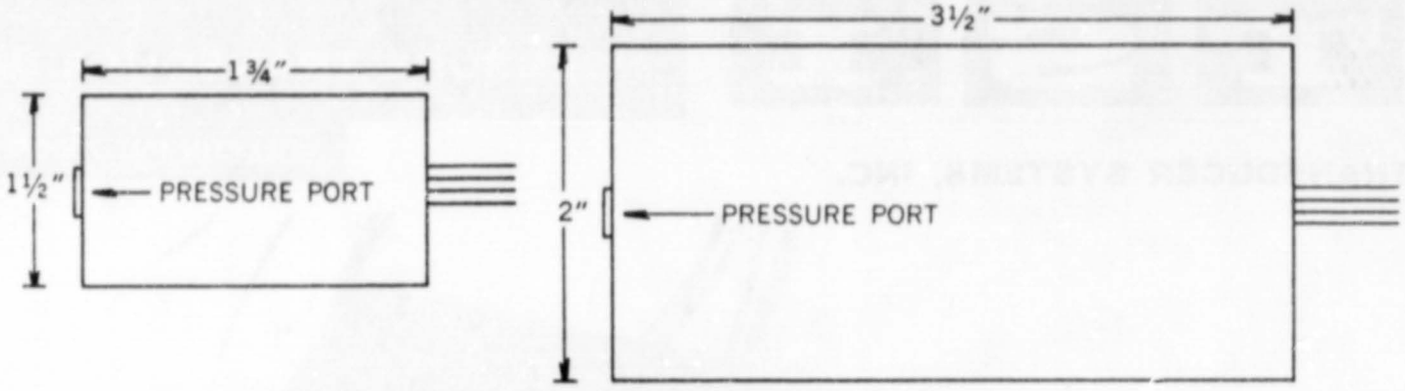


AC/AC UNIT

DC/DC UNIT

Pressure: 0 —2 inches H_2O to 0 —20,000 PSI, gauge, differential or absolute

*Input: 3V RMS @ 5KC

Output: See typical curve below

**Drift: ±.01%/°F (±.01%/°F)

Accuracy: Better than ±2% F.S.

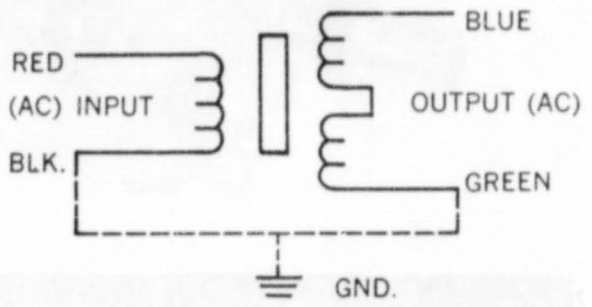
Threshold: Adjustable at factory

Temp Range: —25°F to +300°F

Repeatability: 99.0% over 1 million cycles of operation

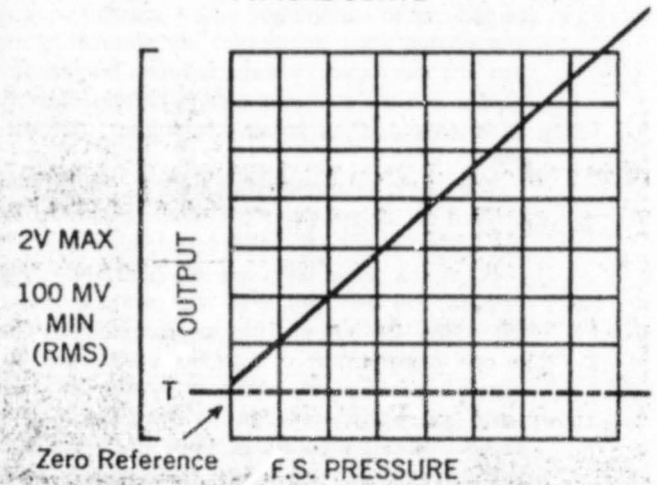
*Units with DC inputs as specified by customer must be so indicated by customer.

**Drift characteristics can be improved with temperature compensation per customer requirements.



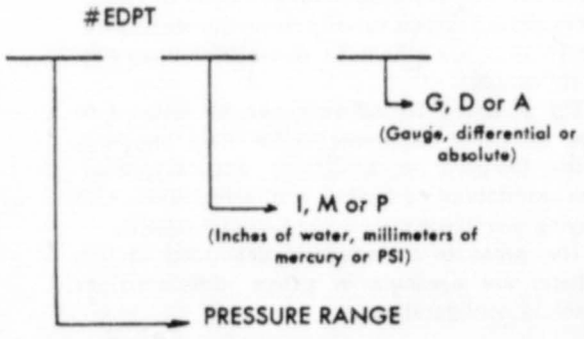
ELECTRICAL CIRCUIT

TYPICAL CURVE



T = THRESHOLD LEVEL — 200 M.V. MAX.

HOW TO SPECIFY YOUR MODEL NO.



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TSI

PRESSURE TRANSDUCERS

TRANSDUCER SYSTEMS, INC.



AC/AC UNIT



DC/DC UNIT

As a result of extensive research and development, **TSI** has come up with a proprietary* technique for pressure sensing utilizing our new highly accurate and highly sensitive proximity transducer in conjunction with a specially formed and coated alloy diaphragm. By eliminating the use of a mechanical linkage between the pressure sensor and the electrical pickoff unit, we have, to all intents and purposes, eliminated hysteresis error.

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*Patent 3,638,497

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TRANSMISSIONS, MANUAL

(CODE **TM**)

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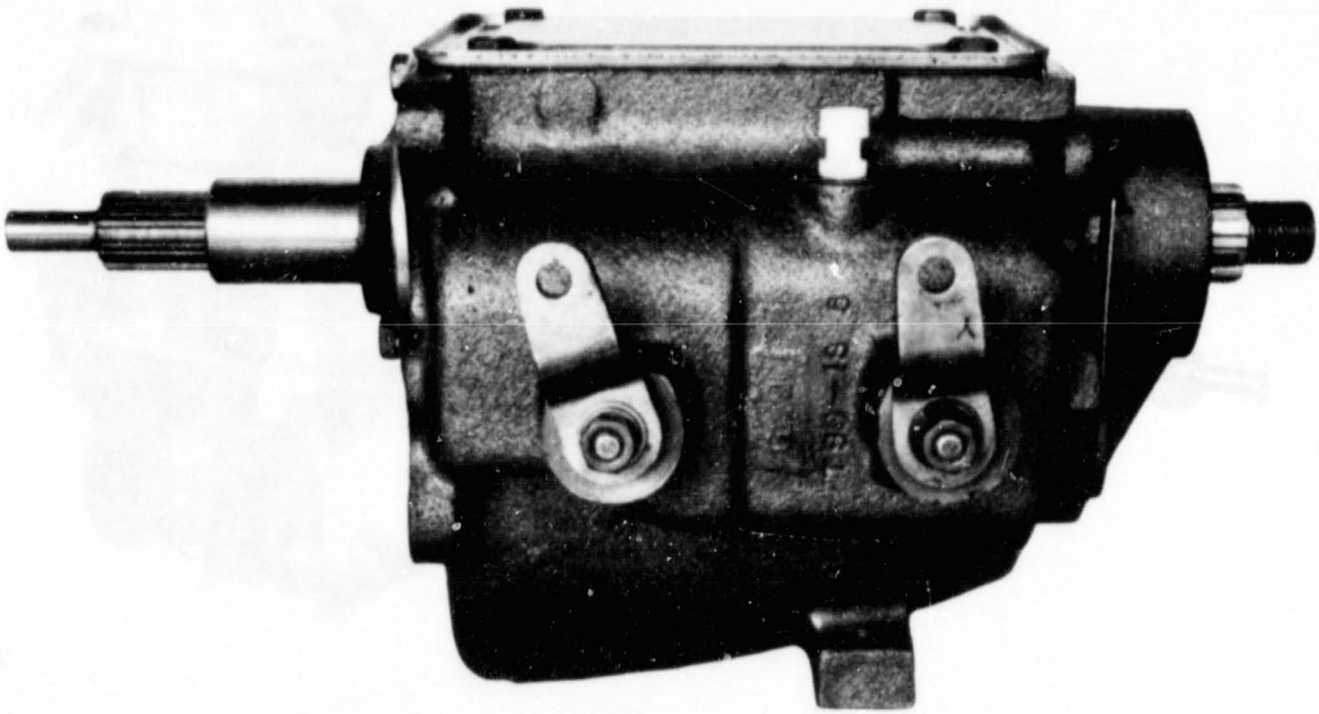
BORG WARNER® Transportation Equipment

T96 Three-Speed Manual Transmission

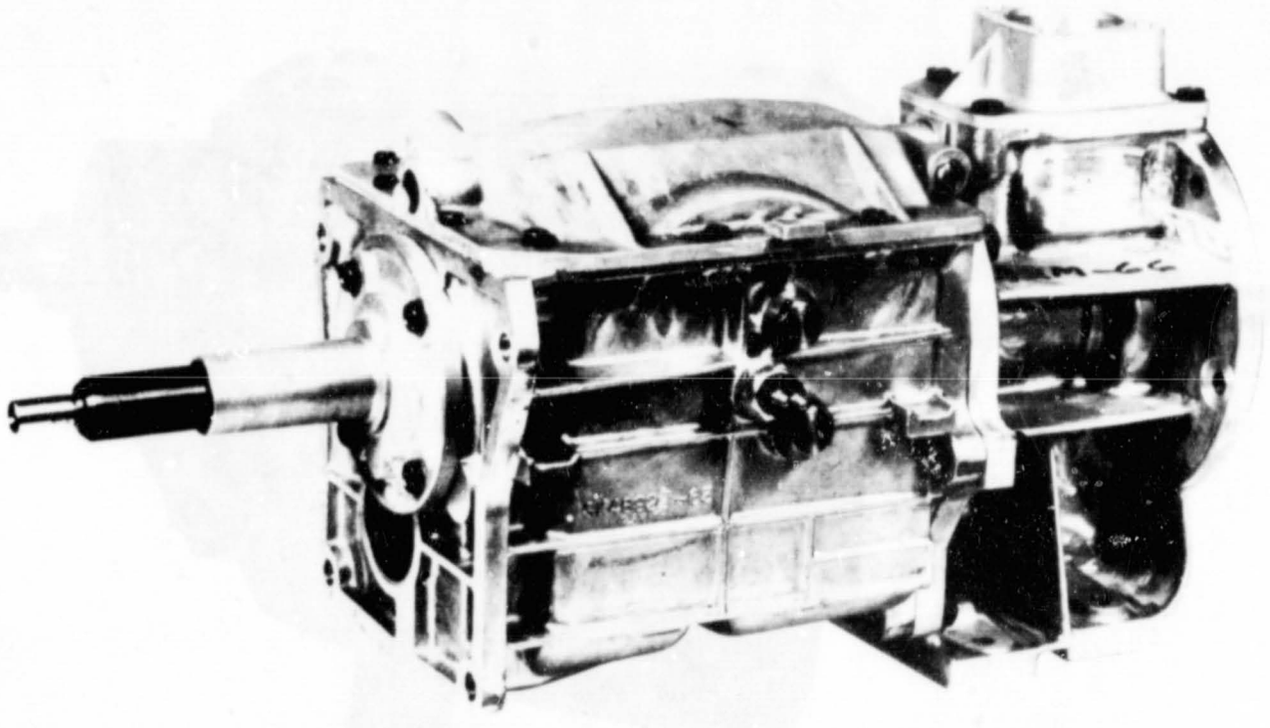


The T96 is a three-speed, helical gear transmission, synchronized in two forward speeds (2nd and 3rd). It is currently used in a variety of applications such as dune buggies, all terrain vehicles, golf carts, personnel carriers, trenchers, haulsters, sewer tools, small garden tractors, military bomb loaders, Post Office vehicles and earth drilling units. It is one of the multiple purpose transmissions manufactured by Warner Gear at Muncie, Indiana where transmission development and engineering has been a tradition since 1901. Intensive research, directed by an awareness of trends and requirements, has been responsible for marked advances in manufacturing procedures, such as numerically controlled machining centers for established products and for new small run production. Quality control and inspection facilities are an integral function of all manufacturing procedures. For more information on this and other Warner Gear power transmission products, contact the Industrial Sales Group.

BORG WARNER **Warner Gear**
A Division of Borg-Warner Corporation
Industrial Sales Group
P.O. Box 2688, Muncie, IN 47302
(317) 286-6100

BORG WARNER

T4 Four-Speed Manual Transmission



The T4 is one of a new family of light weight four- and five-speed manual transmissions for front-engine, rear-wheel drive passenger cars and light trucks. Major markets for it are in vehicles where front-wheel drive is either inappropriate from an application standpoint or inordinately expensive to develop.

The T4 is a four-speed countershaft transmission and is rated at 210 or 250 lb-ft (286-340 Nm), depending on gear ratios. Tapered roller bearings on the input and output shafts and a live countershaft permit its application to a wide range of four-cylinder, six-cylinder and V8 engines in two-wheel drive and four-wheel drive passenger cars and trucks to 6,200 pounds GVW. The transmission uses the conventional "H" shift pattern.

Aluminum die castings for the case, cover, and extension housing minimize the weight of the T4. The "family" design concept between the T4 and T5 maximizes parts interchangeability between transmissions and simplifies driveline installations.

For more information on this and other power transmission products manufactured by Warner Gear, contact the Automotive Sales Group.

BORG WARNER **Warner Gear**
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Industrial Sales Group
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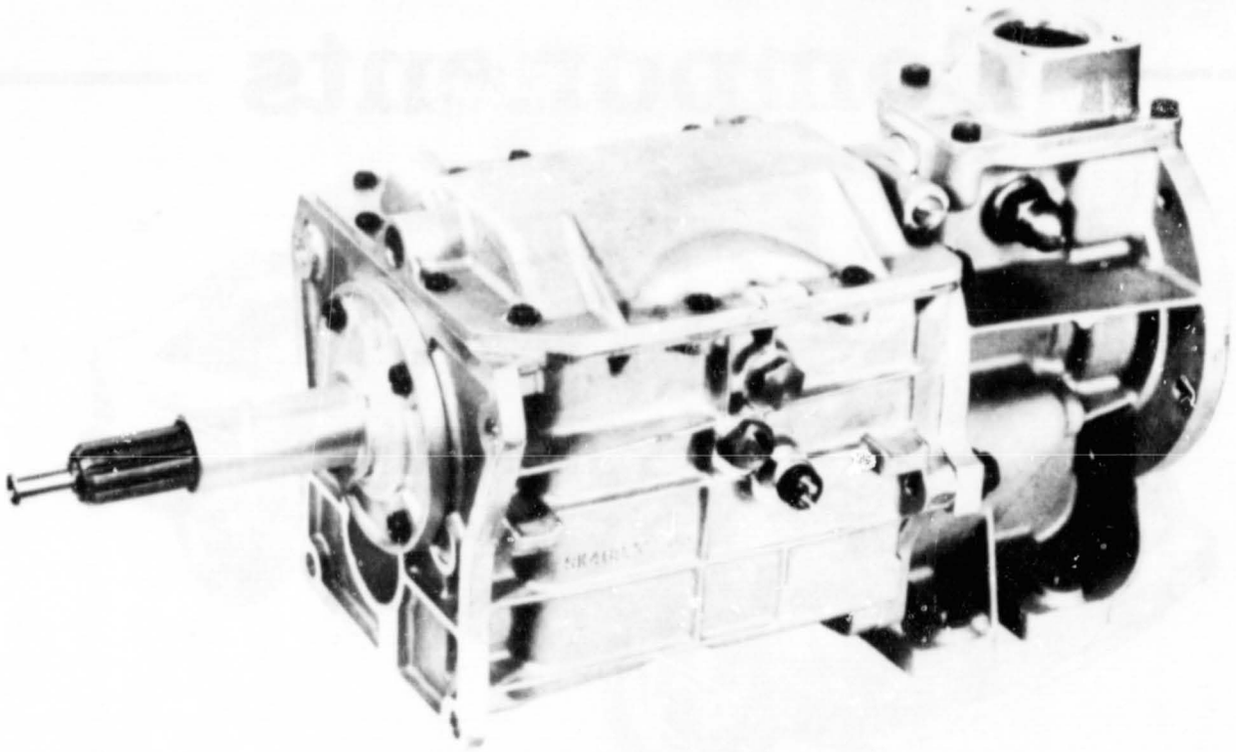
BORG WARNER

T5 Five-Speed Manual Transmission



The T5 is one of a new family of light weight four- and five-speed manual transmissions for front-engine, rear-wheel drive passenger cars and light trucks. Major markets for it will be in vehicles where front-wheel drive is either inappropriate from an application standpoint or inordinately expensive to develop.

The T5 is a five-speed countershaft transmission and is rated at 210 or 250 lb-ft (286-340 Nm), depending on gear ratios. Tapered roller bearings on the input and output shafts and a live countershaft permit its application to a wide range of four-cylinder, six-cylinder and V8 engines in two-wheel drive and four-wheel drive passenger cars and trucks to 6,200 pounds GVW. The transmission uses the conventional "H" shift pattern. Fifth gear in the T5 has overdrive ratios of .76 or .78:1. The overdrive gear synchronizer is located on the countershaft gear.

Aluminum die castings for the case, cover, and extension housing minimize the weight of the T5. The "family" design concept between the T5 and T4 maximizes parts interchangeability between transmissions and simplifies driveline installations.

For more information on this and other power transmission products manufactured by Warner Gear, contact the Automotive Sales Group.

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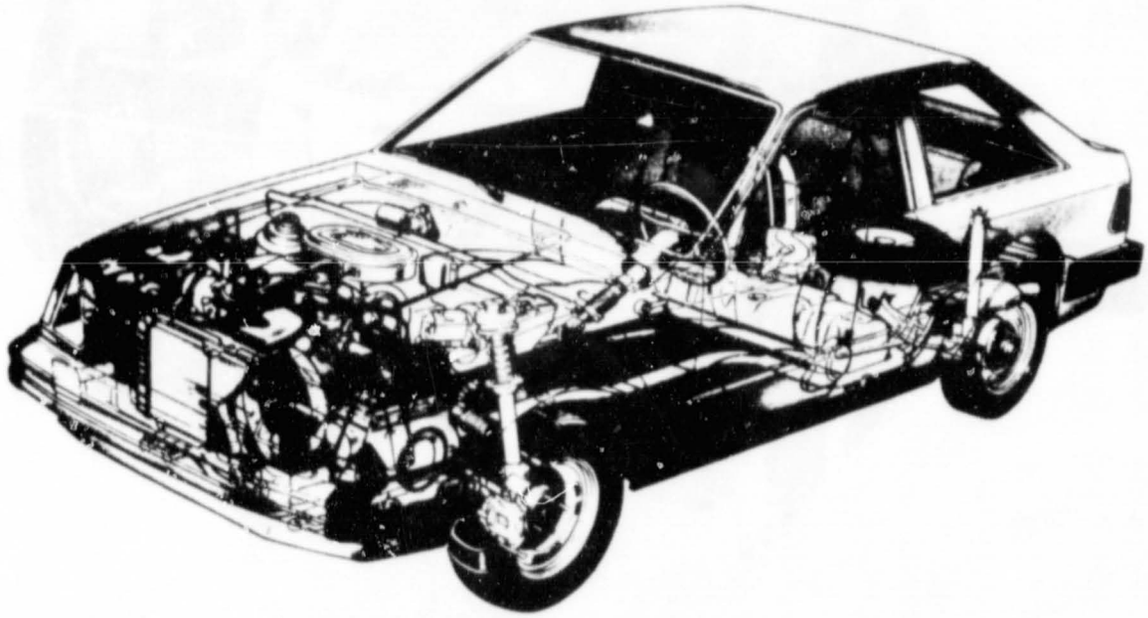
Automotive Components



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Industrial Engine Operations
Ford Parts and Service Division
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TM-7

TRANSDUCERS, CONTROL

POSITION

(CODE **TP**)

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Collyer Insulated Wire Division

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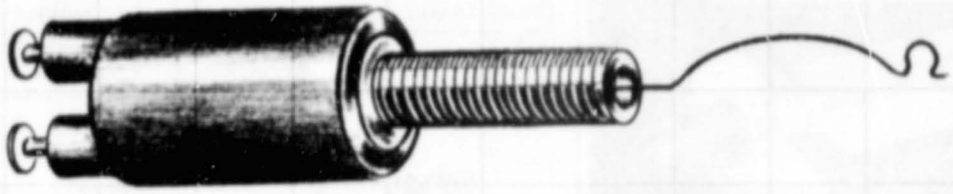
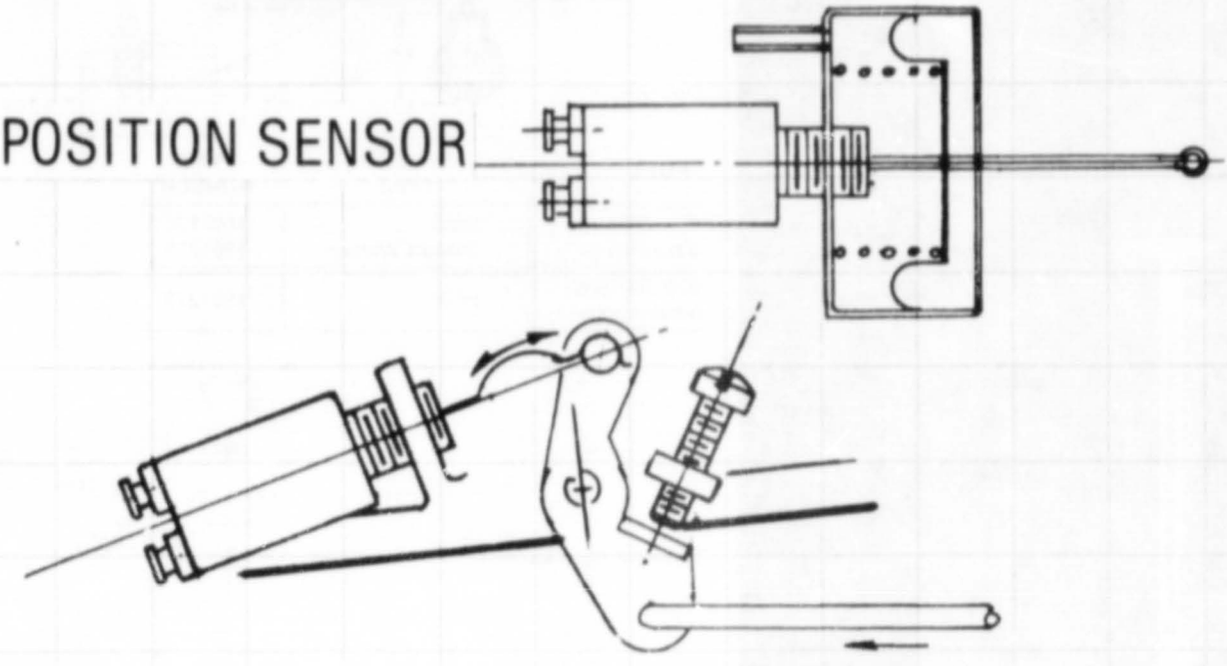
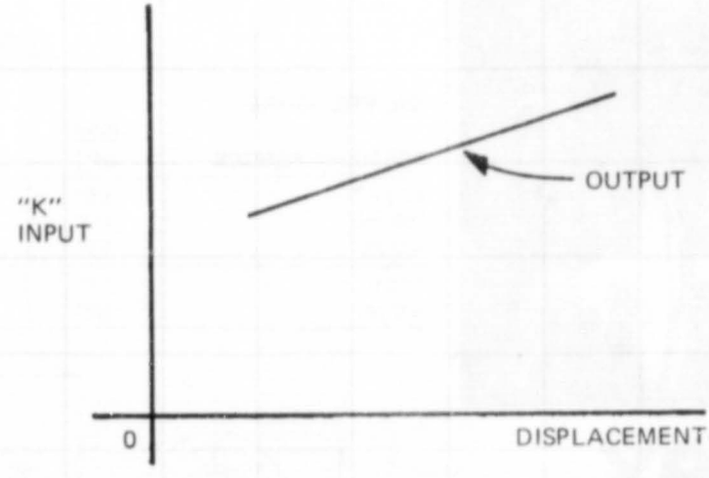
Apparatus Cables	**Single conductor, Type A.I.A.** IPCEA S-28-357, NEMA WC-1; Underwriters' Lab. Sizes #4 AWG and larger. Asb. covered, 300V and 600V.
Appliance Wires	**Single conductor** Collyer P-400 THHN/THWN PVC/NYLON in those sizes which are 19W uncompressed. U.L. Listed Rate AWM 105°C Dry and 80°C in oil.
Control Cables	**Single and multi conductor** THERMOPLASTIC: Collyer C-141 — PZR — PE/NYLON condrs. PVC Jacket 600V, 1000V, 75°C. Collyer C-140 — PVC insulated and jacketed 600V. Collyer C-143 — PE/PVC conductors, PVC jacket 600V, 1000V. Collyer C-153 — PE/NYLON, PZR 90°C, PVC jacket 600V, 1000V. Collyer C-154 — THHN/THWN conductors Type T.C. U.L. Listed.



POSITION SENSOR



This device will modify an A.C. electrical input signal as a function of mechanical position. It can be used to sense throttle position, diaphragm motor position or other position sensing needs.



CONTACT ENGINEER - CLARENCE FOX

BORG WARNER Transportation Equipment

Marvel-Schebler/Tillotson Division
Borg-Warner Corporation
2195 South Elwin Road, Decatur, Illinois 62525
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APPROVED C. Fox

SKETCH NUMBER 145

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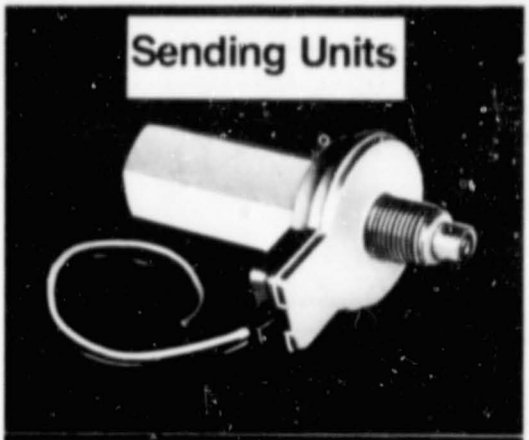
Sending Units

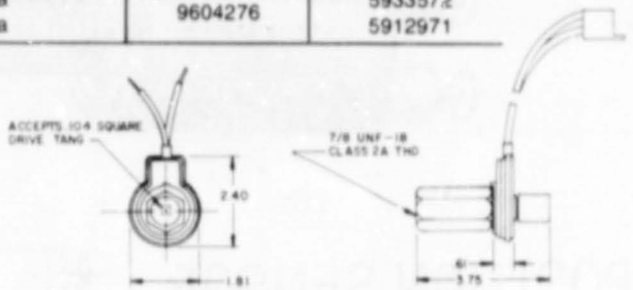






SIGNA-FLEX TACHOMETER

DRIVE TANGS	SENDER PART NUMBER	PART NUMBER
.187 dia	9604276	5933572
.152 dia		5912971



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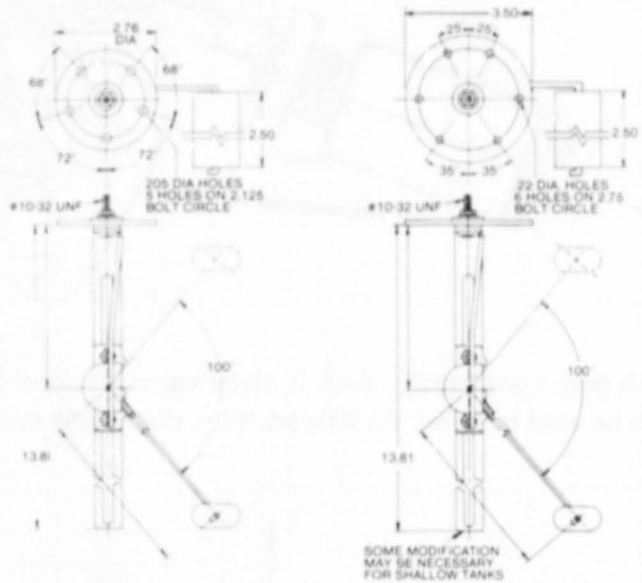
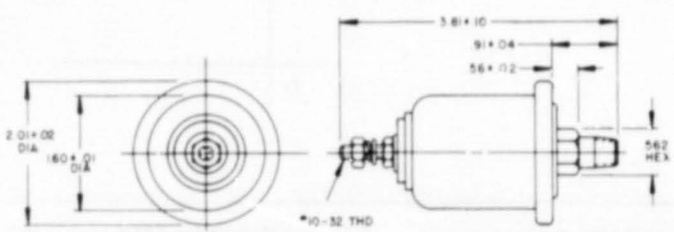
	Stewart Warner	1501775
6" to 24" tank 6 hole flange	Introl	1507273



OIL PRESSURE

PRESSURE RANGES	SIZE NPT	SENDER TYPE	PART NUMBER
80 psi	1/8"	Stewart Warner	1500171
100 psi	1/8"		1501671
120 psi	1/8"		1506177
80 psi	1/8"	Introl	9600171
100 psi	1/8"		9605476



Teleflex INCORPORATED
industrial

Electrical systems:
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Telephone (813) 355-7721

Mechanical systems:
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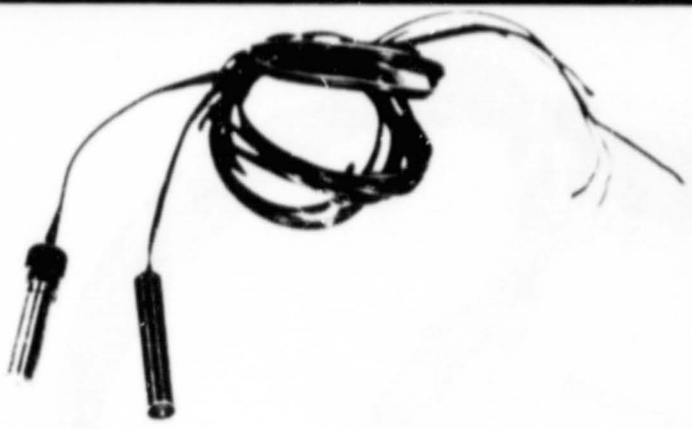
TSI

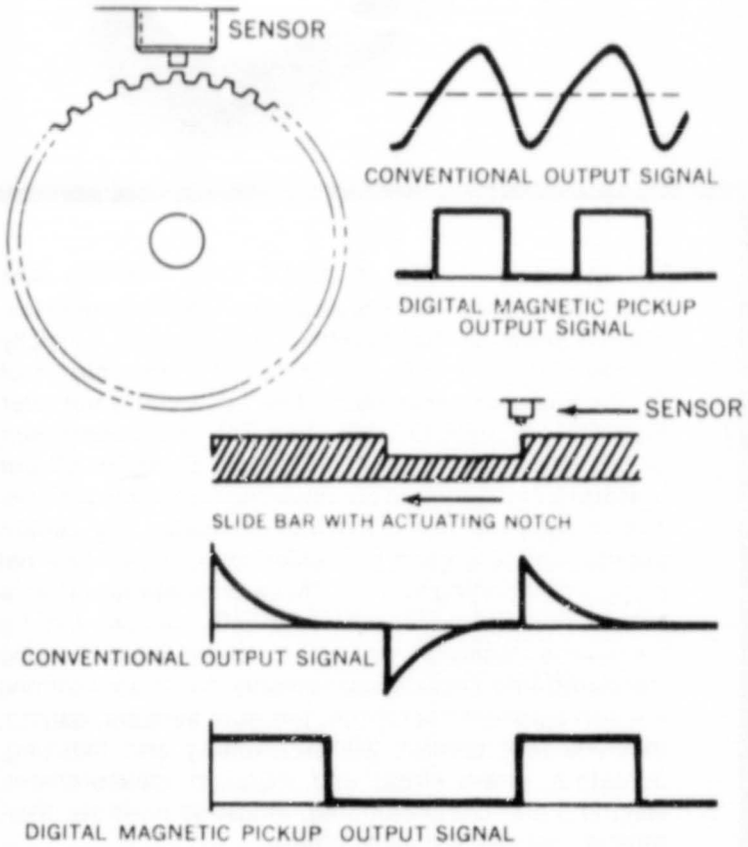
TRANSDUCER SYSTEMS INC.

MODEL NO. DMP 250-1500-AP

DIGITAL MAGNETIC PICKUP



BULLETIN DMP-1 A



Here is the newest electromagnetic Transducer from **TSI**. To meet the needs of the computer peripheral, the electronic controls and the automotive fields, we have come up with a transducer which is compatible with today's digital circuitry, yet which remains small, compact and inexpensive. The **TSI** digital magnetic pickup offers either positive or negative going logic signals, as may be required. Air gap-surface speed combinations vary from 20 inches per second at 0.010" to 2500 inches per second at 0.075". Another feature of the **TSI** digital magnetic pickup is that once the surface speed-air gap specification in exceeded, the output amplitude does not change with further variations of air gap or surface speed. An option for specially shaped chisel tipped pole pieces is available for better resolution for extremely closely spaced teeth or slots. In every application you will find the **TSI** digital magnetic pickup units reliable and competitively priced for your needs.

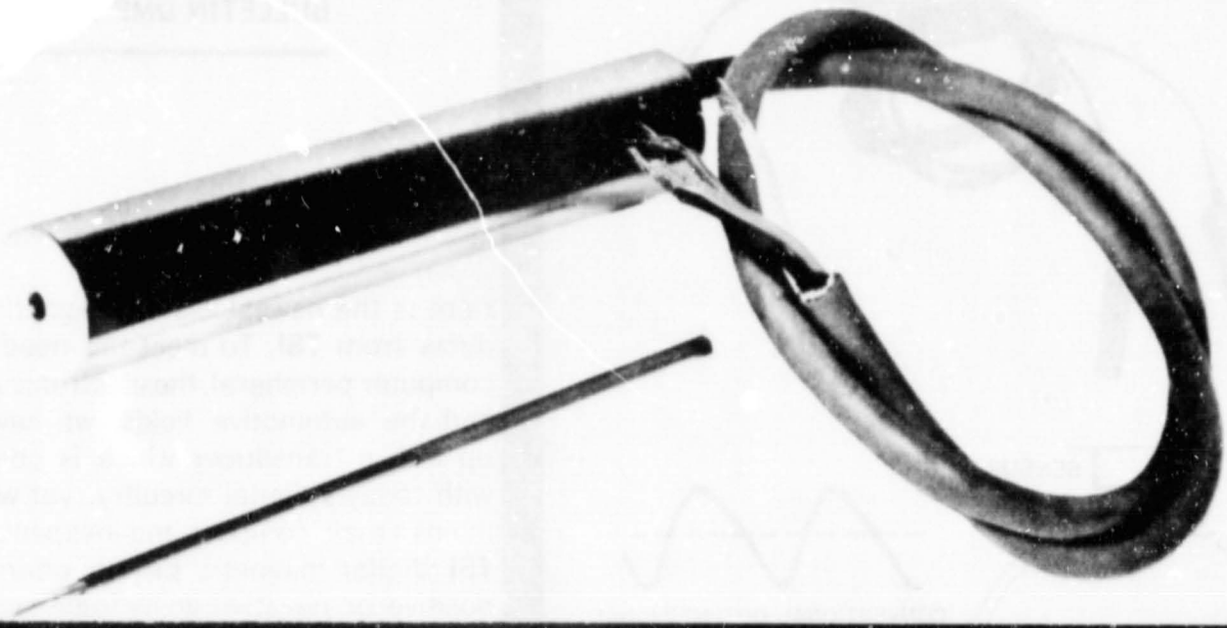
TRANSDUCER SYSTEMS, INC.
710 DAVISVILLE ROAD · WILLOW GROVE, PA. 19090
PHONE AC 215-657-0800

TSI

TRANSDUCER SYSTEMS, INC.

BULLETIN DCDT-1A

DC/DC LVDT's LINEAR VARIABLE DIFFERENTIAL TRANSFORMERS



GENERAL SPECIFICATIONS

Input	24 V dc (nominal), 25 ma
Temperature Range	-65° F to + 200° F.
Null Voltage	0 V dc
Ripple	Less than 1% full scale
Linearity	±0.5% full range
Stability	0.125% full scale
Temperature Coefficient of Scale Factor	0.04%/° F.
Shock Survival	250 g for 11 milliseconds
Vibration Tolerance	10 g up to 2 KHz
Housing Material	Series 400 magnetic stainless steel
Lead Wires	AWG 24, stranded copper, Teflon-insulated, 12 inches long

TSI introduces its line of DC/DC LVDT's in this data sheet. While part numbers and specifications are listed, we will produce, for quantity requirements, specially custom designed units. DC/DC LVDT's maintain all of the desirable characteristics of AC/AC LVDT's but offer the simplicity of DC/DC operation. The unit is comprised of two integral parts: the LVDT itself, an AC in AC out unit and a carrier-signal conditioning electronic module. The integral electronic module eliminates, for certain applications, a larger and costlier conventional external signal conditioning system. These units operate from a simple power source, even dry cells. DC/DC LVDT's measure a variety of physical functions which can be translated into linear displacements. Such applications are servo position feedback, pressure sensors, gaging, machine tool control, X-Y positioning and indexing, actuators, strain stress and vibration measurement, weighing and checkweighing, industrial controls, thermostat controls and many others.

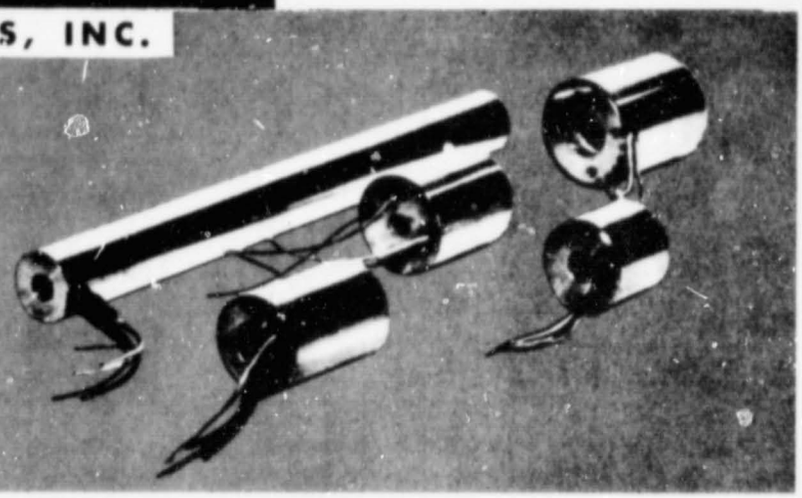
TRANSDUCER SYSTEMS, INC.
710 DAVISVILLE ROAD · WILLOW GROVE, PA. 19090 · AC/215-657-0800

TSI

BULLETIN DT—1000—A

TRANSDUCER SYSTEMS, INC.

The linear variable differential transformer is a highly successful device for accurate measurement and control of mechanical quantities in precise industrial, scientific and military applications.



The linear variable differential transformer (LVDT) is an electro-mechanical transducer which produces a voltage output directly proportional to the displacement of a movable armature or magnetic core. The core is axially positioned inside three transformer coils consisting of a primary with two secondaries connected in series opposite. By energizing the primary with alternating current, a voltage output appears across the secondary circuit when the magnetic core is moved from the central or null position. Winding configurations appear on the last page.

Performance

The increasing demand for higher reliability and better accuracy can be met by **TSI** LVDT's. These LVDT's have the following features:

1. Displacement range. **TSI** LVDT's are available in a variety of linear travel ranges from ±.005 inches to ±25 inches.

2. Unlimited Resolution—The optimum performance of the **TSI** LVDT's is obtained by providing a uniform electro-magnetic field inside of the LVDT housing. There is no discontinuity of the electro-magnetic field inside the LVDT housing and the output versus displacement is thus a perfectly smooth curve and the resolution is only limited by the external circuitry.

3. Wide Temperature Range—**TSI** LVDT's are designed and manufactured to operate in environments from —400° F. to +1200° F.

4. High Temperature Stability — Care has been taken in the design of the LVDT to obtain the most stable performance under varying environmental temperatures.

5. Good Linearity—High degree of linearity is one of the most important features of the **TSI** LVDT's. Independent linearities better than .05% are obtainable, where required.

6. High Sensitivity—LVDT's are available with sensitivity up to 1000 volts output per inch displacement, if required.

7. Frictionless Sensing—The **TSI** LVDT's can be supplied with a large clearance between the core and bore. The core can then be supported at both ends and move without touching the bore. In most applications the core is supported at one end only and will then glide on an oil film in the LVDT bore.

8. Shielded—All **TSI** LVDT's are shielded from external fields.

9. Unlimited Lifetime—The **TSI** LVDT's are solidly potted and encased in a high permeability steel housing. The ferromagnetic core is the only moving part. There are no sliding contacts or moving leads. When properly used, the LVDT shows no wear or deterioration with time and the life is practically unlimited.

10. Extreme Ruggedness—The heavy wall stainless steel construction will withstand the most severe shock and vibration encountered in missiles, aircraft and industry.

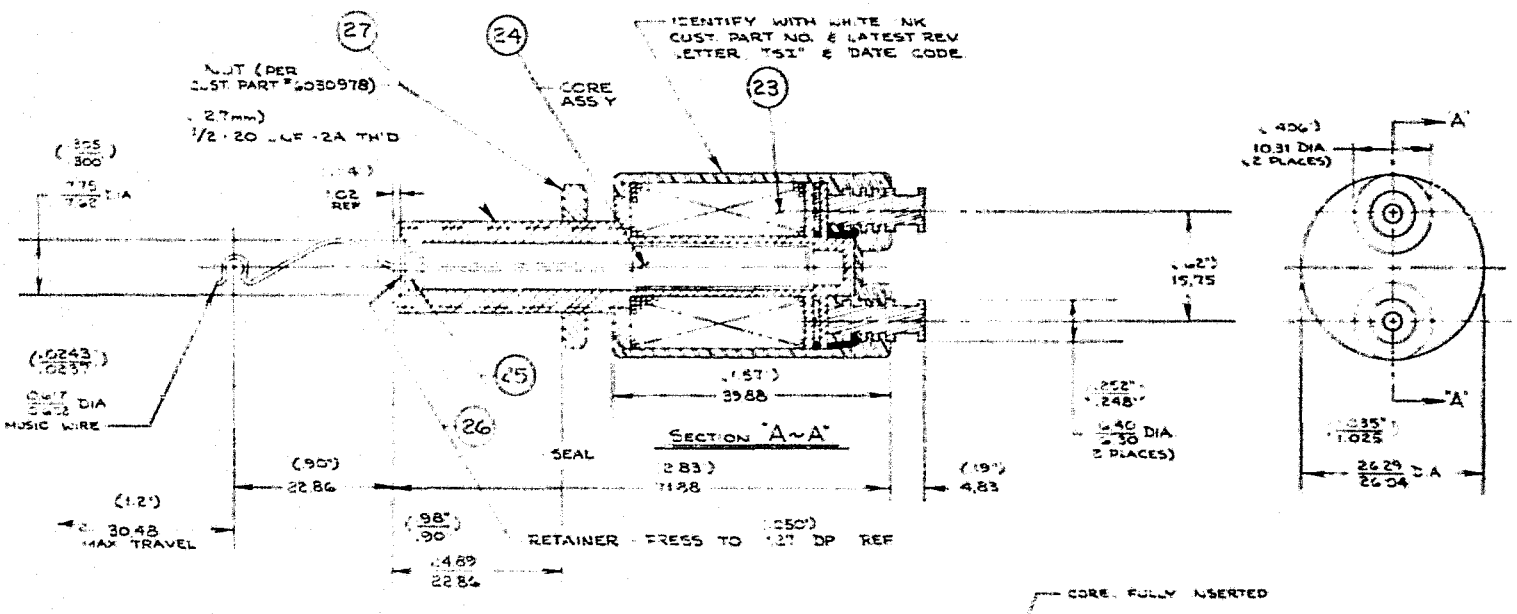
In order to accommodate the ever increasing application of the LVDT other special feutures are available such as radiation resistant units, totally immersible units, explosion proof housings, matched pairs, dual output units and DC input/output units.

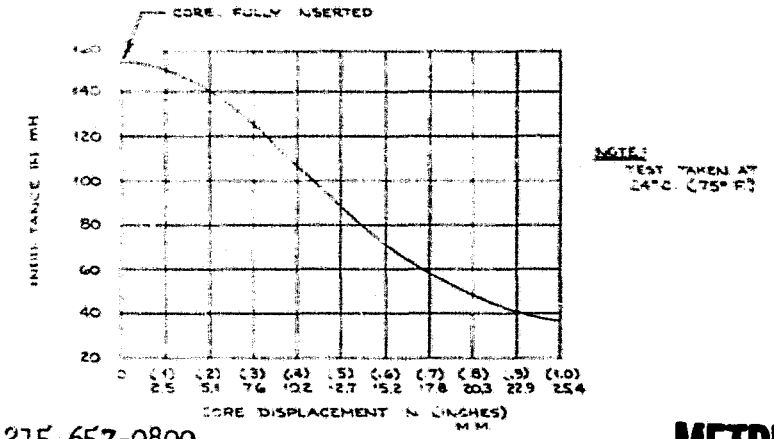
PHONE 215-657-0800

TRANSDUCER SYSTEMS, INC.

710 DAVISVILLE ROAD. WILLOW GROVE. PA. 19090

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
—	C	REDRAWN TO ZONE WZ 3 DWGS. E.N.T. 01003 AIDT-5602 & ACK BTT, PER ECN 052	[illegible]	[illegible]





NOTE: TEST TAKEN AT 24°C. (75°F)

RESPONSE CURVE

I SPECIFICATIONS

A. THE INDUCTANCE OF THE FINAL ASSEMBLY IS 150 MH ± 5 MH WITH THE CORE AT THE MAXIMUM INDUCTANCE POSITION AT A TEMPERATURE OF 21° C TO 27° C (70° F TO 80° F)

B. THE RESISTANCE OF THE COIL ASSEMBLY IS 45 OHMS ± 3 OHMS AT A TEMPERATURE OF 21° C TO 27° C (70° F TO 80° F)

C. THE WIRE ASSEMBLY MUST WITHSTAND A PULL OF 907.2 GRAMS (2 POUNDS) BETWEEN THE WIRE ARM AND THE CERAMIC AT -34° C (-30° F) AND AT 149° C (300° F) WITHOUT SEPARATION.

II LIFE TEST

A. THERMOCYCLE

(1) THE TRANSDUCER MAY BE SUBJECTED TO TEN THERMOCYCLES AS FOLLOWS:

1 HOUR AT 149° C (300° F)
10 MINUTE TRANSITION
1 HOUR AT -29° C (-20° F) — 1 THERMOCYCLE
10 MINUTE TRANSITION

B. VIBRATION

(1) THE TRANSDUCER HAS SUFFICIENT STRENGTH AND RIGIDITY TO WITHSTAND FOUR HOURS OF A VIBRATIONS CYCLE OF 10 TO 250 TO 10 HZ EVERY 30 SECONDS AT A CONSTANT 5 GS INPUT TO THE MOUNTING BRACKET AT THE JUNCTION OF THE MOUNTING BRACKET AND THE TRANSDUCER. THE VIBRATION IS APPLIED IN A PLANE RADIAL TO THE COIL AXIS WITH THE CORE HELD AT APPROXIMATELY THE MAXIMUM INDUCTANCE POSITION.

TEL: 215-657-0800

METRIC

TOLERANCE UNLESS NOTED	
.XX	+.01 −.01
.XXX	+.005 −.005
.XXXX	+.0005 −.0005
DRILLED HOLES	+.003 −.000
FORMED ANGLES	+1/2° −1/2°

UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS ARE IN INCHES AND INCLUDE PLATING WHEN SPECIFIED.

REMOVE ALL BURRS AND BREAK ALL SHARP EDGES.

ALL DIAMETERS TO BE CONCENTRIC WITHIN .005 T.I.R. UNLESS NOTED

ORDER NO.	
[illegible]-02	
DRAWN BY [illegible]	DATE 5-22-79
CHECKED [illegible]	DATE 5/24/79
APPROVED	DATE
APPROVED	DATE

38.48 REF

NEXT ASSEMBLY | FINAL ASSEMBLY

TSI TRANSDUCER SYSTEMS, INC.
WILLOW GROVE, PENNSYLVANIA 19090

OUTLINE & FINAL ASSEMBLY
THROTTLE POSITION TRANSDUCER

SIZE	DRAWING NO.	REVISION
C	C107-01003	D

SCALE 2:1 SHEET 1 of 1

TRANSDUCERS, CONTROL

TORQUE

(CODE **TQ**)



TORQUE SENSORS

In-Line Rotating Shaft Torque Sensor

GSE Inc. offers a complete line of Rotating Torque Sensors, Models 2104 thru 2107. These In-Line Rotating Shaft Torque Sensors have several advantages, such as high accuracy, good frequency response, relatively low cost and a maximum adaptability for many torque applications. The steel sensing shaft is strain-gaged in a full four-arm wheatstone bridge configuration. A protective epoxy bond seals the strain-gaged area, providing a seal against oil, dirt and moisture. The sensor assembly is securely mounted in the one piece outer housing and supported by permanently lubricated and sealed ball bearings. The brush block can easily be removed for routine inspection.

A variety of options are available, including flange and foot mount adaptors, splined shafts, air actuated brush lifter, and speed pick-ups.

All torque transducers are calibrated before shipment. Calibration standards are traceable to the National Bureau of Standards torque calibration up to 250,000 inch lbs.

Instrumentation read-out and control electronics are also offered by GSE Inc. Consult factory for details on your specific requirements.

G.S.E. INC., 26340 Research Drive, Farmington Hills, MI., 48024, (313) 476-7875

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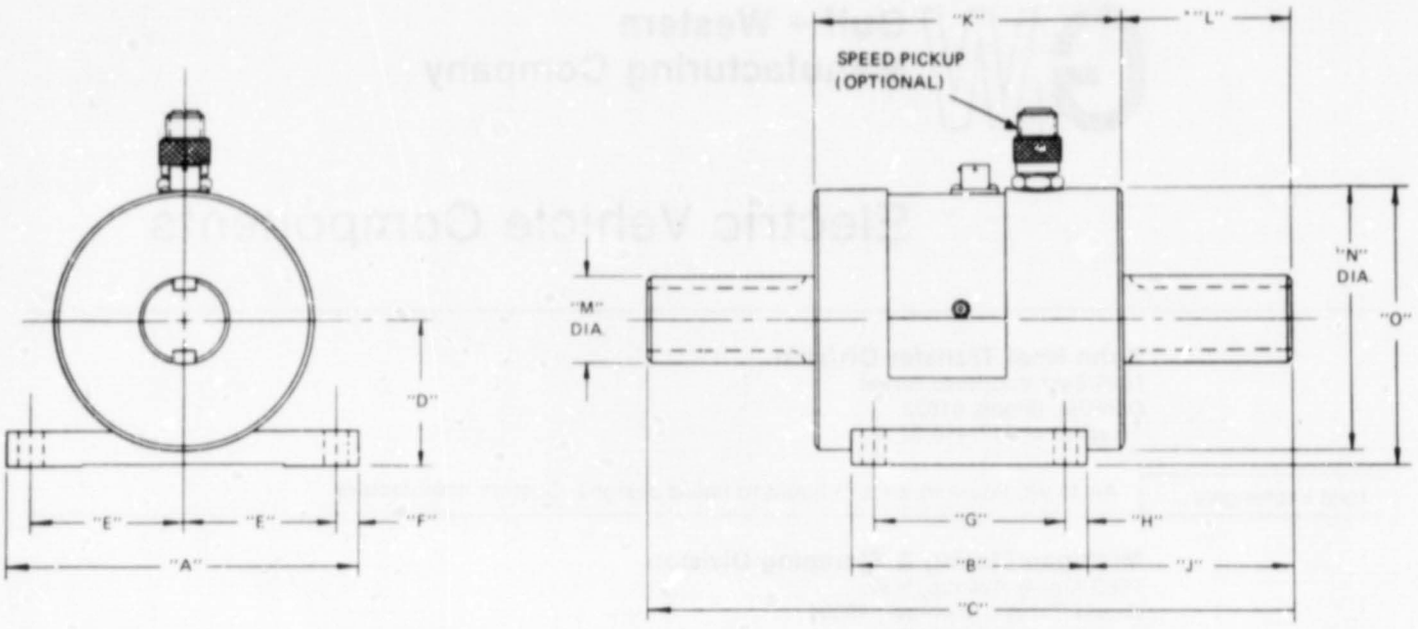
Model 2104-2107



GENERAL SPECIFICATIONS

Bridge Resistance	350 Ohms Nominal
Bridge Voltage	20 Volts Maximum
Output	2 Millivolt/Volt Nominal
Overload	50% Above Full Scale
Compensated Temperature Range	30°F. to 150°F.
Usable Temperature Range	0°F. to 200°F.
Effect of Temperature on Zero	0.002% F.S./°F.
Effect of Temperature on Output	0.002% of Reading/°F.
Non-Linearity	0.1% F.S.

Model No.	Capacity Lb. In.	A	B	C	D	E	F	G	H	J	K	L	M	N	O	Torsional Stiffness Lb. In./Rad.	Rotating Inertia, I_r Lb. In.^{2}	Max Speed RPM	Key Size
2104-200	200	5	3	9	2 1/8	2	1/2	2 1/4	3/8	3	4 1/2	2 1/4	3/4	4	4 1/8	18,000	1.48	9,000	3/16 Sq.
2105-500	500	5	3	9	2 1/8	2	1/2	2 1/4	3/8	3	4 1/2	2 1/4	1	4	4 1/8	47,000	1.50	9,000	1/4 Sq.
2105-1K	1,000	5	3	9	2 1/8	2	1/2	2 1/4	3/8	3	4 1/2	2 1/4	1	4	4 1/8	105,000	1.52	9,000	1/4 Sq.
2105-2K	2,000	5	3	9	2 1/8	2	1/2	2 1/4	3/8	3	4 1/2	2 1/4	1	4	4 1/8	190,000	1.54	9,000	1/4 Sq.
2106-5K	5,000	6	4	11	2 1/2	2 5/8	3/8	3 1/4	3/8	3 1/2	5 1/4	2 7/8	1 1/2	4 1/2	4 3/4	600,000	3.94	9,000	3/8 Sq.
2106-10K	10,000	6	4	11	2 1/2	2 5/8	3/8	3 1/4	3/8	3 1/2	5 1/4	2 7/8	1 1/2	4 1/2	4 3/4	800,000	4.05	9,000	3/8 Sq.

OPTIONAL FEATURES AND ACCESSORIES

Splined Shaft - Available for all models in place of standard keyed shaft ends.

Speed Sensor - A 60-tooth gear is mounted on the shaft inside the housing, and a magnetic pick-up threaded into the main housing to provide an output of 60 pulses per shaft revolution.

Air or Manual Actuated Brush Lifter - Recommended for prolonged runs in which continuous readings are not required. Released brushes do not contact the rings.

Instrumentation - Varied group of digital and analog readout devices available.

G.S.E. INC., 26340 Research Drive, Farmington Hills, MI., 48024, (313) 476-7875

Gulf + Western Manufacturing Company

Electric Vehicle Components

Bohn Heat Transfer Division

1625 East Voorhees Street
Danville, Illinois 61832
Telephone: 217/446-3710

Heat Exchangers	Air to air, liquid to air and liquid to liquid designs. Custom manufacture.

Michigan Plating & Stamping Division

1860 Alpine Avenue, N.W.
Grand Rapids, Michigan 49504
Telephone: 616/363-4847

Fuel Tanks	Supplier to automotive industry of terneplate stamped and welded tanks.

Automotive Marketing and Engineering Center

Detroit Sales and Engineering Office
24114 Research Drive
Farmington Hills, Michigan 48024
Telephone: 313/478-8140

Relays	Miniaturized 12VDC to control circuits to 20 amperes.
Solenoids	Build to customer requirements.
Switches	Build to customer requirements.
Transducers	Current, Position, Pressure, Speed, Temperature, Torque, Voltage - Build to customer requirements.
Voltage Regulators	12VDC Solid State

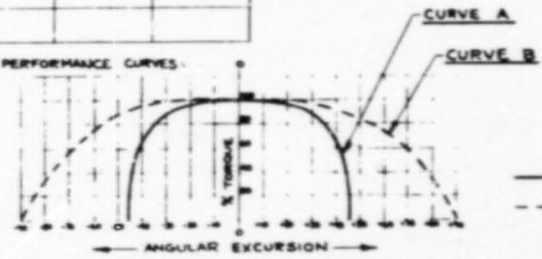
Collyer Insulated Wire Division

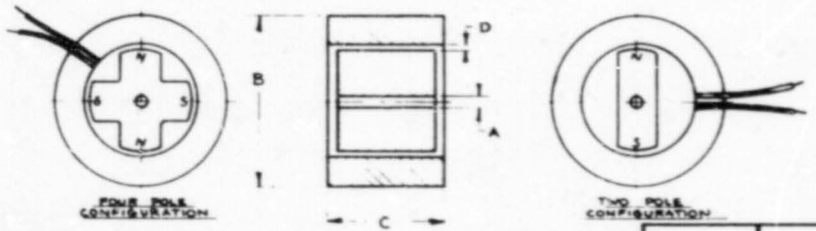
100 Higginson Ave.
Lincoln, RI 02865
Telephone: 401/723-7800

Apparatus Cables	**Single conductor, Type A.I.A.** IPCEA S-28-357, NEMA WC-1; Underwriters' Lab. Sizes #4 AWG and larger. Asb. covered, 300V and 600V.
Appliance Wires	**Single conductor** Collyer P-400 THHN/THWN PVC/NYLON in these sizes which are 19W uncompressed. U.L. Listed Rate AWM 105°C Dry and 80°C in oil.
Control Cables	**Single and multi conductor** THERMOPLASTIC: Collyer C-141 — PZR — PE/NYLON condrs. PVC Jacket 600V, 1000V. 75°C. Collyer C-140 — PVC insulated and jacketed 600V. Collyer C-143 — PE/PVC conductors, PVC jacket 600V, 1000V. Collyer C-153 — PE/NYLON, PZR 90°C, PVC jacket 600V, 1000V. Collyer C-154 — THHN/THWN conductors Type T.C. U.L. Listed.

MODEL NUMBER			BTM 45 A	BTM 45 B	BTM 90			
PARAMETERS		UNIT OF MEASURE						
PEAK TORQUE		OZ-IN	100	34.0	38.0			
POWER @ PEAK TORQUE		WATTS	96	60	64			
TORQUE SENSITIVITY		OZ IN/AMP	50.0	17.0	19.0			
DC RESISTANCE @ 25° C.		OHMS	24.0	15.0	16.0			
PERFORMANCE CURVE (LETTER)		DEGREES	A	A	B			
BACK E.M.F.		V/RAD/SEC	.355	.120	.134			
ELECTRICAL TIME CONSTANT		SECONDS	0.320×10^{-3}	0.171×10^{-3}	0.639×10^{-3}			
ROTOR INERTIA		OZ-IN-SEC^2	.027	.0025	.014			
DIMENSIONS	A	INCHES	.750	.375	.375			
	B	INCHES	3.040	2.300	3.040			
	C	INCHES	2.700	2.000	1.850			
	D	INCHES	.005	.008	.005			

TYPICAL PERFORMANCE CURVES





TEL: 215-657-0800

TOLERANCE UNLESS NOTED
XX +.01 −.01
.XXX +.005 −.005
.XXXX +.0005 −.0005
DRILLED HOLES +.005 −.000
FORMED ANGLES ± 1/2° − 1/2°

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NEXT ASSEMBLY | FINAL ASSEMBLY

ORDER NO.

DRAWN BY R.W. Hinkle DATE 7/4/78

CHECKED DATE 12-8-78

APPROVED DATE 12-8-78

APPROVED -KC DATE 12/8/78

TSI TRANSDUCER SYSTEMS, INC.
WILLOW GROVE, PENNSYLVANIA 19090

TECHNICAL DATA
BRUSHLESS (UMITED ROTATION)
DC. TORQUE MOTOR

SIZE C | DRAWING NO. CEX1872 | REV. B

SCALE NONE | SHEET 1 of 1

TORQUE CONVERTERS

(CODE **TR**)

AUTOMATIC TORQUE CONVERTER

The Salsbury Automatic Torque Converter is a simple device – basically a variable pitch, belt-type drive. This automatic drive has been continually improved from the original design put into production at the Salsbury Plant more than 40 years ago! Ever increasing applications and wider customer acceptance have multiplied the demand for this drive ever since its inception. What are the reasons for its increasing popularity?

First, the drive is fully automatic – operating both as a clutch **and** a transmission. It is easily controlled by the engine's throttle.

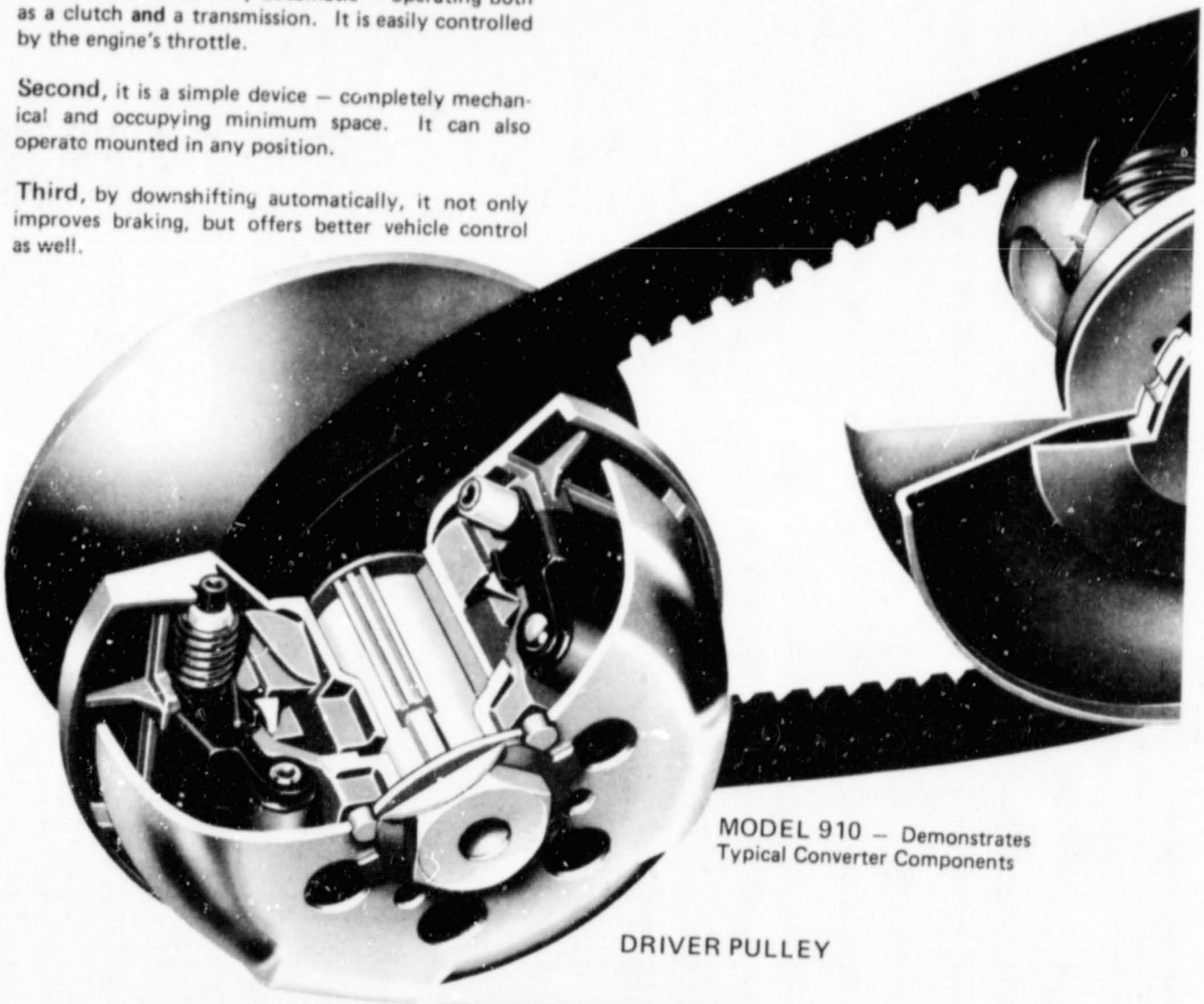
Second, it is a simple device – completely mechanical and occupying minimum space. It can also operate mounted in any position.

Third, by downshifting automatically, it not only improves braking, but offers better vehicle control as well.

Fourth, although it is a low cost drive, it does **not** compromise performance. Its design provides **optimum** ratio selection between engine and drive wheel automatically.

Fifth, because Salsbury drives do **continually** select the proper drive ratio without manual shifting by the operator, life of the driving components (chain, sprocket, bearings, etc.) is lengthened, affording even greater economy for this drive.

Salsbury transmission equipment has proved its superior performance in hundreds of applications . . . from golf carts to snow vehicles, from air compressors to vibrating compactors, from mini-bikes to personnel carriers . . . wherever there's a need for positive power control.



MODEL 910 – Demonstrates Typical Converter Components

DRIVER PULLEY

SALSBURY INDUSTRIES

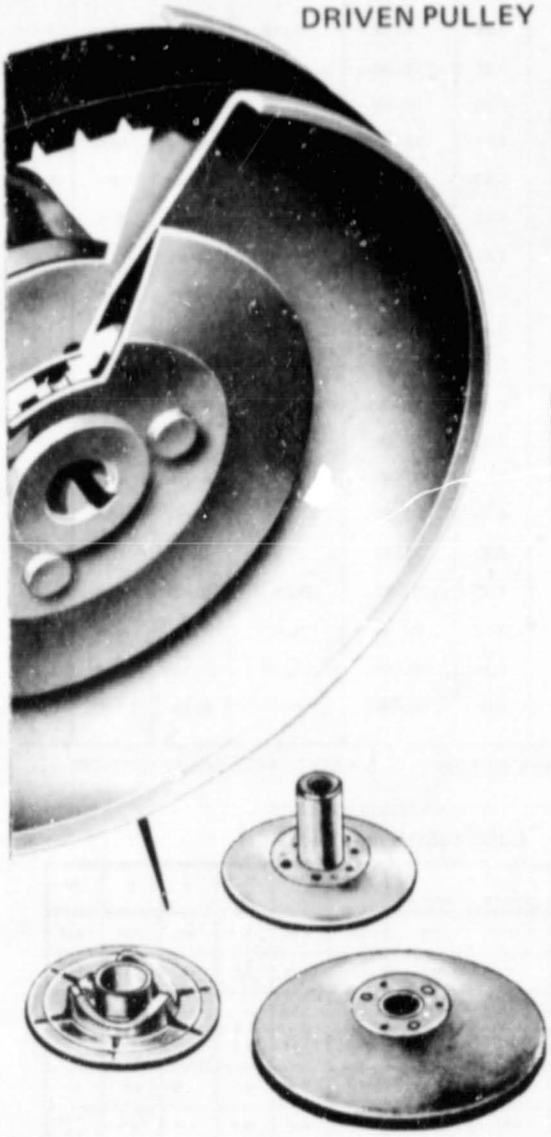
A SUBSIDIARY OF ISC INSTRUMENT SYSTEMS CORPORATION

1010 E. 62nd Street., Los Angeles, Ca. 90001 (213) 242-6181

Two types of driven pulley systems available:

- AUTOMATIC
- SIMPLE
- DEPENDABLE
- QUIET
- ECONOMICAL

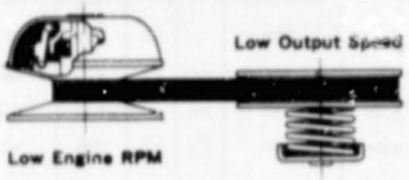
DRIVEN PULLEY



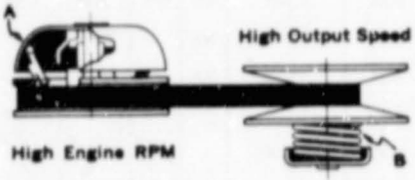
STRONG, LIGHTWEIGHT SHEAVES

Salsbury has developed high strength die-cast aluminum sheaves and stamped steel sheaves to meet the requirements of rugged vehicle operation under all environmental conditions.

SPEED SENSITIVE



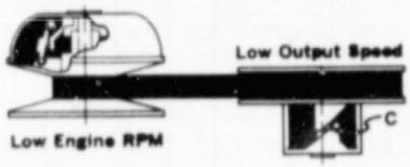
At low speeds the normal position of the driver pulley maintains the V-belt at a smaller diameter which, with the corresponding larger diameter on the driven pulley, creates a "low gear" ratio.



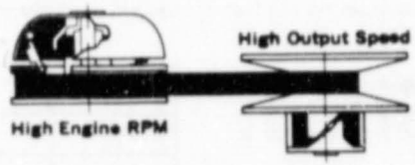
DRIVER PULLEY DRIVEN PULLEY

As the speed increases, the centrifugally actuated roller weights (A) follow the contour of the bowl-shaped ramp plate, forcing the driver sheaves together. This action through the belt compresses the driven-pulley spring (B), thus achieving a "high gear" ratio.

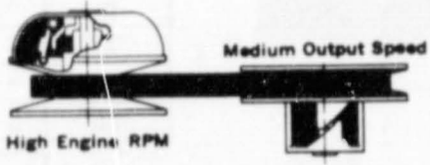
TORQUE SENSITIVE



In the torque sensitive design (as in the speed sensitive design) the normal position of the driver pulley at low engine speeds maintains the V-belt in a small diameter. Normal rotational force on cam actuator (C) keeps driven pulley in "low gear" ratio.



As the driver pulley is essentially the same in both type units, higher engine speeds cause the roller weights to close the driver pulley sheaves, creating a "high gear" ratio (note position of cam actuator).



DRIVER PULLEY DRIVEN PULLEY

If an increased load occurs (such as climbing a hill) after the vehicle is up to speed, the cam actuator on the driven pulley takes over and automatically "downshifts" without loss of engine speed. The engine remains at peak power range for all but the most severe loads, at which time it will shift into peak torque range.

SALSBURY INDUSTRIES

A DIVISION OF INSTRUMENT SYSTEMS CORPORATION
1010 EAST 62nd STREET,
LOS ANGELES, CALIFORNIA 90001

(213) 232–6181

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OF POOR QUALITY

TORQUE CONVERTER

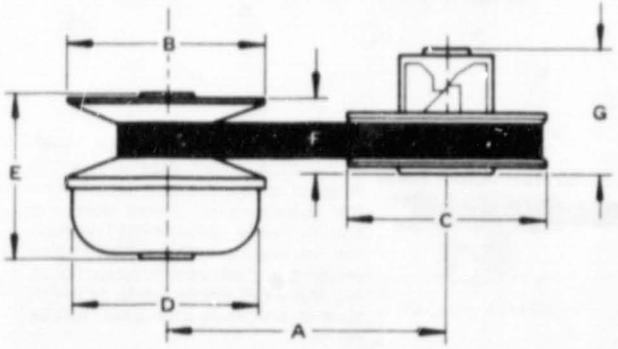
Comprehensive Specifications List

TORQUE CONVERTER MODEL	DRIVE		DRIVEN		BELT TOP WIDTH	DRIVEN STYLE		REDUCTION RATIO:1			HORSEPOWER RANGE		MAXIMUM BORE SIZE		
	MODEL	PULLEY DIA.	MODEL	PULLEY DIA.		SS	TS	LO	HI	OA	2 CYCLE	4 CYCLE	DRIVE TAPER	DRIVE STR.	DRIVEN STR.
330	330	4.50	330	6.06	.628		XX	2.48	.99	2.51	4–8	3–6	25mm	3/4"	3/4"
500	500	5.39	500	7.46	.920	XX	XX	3.35	.90	3.72	8–20	5–10	30mm	1"	*1 1/4"
600	600	6.62	795	8.46	1.188	XX		3.06	.69	4.43	N/A	7–10	N/A	1"	1 1/4"
700	700	7.22	700	9.84	.960	XX	XX	3.95	1.00	3.95	15–25	8–16	30mm	1"	*1 1/4"
705	700	7.22	705	9.84	.960	XX		3.95	1.00	3.95	15–25	8–16	30mm	1"	1 1/4"
770A	780A	7.20	770	9.84	1.188	XX	XX	3.66	.87	4.21	15–30	8–16	30mm	N/A	*1 1/4"
770S	780S	7.22	770	9.84	1.188	XX	XX	3.95	.76	5.20	15–30	8–16	30mm	1"	*1 1/4"
775A	780A	7.20	775	9.84	1.188	XX		3.66	.87	4.21	15–30	8–16	30mm	N/A	1 1/4"
775S	780S	7.22	775	9.84	1.188	XX		3.95	.76	5.20	15–30	8–16	30mm	1"	1 1/4"
780A	780A	7.20	780	9.26	1.188		XX	3.44	.76	4.53	15–30	8–16	30mm	N/A	1"
780S	780S	7.22	780	9.26	1.188		XX	3.71	.69	5.38	15–30	8–16	30mm	1"	1"
790A	780A	7.20	790	8.46	1.188	XX	XX	3.13	.61	5.13	15–30	8–16	30mm	N/A	*1 1/4"
790S	780S	7.22	790	8.46	1.188	XX	XX	3.38	.54	6.26	15–30	8–16	30mm	1"	*1 1/4"
795A	780A	7.20	795	8.46	1.188	XX		3.13	.61	5.13	15–30	8–16	30mm	N/A	1 1/4"
795S	780S	7.22	795	8.46	1.188	XX		3.38	.54	6.26	15–30	8–16	30mm	1"	1 1/4"
815	810	7.20	850	9.84	1.250		XX	3.41	.89	3.83	20–45	N/A	30mm	N/A	1"
816	810	7.20	860	11.26	1.250		XX	3.92	1.14	3.44	20–45	N/A	30mm	N/A	1"
850	800	7.70	850	9.84	1.250		XX	3.28	.77	4.26	30–55	N/A	30mm	N/A	1"
860	800	7.70	860	11.26	1.250		XX	3.77	1.01	3.73	30–55	N/A	30mm	N/A	1"
910	910	7.70	850	9.84	1.250		XX	3.13	.78	4.01	20–45	N/A	30mm	N/A	1"
960	910	7.70	860	11.26	1.250		XX	3.60	1.02	3.53	20–45	N/A	30mm	N/A	1"
1190	1190	8.00	1190	9.84	1.438		XX	3.41	.68	5.01	35–60	16–30	30mm	1 1/4"	1"
1195	1190	8.00	1195	9.84	1.438	XX		3.41	.68	5.01	35–60	16–30	30mm	1 1/4"	1 1/4"

SS = SPEED SENSING TS = TORQUE SENSING A = ALUMINUM HUB DRIVE (SPLINE) S = STEEL HUB DRIVE (SPIDER)

*NOTE: MAXIMUM BORE SIZE: SPEED SENSING — 1 1/4" TORQUE SENSING — 1" STR = STRAIGHT BORE

How It's Sized:



DIMENSIONS (in inches)

MODEL NO.	TYPE (1)	A MIN (2)	A MAX (2)	B	C	D	E	F	G
330	TS	7	13	4.5	6.06	5.16	3.31	1.27	3.12
500	SS	7	14.26	5.38	7.46	6.21	4.5	1.82	3.82
700	SS TS	10.25	13	7.22	9.84	6.21	4.79	1.82	3.82 4.14
770, 775 770	SS TS	9.26 9.42	17.18	7.22	9.84	6.21	4.79	2 2.14	3.89 4.32
780	TS	9.5	17.86	7.22	9.26	6.21	4.79	2.1	4.32
790, 795 790	SS TS	9.12	18.36	7.22	8.46	6.21	4.79	2.04	4.01 4.5
910	TS	10.18	12.80	7.7	9.84	7.10	5.54	2.26	4.56
1190 1195	TS SS	10.18	18.5	8	9.84	8.3	5.81	2.46	4.66 4.10

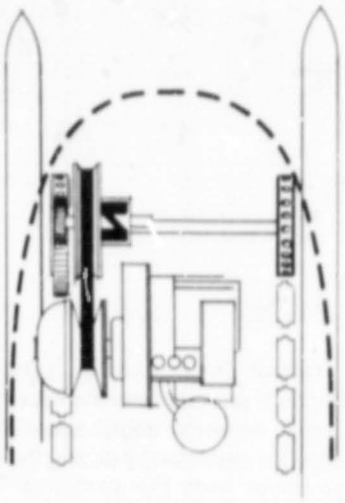
(1) TORQUE SENSITIVE OR SPEED SENSITIVE

(2) AVAILABLE AS STANDARD WITH OPTIONAL SIZES BETWEEN MAX AND MIN. FOR EXCEPTIONAL REQUIREMENTS, REFER TO SALES AND MARKETING DEPARTMENT

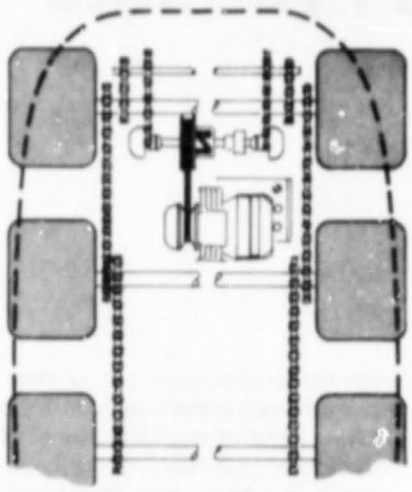
SALSBURY INDUSTRIES

A DIVISION OF INSTRUMENT SYSTEMS CORPORATION
1010 EAST 62nd STREET,
LOS ANGELES, CALIFORNIA 90001
(213) 232–6181

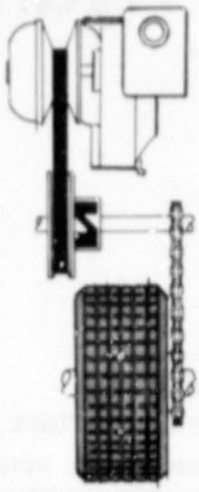
How It's Applied:



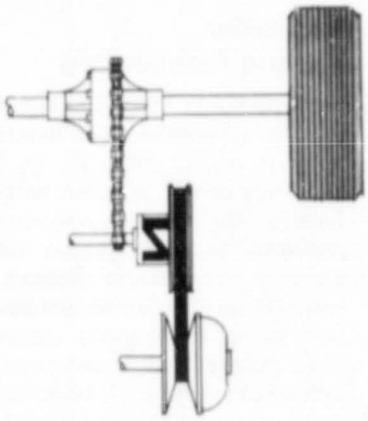
SNOWMOBILE
Typical hook-up through belt or chain to dual sprocket track drive.



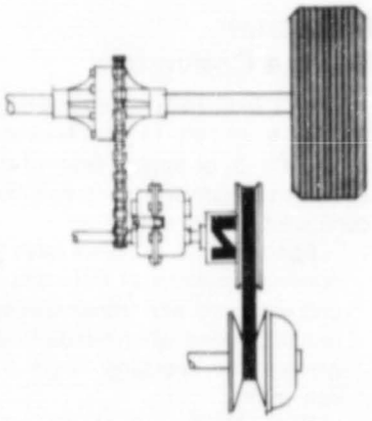
ALL-TERRAIN VEHICLE
Shows typical 6-wheel chain drive with dual clutches for tank-type steering.



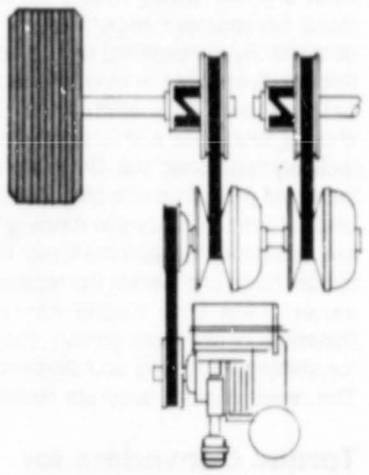
MINI-BIKE OR VEHICLE
Use of jack-shaft to transmit variable ratio to drive wheel(s).



Chain drive through differential.



Chain drive through differential with reverse gear box.



Dual torque converter to individual drive wheels – no differential required.

GEARING FORMULAS

A. USE THE FOLLOWING FORMULA TO DETERMINE TOP SPEED WHEN ALL GEARING IS KNOWN.

1. ER ÷ FS = DRJ
2. DRJ ÷ FGR = RAR
3. RAR X T.C. = FT/MIN
4. FT/MIN X .01136 = CMPH
5. CMPH X .92 = AMPH

B. USE THE FOLLOWING FORMULA TO DETERMINE FINAL GEARING WHEN REQUIRED TOP SPEED IS KNOWN.

1. AMPH ÷ .92 = CMPH
2. CMPH ÷ .01136 = FT/MIN
3. FT/MIN ÷ TC = RAR
4. ER ÷ FS = DRJ
5. DRJ ÷ RAR = FGR : 1

WHERE:
ER = MAXIMUM ENGINE RPM
FS = FULL SHIFT (HI RATIO OF SELECTED TORQUE CONVERTER)
DRJ = DRIVEN RPM @ JACK SHAFT
FGR = FINAL GEAR RATIO (AFTER TORQUE CONVERTER)
RAR = REAR AXLE RPM
TC = TIRE CIRCUMFERENCE (IN FEET)
FT/MIN = FEET PER MINUTE
CMPH = CALCULATED MPH
AMPH = ACTUAL MPH

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A SUBSIDIARY OF [ISC] INSTRUMENT SYSTEMS CORPORATION
1010 E. 62nd Street., Los Angeles, Ca. 90001 (213) 242-6181

7/ Hydraulic Products

Hydraulic Torque Converters

By automatically and instantaneously providing an infinite variety of ratios — in exact proportion to load demands — Twin Disc torque converters eliminate engine lugging and stalling. They also permit engines to operate within their most efficient speed range, producing rated horsepower regardless of load demand. By transmitting torque entirely through fluid mass in motion, mechanical connection is eliminated. Load shocks, vibrations and torsionals are effectively cushioned out. Severe starting loads are picked up smoothly and easily and extreme variations in running loads are compensated automatically by the instant fluid "slip" within the torque converter. Twin Disc torque converters minimize, or eliminate entirely, the need for shifting, clutching and de-clutching. The result is more accurate control.

Torque Converters for Gas Turbine Starting Drives

High Torque Ratio Single-Stage Hydraulic Torque Converters for Gas Turbine Starting Drives are offered in 16, 20 and 22" sizes and are available with several different impellers offering a capacity spread of 3:1 for each model. Capacities up to 2000 hp (may be compounded to 4000 hp). See "Gas Turbine Starting Drives", page 16.

Single-Stage Torque Converters — Bulletin 510

Twin Disc builds a complete line of Single-Stage Rotating Housing Torque Converters including the 1100, 1300, 1500, 1600, 1700 and 1800 Series; the first two digits in the series number indicate the approximate circuit size in inches. Power ranges from 40 to 800 hp.

The 13 and 15" sizes are designed for industrial service meaning that they are capable of a chain drive off the output shaft. All other sizes are limited to in-line drives only and are used primarily for vehicle applications.

Industrial Torque Converters

The 13" industrial converter is rated at 350 lbs.-ft. and the 15" size is available at 650 lbs.-ft. of torque. Both of these sizes can be furnished in three different configurations consisting of:

Spacer Units — These have SAE housing openings at front and rear and are used with transmissions or reduction gears when needed to supplement the operating range of the converter.

Clutch Units — These units are furnished with a disconnect clutch of 11" size, positioned at the input end. They are used for a variety of industrial applications where a disconnect between the engine and the converter input is required.

Reduction Gear Units — These units are clutch units furnished with a reduction gear attached to the rear of the converter. The reduction ratio is 2:1 and rotation is the same as input.

Industrial Units — Accessories

Boom Lowering Freewheel — This device is available on all industrial units and provides a mechanical lock-up from the load to the engine whenever the load over-drives the converter output shaft.

Output Shaft Governor Take-Off — For applications where it is necessary to control converter output speed. Engine speed is regulated by driving the engine governor from the converter output shaft. The governor can be directly mounted on the converter or can be engine-mounted and driven by a flexible cable.

Vehicular Torque Converters

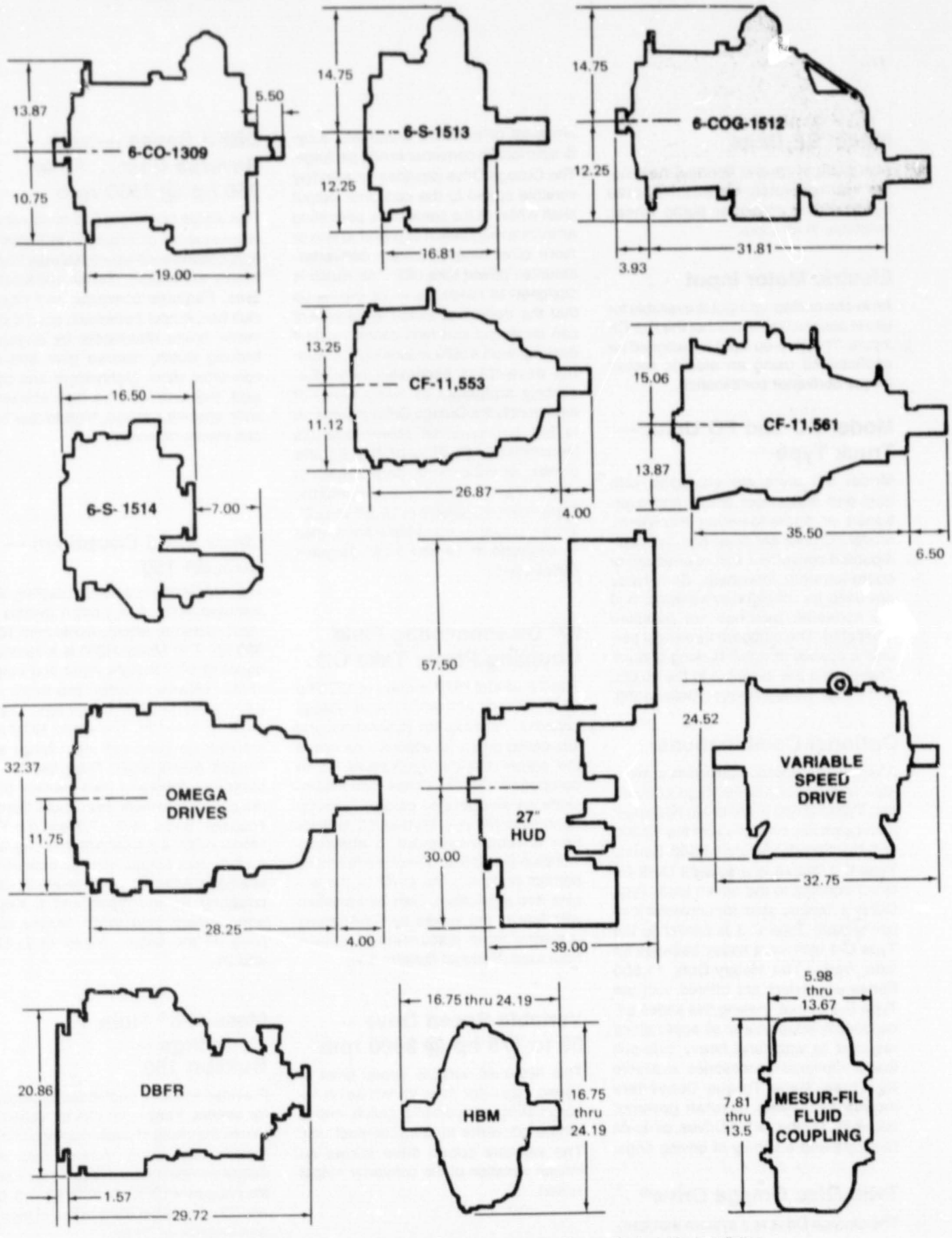
Single-Stage Torque Converters for vehicle applications are available in sizes 11, 13, 14, 14.5, 15, 16, 17 and 18". They can be supplied as stripped units for manufacturers who require the converter to be integrated into their housing and driveline systems. They can also be supplied as self-contained units except for the sump. Optional features include a freewheel stator and a lock-up clutch in the 14, 14.5, 16, 17 and 18" sizes and power take-off pump drives.

Three-Stage Torque Converters — Bulletin 135

Twin Disc offers two sizes of three-stage torque converters with 30 distinct capacities. The 10,000 Series three-stage converter is rated for applications up to 335 hp @ 2400 rpm; the standard-duty 11,500 Series to 420 hp @ 2200 rpm; the heavy-duty 11,500 Series to 560 hp @ 2200 rpm.

Model F Units

Bolts directly to the engine flywheel housing. A positive gear-tooth drive transmits power from flywheel with no clutch. Model F input drive is available on all sizes.



All dimensions in inches. Illustrations not to scale. Use certified print for installation.

TWIN DISC, INCORPORATED • RACINE, WISCONSIN U.S.A.
TEL: 414-634-1981

Model CF Units

Also bolts to engine flywheel housing, but has a clutch between engine flywheel and converter pump wheel. Available in all sizes.

Electric Motor Input

An in-line or step-up input is available for use in conjunction with either the F or CF inputs. The step-up input is designed for applications using an electric motor/torque converter combination.

Model CO and FO Units — Truck Type

Model CO units are equipped with front-end disconnect clutch and over-speed or boom-lowering freewheel. Model FO units are open-end, flywheel-mounted converters with over-speed or boom-lowering freewheel. Both types are used for off-highway vehicles, and the converter bearings are pressure lubricated. The outboard freewheel permits a special downhill braking feature. These units are available in the 10,000 and 11,500 Series. Request Bulletin 509.

Optional Combinations

A variety of output combinations is available with various three-stage converters. Types B and F are chain housings; both types are available with the 10,000 and the Standard-Duty 11,500 Series. Type C-1 output is a straight shaft for direct connect to the driven load; Type C-2 is a flanged shaft for universal joint connection; Type C-3 is similar to the Type C-1 with extra heavy bearings for side loads. The Heavy-Duty 11,500 Series converters are offered with the Type C-3 output, making this series exceptionally adaptable to all applications required to withstand heavy side-pull loads. Optional accessories available for Three-Stage Torque Converters include freewheels, tailshaft governor take-offs, Rubber Block Drives, air-to-oil radiators and a variety of driving rings.

Twin Disc Omega Drive®

The Omega Drive is a system that combines an oil-actuated clutch and a hydraulic torque converter in one package. The Omega Drive provides an infinitely variable speed to the converter output shaft while, at the same time, permitting an infinite modulation of power to one or more other engine-driven, converter-mounted power take-offs. The clutch is designed to modulate — or slip — so that the degree of clutch engagement can be varied and held continuously if desired, from 100% to lock-up . . . without developing excessive heat. Extremely adaptable to many types of equipment, the Omega Drive mounts up to five engine-driven power take-offs transmitting 50-70% of full engine power. Modifications engineered to match 75 to 1500 hp requirements. Type 4 circuit available in 16, 20 and 22". Type 8 circuit — for vehicle application — available in 14 and 14.5". Request Bulletin 515.

27" Disconnecting Fluid Coupling Power Take-Off

The 27" Model HUD is rated at 1375 hp @ 1500 rpm with 4800 lbs.-ft. torque capacity. Features an optional second lubrication pump for applications where the output shaft is backdriven as in compound drives. Other options include an air-operated control valve for remote control operation and a radiator that is rubber-mounted to eliminate vibration problems. Use of blade blocks permits matching the HUD to the engine and application. Can be furnished with four dump valves for applications requiring rapid disconnect of engine from load. Request Bulletin 506.

Variable Speed Drive — 50 to 175 hp @ 3000 rpm

This hydraulic variable speed drive or speed regulator is a transmission incorporating a hydraulic clutch and a torque converter in one, compact unit. The variable speed drive allows an infinite variation of the converter output speed.

DBFR Series — with Reverse Gear . . . 60 to 250 hp @ 2500 rpm

This series is designed to meet various requirements or engine conditions for applications such as off-highway trucks, buses, excavators, cranes and locomotives. Features converter and lock-up clutches, output freewheel, special converter brake obtainable by engaging braking clutch, reverse gear and two converter sizes. Lightweight and compact, this unit features high efficiency, wide operating range, high torque ratio and electronic control.

Large Fluid Couplings — Bulletin 150

The HM Series is a basic coupling with selected input and output groups to meet customer requirements from 10 to 850 hp. The Model HBM is a standard coupling with straight input and output shafts. Mounts between two single engagement flexible couplings. Sizes 14.5, 17.5 and 21. The Model HCM is a standard coupling with input flange and flanged output shaft. Designed for installation between two halves of a double-engagement gear tooth flexible coupling. Sizes 14.5, 17.5 and 21. The Model HEM is a standard coupling with a stub shaft output. Mounts between a specially adapted gear tooth flexible coupling on the input and a single engagement gear tooth flexible coupling on the output. Sizes 14.5, 17.5 and 21.

Mesur-Fil® Fluid Couplings — Bulletin 150

Provides smooth, cushioned protection for motors. Fluid level can be varied to permit matching of fluid couplings to any motor torque curve. Various input and output combinations available including the popular HYDRO-SHEAVE®. 7.0, 9.4 and 12.4 sizes handle a range of motors and engines to 60 hp.

TWIN DISC, INCORPORATED • RACINE, WISCONSIN U.S.A.
TEL: 414-634-1981

TRANSDUCERS, CONTROL

SPEED

(CODE **TS**)

century
BRASS PRODUCTS INC.

59 Mill Street
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203/574-7700

General Products Division

The General Products Division of Century Brass Products Incorporated make several items found in hybrid vehicles.

I. Solenoid Valves

1. E.G.R. Valves

   (Exhaust gas recirculation)

2. Carburetor Dump Valves

3. General purpose solenoid for:

   a. Air Control
   b. Electric Current Control

II. Speed Sensor

1. Signal generator works in conjunction with speedometer cable, and via electrical current converts RPM's into NPH's and is an integral part of the cruise control system.

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Automotive Marketing and Engineering Center
Detroit Sales and Engineering Office
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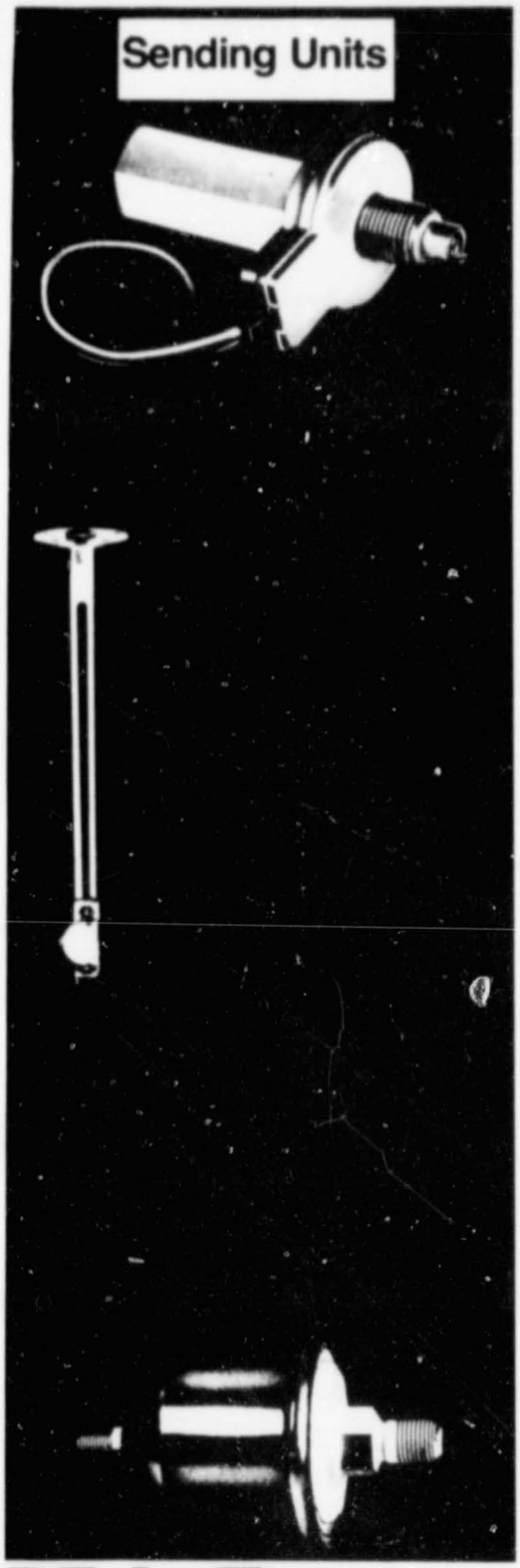
Relays	Miniaturized 12VDC to control circuits to 20 amperes.
Solenoids	Build to customer requirements.
Switches	Build to customer requirements.
Transducers	Current, Position, Pressure, Speed, Temperature, Torque, Voltage - Build to customer requirements.
Voltage Regulators	12VDC Solid State

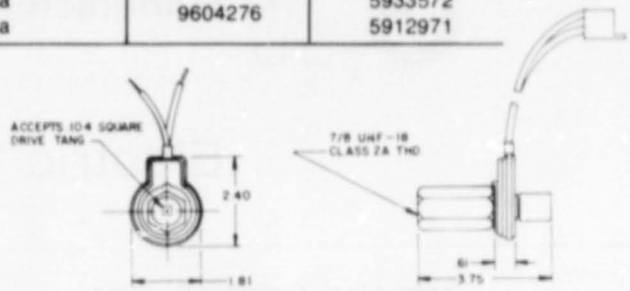
Collyer Insulated Wire Division
100 Higginson Ave.
Lincoln, RI 02865
Telephone: 401/723-7800

Apparatus Cables	**Single conductor, Type A.I.A.** IPCEA S-28-357, NEMA WC-1; Underwriters' Lab. Sizes #4 AWG and larger. Asb. covered, 300V and 600V.
Appliance Wires	**Single conductor** Collyer P-400 THHN/THWN PVC/NYLON in those sizes which are 19W uncompressed. U.L. Listed Rate AWM 105°C Dry and 80°C in oil.
Control Cables	**Single and multi conductor** THERMOPLASTIC: Collyer C-141 — PZR — PE/NYLON condrs. PVC Jacket 600V, 1000V, 75°C. Collyer C-140 — PVC insulated and jacketed 600V. Collyer C-143 — PE/PVC conductors, PVC jacket 600V, 1000V. Collyer C-153 — PE/NYLON, PZR 90°C, PVC jacket 600V, 1000V. Collyer C-154 — THHN/THWN conductors Type T.C. U.L. Listed.

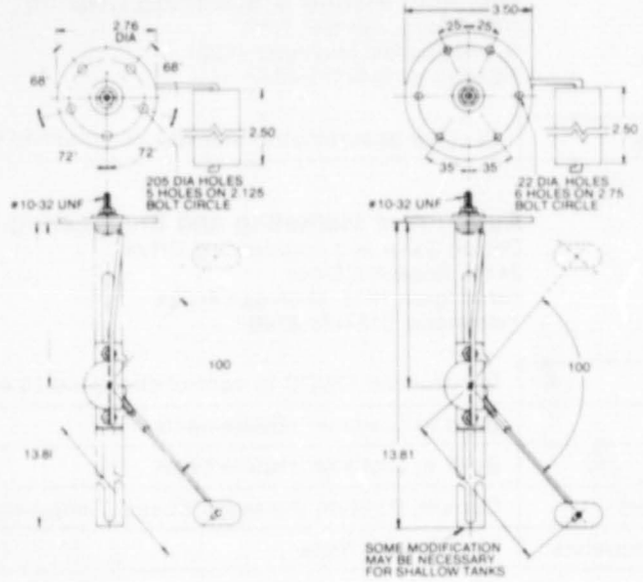


SIGNA-FLEX TACHOMETER

DRIVE TANGS	SENDER PART NUMBER	PART NUMBER
.187 dia .152 dia	9604276	5933572 5912971

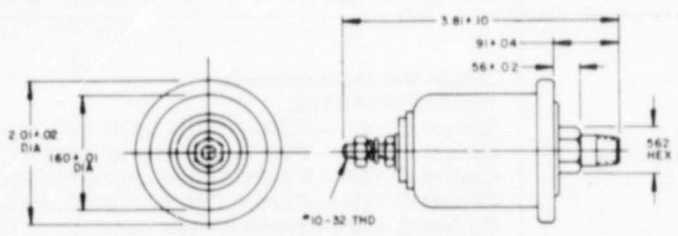


FUEL	SENDER TYPE	PART NUMBER
6" to 24" tank 5 hole flange	Introl Stewart Warner	1507170 1501775
6" to 24" tank 6 hole flange	Introl	1507273



OIL PRESSURE

PRESSURE RANGES	SIZE NPT	SENDER TYPE	PART NUMBER
80 psi 100 psi 120 psi	1/8" 1/8" 1/8"	Stewart Warner	1500171 1501671 1506177
80 psi 100 psi	1/8" 1/8"	Introl	9600171 9605476



Teleflex INCORPORATED
industrial

Electrical systems:
1816 57th Street, Sarasota, Florida 33580
Telephone (813) 355-7721

Mechanical systems:
640 North Lewis Road, Limerick, Pennsylvania 19468
Telephone (215) 495-7011 • Telex 84-6335

TSI

TRANSDUCER SYSTEMS, INC.

BULLETIN 7301-A

VELOCITY TRANSDUCER



In order to respond to the ever increasing demand for linear velocity data in instrumentation and Servo systems, TSI has evolved a complete spectrum of velocity transducers with displacement ranges from 0.50 inches to 20.0 inches as standard products and other in-between ranges UPON REQUEST.

All TSI velocity transducers are completely shielded with an unbroken shield from inside the transducer to the terminus of the shielded cable. Units are available in several configurations. Higher sensitivity units use Alnico 5 magnets. Since, however, Alnico is very brittle material and subject to easy breakage, other materials are available in lower sensitivity models. These magnets are unbreakable.

Upon special request ultra accurate units are available.

Pat. Pending

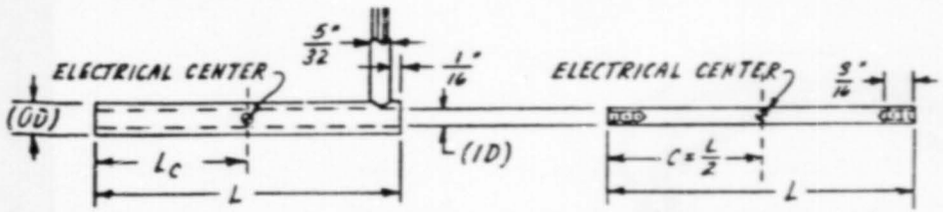
FEATURES

- Choice of magnet (breakable or unbreakable).
- Completely shielded.
- Magnet bearings available as option items.
- Dimensional flexibility upon special request.
- Custom mountings upon special request.
- All units 100% calibrated and shipped with accompanying test data.
- Dual or single tapped magnets.
- Axial or radial leads configuration available.

TRANSDUCER SYSTEMS, INC.
710 DAVISVILLE ROAD · WILLOW GROVE, PA. 19090 · AC 215-657-0800

SPECIFICATIONS: TSI VELOCITY TRANSDUCERS

Model Number	Nominal Output Sensitivity Millivolts Inch/Sec (Open Circuit)	Electrical Impedance (Coils connected in Series) R Ohms ±5%	L Henrys ±10%	Magnet Core Displacement Inches Nominal Working Range	Maximum Usable Stroke	Coil and Housing Dimensions Inches Lc	L	(OD) +.000 —.005	(ID)	Weight Grams Wc	Magnet Core Dimensions Inches L	(OD) ±.002	Thread	Weight Grams Wm
500LZ	120	2,000	0.085	0.50	1.30	1.405	3.16	0.374	0.136	20	2.38	0.125	1-72 NF	3.5
500HZ	450	8,000	0.9	0.5	1.50	1.426	3.23	0.623	0.200	63	2.50	0.187	4-40 NC	8.0
800MZ	500	11,000	1.4	0.80	2.10	2.062	4.50	0.623	0.200	100	3.25	0.187	4-40 NC	10
1000LZ	90	2,500	0.065	1.0	1.90	1.937	4.22	0.374	0.136	25	3.00	0.125	1-72 NF	4.5
1000HZ	500	13,000	1.6	1.0	2.3	2.312	5.00	0.623	0.200	110	3.50	0.187	4-40 NC	11
2000HZ	500	19,000	2.4	2.0	3.4	3.312	7.00	0.623	0.200	150	4.50	0.187	4-40 NC	15
3000MZ	650	18,000	2.9	3.0	4.6	4.687	9.75	0.748	0.312	270	5.75	0.250	4-40 NC	34
3000HZ	500	25,000	3.2	3.0	4.2	4.312	9.00	0.623	0.200	200	5.25	0.187	4-40 NC	17
4000MZ	650	21,000	3.4	4.0	5.5	5.437	11.25	0.748	0.312	300	6.75	0.250	4-40 NC	40
4000HZ	500	32,000	4.0	4.0	5.5	5.437	11.25	0.623	0.200	240	6.75	0.187	4-40 NC	22
6000MZ	350	11,500	1.9	6.0	8.0	7.687	15.75	0.748	0.312	420	9.25	0.250	4-40 NC	54
9000MZ	350	17,000	2.8	9.0	11.0	11.187	22.75	0.748	0.312	610	11.75	0.250	4-40 NC	69
20000LZ	20	3,000	0.035	20.0	22.0	14.50	30.00	0.748	0.312	800	6.75	0.250	4-40 NC	40



COIL AND HOUSING — MAGNET CORE

COIL AND CORE DIMENSIONS (SEE CHART ABOVE)

NOTE:
4 LEAD WIRES ARE SUPPLIED WITH NOMINAL LENGTH OF 12"

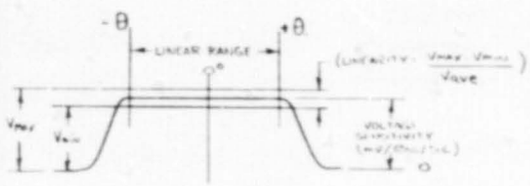
ORIGINAL PAGE IS OF POOR QUALITY

TRANSDUCER SYSTEMS, INC.
710 DAVISVILLE ROAD · WILLOW GROVE, PA. 19090 · AC 215-657-0800

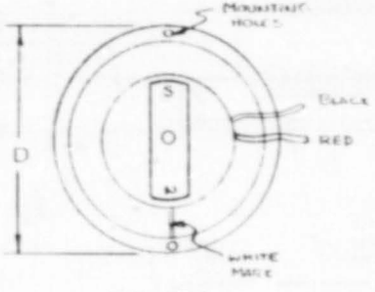
MODEL NUMBER	LINEAR RANGE IN DEGREES ± θ	VOLTAGE SENSITIVITY mV/RAD/SEC ±10% (NO LEAD)	LINEARITY (WITHIN THE LINEAR RANGE)	OPERATING TEMPERATURE °C	RESISTANCE (ohms ± 10%)	OVERALL DIMENSIONS (INCHES) O.D. 'D'	THICKNESS	BORE	MAGNET PARAMETERS (INCHES) O.D.	THICKNESS	BORE	SHAFT PARAMETERS (INCHES) DIA.	LENGTH	THREAD	AIR GAP BETWEEN STATOR & MAGNET (INCHES)	TOTAL WEIGHT (INCLUDING MAGNET & SHAFT) (GRAMS)	REMARKS
AVT-15-2500	±8	350	±3%	0° TO 40°C	10,000	2.5"	.500"	.562"	1.38"	.200"	.086"	.138"	.830"	2-56 UNC	.010"	90	NO RESONANCE BELOW 600 HZ
AVT-15-1700	±8	43	±3%	0° TO 40°C	3,700	1.70"	.400"	.562"	.800"	.200"	.086"	.138"	.830"	2-56 UNC	.010	60	NO RESONANCE BELOW 600 HZ
AVT-15-2000	±8	43	±3%	0° TO 40°C	3,700	2.00"	.450"	.562"	.800"	.200"	.086"	.138"	.830"	2-56 UNC	.010"	40	NO RESONANCE BELOW 600 HZ

REVISIONS

ZONE	LTR	DESCRIPTION	DATE	APPROVED
—	A	RELEASE	11/9/78	CRG
—	B	ADDED AVT-15-2000 & SPECS.	[illegible]	[illegible]
—	C	ECN 1[illegible]	5-31-71	[illegible]



SENSITIVITY PROFILE



TOP VIEW

POLARITY: FOR CLOCKWISE MOTION OF THE MAGNET, THE RED LEAD IS POSITIVE WITH RESPECT TO THE BLACK LEAD WHEN THE NORTH POLE OF THE MAGNET CROSSES THE WHITE MARK ON THE UNIT WHEN VIEWED FROM TOP.

TEL: 215-657-0800

MATERIAL	HEAT TREAT	FINISH

TOLERANCE UNLESS NOTED

.XX	+.01 −.01
.XXX	+.005 −.005
.XXXX	+.0005 −.0005
DRILLED HOLES	+.003 −.000
FORMED ANGLES	+1/2° −1/2°

UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS ARE IN INCHES AND INCLUDE PLATING WHEN SPECIFIED.

REMOVE ALL BURRS AND BREAK ALL SHARP EDGES.

ALL DIAMETERS TO BE CONCENTRIC WITHIN .005 T.I.R. UNLESS NOTED

NEXT ASSEMBLY	FINAL ASSEMBLY

ORDER NO.

		DATE
DRAWN BY	[illegible]	7/1/78
CHECKED	[illegible]	11/9/78
APPROVED	GEG	11/6/78
APPROVED		

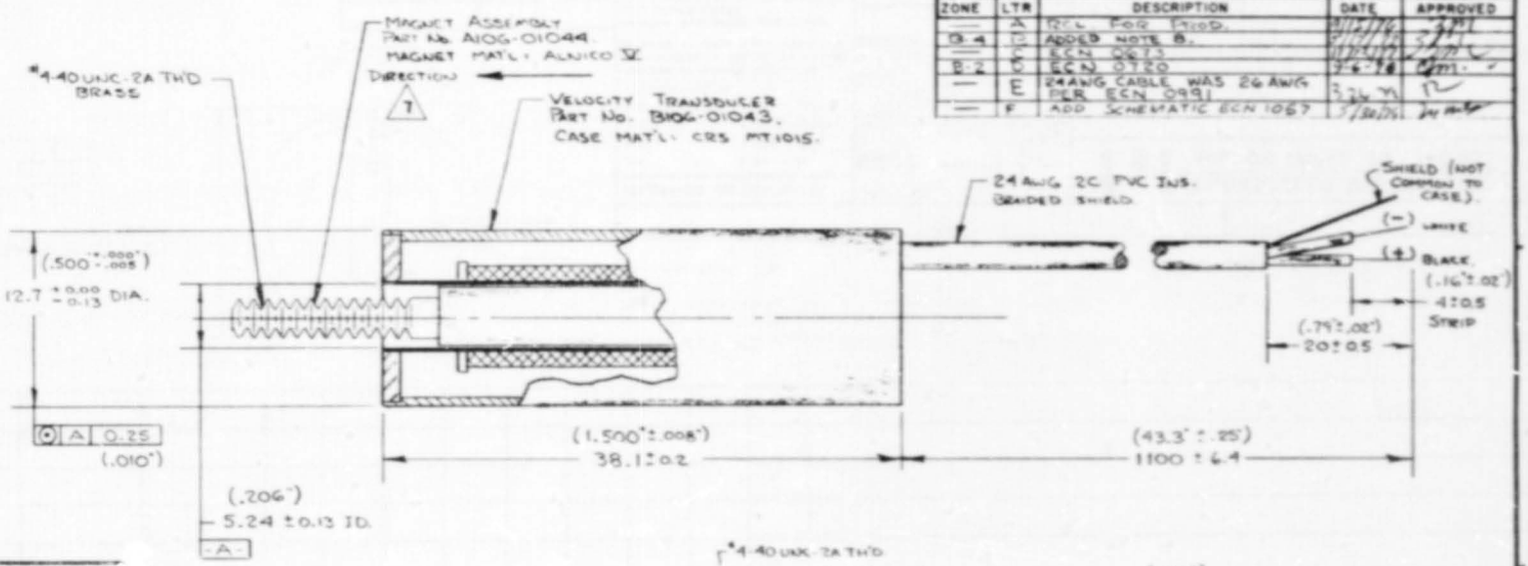
TSI TRANSDUCER SYSTEMS, INC.
WILLOW GROVE, PA. 19090

TECHNICAL DATA
ANGULAR VELOCITY
TRANSDUCER

SIZE	DWG NO.	REV.
B	BEX 1871	C

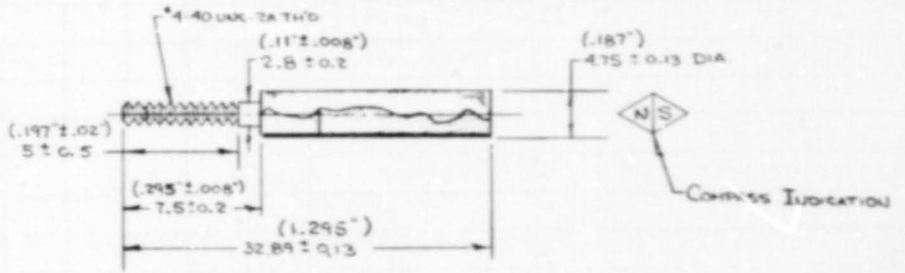
SCALE NONE SHEET 1 of 1

REVISIONS				
ZONE	LTR	DESCRIPTION	DATE	APPROVED
—	A	REL FOR PROD.	[illegible]	[illegible]
B-4	B	ADDED NOTE 8.	[illegible]	[illegible]
—	C	ECN 0673	[illegible]	[illegible]
B-2	D	ECN 0720	9-6-78	[illegible]
—	E	24 AWG CABLE WAS 26 AWG PER ECN 0991	3-26-79	[illegible]
—	F	ADD SCHEMATIC ECN 1067	5/30/79	[illegible]

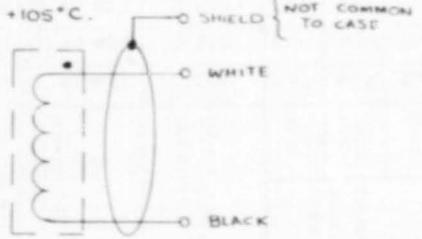


SPECIFICATIONS

1. LINEAR RANGE: 3.81mm (.150") = 1.9mm (.075") EACH SIDE OF ELECTRICAL CENTER.
2. LINEARITY: < 3%.
3. OUTPUT: 75 mV/in/SEC. MINIMUM
   85 mV/in/SEC. MAXIMUM
4. RESISTANCE: 1.18 K ohms ± 10%
5. INDUCTANCE: (COIL ONLY, MAGNET REMOVED): 52 mH ± 20%.
6. LOAD: OPEN.
7. POLARITY: WHITE LEAD NEGATIVE WITH RESPECT TO BLACK LEAD WHEN MAGNET ASSEMBLY MOVES AWAY FROM LEAD END.
8. MAGNET GAUSS: 1100 NOM.
9. TEMP RANGE: −40° TO +105°C.



MAGNET ASSEMBLY
A106-01044



SCHEMATIC

TEL: 215-657-0800

METRIC

NEXT ASSEMBLY	FINAL ASSEMBLY
—	B106-01043

TOLERANCE UNLESS NOTED	
.XX	+.01 −.01
.XXX	+.005 −.005
.XXXX	+.0005 −.0005
DRILLED HOLES	+.005 −.000
FORMED ANGLES	+1/2° −1/2°

UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS ARE IN INCHES AND INCLUDE PLATING WHEN SPECIFIED.

REMOVE ALL BURRS AND BREAK ALL SHARP EDGES.

ALL DIAMETERS TO BE CONCENTRIC WITHIN .005 T.I.R. UNLESS NOTED

ORDER NO. 08-03		
DRAWN BY K.W. Hinkle	DATE 9/15/76	
CHECKED [illegible]	DATE 9/15/76	
APPROVED C.M.	DATE 9-6-78	
APPROVED	DATE	
0960-0498-1	C	

TSI TRANSDUCER SYSTEMS, INC.
WILLOW GROVE, PA. 19090

OUTLINE
HZ 75
VELOCITY TRANSDUCER

SIZE	DWG NO.	REV.
B	B106-40002	F

SCALE NONE — SHEET 1 of 1

TRANSDUCERS, CONTROL

TEMPERATURE

(CODE **TT**)

ANALOG DEVICES

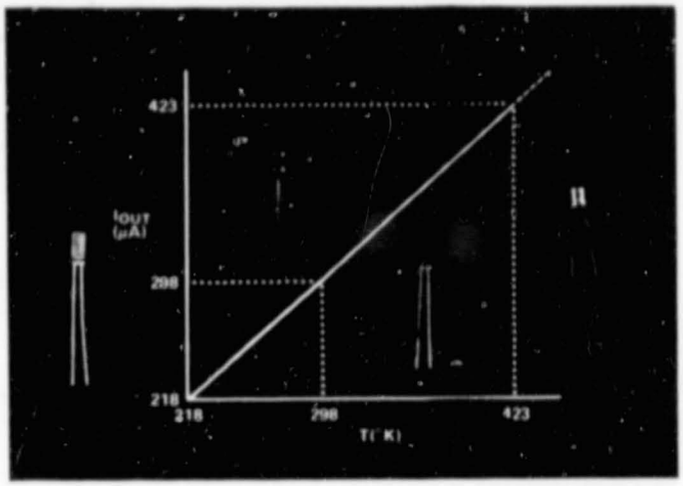
Two-Terminal IC Temperature Transducer

AD590

PRELIMINARY TECHNICAL DATA

FEATURES

- Linear Current Output: 1μA/°K
- Wide Range: -55°C to +150°C
- Probe Compatible Ceramic Sensor Package
- Two-Terminal Device: Voltage In/Current Out
- Laser Trimmed to ±0.5°C Calibration Accuracy (AD590M)
- Excellent Linearity: ±0.3°C Over Full Range Range (AD590M)
- Wide Power Supply Range: +4V to +30V
- Sensor Isolation from Case
- Low Cost: $1.65 (100's, AD590IH)



PRODUCT DESCRIPTION

The AD590 is a two-terminal integrated circuit temperature transducer which produces an output current proportional to absolute temperature. For supply voltages between +4V and +30V the device acts as a high impedance, constant current regulator passing 1μA/°K. Laser trimming of the chip's thin film resistors is used to calibrate the device to 298.2μA output at 298.2°K (+25°C).

The AD590 should be used in any temperature sensing application below +150°C in which conventional electrical temperature sensors are currently employed. The inherent low cost of a monolithic integrated circuit combined with the elimination of support circuitry makes the AD590 an attractive alternative for many temperature measurement situations. Linearization circuitry, precision voltage amplifiers, resistance measuring circuitry and cold junction compensation are not needed in applying the AD590.

In addition to temperature measurement, applications include temperature compensation or correction of discrete components, biasing proportional to absolute temperature, flow rate measurement, level detection of fluids and anemometry. The AD590 is available in chip form making it suitable for hybrid circuits and fast temperature measurements in protected environments.

The AD590 is particularly useful in remote sensing applications. The device is insensitive to voltage drops over long lines due to its high impedance current output. Any well-insulated twisted pair is sufficient for operation hundreds of feet from the receiving circuitry. The output characteristics also make the AD590 easy to multiplex: the current can be switched by a CMOS multiplexer or the supply voltage can be switched by a logic gate output.

PRODUCT HIGHLIGHTS

1. The AD590 is a calibrated two terminal temperature sensor requiring only a dc voltage supply (+4V to +30V). Costly transmitters, filters, lead wire compensation and linearization circuits are all unnecessary in applying the device.
2. State-of-the-art laser trimming at the wafer level in conjunction with extensive final testing insures that AD590 units are easily interchangeable.
3. Superior interference rejection results from the output being a current rather than a voltage. In addition, power requirements are low (1.5mW's @ 5V @ +25°C). These features make the AD590 easy to apply as a remote sensor.
4. The high output impedance (>10MΩ) provides excellent rejection of supply voltage drift and ripple. For instance, changing the power supply from 5V to 10V results in only a 1μA maximum current change, or 1°C equivalent error.
5. The AD590 is electrically durable. it will withstand a forward voltage up to 44V and a reverse voltage of 20V. Hence, supply irregularities or pin reversal will not damage the device.
6. The device is hermetically sealed in both a ceramic sensor package and in the TO-52 package. MIL-STD-883B processing to level B is available and, for large unit volumes, special accuracy requirements over limited temperature ranges can be satisfied by selections at final test. The device is also available in chip form.

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Route 1 Industrial Park; P.O. Box 280; Norwood, Mass. 02062
Tel: 617/329-4700 TWX: 710/394-6577

West Coast	Mid-West	Texas
213/595-1783	312/894-3300	214/231-5094

ANALOG DEVICES

ROUTE 1 INDUSTRIAL PARK • P.O. BOX 280 • NORWOOD, MASS. 02062 • 617/329-4700

SPECIFICATIONS (typical @ +25°C and V_S = 5V unless otherwise noted)

MODEL	AD590I	AD590J	AD590K	AD590L	AD590M
ABSOLUTE MAXIMUM RATINGS					
Forward Voltage (E+ to E-)	+44V	*	*	*	*
Reverse Voltage (E+ to E-)	-20V	*	*	*	*
Breakdown Voltage (Case to E+ or E-)	±200V	*	*	*	*
Rated Performance Temperature Range[1]	-55°C to +150°C	*	*	*	*
Storage Temperature Range[1]	-65°C to +175°C	*	*	*	*
Lead Temperature (Soldering, 10 sec)	+300°C	*	*	*	*
POWER SUPPLY					
Operating Voltage Range	+4V to +30V	*	*	*	*
OUTPUT					
Nominal Current Output @ +25°C (298.2°K)	298.2μA	*	*	*	*
Nominal Temperature Coefficient	1μA/°C	*	*	*	*
Calibration Error @ +25°C	±10.0°C max	±5.0°C max	±2.5°C max	±1.0°C max	±0.5°C max
Absolute Error[2] (over rated performance temperature range)					
Without External Calibration Adjustment	±20.0°C max	±10.0°C max	±5.5°C max	±3.0°C max	±1.7°C max
With +25°C Calibration Error Set to Zero	±5.8°C max	±3.0°C max	±2.0°C max	±1.6°C max	±1.0°C max
Nonlinearity	±3.0°C max	±1.5°C max	±0.8°C max	±0.4°C max	±0.3°C max
Repeatability[3]	±0.1°C/month max	*	*	*	*
Long Term Drift[4]	±0.1°C max	*	*	*	*
Current Noise		*	*	*	*
Power Supply Rejection					
+4V ≤ V_S ≤ +5V	0.5μA/V	*	*	*	*
+5V ≤ V_S ≤ +15V	0.2μA/V	*	*	*	*
+15V ≤ V_S ≤ +30V	0.1μA/V	*	*	*	*
Case Isolation to Either Lead	$10^{10}\Omega$	*	*	*	*
Effective Shunt Capacitance	100pF	*	*	*	*
Electrical Turn-On Time[5]	20μs	*	*	*	*
Reverse Bias Leakage Current[6] (Reverse Voltage = 10V)	10pA	*	*	*	*

*Specifications same as AD590I

[1] The AD590 has been used at -100°C and +200°C for short periods of measurement with no physical damage to the device. However, the absolute errors specified apply to only the rated performance temperature range.

[2] See page 4 for explanation of error components. Note that ±1°C error is the equivalent of ±1μA error.

[3] Maximum deviation between +25°C readings after temperature cycling between -55°C and +150°C; guaranteed not tested.

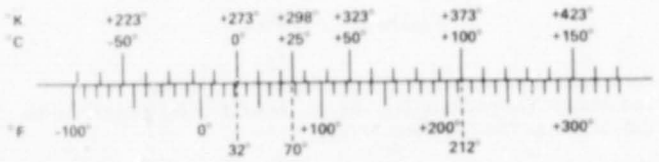
[4] Conditions: constant +5V, constant +125°C; guaranteed, not tested.

[5] Does not include self heating effects; see page 5 for explanation of these effects.

[6] Leakage current doubles every 10°C.

[7] Chips are available to J specifications; minimum order is 25 chips; 25-99 price: $2.00/chip; 100-999 price: $1.40/chip; consult local sales office for large volume pricing; consult factory for applications detail.

Specifications subject to change without notice.



TEMPERATURE SCALE CONVERSION EQUATIONS

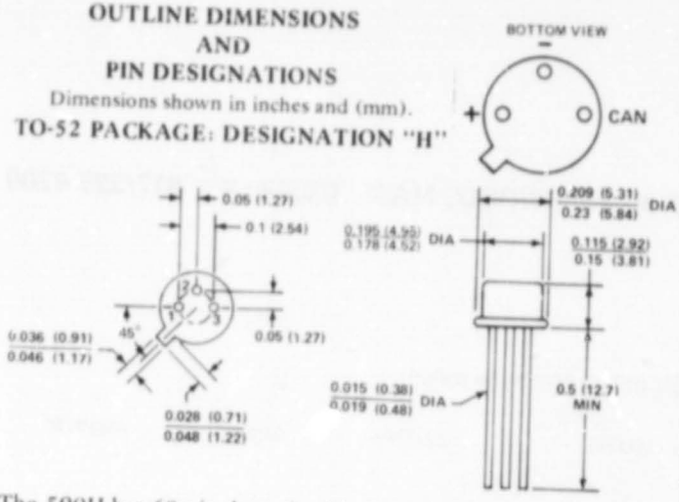
$$^{\circ}C = \frac{5}{9}(^{\circ}F - 32) \qquad ^{\circ}K = ^{\circ}C + 273.15$$

$$^{\circ}F = \frac{9}{5}\,^{\circ}C + 32 \qquad ^{\circ}R = ^{\circ}F + 459.7$$

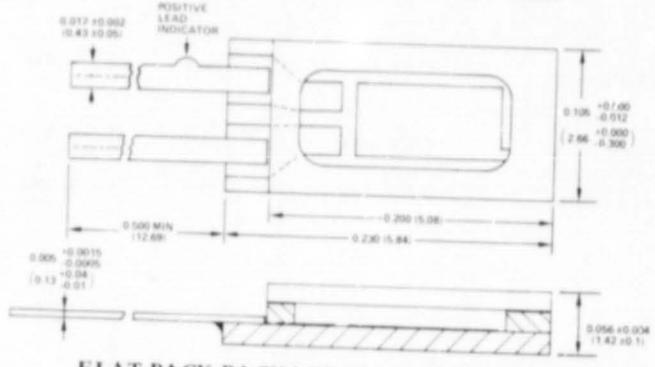
OUTLINE DIMENSIONS AND PIN DESIGNATIONS

Dimensions shown in inches and (mm).

TO-52 PACKAGE: DESIGNATION "H"

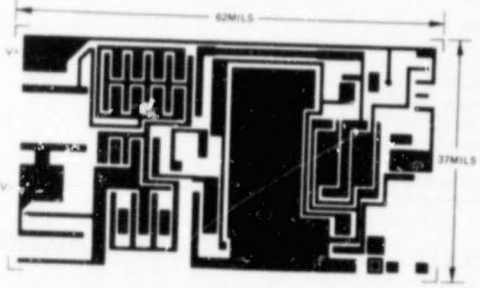


The 590H has 60μ inches of gold plating on its Kovar leads and Kovar header. A resistance welder is used to seal the nickel cap to the header. The AD590 chip is eutectically mounted to the header and ultrasonically bonded to with 1 mil aluminum wire. Kovar composition: 53% iron nominal; 29% ±1% nickel; 17% ±1% cobalt; 0.65% manganese max; 0.20% silicon max; 0.10% aluminum max; 0.10% magnesium max; 0.10% zirconium max; 0.10% titanium max; 0.06% carbon max.



FLAT-PACK PACKAGE: DESIGNATION "F"

The 590F is a ceramic package with gold plating on its Kovar leads, Kovar lid, and chip cavity. Solder of 80/20 Au/Sn composition is used for the 1.5 mil thick solder ring under the lid. The chip cavity has a nickel underlay between the metalization and the gold plating. The AD590 chip is eutectically mounted in the chip cavity at 400°C and ultrasonically bonded to with 1 mil aluminum wire. Note that the chip is in direct contact with the ceramic base, not the metal lid.



Metalization Diagram

CIRCUIT DESCRIPTION[1]

The AD590 uses a fundamental property of the silicon transistors from which it is made to realize its temperature proportional characteristic: if two identical transistors are operated at a constant ratio of collector current densities, r, then the difference in their base-emitter voltages will be (kT/q)(In r). Since both k, Boltzman's constant and q, the charge of an electron, are constant, the resulting voltage is directly proportional to absolute temperature (PTAT).

In the AD590, this PTAT voltage is converted to a PTAT current by low temperature coefficient thin film resistors. The total current of the device is then forced to be a multiple of this PTAT current. Referring to Figure 1, the schematic diagram of the AD590, Q8 and Q11 are the transistors that produce the PTAT voltage. R5 and R6 convert the voltage to current. Q10, whose collector current tracks the collector currents in Q9 and Q11, supplies all the bias and substrate leakage current for the rest of the circuit, forcing the total current to be PTAT. R5 and R6 are laser trimmed on the wafer to calibrate the device at +25°C.

Figure 2 shows the typical V–I characteristic of the circuit at +25°C and the temperature extremes.

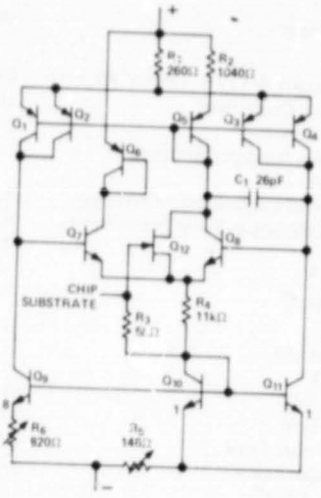


Figure 1. Schematic Diagram

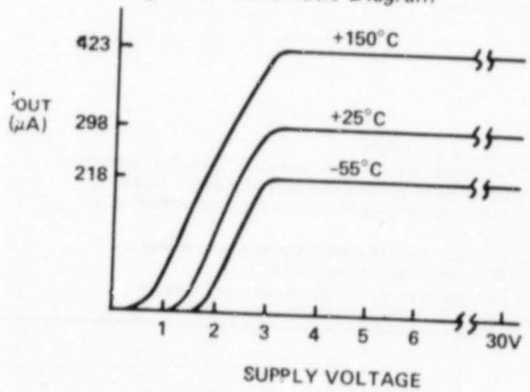


Figure 2. V–I Plot

[1] For a more detailed circuit description see M.P. Timko, "A Two-Terminal IC Temperature Transducer," IEEE J. Solid State Circuits, Vol. SC-11, p. 784-788, Dec. 1976.

ANALOG DEVICES

ROUTE 1 INDUSTRIAL PARK • P.O. BOX 280 • NORWOOD, MASS. 02062 • 617/329-4700

General Specifications

MODEL 4156 TEMPERATURE TRANSMITTER

Housing
Heavy, one piece brass, permanently sealed.

Thermal Element
High temperature disc type thermistor.

Terminal
10–32 brass stud with brass nuts or button type is standard.

Accuracy
5% of full scale range.

Repeatability
2% of full scale range.

Power
Up to 1/2 watt dissipation.

Standard Resistances
See Fig. 3 and table on other side.

Overtemperature
350° F. maximum above scale range.

Vibration
Will operate under 3 g's vibration intensity, up to 100 cps. Will withstand up to 5 g's intensity.

Shock
Will withstand up to 10 g's shock without damage

Adverse Environment
Fully weatherproof, sealed against rain, ice, sand and dust.

Connections
1/4" and 1/2" N.P.T. See table on other side

When Ordering, Specify:

1. Model number (including dash number -- see table)
2. System Voltage
*3. Full Scale Resistance
*4. Full Scale Temperature
5. Connection Size

*Items 3 and 4 could be covered more fully by a desired resistance-temperature curve.

DIMENSIONS

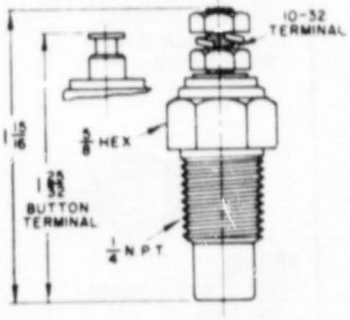


Fig. 4 – Models 4156-6 and 4156-8
Curve "A"

Model 4156-17
curve "C"

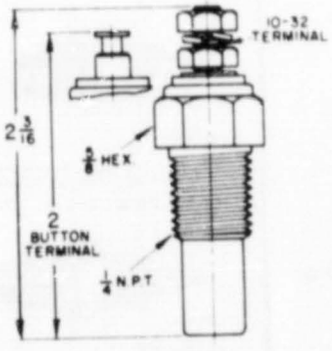


Fig. 5 – Models 4156-7 and 4156-9
Curve "B"

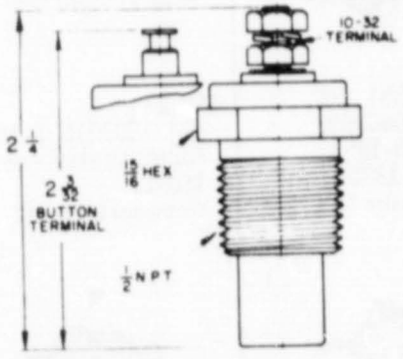


Fig. 6 – Models 4156-4 and 4156-10
Curve "C"

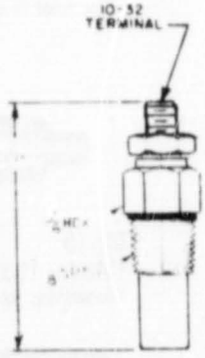


Fig. 7 - Models
4156-21 curve "C"
4156-28 curve "A"

THOMAS G. FARIA CORPORATION
UNCASVILLE, CONNECTICUT 06382 • PHONE 203: 848-9271

TEMPERATURE SENDING UNITS



TSU-2
(AL: 14405A, 1545220; Chrys: 1770732, CH-2503)
Chrysler Division 59-57
DeSoto 59-57
Dodge Division 58-57
Plymouth Division 59-57
Studebaker 63-57



TSU-3
(Amer. Mtrs.: 3161270; Chrys: 2084459, 2240744, 2256302; CH-2504, 5, 6)
Chrysler Division 63-60
DeSoto 61-60
Dodge Division 63-60
Plymouth Division 63-60

TSU-14
(DR: 1993350, 1993561, 1998189, 6402372, D-1851) For illustration see TSU-11
Oldsmobile Division 58-57
Pontiac Division 60-59



TSU-15
(GM: 1993351, 462, 1993564, 6400092, 6402666, D-1852, D-1853, D-1855)
Chevrolet Division 71-70, 66-62



TSU-18
(Stude: 1539876)
Studebaker 58-56



TSU-22
(Jeep: 914847)
Jeep Corp. 71-63



TSU-4
(Amer. Mtrs.: 3153688, 906773; FR.: B7A, C1AZ, CODF-10884A, SW-343, SW-707; Jeep: 905926; K.S: 44255)
American Motors 63-59
Edsel 60-58
Ford Division 65-57
Lincoln Division 63-57
Mercury Division 63-57



TSU-5
(GM: 546702, 1513321, 6402383, G-1852, G-1856, G-1867)
Buick Division 79-64
Cadillac Division 67-65
Chevrolet Division 78-57
Oldsmobile Division 78-66
Pontiac Division 79-65



TSU-26
(FR: C5AZ-10884A, B, D6LZ-10884A, SW-626, SW-1345)
Ford Division 79-65
Lincoln Division 79-66
Mercury Division 79-67

TSU-27
(DR: 1993316, D-1850) For illustration see TSU-11
Oldsmobile Division 63



TSU-28
(FR: C6DZ-10884A, C6DZ-10884B, C6TZ, D0HZ, D0OZ, D0WY, D0ZZ-10884A) (with Dial Tvpe Gauge)
Ford Division 79-65
Lincoln Division 72-69
Mercury Division 79-66



TSU-6
(GM: 1513130, 6400759, G-1851)
Cadillac Division 65-56
Chevrolet Division 79-78, 56
Oldsmobile Division 79-78
Pontiac Division 78-77



TSU-9
(DR: 1993426, 1993513, 18, 82, 88; D-1858, D-1859)
Buick Division 67-64
Chevrolet Division 68
Oldsmobile Division 66-61
Pontiac Division 68-61



TSU-31
(DR: 6400211)
Chevrolet Truck 63-62

TSU-32
(Chrys: 2497551, 2580242, 2857562, CH-2515, CH-2516, CH-2520) (Replaces switches marked 240° or 246°) For Illustrations see TSU-31
Chrysler Division 73-64
Dodge Division 66-65
Plymouth Division 66-65



TSU-33
(DR: 1998193, D-1861)
Pontiac Division 68-66



TSU-34
(DR: 1993369, 409, D-1863)
Chevrolet Division 71-67
Pontiac Division 70-69



TSU-10
(GM: 1512678, 1513462, 6489278, G-1850, G-1854)
Cadillac Division 68
Chevrolet Division 72-71
Oldsmobile Division 55-53
Pontiac Division 72-71, 64-57



TSU-11
(DR: 1993303, 1993521, 1993581, 1998140, 181, 1998746, D-1857, D-1860)
Buick Division 69-60
Oldsmobile Division 69-67
Pontiac Division 67-59

TSU-38
When present stock is exhausted use TSU-34



TSU-39
(FR: C8GY, D6AZ-10884-A, SW-663, SW-1344) (Models w/light)
Ford Division 79-68
Mercury Division 79-69



TSU-40
(FR: C9WY-10884A, SW-888)
Ford Division 69
Mercury Division 70-69



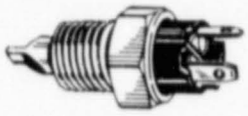
TSU-41
(Amer. Mtrs: 3177594)
American Motors 78-67
Jeep Corp. 79-62

GP Guaranteed Parts Company - Seneca Falls, New York 13148
TEL: 315-568-5844

TEMPERATURE SENDING UNITS



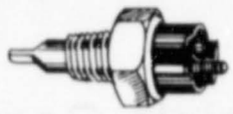
TSU-44
(DR: 1994095, D-1866)
Chevrolet Division 70



TSU-45
(GM: 6489903)
Buick Division 72-71
Pontiac Division 72-71



TSU-23
(Amer. Mtrs: 3173363, 3179953; Chrys: 2426458, 4051140, 41; FR: C3AZ, C3TZ, C5DZ, D0TZ-10884A, D1FZ-10884B)
American Motors 66-65
Chrysler Division 79-69
Dodge Division 79-64
Ford Division 78-63
Lincoln Division 65-64
Mercury Division 65-64
Plymouth Division 79-64



TSU-46
(FR: D1FZ-10884A, SW-983)
Pinto 73-71



TSU-47
(GM: 6490454)
Chevrolet Division 74-73
Oldsmobile Division 74-73
Pontiac Division 73



TSU-29
(Chrys: 2426459, CH-2511) (with Air Conditioner)
Chrysler Division 66-64
Dodge Division 68-65
Plymouth Division 68-65



TSU-30
(Amer. Mtrs: 934724, 3164144)
American Motors 66-62
Jeep Corp. 71-62



TSU-48
(GM: 6490452)
Chevrolet Division 76-73
Oldsmobile Division 76
Pontiac Division 76-75



TSU-49
(GM: 6489395, 6490694, 970)
Buick Division 79-71
Cadillac Division 79-76
Chevrolet Division 79-73
Oldsmobile Division 79-78
Pontiac Division 79-75



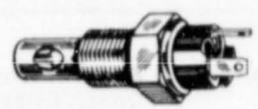
TSU-35
(DR: 1993427)
Chevrolet Division 69-68
Pontiac Division 69-68



TSU-37
(DR: 1993400, 6402784)
Chevrolet Truck 69-67
Oldsmobile Division 78



TSU-50
(GM: 8992538)
Chevrolet Division 77-76
Pontiac Division 76



TSU-42
(DR: 1993444)
Buick Division 68
Oldsmobile Division 70-63
Pontiac Division 69-59



TSU-43
(DR: 1993445, 1993496, 1994061, 6489395, D-1867)
Cadillac Division 76
Buick Division 75-68
Oldsmobile Division 72-71

TEL: 315-568-5844
Guaranteed Parts Company - Seneca Falls, New York 13148

Gulf + Western
Manufacturing Company

Electric Vehicle Components

Bohn Heat Transfer Division

1625 East Voorhees Street
Danville, Illinois 61832
Telephone: 217/446-3710

Heat Exchangers	Air to air, liquid to air and liquid to liquid designs. Custom manufacture.

Michigan Plating & Stamping Division

1860 Alpine Avenue, N.W.
Grand Rapids, Michigan 49504
Telephone: 616/363-4847

Fuel Tanks	Supplier to automotive industry of terneplate stamped and welded tanks.

Automotive Marketing and Engineering Center

Detroit Sales and Engineering Office
24114 Research Drive
Farmington Hills, Michigan 48024
Telephone: 313/478-8140

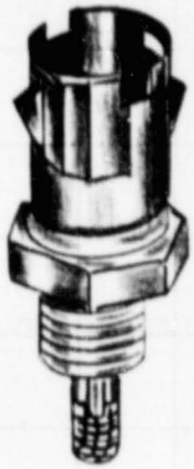
Relays	Miniaturized 12VDC to control circuits to 20 amperes.
Solenoids	Build to customer requirements.
Switches	Build to customer requirements.
Transducers	Current, Position, Pressure, Speed, Temperature, Torque, Voltage - Build to customer requirements.
Voltage Regulators	12VDC Solid State

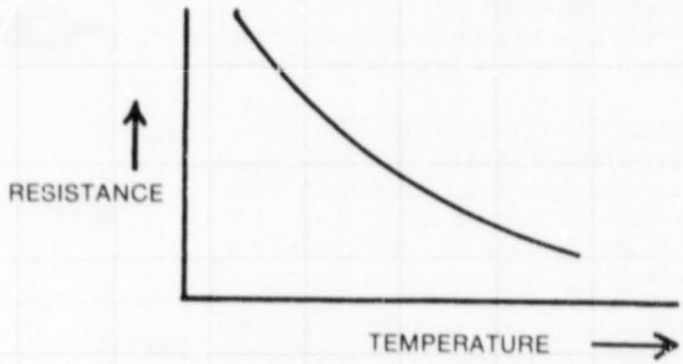
Collyer Insulated Wire Division

100 Higginson Ave.
Lincoln, RI 02865
Telephone: 401/723-7800

Apparatus Cables	**Single conductor, Type A.I.A.** IPCEA S-28-357, NEMA WC-1; Underwriters' Lab. Sizes #4 AWG and larger. Asb. covered, 300V and 600V.
Appliance Wires	**Single conductor** Collyer P-400 THHN/THWN PVC/NYLON in those sizes which are 19W uncompressed. U.L. Listed Rate AWM 105°C Dry and 80°C in oil.
Control Cables	**Single and multi conductor** THERMOPLASTIC: Collyer C-141 — PZR — PE/NYLON condrs. PVC Jacket 600V, 1000V, 75°C. Collyer C-140 — PVC insulated and jacketed 600V. Collyer C-143 — PE/PVC conductors, PVC jacket 600V, 1000V. Collyer C-153 — PE/NYLON, PZR 90°C, PVC jacket 600V, 1000V. Collyer C-154 — THHN/THWN conductors Type T.C. U.L. Listed.

AIR TEMPERATURE SENSOR





The air temperature sensor was developed to provide an electrical output signal proportional to a media temperature.

Temperature range, output characteristic and accuracy can be modified to your specific requirements.

USES:
Inlet Air and Manifold Air Temperature.

CONTACT ENGINEER - JOHN AUBEL

BORG WARNER Transportation Equipment

Marvel-Schebler/Tillotson Division
Borg-Warner Corporation
2195 South Elwin Road, Decatur, Illinois 62525
Phone 217/428-4631

DRAWN
CHECKED
APPROVED

SKETCH NUMBER 146

RITE AUTOTRONICS CORP. 3485 S. LA CIENEGA BLVD., LOS ANGELES, CALIFORNIA 90016
TEL: 213-836-7900

INSTALLATION AND ADAPTER KITS

METRIC ADAPTER KITS for adapting oil pressure gauges, electrical temperature gauges and all dual and trio gauge sets containing either or both of the above instruments, to imported cars and U.S. built vehicles with metric engines. Kits are available for all gauges in this catalog marked with Ⓜ symbol.

734 FOR OIL PRESSURE SINGLE GAUGE AND OIL PRESSURE/AMMETER DUAL GAUGES. Contains: Two tubing fittings with 1/8-28 BSPT and M 14 x 1.5 threads, complete instructions • Pack: 24 to a carton, carton weight: 3 lbs.



735 FOR ELECTRONIC WATER TEMPERATURE SINGLE GAUGE AND ELECTRONIC WATER TEMPERATURE/AMMETER DUAL GAUGES. Contains: Reducing bushing 1/8 NPT to M 16 x 1.5, temperature sending unit with 1/8-28 BSPT, complete instructions • Pack: 24 to a carton, carton weight: 3 lbs.



736 FOR OIL PRESSURE/ELECTRONIC WATER TEMPERATURE DUAL GAUGE AND OIL PRESSURE/ELECTRONIC WATER TEMPERATURE/AMMETER TRIO GAUGES. Contains: Two tubing fittings with 1/8-28 BSPT and M 14 x 1.5 threads, reducing bushing 1/8 NPT to M 16 x 1.5, temperature sending unit with 1/8-28 BSPT, complete instructions • Pack: 24 to a carton, carton weight: 4 lbs.



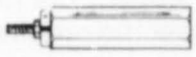
1/8" P.T. SENDING UNIT KIT for U.S. thread engines. For all RAC electronic temperature gauges except head temperature. Includes sender, 1/4", 3/8" and 1/2" P.T. adapters. Specify: 72703 for all 1972 and later gauges, has blue insulator; 72701 for deluxe, custom 1971 and earlier, has white insulator; 72702 for continental, continental 500, 1971 and earlier, has red insulator • Pack: 6 to a carton, carton weight: 2 lbs.

727

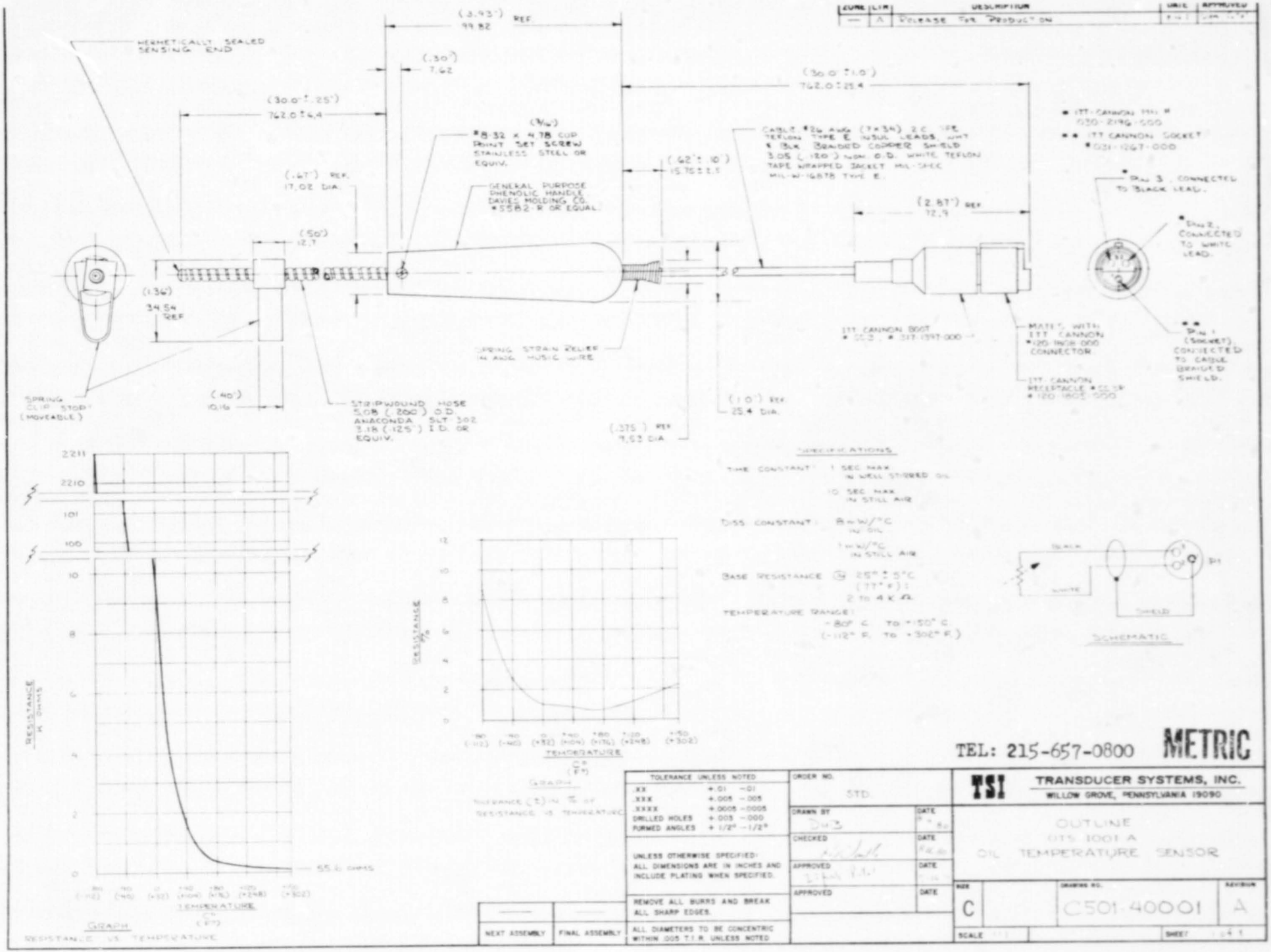


HEAD TEMPERATURE SENDING UNIT fits Corvair, others with 3/8–24 threads. Use with 441, 443 model gauges. Specify: 72801 for 150°–350° meter; 72800 for 130°–300° meter • Pack: 6 to a carton, carton weight: 2 lbs.

728



ZONE	LTR	DESCRIPTION	DATE	APPROVED
—	A	RELEASE FOR PRODUCTION		



TEL: 215-657-0800 **METRIC**

TOLERANCE UNLESS NOTED	
.XX	+.01 -.01
.XXX	+.005 -.005
.XXXX	+.0005 -.0005
DRILLED HOLES	+.003 -.000
FORMED ANGLES	+ 1/2° -1/2°

UNLESS OTHERWISE SPECIFIED: ALL DIMENSIONS ARE IN INCHES AND INCLUDE PLATING WHEN SPECIFIED.

REMOVE ALL BURRS AND BREAK ALL SHARP EDGES.

ALL DIAMETERS TO BE CONCENTRIC WITHIN .005 T.I.R. UNLESS NOTED

NEXT ASSEMBLY	FINAL ASSEMBLY
—	—

ORDER NO. STD.		
DRAWN BY DWB	DATE	
CHECKED	DATE	
APPROVED	DATE	
APPROVED	DATE	

TSI TRANSDUCER SYSTEMS, INC.
WILLOW GROVE, PENNSYLVANIA 19090

OUTLINE
OTS 1001 A
OIL TEMPERATURE SENSOR

SIZE	DRAWING NO.	REVISION
C	C501-40001	A

SCALE | SHEET 1 of 1

TRANSDUCERS, CONTROL

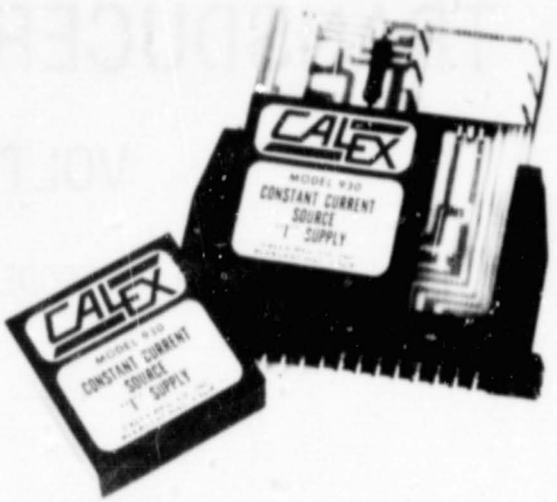
VOLTAGE

(CODE **TV**)

MODEL 930/MK 298
VOLTAGE TO CURRENT TRANSDUCER

FEATURES:

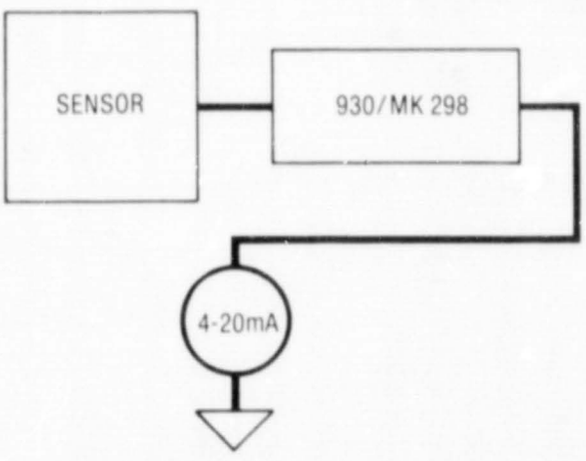
- Converts any voltage to instrument current
- Easy hook-up and interfacing of Model 930 Constant Current Source
- Small size
- External zero and span adjustment
- "Live zero"



DESCRIPTION

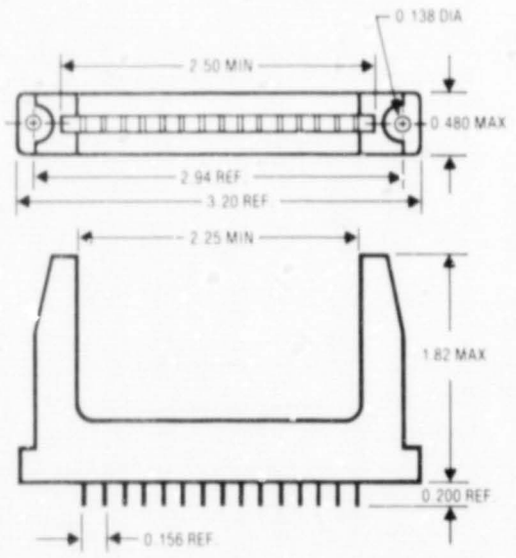
The Model 930/MK298 consists of a Model 930 Programmable Current Source, a PC card, 15 pin mating connector and all the pots and resistors necessary for convenient interfacing of the Model 930. Two pots allow the user to generate a "live zero" and thus to output a 4-20mA current compatible with standard process control instruments. Other current ranges may be obtained by simply changing one resistor.

APPLICATIONS

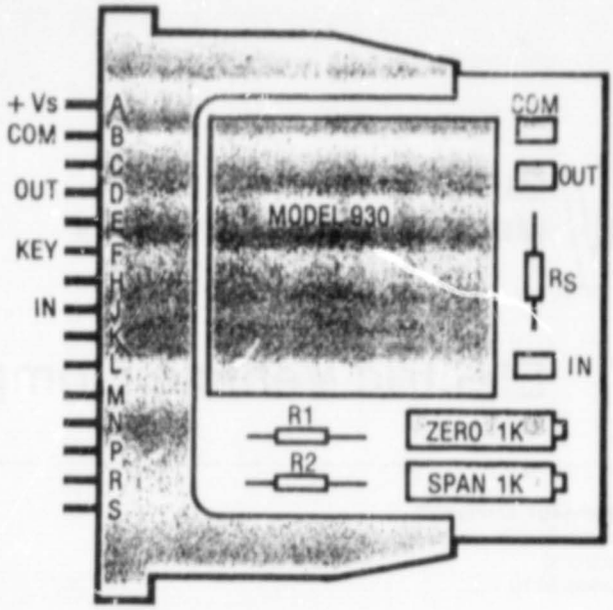


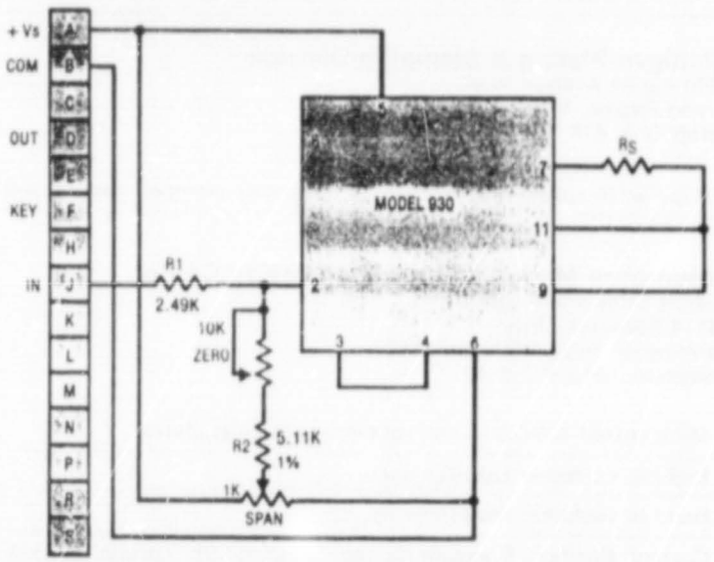
PIN CONNECTOR

The mounting kits use a standard 15 pin connector. The use of this type connector makes rack mounting, vertical chassis mounting on "rails" or angle bracket mounting a convenient method of constructing the most professional looking systems. For convenience in designing your system, the connector profiles and dimensions are presented below.



CALEX MFG. CO., INC., 3355 Vincent Road, Pleasant Hill, CA 94523
Telephone: (415)932-3911





To program output using input voltage ranges spanning less than 0-10V, calculate the value of R_S using the formula:

$$R_S = \frac{V_{in}\ (max)}{10\ I_o\ (max)}$$

Where: V_{in} (max) equals the maximum value of input voltage

I_o (max) equals the maximum value of output current.

Note: $+V_S$ must be connected to a regulated power supply.

To calibrate:

1. With input voltage at maximum (+ 10V.), adjust span pot for maximum output current.
2. With input voltage at minimum (0V.), adjust zero pot for minimum output current.

Gulf + Western
Manufacturing Company

Electric Vehicle Components

Bohn Heat Transfer Division

1625 East Voorhees Street
Danville, Illinois 61832
Telephone: 217/446-3710

Heat Exchangers	Air to air, liquid to air and liquid to liquid designs. Custom manufacture.

Michigan Plating & Stamping Division

1860 Alpine Avenue, N.W.
Grand Rapids, Michigan 49504
Telephone: 616/363-4847

Fuel Tanks	Supplier to automotive industry of terneplate stamped and welded tanks.

Automotive Marketing and Engineering Center

Detroit Sales and Engineering Office
24114 Research Drive
Farmington Hills, Michigan 48024
Telephone: 313/478-8140

Relays	Miniaturized 12VDC to control circuits to 20 amperes.
Solenoids	Build to customer requirements.
Switches	Build to customer requirements.
Transducers	Current, Position, Pressure, Speed, Temperature, Torque, Voltage - Build to customer requirements.
Voltage Regulators	12VDC Solid State

Collyer Insulated Wire Division

100 Higginson Ave.
Lincoln, RI 02865
Telephone: 401/723-7800

Apparatus Cables	**Single conductor, Type A.I.A.** IPCEA S-28-357, NEMA WC-1; Underwriters' Lab. Sizes #4 AWG and larger. Asb. covered, 300V and 600V.
Appliance Wires	**Single conductor** Collyer P-400 THHN/THWN PVC/NYLON in those sizes which are 19W uncompressed. U.L. Listed Rate AWM 105°C Dry and 80°C in oil.
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UNIVERSAL JOINTS

(CODE **UJ**)

Spicer® JOURNAL & BEARING KITS

A Universal joint series is related to the torque capacities of a driveline. Modern drivelines have become highly complex. In addition heavy duty trucks are largely custom built inasmuch as driveline components are concerned. For these reasons most vehicle manufacturers and universal joint suppliers are cataloging journal and bearing kits by series.

The following information is designed to provide an easy method for Identification and Selection of the proper series and journal and bearing kits.

SPICER®

Spicer Journal and Bearing Kits are made in a complete range of sizes for passenger car, truck, bus and off-highway applications.

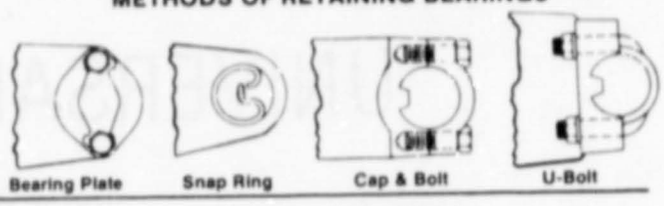
The basic design of all sizes of Spicer Journal and Bearing Kits is similar. Each kit includes a journal and four (4) bearings; however there are several methods of retaining the bearings in the yokes.

Bearings are retained in the joint yokes with Snap Rings, Bearing Plates, Cap & Bolts and U-Bolts. The Snap Rings and Bearing Plates are used with the closed-end End Yokes, the Cap & Bolts and U-Bolts with open-end End Yokes.

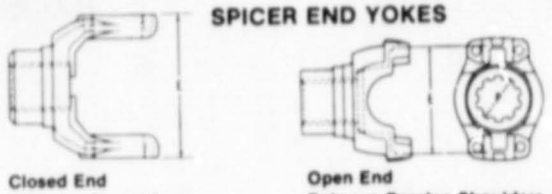
A Spicer Series may be determined by measuring the End Yokes or the Journal. The closed-end End Yokes measure across the lugs "E" and the diameter of the Bearing Hole "D". The open-end End Yokes should be measured between the bearing shoulders "E". When measuring the Journal, less the bearings, measure the overall length "O" and the Trunnion Diameter "N".

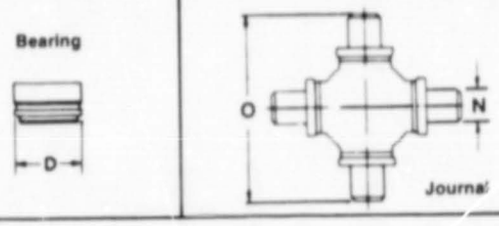
Listed below is a Table showing the Spicer Series with End Yoke and Journal Dimensions.

METHODS OF RETAINING BEARINGS



SPICER END YOKES





SERIES IDENTIFICATION TABLE

SPICER® JOINT SERIES	END YOKE — "E"		BEARING DIAMETER "D"	JOURNAL DIMENSIONS		Standard Journal & Bearing Kits
	Closed-End Across Lugs	Open-End Betw. Brg. Shoulders		Overall Length "O"	Trunnion Diameter "N"	
1000	2 3/16"	- - -	15/16"	2 5/64"	1/2"	5-170X
1100	2 21/32"	- - -	15/16"	2 13/64"	35/64"	5-100X
1280	3 15/32"	3 7/32"	1 1/16"	2 31/64"	39/64"	5-200X
1310	3 15/32"	3 7/32"	1 1/16"	2 31/64"	21/32"	5-153X
1330	3 1/8"	3 1/8"	1 1/16"	3 1/8"	21/32"	5-213X
1350	3 1/8"	3 1/8"	1 3/16"	3 1/8"	49/64"	5-178X
1410	4 1/16"	4 3/16"	1 3/16"	3 15/16"	49/64"	5-160X
1480	4 1/16"	4 3/16"	1 3/8"	3 7/8"	53/64"	5-188X
1500	4 5/16"	- - -	1 3/16"	4 1/4"	1"	5-115X
1550	5 1/4"	4 31/32"	1 3/8"	4 21/32"	57/64"	5-155X
1610	5 5/16"	- - -	1 3/8"	5"	1 17/64"	5-279X
1650	5 31/32"	5 9/32"	1 5/8"	5 3/16"	1 3/64"	5-165X
1710	6 1/32"	- - -	1 15/16"	5 25/32"	1 19/64"	5-280X
1800	6 9/32"	- - -	2 5/16"	6 3/32"	1 11/16"	5-124X
1810	7 35/64"	- - -	1 15/16"	7 1/4"	1 19/64"	5-281X
1850	8"	8 1/32"	2 3/16"	7 19/32"	1 3/8"	5-185X
1880	8 1/32"	- - -	2 3/16"	7 19/32"	1 3/8"	5-308X
1900	8 25/32"	- - -	2 13/16"	8 11/32"	1 51/64"	5-54X
1950	- - -	10 3/64"	3 1/16"	9 5/32"	2"	5-192X
2050	- - -	12 7/32"	3 13/16"	11 17/32"	2 1/2"	5-250X
2150	- - -	15 1/8"	4 1/4"	14 5/16"	3 5/32"	5-298X

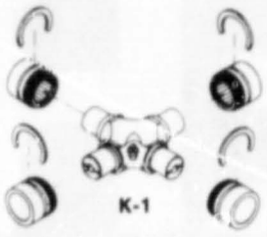
DRIVETRAIN SERVICE DIVISION
P.O. BOX 321 • TOLEDO, OHIO 43691

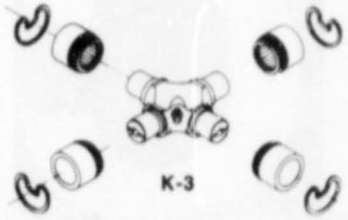
DANA CORPORATION
TELEPHONE: (419) 866-1841

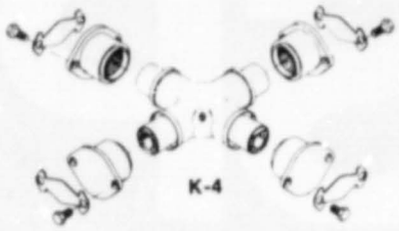
Spicer

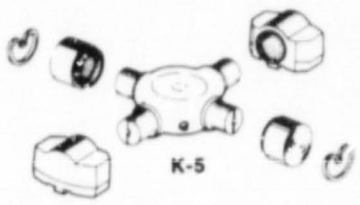
SPICER
JOURNAL & BEARING KITS

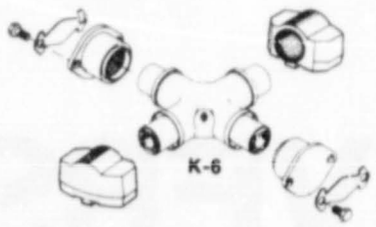
KIT STYLES



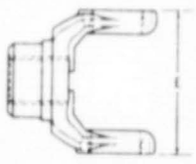


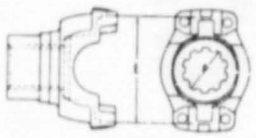




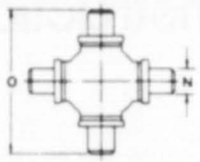


END YOKES

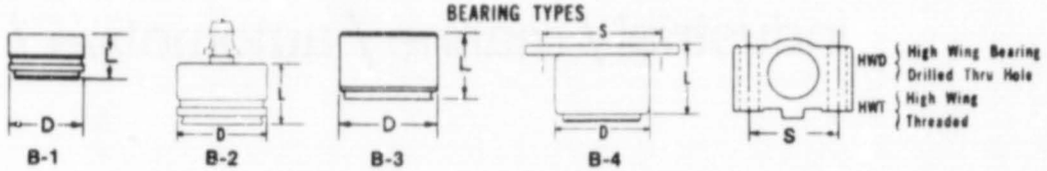




JOURNAL



BEARING TYPES



DRIVETRAIN SERVICE DIVISION
P.O. BOX 321 • TOLEDO, OHIO 43691

DANA

DANA CORPORATION
TELEPHONE: (419) 866-1841

SPICER

UNIVERSAL JOINTS

industrial / marine / automotive / construction

VEHICULAR GROUP
P.O. BOX 8788
TOLEDO, OHIO 43623

DANA CORPORATION
TELEPHONE: (419) 535-5452

Basic Torque Ratings

On the opposite page, a basic torque rating chart will provide ready reference for the complete universal joint series from light duty to extra heavy duty classification.

The ratings are divided into the respective joint duty sizes and are based on the following:

***Electric Motor** . . . continuous running rating based on minimum bearing life expectancy of 3000 hrs. operating at 3° Joint Angle @ 1750 r.p.m.

***Gas or Diesel Engines** . . . continuous running rating based on minimum bearing life expectancy of 5000 hrs. operating at 3° Joint Angle @ 3000 r.p.m.

Short Duration . . . represents the joints' capability to withstand momentary loading accompanying start-stop service.

Torsional Strength (minimum elastic limit) . . . represents the maximum torque load the universal joint will transmit instantaneously without brinelling bearing or yield in any part. This may be assumed to be the maximum safe shock load.

Maximum Operating Speed . . . is based on suitable proportions of length and tube diameter. For speeds below 100 RPM and above 6000 RPM contact Spicer Universal Joint Division, Engineering Department.

Vehicle Applications

The truck application chart illustrated below will provide quick reference for universal joint application as classified by vehicle duty from light to extra heavy service.

Spicer U-Joint Series			1280	1310	1330	1350	1410	1480	1550	1610/1650	1710	1810	1880	1950	2050	2150
MAXIMUM GVW			6000	10000	13000	16000	22000	Over 22000								
MAXIMUM TORQUE RATING (Lb. Ft.)	WHEEL SLIP (Lb. Ft.)		750	1050	1200											
	LOW GEAR RATIO	8.5 to 1			1200	1400	1600	2100	2600	**3800**	5100	6800	9300	18400	36000	72000
		11 to 1				1610	1840	2300	3000	**4400**	5850	7800	10700	21200	41500	83000
		18 to 1				2100	2400	3000	3900	**5700**	7650	10200	14000	27600	54000	108000

The Torque Ratings and Gross Vehicle Weights for the respective joint sizes are based on the following:

Light Duty Vehicles . . . 4,000 to 10,000 lbs. GVW . . . joint size is determined by Wheel Slip Torque. Generally, the effective torque transmitted to the axle is limited by the weight of the vehicle and represented by Wheel Slip Torque. Use 0.67 to 0.8 coefficient of friction depending on application.

$$\frac{RAL \times CF \times TRR}{AR} = \text{Drive Line Torque to Slip Wheels (In. Lbs.)}$$

Medium Duty Vehicles . . . 10,000 to 22,000 lbs. GVW generally do not develop sufficient torque to slip the wheels. Required joint size is determined by the Engine Torque x Low Gear Ratio. To compensate for power losses, this ratio should be multiplied by 0.85 for Mechanical Transmissions, and 0.72 for Hydraulic Transmissions (Stall Torque).

Heavy Duty Vehicles . . . over 22,000 lbs. GVW based on the same factors as Medium Duty Vehicles, except as gear ratios are increased above 8.5 to 1, torque ratings are increased to allow for the lower percentage of time the vehicle uses low gear. To compute Low Gear Torque: ET x TL x 0.85 = LGT (Ft. Lbs.)

In applications using Auxiliary Transmissions or Transfer Cases in conjunction with the Main Transmission, Low Gear Torque is computed as follows:

Auxiliary Transmission: LGT x AL x 0.85 = ALGT (Ft. Lbs.)

Transfer Case: LGT x TCL x 0.85 = CLGT (Ft. Lbs.)

AL: Auxiliary Low Gear Ratio
ALGT: Auxiliary Low Gear Torque.
AR: Axle Ratio
CF: Coefficient of Friction
CLGT: (Transfer) Case Low Gear Torque
ET: Engine Torque
LGT: Low Gear Torque
RAL: Rear Axle Load
TCL: Transfer Case Low Gear Ratio
TL: (Main) Transmission Low Gear Ratio
TRR: (Driving) Tire Rolling Radius (Inches)
WST: Wheel Slip Torque

*Applies to those universal joint sizes that have speed capability indicated.

VEHICULAR GROUP
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Universal Joint Sizes / Ratings / Speeds / Tube Sizes

SPICER U-JOINT SIZES	Electric Motor Torque			Gas or Diesel Torque		Short Duration Torque		Torsional Strength Min. Elastic Limit		* Max. r.p.m.	Standard Tube Size	**Max. Length ℄–℄ Installed @ Max. Rated r.p.m.
	H.P per 100 r.p.m.	Lb. In.	Lb. Ft.	Lb. In.	Lb. Ft.	Lb. In.	Lb. Ft.	Lb. In.	Lb. Ft.			
Light Duty												
1000	1.42	900	75	600	50	3,720	310	5,040	420	2,500	1¼" x .065	55"
1210	1.81	1,140	95	780	65	5,040	420	10,200	850	6,000	2½" x .065	43"
● 1280	2.66	1,680	140	1,140	95	6,840	570	15,000	1,250	6,000	2½" x .083	43"
1310	3.71	2,340	195	1,560	130	9,600	800	19,200	1,600	6,000	3" x .083	47"
1330	4.18	2,640	220	1,800	150	10,680	890	22,200	1,850	5,000	3½" x .083	50.5"
											4" x .083	54"
Medium Duty												
1350	**5.90**	**3,720**	**310**	**2,520**	**210**	**14,880**	**1,240**	**27,120**	**2,260**	**5,000**	**3" x .083**	**51"**
											3½" x .083	**55"**
											4" x .083	**59"**
● 1410	**7.14**	**4,500**	**375**	**3,000**	**250**	**18,000**	**1,500**	**32,400**	**2,700**	**5,000**	**3" x .083**	**51"**
											3½" x .083	**55"**
											4" x .083	**59"**
● 1480	**9.52**	**6,000**	**500**	**4,080**	**340**	**24,000**	**2,000**	**39,960**	**3,330**	**5,000**	**3½" x .083**	**55"**
											4" x .083	**59"**
											4½" x .095	**63"**
Heavy Duty												
● 1550	12.18	7,680	640	5,160	430	28,800	2,400	52,800	4,400	5,000	3½" x .095	55"
											4" x .083	59"
											4½" x .095	63"
● 1650	18.13	11,424	952	7,620	635	43,680	3,640	76,800	6,400	4,000	3½" x .134	61"
											4" x .134	66"
											4½" x .095	70"
1610	18.56	11,700	975	7,680	640	43,800	3,650	78,000	6,500	4,500	3½" x .134	58"
											4" x .134	62"
											4½" x .095	66"
1710	25.33	15,960	1,330	10,800	900	57,600	4,800	96,000	8,000	4,500	4" x .134	62"
											4½" x .134	66"
● 1810	35.23	22,200	1,850	15,000	1,250	78,000	6,500	144,000	12,000	4,500	4½" x .134	66"
											4½" x .259	65"
● 1880	48.55	30,600	2,550	20,400	1,700	106,800	8,900	192,000	16,000	3,000	4½" x .259	80"
Extra Heavy Duty												
● 1910	**68.55**	**43,200**	**3,600**	**28,800**	**2,400**	**144,000**	**12,000**	**249,600**	**20,800**	**2,500**	**4¼" x .250**	**80"**
1950	**102.82**	**64,800**	**5,400**	**43,200**	**3,600**	**216,000**	**18,000**	**408,000**	**34,000**	**2,500**	**5¼" x .375**	**80"**
2050	**218.96**	**138,000**	**11,500**	**90,000**	**7,500**	**432,000**	**36,000**	**816,000**	**68,000**	**2,000**	**8" x .375**	**80"**
2150	**428.40**	**270,000**	**22,500**	**180,000**	**15,000**	**864,000**	**72,000**	**1,632,000**	**136,000**	**1,500**	**9" x .625**	**80"**

*Rating applies to Universal Joint.

**Lengths shown with exception of 1900 thru 2150 sizes are based on .66 of the calculated critical speed at max. rated RPM (as applied to industrial applications). For vehicle applications or driveshaft assembly lengths exceeding 80 inches, consult Spicer Universal Joint Division, Application Engineering with complete design requirements.

●Wing bearings for use in the outboard position available in these sizes. See Bulletin #3226 for additional information.

Operating Angles† For Two Joint Shafts with Equal Or Intersecting Angles

Driveshaft RPM	Maximum Operating Angle	Driveshaft RPM	Maximum Operating Angle
5000	3° 15′	3000	5° 50′
4500	3° 40′	2500	7° 0′
4000	4° 15′	2000	8° 40′
3500	5° 0′	1500	11° 30′

†Based on application experience (1000 rad/sec² acceleration).

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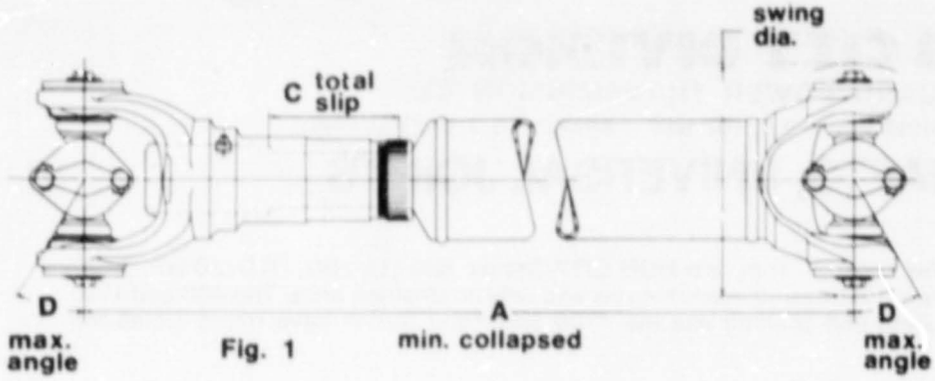


Fig. 1

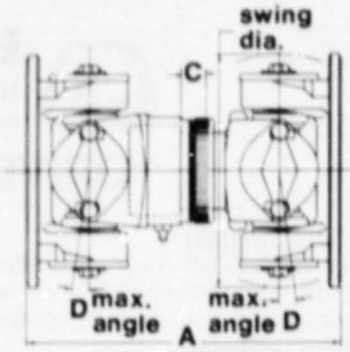


Fig. 2 min. collapsed

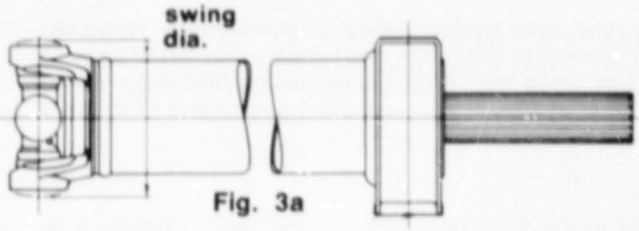


Fig. 3a

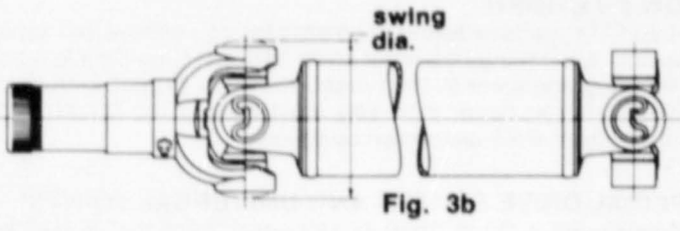


Fig. 3b

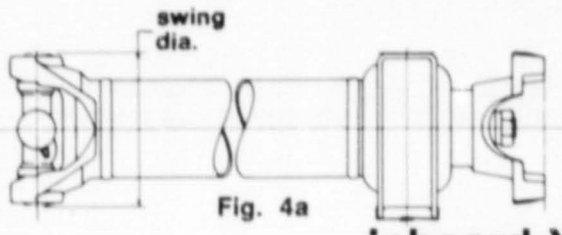


Fig. 4a

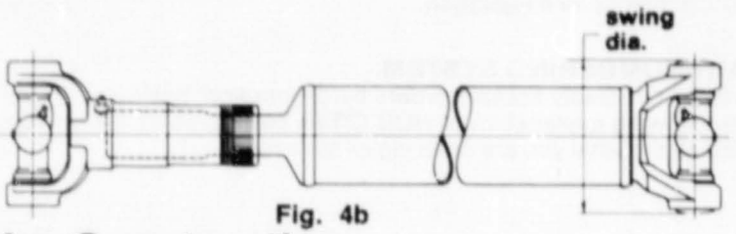


Fig. 4b

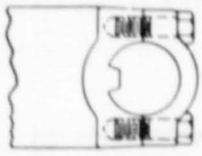
Inboard Yoke Construction



snap ring
S-R



bearing plate
B-P



cap & bolt
C&B

SPICER U-JOINT SIZES	Swing Dia.	FIGURE 1 (TUBULAR) "A" Min. Collapsed	"C" Slip	"D" Max. Angle	FIGURE 2 (SHORT COUPLED) "A" Min. Collapsed	"C" Slip	"D" Max. Angle	Inboard Yoke Construction	FIGURE 3 & 4 Coupling Shaft (a) Driveshaft (b) Series Availability ● 3a.	3b.	4a.	4b.
1000	2.50	9.13	1.75	60°	—	—	—	S-R	—	—	—	—
1280	3.75	8.56	3.13	30°	7.06	.81	5°	S-R	●	●	●	●
1310	3.75	8.56	3.13	30°	7.06	.81	5°	S-R	●	●	●	●
1330	4.13	10.25	2.75	15°	—	—	—	S-R	●			●
1350	4.25	11.63	3.63	30°	9.5	.75	12°	S-R	●			●
1410	4.69	12.31	3.47	28°	8.75	1.00	8°	S-R	●			●
1480	4.81	14.00	4.50	35°	8.50	1.00	8°	S-R	●			●
1550	5.63	15.38	5.00	35°	8.50	1.00	8°	S-R	●			●
1650	6.38	18.31	5.00	35°	9.00	1.00	8°	S-R	—			●
1610	7.00	17.44	4.88	34.5°	9.13	.75	8°	B-P	—		●	●
1710	7.75	18.38	5.25	29.5°	10.63	.75	8°	B-P	—	—	●	●
1810	9.13	19.75	5.00	30°	13.41	1.13	12°	B-P	—	—	●	●
1880	9.75	20.31	5.13	22.5°	13.63	1.00	8°	B-P	—	—	●	●
1900	10.56	24.50	3.38	22°	21.69	1.38	22°	B-P	—	—	—	—
1950	11.25	26.81	5.00	20°	33.94	2.31	20°	C & B	—	—	—	—
2050	14.13	31.81	2.88	20°	33.75	1.88	17°	C & B	—	—	—	—
2150	17.50	37.94	5.00	19.5°	—	—	—	C & B	—	—	—	—

VEHICULAR GROUP
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TOLEDO, OHIO 43623

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TELEPHONE: (419) 535-5452

HUB CITY DIVISION
SAFEGUARD POWER TRANSMISSION CO.
Phone (605) 225-0360 — P.O. BOX 1089 — ABERDEEN, S. DAKOTA 57401

DRIVE SHAFTS, UNIVERSAL JOINTS

FOUR SERIES:

Four Drive Shaft Series are offered in this catalog. They are HUB CITY Series 600 (15 HP), 1700 (30 HP), 2100 (58 HP), and 2600 (90 HP). They are all offered in three standard lengths and only as shielded units. The 600 and 1700 Series are constructed of rectangular tubing and shafting and the 2100 and 2600 Series have round tubing and square shafting.

HOW TO ORDER:

HUB CITY wants ordering to be easy for you and we will accept your order by description or part number. However, there are some things we must know and you should have no problem finding them in this catalog. You sould select a Drive Shaft adequate to the horsepower you expect to transmit (see page 235). After you have decided which series D.ive Shaft you need, then you must specify the length and the End Yokes you require. Lengths and End Yokes available from stock are shown by series.

SPECIAL DRIVE SHAFTS AND UNIVERSAL JOINTS:

If you need a Drive Shaft or Universal Joint that is special in some way, HUB CITY will be happy to make it for you. Contact us for a quotation.

PART NUMBERING SYSTEM:

HUB CITY gladly accepts orders by description, however, your packing slips and invoices will show part numbers. The following explanation of HUB CITY's part numbers for Universal Joints and Drive Shafts should help you better understrand what you are ordering or have received.

The **four digit prefix** tells **WHAT IT IS**

- **03-29-** Universal Joint.
- **03-30-** Drive Shaft without End Yokes.
- **03-33-** Drive Shaft with End Yokes assembled.
- **03-35-** Yokes or Cross and Bearing Kits.

The **five center digits** tell **SERIES DRIVE SHAFT OR U-JOINT**

- **10000-** 600 Series.
- **20000-** 1700 Series.
- **30000-** 2100 Series.
- **40000-** 2600 Series.

The **last three digits** tell **COMPRESSED LENGTH**

- **029** 29 inches minimum length.
- **039** 39 inches minimum length.
- **052** 52 inches minimum length.

A **1700 Series Drive Shaft** with 40 inch minimum length and with 1⅜-6 Spline Q.D. on one end and 1¼" Round with ¼" Keyway on opposite end is made up as shown below:

Shaft w/o End Yokes	1⅜-6 Spline Q.D.	1¼" Rd., w/¼" KW
03-30-20000-040	03-35-01702	03-35-01716

03-33-20216-040

Complete Drive Shaft with End Yokes Assembled

Minimum Compressed Length

A **1700 Series Universal Joint** Assembly Number:

1" Rd., with 1¼" KW	1¼" Rd., w 2¼" KW
03-35-01706	03-35-01716

03-29-20616

Assembled Universal Joint

1700 Series

HUB CITY DIVISION
SAFEGUARD POWER TRANSMISSION CO.
Phone (605) 225-0360 — P.O. BOX 1089 — ABERDEEN, S. DAKOTA 57401

CROSS AND BEARING KITS

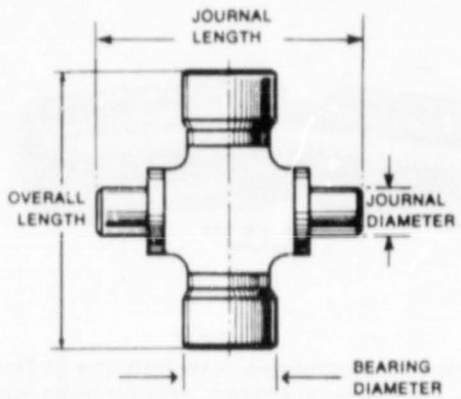
CROSS AND BEARING KITS—DIMENSIONS AND H.P. RATINGS

JOURNAL DIAMETER	BEARING DIAMETER	JOURNAL LENGTH	OVERALL LENGTH	SNAP RING LOCATION	H.P. @ 540 R.P.M.	SERVICES HUB CITY SERIES	NET WEIGHT	HUB CITY KIT NO.
19/32"	15/16"	2	2¼"	Bearing	Not Rated		.7	03-35-90068
21/32"	⅞"	2 23/32"	2 31/32"	Yoke	10		.9	03-35-90070
35/64"	31/32"	2 1/16"	2 5/16"	Bearing	12		.9	03-35-90071
½"	15/16"	2"	2¼"	Bearing	10		.7	03-35-90069
35/64"	15/16"	2 1/16"	2 5/16"	Bearing	15	600	.8	03-35-90186*
41/64"	1 1/16"	2 5/16"	2 5/16"	Bearing	25		1.0	03-35-90075
37/64"	1"	2⅜"	3⅛"	Bearing	30	1700	.6	03-35-90073
23/32"	1⅛"	2 13/32"	2⅝"	Yoke	35		1.0	03-35-90072
27/32"	1¼"	2 15/16"	3 3/32"	Yoke	58	2100	1.2	03-35-90076
57/64"	1⅜"	3⅜"	4 3/16"	Yoke	90	2600	2.6	03-35-90067

*Will also fit old Series 10 and 110.

The Nominal Horsepower Ratings of a Universal Joint is a combined function of speed, life expectancy, angularity, ratio of normal load to shock load, and other contributing factors.

For these reasons, the table above is offered only as a guide to selecting a drive line. Horsepower Ratings shown assume an average agricultural application, correct drive line installation and normal shock loads.



CROSS AND BEARING KIT INTERCHANGEABILITY BY SERIES

HUB CITY KIT NO.	HUB CITY SERIES	G & G MFG. SERIES	WESCO SERIES	ROCKWELL (BLOOD BROS.) SERIES	HAYES-DANA (SPICER) SERIES	NEAPCO SERIES
03-35-90068§	10*		1A			0500
03-35-90070				1FR		
03-35-90071		TR6N	6N	L6N		
03-35-90069§	110*		1B		1000	0600
03-35-90186	600					0675
03-35-90075	1200*	TR12N	12N	L12N	1140	1200
03-35-90073	1700					1800
03-35-90072	14N*	TR14N	14N	L14N	1240	2000
03-35-90076	2100	TR35N	35N	35N	1340	2200
03-35-90067	2600				1480	2600

*Discontinued Series—Drive Shafts only, Cross and Bearing Kits still available. §Discontinued, will be replaced by 03-35-90186

SIZE TO CAPACITY DATA FOR HUB CITY DRIVE SHAFTS

HUB CITY SERIES	SAE & ASAE CATEGORIES	H.P. @ 540 RPM	H.P. @ 1000 RPM	STATIC TORQUE	RUNNING TORQUE	SHAFT SIZE	TUBE SIZE
600	1	15	24	7500	1750	¾" x ⅞"	1" x 1⅛" x ⅛"
1700	3	30	48	19000	3500	1" x 1⅛"	1¼" x 1⅜" x ⅛"
2100	4	58	93	26000	6000	1 3/16" Sq.	2¼" x .120"
2600	5	90	144	37000	10500	1¼" Sq.	2¾" x .109"

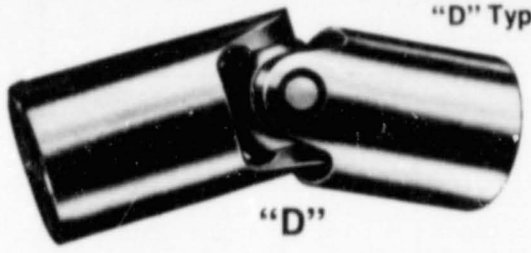
NOTE: There is a 50% decrease in life for each 5° angle from 0° to 20°.

Universal Joints

Model "D" and "LOJ" Type

LOVEJOY, INC., 2655 Wisconsin Ave.
Downers Grove, IL 60515
TEL: 312-852-0500

"D" Type



"D"

Model Number		Max. O.D.	Overall Length	Bore Diameter		Static Breaking Torque/In.-Lbs.
Solid	Bored			Standard	Maximum	
D-1	D-1B	3/8	1-3/4	3/16	1/4	182
D-2	D-2B	1/2	2	1/4	3/8	378
D-3	D-3B	5/8	2-1/4	5/16	1/2	654
D-4	D-4B	3/4	2-11/16	3/8	5/8	768
D-5	D-5B	7/8	3	7/16	11/16	1,176
D-6	D-6B	1	3-3/8	1/2	3/4	1,680
D-7	D-7B	1-1/8	3-1/2	9/16	7/8	2,880
D-8	D-8B	1-1/4	3-3/4	5/8	1	5,220
D-10	D-10B	1-1/2	4-1/4	3/4	1-1/8	7,920
D-11	D-11B	1-3/4	5	7/8	1-1/4	10,680
D-12	D-12B	2	5-7/16	1	1-1/2	15,600
D-13	D-13B	2-1/2	7	1-1/4	1-3/4	33,120
D-14	D-14B	3	9-1/16	1-1/2	2	65,400
D-15	D-15B	4	10-5/8	2	2-1/2	138,000

All "D" universal joints are treated with a black rust inhibitor, for better appearance and protection.

Maximum angular offset is 25°



"LOJ"

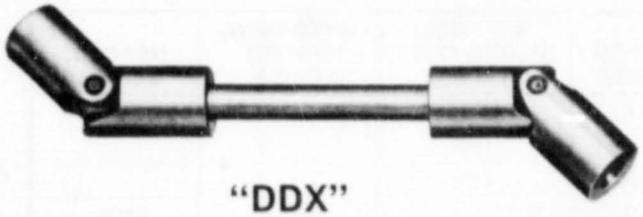
"LOJ" Type

For hand operated *low torque* drives, Lovejoy recommends the "LOJ", an off-set pin type joint forged from medium carbon steel.

Model Number		Max. O.D.	Overall Length	Standard Bore
Solid	Bored			
LOJ-6	LOJ-6B	7/8	2-15/16	1/2
LOJ-8	LOJ-8B	1-1/8	3-3/8	5/8
LOJ-10	LOJ-10B	1-7/16	3-3/4	3/4

Maximum angular offset is 25°

Lovejoy manufactures a complete line of Double "D" type joints and needle-bearing universal joints. Special orders for boots, special bore shapes, splined hubs, extended center bodies, etc., are available through Lovejoy Customer Service Department.



"DDX"



"Needle Bearing"

How To Select a Joint:

The suggested correction factor tables, given here, are based on the results of extensive tests carried out on our joints. For ease of selection, applications are divided into two types: intermittent running and continuous running.

An intermittent running application is one on which joints are not required to operate for periods longer than 15 minutes. The criterion is generated heat, which must be dissipated before further operations are commenced.

Applications involving unbroken running periods under load longer than 15 minutes up to a maximum running time of 8 hours per day, are considered to be continuous running.

Step I:—Knowing your drive running condition, operating speed in R.P.M. and angle of operation in degrees, refer to corresponding suggested correction factor table and find out appropriate correction factor. For continuous running conditions multiply the appropriate correction factor by 2.

Step II:—Know your torque requirements. Multiply the required torque by your correction factor to determine the breaking torque capacity of the joint that can be used.

Step III:—Refer to the breaking torque column and select a joint having the same or greater torque.

For best performance and longer life the universal joint should be mounted properly.

Contact Lovejoy for proper mounting configurations.

SUGGESTED CORRECTION FACTOR

SPEED R.P.M.	ANGLE OF OPERATION — DEGREES							
	0	3	5	7	10	15	20	25
1800	9	20	34	45	—	—	—	—
1500	8	16	28	39	—	—	—	—
1200	7	13	22	32	40	—	—	—
900	6	11	16	23	34	—	—	—
600	5	8	11	15	22	34	40	—
300	4	5	7	8	11	16	22	28
100	3	4	4	5	6	8	9	11

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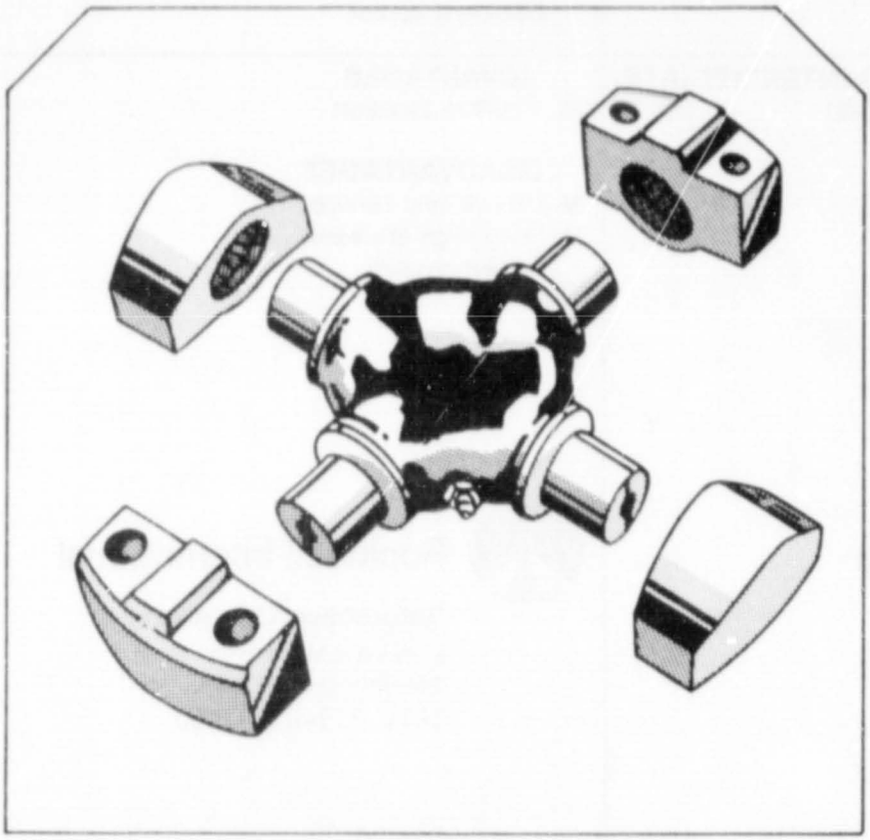
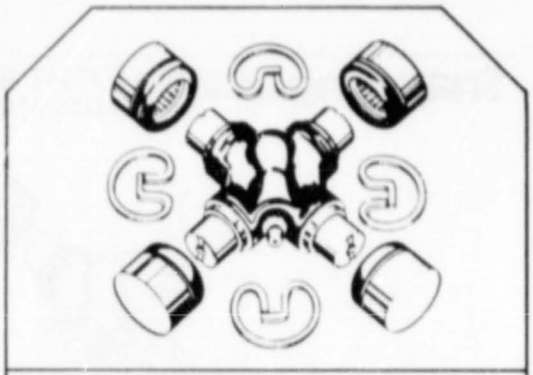
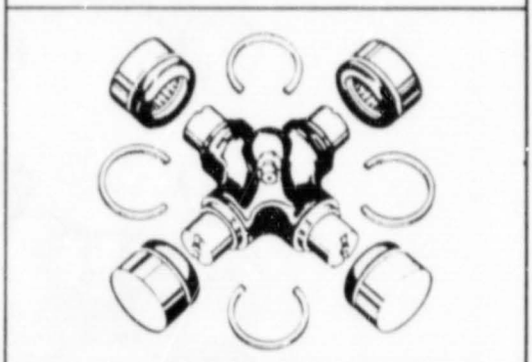
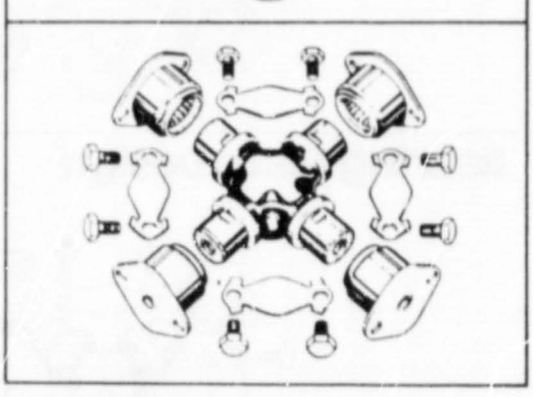
Troy, Michigan 48084
Tel. 313-435-1000

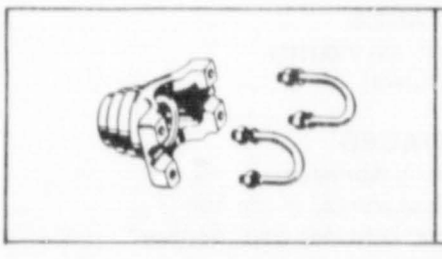
SPECIFYING THE RIGHT U-JOINT JOURNAL ASSEMBLIES FOR YOUR EQUIPMENT

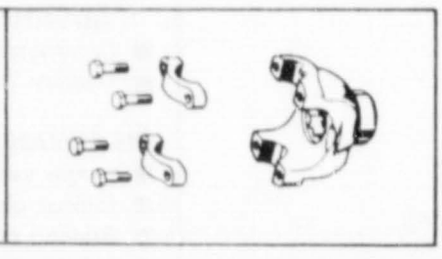












SAVE WARRANTY DOLLARS, BUILD CUSTOMER LOYALTY AND CONFIDENCE

U-JOINT JOURNAL ASSEMBLIES
ROUND STYLE

U-Bolt or Cap and Bolt Type
(LIGHT APPLICATION)



ADVANTAGES
- Low Cost
- Easy Installation

DISADVANTAGES
- Light application only
  Cap and bolt assembly
- Not suitable for heavier loads
- U-bolt tightening may apply un-uniform pressure on bearing cup resulting in bearing distortion

Snap-Ring Design (LIGHT AND INTERMEDIATE APPLICATION):





ADVANTAGES
- Positive location

DISADVANTAGES
- Difficult field service
- Snap-rings are weak Point in system

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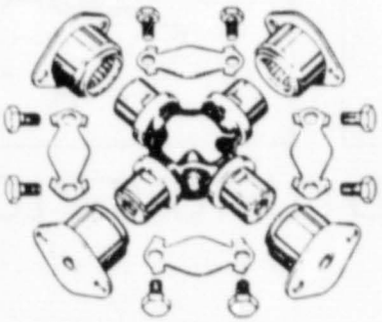
Bearing Plate Design

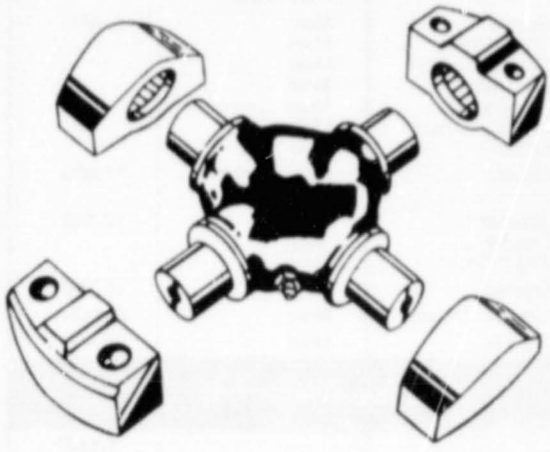


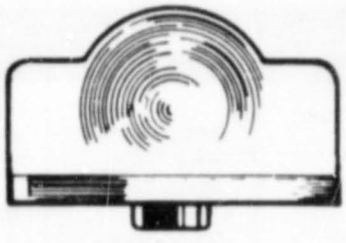
ADVANTAGES
- Common in the industry.
- Captive Trunion

DISADVANTAGES
- Larger swing diameter
- Difficult disassembly in the field
- Bearing cup corrodes and "freezes" in the yoke
- Yoke ID enlarges, thus forcing simultaneous replacement of centerpart and yoke

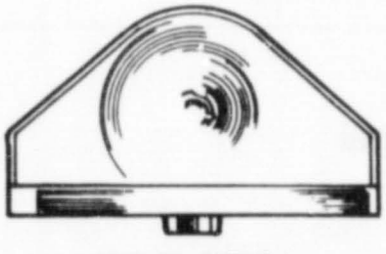
U-JOINT JOURNAL ASSEMBLIES

WING BEARING STYLE





HIGH WING



DELTA WING

ADVANTAGES

- They can be installed in tighter spaces, shorter assembly lengths are possible.
- Ease of Installation—They do not require disassembly of the bearing kit for installation, thereby eliminating dropped components, or bearing contamination.
- Greater Serviceability—Repair of field equipment can be accomplished without destruction of end yokes, thus saving time and money. Disassembly from axle or gear cases is accomplished by simply removing four bolts and dropping the driveline. This permits much easier handling and less equipment downtime in the field.
- Lower Driveline Costs—Wing bearing drivelines can be lower in cost than comparable round bearing drivelines, since wing bearing drivelines do not require intermediate flange yokes for attachment.
- High Quality Assembly—160,000 PSI minimum tensile strength bolts are used to assure high assembly integrity.
- Rockwell wing bearing universal joints are available in the unique "Delta" wing version giving greater strength and permitting higher operating angles.
- Smaller wing diameter.
- Good vibration resistance: New patented yoke nut thread.

DISADVANTAGES

- Bolt tightening must be controlled

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SELECT YOUR U-JOINT JOURNAL ASSEMBLIES FOR PERFORMANCE AND LONG LIFE

AUTOMOTIVE APPLICATIONS

SERIES	MACHINE OR VEHICLE	APPLICATION	YIELD TORQUE (FT. LB.)
L6S/R	Medium & Heavy Truck	Steering	670
L6S/R	Light Truck	Steering	670
L6N/R	Medium & Heavy Truck	Auxiliary Drive	670
L6S/R	Heavy Truck	Shift Linkage	670
L6R	Recreation Vehicle	Wheel & Axle	670
58WB**	Truck	Main & Inter-Axle Drive	7,025
62N**	Truck	Main & Inter-Axle Drive	5,000
72N**	Truck	Main & Inter-Axle Drive	7,080
16N**	Truck	Main & Inter-Axle Drive	7,100
82N**	Truck	Main & Inter-Axle Drive	11,083
17N**	Truck	Main & Inter-Axle Drive	11,000
750N	Military Truck	Wheel/Axle	5,760
850N	Truck	Wheel/Axle	16,700
950N**	Truck	Wheel/Axle	30,000
18N**	Truck	Main & Inter-Axle Drive	21,000
85WB**	Truck	Main & Inter-Axle Drive	12,500
92N**	Truck	Main & Inter-Axle Drive	23,000

CONSTRUCTION APPLICATIONS

SERIES	MACHINE OR VEHICLE	APPLICATION	YIELD TORQUE (FT. LB.)
L6S/R	Dump Body Crawler Tractor Ditcher Elevating Scraper Front End Loader	Hydraulic Hoist Pump Drive Winch Drive Pump Drive Pump Drive	670
L6S/R	Grader	Steering	670
L12R	Grader Dump Body	Controls Hoist	1,400
L14R	Tow Truck Mining Car Front End Loader	Main Drive Hoist Hydraulic Pump	2,280
35R	Lift Truck Crawler Tractor Truck Cranes Mining Car	Pump Pump Pump Pump	2,960
44R	Ditcher Construction Equipment	Wheel/Axle Main Drive	4,170 5,400
55N	Front End Loader Ditcher Mining Car	Pump Wheel/Axle Wheel/Axle	5,420

SERIES	MACHINE OR VEHICLE	APPLICATION	YIELD TORQUE (FT. LB.)
62N**	Skidder, Loader Truck Crane Lift Truck	Main & Inter-Axle Drive Main & Inter-Axle Drive Main & Inter-Axle Drive	5,000
72N**	Grader Truck Crane Crawler Loader Lift Truck Compacter Rough Terrain Crane	Main Main Main Main Main Main & Inter-Axle Drive	7,080
17N**	Loader	Main & Inter-Axle Drive	11,000
85WB**	Scraper Loader Truck Crane	Main Main Main	12,500
850N	Loader	Wheel/Axle	16,700
92N**	Crawler Tractor	Main	23,000
490N**	Loader	Main	36,400

INDUSTRIAL APPLICATIONS

SERIES	MACHINE OR VEHICLE	APPLICATION	YIELD TORQUE (FT. LB.)
L6S/R**	Sweeper	Broom, Pump Drive	670
72N**	Mill	Roll Drive	7,080
17N**	Mill	Roll Drive	11,000
85WB**	Mill	Roll Drive	12,500
92N**	Mill	Roll Drive	23,000

AGRICULTURAL APPLICATIONS

SERIES	MACHINE OR VEHICLE	APPLICATION	YIELD TORQUE (FT. LB.)
L6S/R	Implements Garden Tractor	PTO Mower Drive	670
L6S/R	Tractors	Steering	670
L12R	Implements	PTO/Auxiliary	1,400
L14R	Implements	PTO/Auxiliary	2,280
35R	Implements	PTO/Auxiliary	2,960
44R	Cutters Harvester	PTO/Auxiliary PTO/Auxiliary	4,170
55N	Implements	PTO/Auxiliary	5,420
62N**	Four-Wheel-Drive Tractor (Farm)	Main	5,000
72N**	Four-Wheel-Drive Tractor (Farm)	Main	7,080

*Applications subject to engineering approval. **"X-tra Life" features incorporated

Rockwell International

Automotive Operations

2135 West Maple Road

Troy, Michigan 48084

Tel. 313-435-1000

5/ Industrial Universal Joints
Bulletin 525

Twin Disc Universal Joints are true heavy-duty industrial universal joints.

Twin Disc now offers twelve sizes of American-designed and manufactured J Series Industrial Universal Joints — J-170, J-230, J-310, J-490, J-800, J-1200, J-2500, J-4000, J-6500, J-10,000, J-20,000 and J-40,000 — with different types in each size. Capacities range from 4250 to 1,500,000 lbs.-ft. rated static torque.

Twin Disc is the first American manufacturer to calculate a U-joint lifespan based on all four variables — torque, speed, angularity, and application factors. For this reason, you can choose a U-joint designed to match the predicted lifespan of the other components in your drive system.

J-170 to J-1200 series — 4250 lbs.-ft. to 26,000 lbs.-ft. rated static torque — all using high-wing bearing cap design exclusively. High-wing construction provides longer capscrews for attaching the bearing caps. These longer capscrews, when properly torqued, will remain tight under the most severe operating conditions. Rated torque capacities of these sizes include J-170, 4250 lbs.-ft.; J-230, 6100 lbs.-ft.; J-310, 8400 lbs.-ft.; J-490, 12,500 lbs.-ft.; J-800, 18,000 lbs.-ft.; and J-1200, 26,000 lbs.-ft.

J-2500 to J-40,000 series — 52,500 lbs.-ft. to 1,500,000 lbs.-ft. rated static torque — are of the round-bearing type. Each pair of bearing caps is installed in full round yoke arms which are integral with flanges, eliminating the need for split bearing strap installation screws on these larger, heavier models.

Wing-Bearing Type Double Universal Joint Assemblies

TYPE "TS" (with tube and slip) — J-170 through J-310 Series consists of two U-Joints coupled by a tube and integral spline connection. Standard maximum working angle of 20°. With slip provided in the Type "TS" joint, mating yokes at the ends of the assembly can be axially fixed with the respective machinery components. Primarily designed for vehicular applications. Type "TS" assemblies are also well-suited to industrial machinery where length is not a limiting factor, such as connecting remotely-mounted components. For extremely long drives with critical speed limitations, the Type "TS" can be used with a single U-Joint with tube and a center bearing. All slip spline members incorporate a blind tooth to prevent incorrect assembly.

TYPE "TSI" (with tube and inverted, large diameter slip spline) — J-490, J-800 and J-1200 Series consists of two U-joints coupled by a tube and large diameter spline. Standard maximum working angle of 20°. The large diameter spline provides less slip resistance under load and smoother operating shaft at high speeds. All slip spline members incorporate a blind tooth to prevent incorrect assembly.

TYPE "CS" (with slip and without tube — close-coupled) — Consists of two U-Joints connected by a slip spline. Slip is provided in the U-Joint assembly so that fitting yokes at the ends of the assembly can be axially fixed to the respective connecting components. One application for the Type "CS" is in the center of all-wheel-drive vehicles with articulated steering (front and rear halves of the vehicle pivoting about a vertical center pin). Other applications include industrial machinery where the components ahead of and behind the U-Joint assembly are close together. Standard maximum working angle of 20°.

TYPE "T" (with tube and without slip) — Consists of two U-Joint assemblies connected by a tubular shaft. Standard maximum working angle of 20°. Identical to Type "TS" except that no slip is provided. Compensating slip must be taken up in one of the yokes at the ends of the assembly.

TYPE "CP" (with coupling plate and without slip — close-coupled) — Consists of two cross-and-bearing assemblies connected by a coupling plate. Standard maximum working angle of 15°. Compensating slip must be taken up in one of the yokes at the ends of the assembly. Type "CP" is primarily designed for front-wheel-drive installations. If properly applied, this U-Joint will give performance similar to constant velocity joints at substantial cost savings. Type "CP" operates in the open, requires no grease-tight enclosure. Cross-and-bearings can be replaced without complete disassembly of the axle. This assembly is also recommended for industrial machinery where space is at a premium.

TYPE "CP7" (with coupling plate and without slip — close-coupled) — Similar

in construction to Type "CP" but designed to fit in an even shorter space. Standard maximum working angle of 7°. One application is in vehicle installations for the drive between a torque converter and a midship-mounted transmission.

Optional Quick Disconnect Attachments

Permits disconnecting a driveline quickly and completely by loosening one bolt. Designed for use with the J-310, J-490 and J-1200 Series Twin Disc Industrial Universal Joints. This device also can be adapted to most flexible coupling drives. Ultimate short disconnect-and-connect time. No loose parts to drop. No special tools. Simple operation. Has the same swing diameter as its adjoining universal joint. Available as a Flange Type Disconnect or Yoke Type Disconnect.

Universal Joint Vertical Drives

Twin Disc Universal Joint Flexible Drive Shafts for high-horsepower, vertical and horizontal drives are available in multiple, single and close-coupled models including the J-170, J-230, J-310, J-490, J-800, J-1200, J-2500, J-4000, J-6500 and J-10,000 Series.

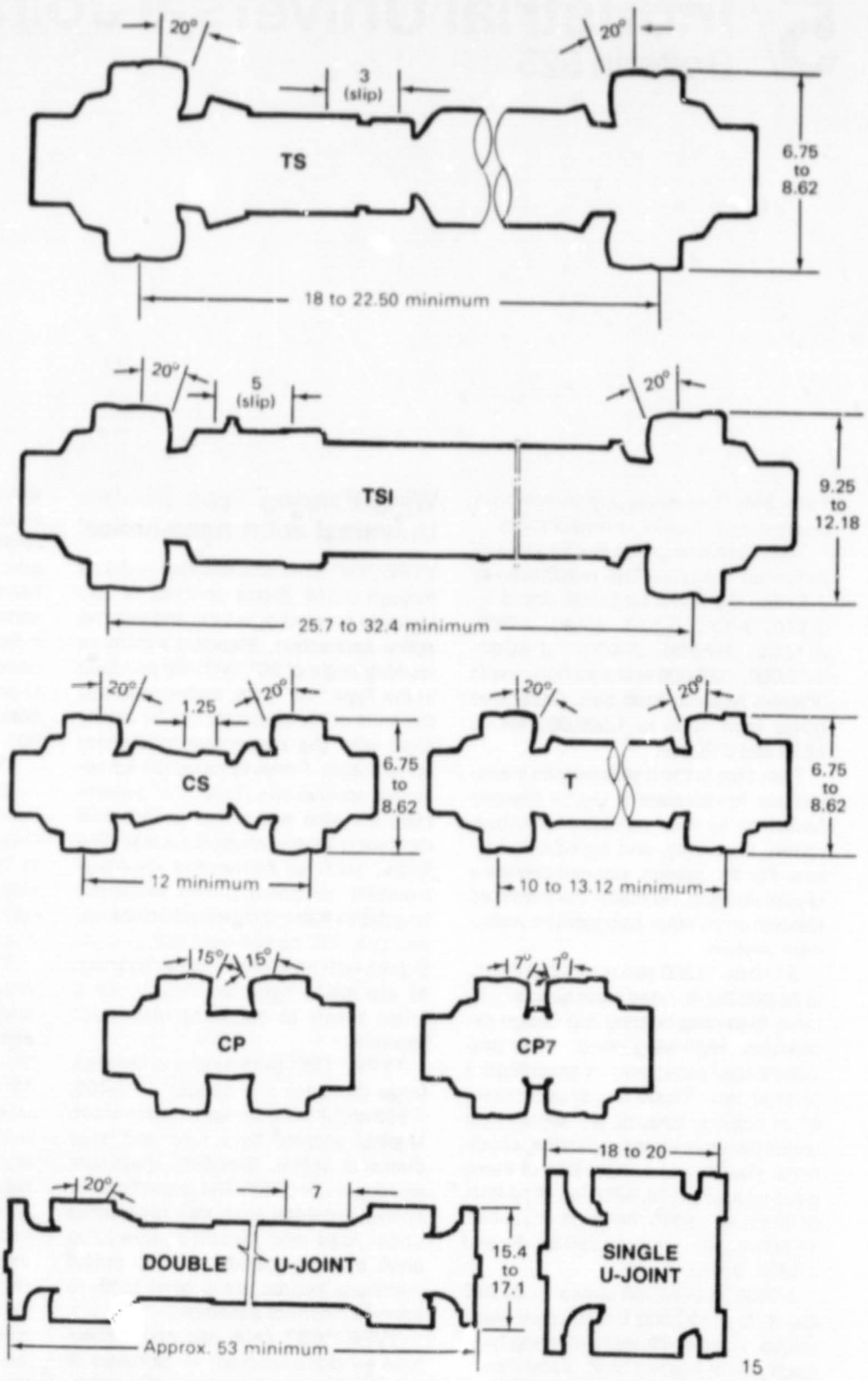
Round-Bearing Type Universal Joint Assemblies

Double U-Joint Assemblies are available for the J-2500, J-4000 and J-6500 Series. These include the Type "TS" with tube and slip and the Type "CS" with slip and without tube. The J-2500, J-4000, J-6500, J-10,000, J-20,000 and J-40,000 Series are available as single U-joint assemblies.

Fitting Yokes

Twin Disc offers a complete range of fitting yokes for the J-170, J-230, J-310, J-490, J-800 and J-1200 Series. These yokes include: Forged and Cast Yokes with straight bore and keyway; Slip Fitting Yoke Splined; Fixed Fitting Yoke Splined; Flanged Yokes; and, Brake Flanges.

Wing-Bearing Type



All dimensions in inches. Illustrations not to scale. Use certified print for installation.

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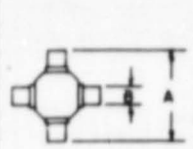
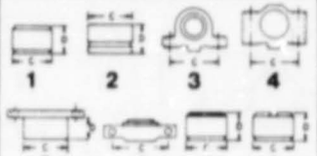
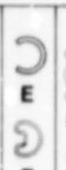
TEL: 414-634-1981

UNIVERSAL JOINTS
NUMERICAL LISTING





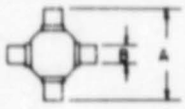


QUICK REFERENCE IDENTIFICATION INFORMATION

OUR NO.	ILL. NO.	O.E. NO.	SERIES or TYPE	CROSS Dim. "A"	CROSS Dim. "B"	BEARINGS Quan.	BEARINGS Type	BEARINGS Dim. "C"	BEARINGS Dim. "D"	SNAP RINGS Q.-T.	LOCK PLATE Q.-T.	CAP SCREW Quan.	Fig.	A	B	C1
2060-W	4	114-2140	2RL	2 7/8	37/64	2	2	1	21/32	2-E	—	—	6	—	2 3/8	—
		114-2153				2	1	1 1/16	45/64	—	—	—		3 3/16	—	—
2060-WF	4	114-2173	2RL	2 7/8	37/64	2	2	1	21/32	2-E	—	—	2	—	2 3/8	—
						2	2	1 1/8	45/64	2-E	—	—		—	2 3/8	—
2060-X	6	114-2117	2CL	2 7/8	37/64	4	3D	1 5/16	—	—	8-J	8	4	—	—	2 3/8
2060-XB	6			2 7/8	37/64	3	3D	1 5/16	—	—	—	—	4	—	—	2 3/8
						1	3D‡	1 5/16	—	—	—	—		—	—	—
2060-XC	6	114-2186	2CL	2 7/8	37/64	3	3D	1 5/16	—	—	6-J	6	4	—	—	2 3/8
						1	3D‡	1 5/16	—	—	2-J	2		—	—	2 3/8
2060-Y	6	114-2116	2CL	2 7/8	37/64	2	3T	1 5/16	—	—	4-J	4	4	—	—	2 3/8
						2	3D	1 5/16	—	—	4-J	4		—	—	2 3/8
2060-YC	6	114-2185	2CL	2 7/8	37/64	2	3T	1 5/16	—	—	4-J	4	4	—	—	2 3/8
						1	3D	1 5/16	—	—	2-J	2		—	—	2 3/8
						1	3D‡	1 5/16	—	—	2-J	2		—	—	2 3/8
2115-A	2		H-10	2 1/4	37/64	4	2	1	—	4-E	—	—	2	—	1 3/32	—
2207-A	2	5-170X	1000	2 5/64	1/2	4	2	15/16	5/8	4-E	—	—	2	—	1 1/2	—
2207-B	2	5-103X	1000SG	2 5/64	1/2	4	2	15/16	5/8	4-E	—	—	2	—	1 1/2	—
2207-C	2	5-172	(Used with Pipe Plug)	2 5/64	1/2	4	2	15/16	5/8	4-E	—	—	2	—	1 1/2	—
2207-E	2			2 1/16	1/2	4	2	15/16	5/8	4-E	—	—	2	—	1 1/2	—
2207-G	2	5-170-IX		2 5/64	1/2	3	2	15/16	5/8	3-E	—	—	2	—	1 1/2	—
						1	2‡	15/16	5/8	1-E	—	—		—	1 1/2	—
2207-P	2	5-170X	1000	2 5/64	1/2	4	2	15/16	5/8	4-E	—	—	2	—	1 1/2	—
						(PLAIN BEARING—NO NEEDLE ROLLERS)										
2207-PE	2			2 1/16	1/2	4	2	15/16	5/8	4-E	—	—	2	—	1 1/2	—
						(PLAIN BEARING—NO NEEDLE ROLLERS)										
2225-B	1	5-14X	1100	2 1/4	37/64	4	1	15/16	39/64	4-F	—	—	1	2 7/16	—	—
		5-111X	1100		(Kit has long Zerk)											
2225-C*	1	5-101X	1100	2 1/4	37/64	4	1	15/16	39/64	4-F	—	—	1	2 7/16	—	—
		5-181X	1100													
2225-D	1	(65° Zerk in center of Cross)		2 1/4	37/64	4	1	15/16	39/64	4-F	—	—	1	2 7/16	—	—
2225-E	1	5 315X	1210	2 1/4	37/64	4	1	1 1/16	5/8	4-F	—	—	1	2 7/16	—	—
2225-W	—	5-248X	1110	2 1/4	37/64	2	2	1	21/32	2-E	—	—	6	—	1 11/16	—
						2	1	1 1/16	5/8	2-F	—	—		2 7/16	—	—
2226-A	2	5-105X	1110	2 1/4	37/64	4	2	1	21/32	4-E	—	—	2	—	1 11/16	—
2226-B*	2	5-100X	1110	2 1/4	37/64	4	2	1	21/32	4-E	—	—	2	—	1 11/16	—
2275-B	1	5-4X	1300	2 3/4	21/32	4	1	1 1/16	21/32	4-F	—	—	1	2 15/16	—	—
2290-A	1	5-121X	1260-1270	2 31/32	19/32	4	1	1 1/16	9/16	4-F	—	—	1	3 3/32	—	—
2290-B	1	5-121XU	1260-1270	2 31/32	19/32	4	1	1 1/16	9/16	4-F	—	2 U-Bolts	1	3 3/32	—	—
2290-D	2	5-1201X	S-55 SP.	2 31/32	39/64	2	1	1 1/8	9/16	—	—	—	1	3 3/32	—	—
						2	1	1 1/16	9/16	2-F	—	—		3 3/32	—	—
2296-B		5703383		2 31/32	19/32	2	1	1 1/16	9/16	—	—	2	6	3 3/16	—	—
						2	2			2-E	—	U-Bolts		—	2 5/16	—

* LOCK PLATES OR LOCK WASHERS MAY BE INCLUDED
‡ TAPPED FOR GREASE FITTING • NON - LUBE ° NOT DRILLED ⋆ LESS SEAL
† INSIDE AND OUTSIDE SNAP RINGS INCLUDED—USE WHICHEVER ONES ARE CORRECT FOR YOUR APPLICATION.

UNIVERSAL JOINTS
NUMERICAL LISTING







QUICK REFERENCE IDENTIFICATION INFORMATION

OUR NO.	ILL. NO.	O.E. NO.	SERIES or TYPE	CROSS Dim. "A"	CROSS Dim. "B"	BEARINGS Quan.	BEARINGS Type	BEARINGS Dim. "C"	BEARINGS Dim. "D"	SNAP RINGS Q.-T.	LOCK PLATE Q.-T.	CAP SCREW Quan.	Fig.	A	B	C1
2297-A	1	5-200X	1280	2 31/32	35/64	4	1	1 1/16	5/16	4-F	—	—	1	3 1/32	—	—
2297-AU	1	5-200XU	1280	2 31/32	35/64	4	1	1 1/16	5/16	4-F	—	2 U-Bolts	1	3 1/32	—	—
2331-2B*	4	71425-2	7140	2 1/4	35/64	4	2	1 1/64	5/8	4-E	—	—	2	—	1 3/4	—
2375-D	4	51625-2	5160	2 3/4	45/64	4	2	1 13/64	13/16	4-E	—	—	2	—	2	—
2387-A	12	72625-2	7260	2 3/8	21/32	2	2	1 3/64	49/64	2-E	—	—	3	—	2 1/8	—
						2	6	1 3/4	—	2-E	—	—		—	—	2 11/16
2387-E	4	72625-3	7260	2 3/8	21/32	4	2	1 3/64	49/64	4-E	—	—	2	—	2 1/8	—
2387-EA	4	3004900	7260	2 3/8	21/32	3	2	1 3/64	49/64	3-E	—	—	2	—	2 1/8	—
						1	2‡	1 3/64	49/64	1-E	—	—		—	2 1/8	—
2387-F	4	72625-4	7260	2 3/8	21/32	4	2	1 3/64	49/64	4-E	4-J	4 (2 Bearing Straps)	2	—	2 1/8	—
2464-A	11	S53-55	53	2 41/64	21/32	4	8	1 3/64	13/16	—	4-J	4	1	3 1/16	—	—
2464-AB	1		53 & 96	2 41/64	.601	4	1	1 3/64	25/32	—	—	—	—	—	—	—
	2464-A & B are being replaced by a new kit 2464-AB															
2464-B	10	S96-55	96	2 41/64	21/32	4	7	1 3/64	49/64	—	5-J	8	1	2 13/16	—	—
2487-A	10	P96-55-1	96	2 3/8	19/32	4	7	1 3/64	25/32	—	4-G	8	1	3 3/16	—	—
2496-A	4	T55-55-2	55	2 31/32	35/64	4	2	1 5/16	39/64	4-E	—	—	2	—	2 3/8	—
2496-B	4	TS55-55-2	55	2 31/32	35/64	2	2	1 5/16	39/64	2-E	—	—	2	—	2 3/8	—
						2	2	1 5/16	39/64		—	—		—	2 3/8	—
2520-A	4	CPL10N2		2 13/64	1/2	3	1	7/8	23/32	3-F	—	—	1	2 5/16	—	—
						1	1‡	7/8	23/32	1-F	—	—		2 5/16	—	—
2525-A	4	CPL12N	L12N L12R	2 1/4	37/64	4	1	1 1/16	11/16	4-E	—	—	2	—	1 13/16	—
2537-A	4	CPL14N	L14N L14R L14S	2 13/32	23/32	4	1	1 1/8	5/16	4-F	—	—	1	2 5/8	—	—
2571-A	4	CP1FR	CP1FR	2 23/32	21/32	4	1	7/8	23/32	4-F	—	—	1	2 25/32	—	—
2593-A	1	CP35N3	35N	2 15/16	3/4	3	1	1 1/4	3/4	3-F	—	—	1	3 13/64	—	—
		CP35N4	35R			1	1‡	1 1/4	3/4	1-F	—	—		3 13/64	—	—
2800-A	4	37125-18025		2	27/64	4	2	25/32	15/32	4-E	—	—	2	—	1 1/2	—
		04371-10010								4-F	—	—		—	—	—
2825-A	4	37125-14625		2 1/4	37/64	4	2	45/64	21/32	4-E	—	—	2	—	1 3/4	—
		37125-14627														
2825-B	4	04371-20010		2 1/4	37/64	4	2	1 1/32	23/32	4-E	—	—	2	—	1 7/8	—
2825-C	4	MA12633 MA12634		2 1/4	37/64	4	2	45/64	21/32	4-F	—	—	1	2 3/8	—	—
2825-D	4	0259-89-2510		2 1/4	37/64	4	2	45/64	21/32	4-E	—	—	2	—	1 13/16	—
2887-A	4	39625-21025		2 3/8	21/32	4	2	1 1/32	25/32	4-E	—	—	2	—	2 3/16	—
3010-A	5	114-2017	2CRL	3 1/16	11/16	2	2	1	—	2-E	—	—	3	—	2 3/32	—
						2	3D	1 5/16	—	—	2-H	4		—	—	2 1/8
3031-B	4	114-3105	3RL	3 5/16	21/32	4	2	1 1/8	13/16	4-E	—	—	2	—	2 5/16	—
		114-3011														
3031-2B*	4	114-3008	3RL	3 5/16	21/32	4	2	1 1/8	13/16	4-E	—	—	2	—	2 5/16	—
		114-3111														

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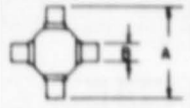
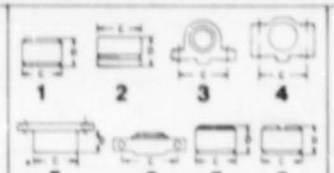
NUMERICAL LISTING







OUR NO.	ILL. NO.	O.E. NO.	SERIES or TYPE	CROSS Dim. "A"	CROSS Dim. "B"	BEARINGS Quan.	BEARINGS Type	BEARINGS Dim. "C"	BEARINGS Dim. "D"	SNAP RINGS Q.-T.	LOCK PLATE Q.-T.	CAP SCREW Quan.	QUICK REFERENCE IDENTIFICATION INFORMATION Fig.	A	B	C1
3031-C	13	SPECIAL	Chevrolet Constant Velocity	3 5/16	21/32	4	—	1 1/8	1	4-E	—	—	5/16-20 Thread on End of Bearing			
											—	—				
3031-D	5	114-3102	3CRL	3 5/16	21/32	2	2	1 1/8	13/16	2-E	—	—	3	—	2 5/16	—
						2	3T	1 3/16	—	—	2-H*	4		—	—	2 3/4
3031-G	4	114-3114	3RL	3 5/16	21/32	3	2	1 1/8	—	3-E	—	—	2	—	2 5/16	—
						1	2‡	1 1/8	—	1-E	—	—		—	2 5/16	—
3031-GM	4			3 5/16	21/32	4	2	1 1/8	13/16	—	—	—	2	—	2 13/16	—
								(Two Grooves in Brg. O.D.)								
3031-H	6	114-3152	3CL	3 5/16	21/32	4	3T	1 3/16	—	—	4-H*	8	4	—	—	2 3/4
3031-2H*	6	114-3000 114-3106	3CL	3 5/16	21/32	4	3T	1 3/16	—	—	4-H*	8	4	—	—	2 3/4
3031-HB	6	114-3118	3CL	3 5/16	21/32	3	3T	1 3/16	—	—	3-H*	6	4	—	—	2 3/4
						1	3T‡	1 3/16	—	—	1-H*	2		—	—	2 3/4
3031-HC	6	114-3119	3CSL	3 5/16	21/32	2	3D	1 3/16	—	—	—	—	4	—	—	2 3/4
		114-3117				1	3T	1 3/16	—	—	—	—		—	—	2 3/4
						1	3T‡	1 3/16	—	—	—	—		—	—	2 3/4
3031-L	5	114-3116	3CSRL	3 5/16	21/32	1	2	1 1/8	13/16	1-E	—	—	3	—	2 5/16	—
		114-3104	3CSRL			1	2‡	1 1/8	13/16	1-E	—	—		—	2 5/16	—
						2	3D	1 3/16	—	—	4-J	4		—	—	2 3/4
3031-N	5	114-3113	3CRL	3 5/16	21/32	1	2	1 1/8	13/16	1-E	—	—	3	—	2 5/16	—
						1	2‡	1 1/8	13/16	1-E	—	—		—	2 5/16	—
						2	3T	1 3/16	—	—	2-H*	4		—	—	2 3/4
3031-P	6	114-3101	3CL	3 5/16	21/32	2	3T	1 3/16	—	—	4-H*	4	4	—	—	2 3/4
		114-3150				2	3D	1 3/16	—	—	—	4		—	—	2 3/4
3031-Q	8	114-3125	3BL	3 5/16	21/32	4	4	1 3/16	—	—	—	—	4	—	—	2 3/4
3031-R	7	114-3121	3CBL		21/32	2	4	1 3/16	—	—	—	—	4	—	—	2 3/4
		114-3158	3CBL	3 5/16		2	3T	1 3/16	—	—	—	—		—	—	2 3/4
3031-S	5	114-3013	3C	3 5/16	21/32	2	2	1 1/8	13/16	2-E	—	—	4	—	2 5/16	—
						2	3*	—	—							
3031-T	9	114-3120	3RBL	3 5/16	21/32	2	2	1 1/8	13/16	2-E	—	—	3	—	2 5/16	—
						2	4	1 3/16	—	—	—	4		—	—	2 3/4
3031-V	—	114-596	—	3 5/16	21/32	2	2	1 1/8	13/16	2-E	—	—	6	—	2 5/16	—
						2	1	1 3/16	13/16	—	—	—		3 3/16	—	—
3031-W	6	114-3103	3CL	3 5/16	21/32	4	3D	1 3/16	—	—	8-J	8	4	—	—	2 3/4
3093-A	4	114-590	—	3 3/32	43/64	4	2	1 1/8	21/32	4-E	—	—	2	—	2 3/8	—
3200-A	1	5-153X	1310	2 13/32	21/32	4	1	1 1/16	11/16	4-F	—	—	1	3 3/32	—	—
3200-B	1	5-153XU	1310	2 13/32	21/32	4	1	1 1/16	11/16	4-F	—	2 U-Bolts	1	3 3/32	—	—
3200-C	4	5-74X	1310WJ	2 13/32	21/32	4*	2	1 1/16	45/64	4-E	—	—	2	—	2 5/16	—
3200-D	4	5-260X	1310WJ	2 13/32	21/32	4	2	1 1/16	45/64	4-E	—	—	2	—	2 5/16	—
3200-E	2	5-350X		2 13/32	21/32	4	2	1 1/16	45/64	4-E	—	—	2	—	2 13/32	—
3210-A	4	5-297X	1310HDWJ	2 5/16	3/4	4	2	1 1/16	45/64	4-E	—	—	2	—	2 5/16	—
3237-A	1	5-213X	1330	3 3/8	21/32	4	1	1 1/16	11/16	4-F	—	—	1	3 3/8	—	—
3237-B	2	5-230X 5-133X	1330T	3 3/8	21/32	4	2	1 1/16	45/64	4-E	—	—	2	—	2 3/4	—

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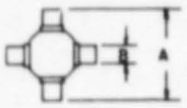





QUICK REFERENCE IDENTIFICATION INFORMATION

OUR NO.	ILL. NO.	O.E. NO.	SERIES or TYPE	CROSS Dim. "A"	CROSS Dim. "B"	BEARINGS Quan.	BEARINGS Type	BEARINGS Dim. "C"	BEARINGS Dim. "D"	SNAP RINGS Q.-T.	LOCK PLATE Q.-T.	CAP SCREW Quan.	Fig.	A	B	C1
3237-C	1	5-231X	1330 SP.	3 3/8	21/32	2	1	1 1/16	11/16	2-F	—	—	6	3 5/8	—	—
						2	1z	1 1/8	23/32	—	—	—		—	2 5/16	—
										To Outside of Flange						
3240-A	1	5-178X	1350	3 3/8	25/32	4	1	1 3/16	25/32	4-F	—	—	1	3 5/8	—	—
3240-B	1	5-178XU	1350	3 3/8	25/32	4	1	1 3/16	25/32	4-F	—	2 U-Bolts	1	3 5/8	—	—
3240-C	—	5-86X	1350WJ	3 3/8	25/32	4	1*	1 3/16	25/32	4-F	—	—	1	3 5/8	—	—
3275-A	1	5-150X	1310	2 31/32	21/32	2	1	1 1/16	11/16	2-F	—	—	6	3 1/32	—	—
			1330	3 3/8	21/32	2	1z	1 1/8	23/32	To Outside of Flange				—	2 5/16	—
3275-AE	1	5-134X	1310	2 31/32	21/32	4	1	1 1/16	11/16	4-F	—	—	1	3 1/32	—	—
			1330	3 3/8	21/32	—	---	—	—	—	—	—		3 5/8	—	—
3287-A	1	5-188X	1480	3 7/8	57/64	4	1	1 3/8	15/16	4-F	—	—	1	4 3/16	—	—
3290-A	1	5-160X	1410	3 15/16	25/32	4	1	1 3/16	25/32	4-F	—	—	1	4 3/16	—	—
3290-B	1	5-160XU	1410	3 15/16	25/32	4	1	1 3/16	25/32	4-F (2 U-Bolts)	4-J		1	4 3/16	—	—
3331-A	4	2852175	7290	3 5/16	21/32	4	2	1 1/8	13/16	4-E	—	—	2	—	2 5/8	—
3400-A	4	S55-55-2	55	2 31/32	21/32	4	2	1 1/16	45/64	4-E	—	—	2†	—	—	—
										4-F	—	—		3 1/32	2 3/8	—
3400-B	4	S55-55-675	55	2 31/32	21/32	2	2	1 1/16	45/64	2-E	—	—	2†	3 1/32	2 3/8	—
						2	2	1 1/8	45/64	2-F	—	—		3 1/32	2 3/8	—
3437-A	4	R55-55-2	55	3 3/8	25/32	4	2	1 3/16	25/32	4-E	—	—	2†	—	—	—
										4-F	—	—		3 5/8	2 5/16	—
3437-B	10	R96-55-1	96	3 3/8	23/32	4	7	1 5/64	7/8	—	4-H	8	1	3 11/16	—	—
3437-C	4	P55-55-145	55	3 3/8	21/32	2	2	1 1/16	45/64	2-E	—	—	2†	3 5/8	2 3/4	—
						2	2	1 1/8	11/16	2-F	—	—		3 5/8	2 3/4	—
3437-D	4	P55-55-140	55	3 3/8	21/32	4	2	1 1/16	45/64	4-E	—	—	2†	—	—	—
										4-F	—	—		3 5/8	2 3/4	—
3475-A	4	S55-55-1330	55	2 31/32	21/32	2	2	1 1/16	45/64	2-E	—	—	6	—	2 3/4	—
				3 3/8	21/32	2	1	1 1/16	11/16	4-F	—	—		3 3/16	—	—
3481-A	10	096-55	96	3 13/16	23/32	4	7	1 5/64	7/8	—	4-H	8	1	4 1/8	—	—
3493-A	4	055-55-2	55	3 15/16	25/32	4	2	1 3/16	25/32	4-E	—	—	2†	4 3/16	3 1/8	—
										4-F	—	—		—	—	—
3493-B	10	D56-55-2	56	3 7/8	57/64	4	7	1 3/8	15/16	—	—	—	1	4 3/16	—	—
3568-A	—	CP3DR	3DR	3 11/16	3/4	4	1	1	63/64	4-F	—	—	1	3 15/16	—	—
										(Plain Bearings, No Needle Rollers)						
3575-A	4	CP4N	4N	3 3/4	3/4	4	8	1 1/4	29/32	—	4-H	8	1	4 1/16	—	—
3575-B	4	CP44R	44R	3 3/4	27/32	4	2	1 5/16	55/64	4-E	—	—	2	—	2 25/32	—
4000-A	6	114-4100	4CL	4	21/32	4	3T	1 3/16	—	—	4-H*	8	4	—	—	3 3/16
4000-B	4	114-4106	4RL	4	21/32	4	2	1 1/8	25/32	4-E	—	—	2	—	3 1/2	—
4000-DA	6	114-4101	4CL	4	21/32	2	3T	1 3/16	—	—	2-H*	4	4	—	—	3 3/16
		114-4103				2	3D	1 3/16	—	—	—	4		—	—	3 3/16
4000-E	8	114-4113	4BL	4	21/32	3	4	1 3/16	—	—	—	6	4	—	—	3 3/16
						1	4‡	1 3/16	—	—	—	2		—	—	3 3/16
4000-J	5	114-4102	4CRL	4	21/32	2	2	1 1/8	25/32	2-E	—	—	3	—	3 1/4	—
						2	3T	1 3/16	—	—	2-H*	4		—	—	3 3/16

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† INSIDE AND OUTSIDE SNAP RINGS INCLUDED—USE WHICHEVER ONES ARE CORRECT FOR YOUR APPLICATION.

VOLTAGE REGULATORS

(CODE **VR**)

4600 series voltage regulators

Cableform



Input Voltage Range:
36 — 80V DC
or
84 — 140V DC.
Output Voltage: 12V or 24V.
Max Output Power: 100W or 200W.

The 4600 Series Voltage Regulators are rugged fully enclosed units which provide a choice of either 12 or 24 volts supplies from the higher voltages used in battery operated vehicles. The low voltage output from the Regulator is used to supply the auxiliary services of the vehicles, such as lights, indicators, horn, relays etc. Various models are available according to voltage and power requirements.

Cableform Inc.

ZION CROSS ROADS
TROY, Va 22974 U.S.A.
Tel:(804) 589 -8224

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OF POOR QUALITY

Features

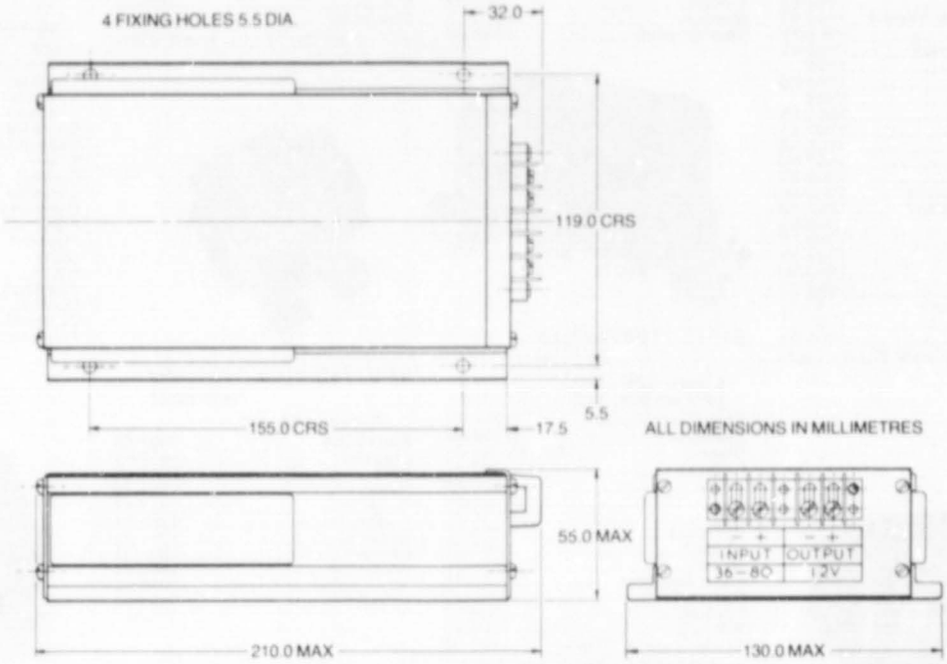
- Reliability and long service life.
- The unit functions without the need for an auxiliary battery to be floated across its output.
- The output of the Regulator is fully protected against overload conditions, including prolonged short circuit. On removal of the short circuit the unit will operate normally.
- The output circuit is fused in order to protect the load against over-voltage.
- Protection against reverse polarity of the supply voltage is provided.
- Trouble free operation into resistive, inductive or capacitive loads.
- Immune to fast transients and noise such as induced spikes due to contactor operation.

Mounting

4 x 5mm clearance holes are provided in the flange of the extruded aluminium casing for securing the unit to the vehicle.

The Voltage Regulator can be mounted in any plane provided that it is applied against a thermally non-committed mass of metal weighting at least 5 kg to provide adequate heat dissipation.

Installation



Connection

Terminal block fitted with 4 x 3.5mm screw connections.
The input and output negative terminals must not be strapped.

Cableform inc.

ZION CROSS ROADS
TROY, Va 22974 U.S.A.
Tel:(804) 589 -8224

Specification

Efficiency at part load	80%
Efficiency at full load	75%
Output stability	± 5% for 4 hours.
Temperature range	from —15°C to +40°C (ambient temperature of the mounting plate).

Order Writing Information

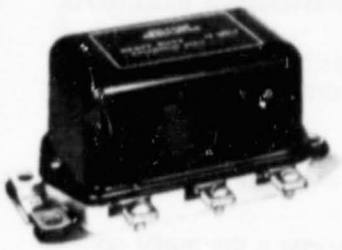
The appropriate model number to quote is given in the table below. This should be suffixed by a "1" for input voltages ranging between 36V and 80V and by a "2" for input voltages ranging between 84V and 140V.

		OUTPUT VOLTAGE	
		12V	24V
OUTPUT POWER	100 Watts	4611	4612
	200 Watts	4621	4622

Example:

Voltage Regulator having 72V input voltage, 24V output voltage and 100 Watt output power.

Please specify: MODEL 4612 — 1.



54910-2100 Voltage Regulator

12 volt, 36 amp, neg. grd.

Buick	1962-53
Buick Special & Skylark	1962-61
Cadillac	1962-53
Chevrolet & Truck	1962-55
Chevy II	1962
Corvair	1964-60
Corvette	1962
Diamond T	1961-55
F-85	1962-61
GMC	1965-56
Hudsnn	1957-56
IHC	1964-57
McCormick-Deering	1962-60
Minneapolis-Moline	1964-62
Oldsmobile	1962-53
Packard	1958-56
Pontiac	1961-55
Rambler	1963-56
Reo	1966-59
Studebaker Truck	1963-57
Tempest	1962-61
White	1966-58

and other Car and Truck applications



54911-2100 Voltage Regulator

12 volt, 3 unit, 35-45 amp, neg. grd.

Brockway	1969-44
Checker	1963-57
Chrysler	1962-50
DeSoto	1960-56
Dodge & Truck	1960-56
Fargo	1966-55
Kaiser Jeep	1965-58
Plymouth	1960-55
Myers Tractor	1959-58
Willys Engine	1965-58

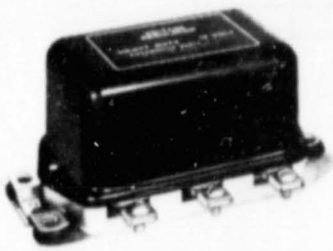
and other Car, Truck and Tractor applications



54912-2100 Voltage Regulator

12 volt 35 amp, neg. grd.

Comet	1964-60
Edsel	1960-58
Fairlane	1964-62
Falcon	1964-60
Ford & Truck	1964-56
Lincoln	1962-57
Mercury	1963-57
Thunderbird	1962-56



54913-2100 Voltage Regulator

6 volt, 32-42 amp, pos. or neg. grd.

Chevrolet Truck	1954-53
Diamond T	1958-50
Divco	1960-53; '47-44
Federal	1953-47
FWD	1959-48
GMC	1955-38
IHC	1956-40
KW Dart	1953-52
Kaiser	1954-51
Mack	1959-38
Nash-Rambler	1955-48
Packard	1951-50
Pontiac	1952-40
Reo	1956-40
Studebaker & Truck	1951-50

and other Car, Truck and Tractor applications



54914-2100 Voltage Regulator

6 volt, 40 amp, pos. or neg. grd.

Ford & Truck	1955-37
Lincoln Cont.	1955-38
Mercury	1955-39
Thunderbird	1955



54915-2100 Voltage Regulator

6 volt, 40-51 amp, pos. or neg. grd.

Brockway	1969-44
Chrysler	1955-46
DeSoto	1955-46
Diamond T	1956-46
Dodge & Truck	1955-49
Hudson	1955-53
Plymouth	1955-49

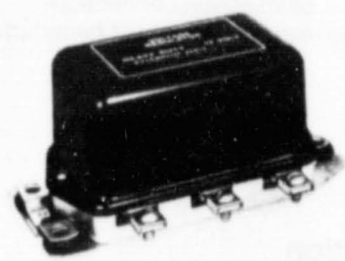
and other Car, Truck and Tractor applications



87-87110-2100 Alternator Regulator

12 volt, neg. grd.

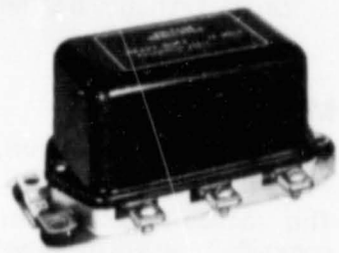
Barracuda	1969-65
Chrysler	1969-61
Dart	1969-63
DeSoto	1961-56
Dodge	1969-61
Dodge Truck	1965-61
Imperial	1969-61
Lancer	1962-61
Plymouth	1969-61
Studebaker & Truck	1966-62
Valiant	1969-61



87-87405-2100 Alternator Regulator

12 volt, neg. grd.

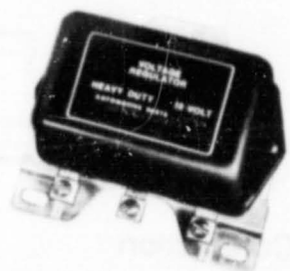
Pontiac	1968-63
Tempest	1963



87-87504-2100 Alternator Regulator

12 volt, neg. grd.

Buick	1972-62
Buick Special, Skylark	1972-63
Cadillac	1972-63
Camaro	1972-67
Checker	1971-66
Chevelle	1972-64
Chevrolet & Truck	1972-62
Chevy II, Nova	1972-62
Corvair	1969-63
Corvette	1968-63
Diamond Reo	1970-67
F-85	1972-64
Firebird	1969-67
GMC	1972-63
IHC	1970-63
Oldsmobile	1972-64
Pontiac	1970-69
Tempest	1970-64
Toronado	1971-66



87-87605-2100 Alternator Regulator

12 Volt, neg. grd.

Bronco	1977-66
Comet, Montego	1978-64
Cougar	1978-67
Fairlane, Torino	1978-65
Falcon	1970-65
Ford	1978-63
Ford Truck	1978-61
Lincoln, Mark III, IV	1977-64
Mercury	1978-63
Mustang	1978-65
Thunderbird	1978-63

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6233 CONCORD AVENUE • DETROIT, MICHIGAN 48211

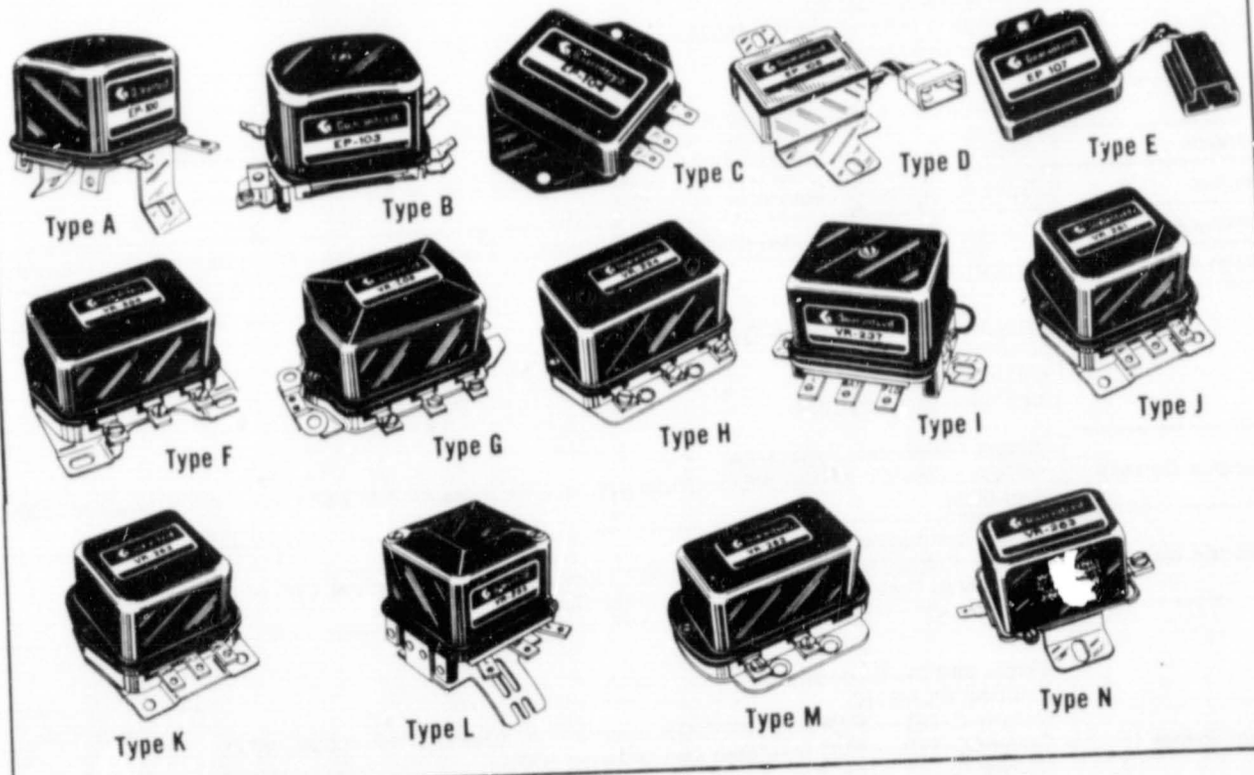
VOLTAGE REGULATOR SPECIFICATION CHART

Part No.	Unit or Type	Volt	Ground	Current Setting Amp.
EP-100	2-Gen.	6	N	....
EP-102	2-Gen.	6	N	....
EP-103	2-Gen.	12	N	....
EP-104	Alternator	12	N	Solid State
EP-105	Alternator	12	N	Solid State
EP-106	Alternator	12	N	Solid State
EP-107	Alternator	12	N	Solid State
RPM-50	3-Gen.	12	N	10
VR-201	3-Gen.	6	P	38-42
VR-203	3-Gen.	12	N	27-31
VR-204	3-Gen.	12	N	37-41
VR-205	3-Gen.	6	P	37-41
VR-206	3-Gen.	6	N	37-41
VR-208	3-Gen.	6	N	42-46
VR-211	3-Gen.	12	N or P	32-36
VR-214	3-Gen.	12	N	42-46
VR-224	3-Gen.	6	N	32-36
VR-225	3-Gen.	6	P	37-41
VR-226	3-Gen.	6	P	42-46
VR-237	2-Gen.	12	N	....
VR-238	3-Gen.	12	N or P	48-52
VR-242	3-Gen.	12	N	27-31
VR-247	3-Gen.	6	N	42-46
VR-250	3-Gen.	6	N or P	37-41
VR-251	2-Gen.	6	P	....
VR-252	2-Gen.	6	P	....
VR-253	2-Gen.	6	P	....

Part No.	Unit or Type	Volt	Ground	Current Setting Amp.
VR-254	2-Gen.	6	P	....
VR-255	2-Gen.	12	N or P	....
VR-256	2-Gen.	12	N or P	....
VR-260	3-Gen.	12	N	40-51
VR-262	3-Gen.	12	N	27-31
VR-263	Alternator	12	N	Solid State
VR-264	3-Gen.	12	P	22-26
VR-265	3-Gen.	12	N	25-35
VR-268	2-Gen.	12	N or P	....
VR-273	Alternator	12	N	....
VR-274	Alternator	12	N	....
VR-278	2-Gen.	6	N	....
VR-279	2-Gen.	6	P	....
VR-280	3-Gen.	12	N or P	48-52
VR-283	Alternator	12	N	....
VR-284	Alternator	12	N	....
VR-286	Alternator	12	N	Solid State
VR-287	Alternator	12	N	Solid State
VR-288	Alternator	12	N	Solid State
VR-289	Alternator	12	N	Solid State
VR-290	Alternator	12	N	Built-in Type
VR-291	Alternator	12	N	Solid State
VR-292	Alternator	12	N	....
VR-293	Alternator	12	N or P	....
VR-295	Alternator	12	N	Solid State
VR-296	Alternator	12	N	Solid State

VOLTAGE REGULATORS

Note: These are general illustrations. There may be minor differences between the actual regulator and the sample illustration.



TEL: 315-568-5844

Guaranteed Parts Company - Seneca Falls, New York 13148

Gulf + Western Manufacturing Company

Electric Vehicle Components

Bohn Heat Transfer Division

1625 East Voorhees Street
Danville, Illinois 61832
Telephone: 217/446-3710

Heat Exchangers	Air to air, liquid to air and liquid to liquid designs. Custom manufacture.

Michigan Plating & Stamping Division

1860 Alpine Avenue, N.W.
Grand Rapids, Michigan 49504
Telephone: 616/363-4847

Fuel Tanks	Supplier to automotive industry of terneplate stamped and welded tanks.

Automotive Marketing and Engineering Center

Detroit Sales and Engineering Office
24114 Research Drive
Farmington Hills, Michigan 48024
Telephone: 313/478-8140

Relays	Miniaturized 12VDC to control circuits to 20 amperes.
Solenoids	Build to customer requirements.
Switches	Build to customer requirements.
Transducers	Current, Position, Pressure, Speed, Temperature, Torque, Voltage - Build to customer requirements.
Voltage Regulators	12VDC Solid State

Collyer Insulated Wire Division

100 Higginson Ave.
Lincoln, RI 02865
Telephone: 401/723-7600

Apparatus Cables	**Single conductor, Type A.I.A.** IPCEA S-28-357, NEMA WC-1; Underwriters' Lab. Sizes #4 AWG and larger. Asb. covered, 300V and 600V.
Appliance Wires	**Single conductor** Collyer P-400 THHN/THWN PVC/NYLON in those sizes which are 19W uncompressed. U.L. Listed Rate AWM 105°C Dry and 80°C in oil.
Control Cables	**Single and multi conductor** THERMOPLASTIC: Collyer C-141 — PZR — PE/NYLON condrs. PVC Jacket 600V, 1000V, 75°C. Collyer C-140 — PVC insulated and jacketed 600V. Collyer C-143 — PE/PVC conductors, PVC jacket 600V, 1000V. Collyer C-153 — PE/NYLON, PZR 90°C, PVC jacket 600V, 1000V. Collyer C-154 — THHN/THWN conductors Type T.C. U.L. Listed.

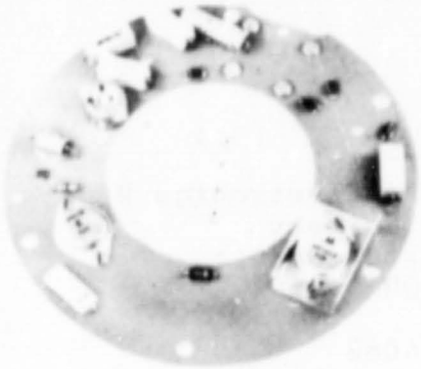
The Prestolite Company

DATA SHEET

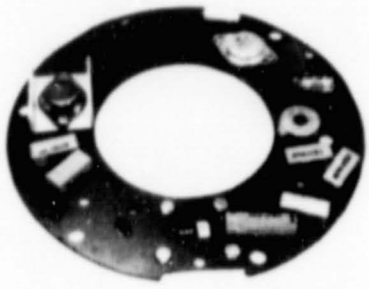
Company Name -	Prestolite Electronics Div. an Eltra Company 511 Hamilton Street Toledo, OH 43694
Company Phone Number -	419/255-4068
Name of Items -	
DC - DC Converters (on board)	Low Power (Instrument lighting only)
Relays, AC & DC (up to 300V, AC & DC)	Low Voltage, only i.e. 6 to 24 volt (horn relays, etc.)
Solenoids	Up to 72 Volt; SAZ, SBC, SAW, SAS, etc.
Switches (6-3000V, 1-20 Amp, AD&DC)	High Current low voltage push type switches
Transducers, Control Current	Brush Wear Indicators
Voltage Regulators	Generator & Alternator Voltage Regulators for 6 to 36 volt applications Solid state and Electro Mechanical types, i.e. VSH, VBC, VCA, etc.
Production Status of Above Items -	All are currently in production

ipm replacement parts for delco remy alternators

voltage regulators, integral



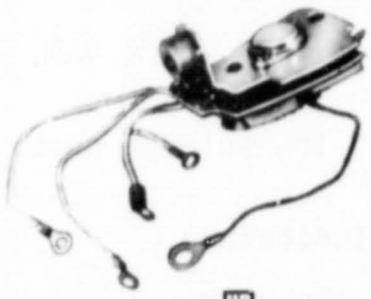
IPM NO. 1A-6000
VR-12V INT.
Former No. 8596
OEM No. 1963876
Used in OEM 1117123, 32,35



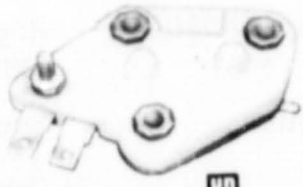
IPM NO. 1A-6001
VR-24V INT.
Former No. 8599
OEM No. 1963875
Used in OEM 1117121, 31, 34



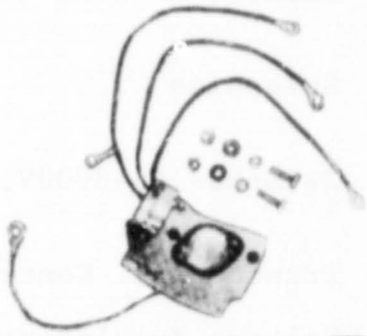
IPM NO. 1A-6004
VR-12V INT. - Neg.
Former No. 6191
OEM No. 1968949
Used in OEM 1117225, 31, 34 (25 SI)



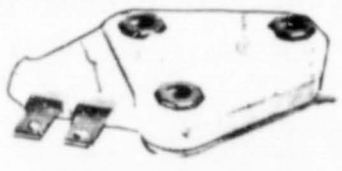
IPM NO. 1A-6005
VR-12V INT. - Pos.
Former No. 05-1704
OEM No. 800784
Used in OEM 1117232, 35 (25SI)



IPM NO. 1A-6006
VR-12V INT. 80A (200 Series) Neg.
Former No. –
OEM No. 1116389
Used in OEM 1100080, 81,82,83,86,87,88(27SI)



IPM NO. 1A-6007
VR-24V INT. - Neg.
Former No. 05-1714
OEM No. 1969110
Used in OEM 1117226, 29, 36, 38, 39 (25SI)



IPM NO. 1A-6009
VR-12V INT. W/SUPRESSOR
Former No. –
To replace OEM 1116387
Used in 10SI Alts.



IPM NO. 1A-6010
VR-12V INT.
Former No. 8141
OEM No. 1116387
Used in 10SI Alts.

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200 E. Daniels Road
Palatine, Illinois 60067
(312) 359-4710

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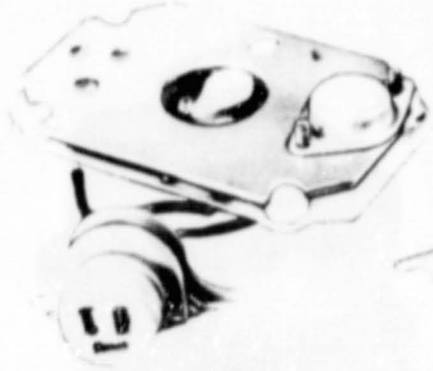
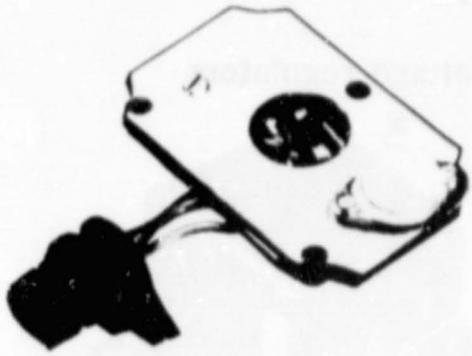
voltage regulators & panels



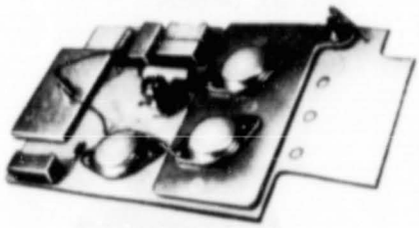
IPM NO. 1A-6030 HD
PANEL - VR 24V N/P
Former No. 05-1705
Used in OEM 9000591 VR



IPM NO. 1A-6031 HD
PANEL - VR 12V N/P
Former No. 05-1701
Used in OEM 9000590 VR



IPM NO. 1A-6032 HD
PANEL - VR 32V N/P
Former No. 1A-6005
Used in OEM 9000593 VR

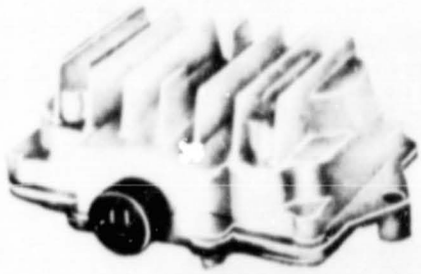


IPM NO. 1A-6033 HD
PANEL - VR 12V N/P
Former No. 1A-6056
Used in OEM 9000551 VR

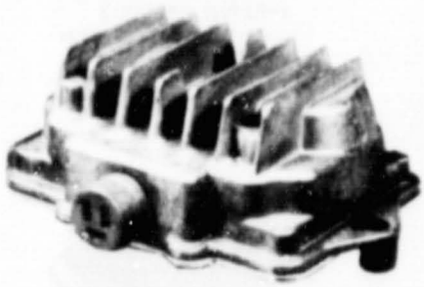


New style to replace 1A-6031

IPM NO. 1A-6034
PANEL - VR 12V N/P
Used in OEM 9000590 VR



IPM NO. 1A-6050 HD
VR – 12V N/P
Former No. 05-1001
OEM No. 9000590



IPM NO. 1A-6051 HD
VR – 24V N/P
Former No. 05-1002
OEM No. 9000591



IPM NO. 1D-6000
VOLT. REG. -24V NEG.
Former No. –
OEM No. VSH-6401 (8-384)



IPM NO. 1C-6050
VOLTAGE REG.-12V NEG.
Former No. 9724
OEM Nos. 2098300,
3000074, CH-524, CH-531

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200 E. Daniels Road
Palatine, Illinois 60067
(312) 359-4710



IPM NO. 1C-6052
VOLTAGE REG.-12V NEG.
OEM No. 3755850, 3874520 (CH-543)

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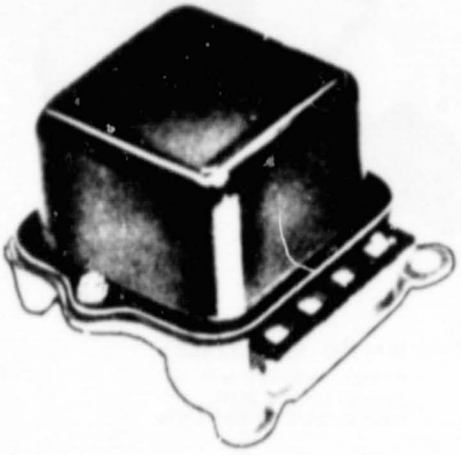
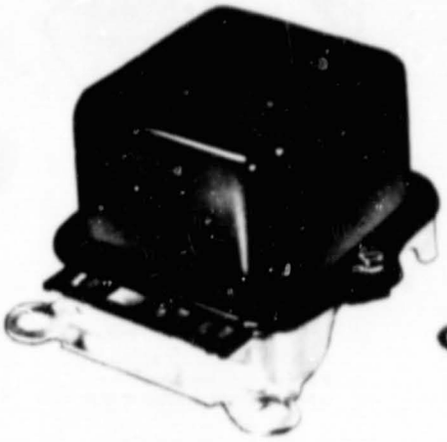
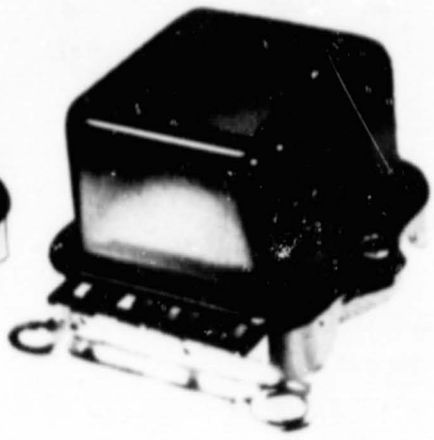
voltage regulators



IPM NO. 1A-6052
VR – 12V NEGATIVE
Former No. 6045
OEM No. 1119506, 1119512, 1119515



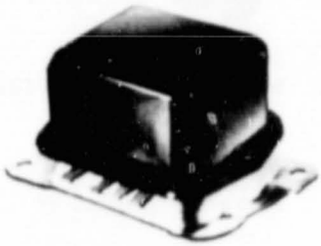
IPM NO. 1A-6053
VR – 12V NEGATIVE
Former No. 6044
OEM No. 1119507



IPM NO. 1A-6054
VR – 12V NEGATIVE
Former No. 6043
OEM No. 1119511



IPM NO. 1B-6000
VR-14V-NEG.
OEM No. D4TZ-10316A,
GR-3418



IPM NO. 1B-6001
VR-14V NEG.
OEM No. D4HZ-10316A,
GR-503 (Truck)



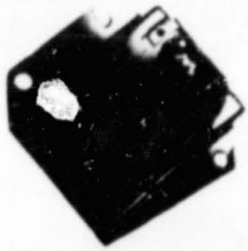
IPM NO. 1B-6003
VR-TRANSISTORIZED
14V NEG.
Former No. 05-2002
OEM No. C8SZ-10316A,
GR-383



IPM NO. 1B-6004
VR-14V NEG. 65, 70, 90 AMP
Former No. 05-2001
OEM No. D3TZ-10316A
GR-341A



IPM NO. 1B-6005
VR-14V NEG. (70/90 amp.)
OEM No. D8BZ-10316A,
D8BF-10316AA (GR-533)
A.M.C. 3229408



IPM NO. 1C-6051
VOLTAGE REG.-12V NEG.
Former No. 6061
OEM No. 3438150 (CH-537)

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200 E. Daniels Road
Palatine, Illinois 60067
(312) 359-4710

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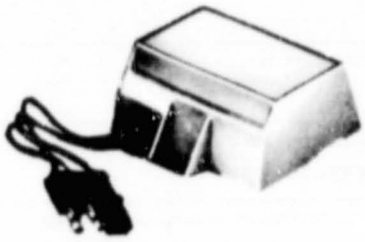
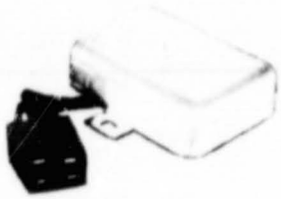
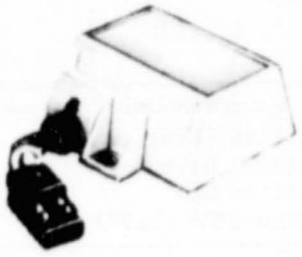
voltage regulators



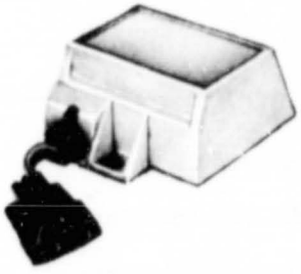
IPM NO. 1F-6000
VOLTAGE REG. 12V N/P
Former No. 6280
OEM No. 5-1
CAN USE 1F-6007



IPM NO. 1F-6001
VOLTAGE REG. 12V N/P
Former No. 05-6001
OEM No. 5-76



IPM NO. 1F-6002
VOLTAGE REGULATOR
Former No. 05-6002
OEM No. 5-24



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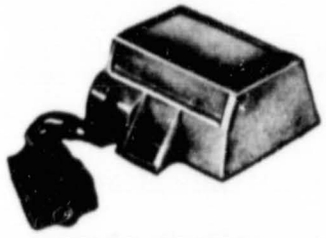
VOLTAGE REG. 12V
Former No. 05-6006
OEM No. 5-44



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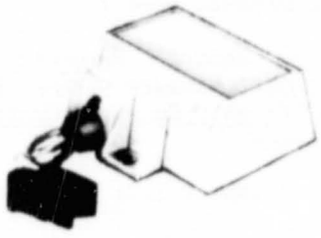
VOLTAGE REG. 12V N/P
Former No. 05-6003
OEM No. 5-72



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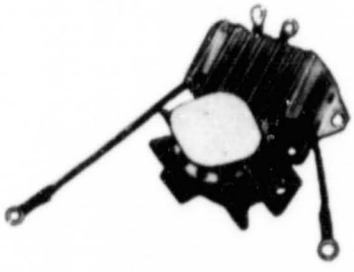
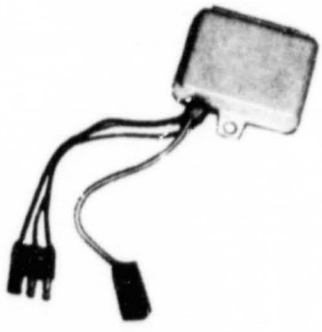
VOLTAGE REG. 12V NEG.
Former No. 05-6004
OEM No. 5-81



IPM NO. 1F-6006
VOLTAGE REG. 12V N/P
OEM No. 5-23



IPM NO. 1F-6007
VOLTAGE REG. 12V Neg.
OEM No. 5-130



IPM NO. 1F-6008
VOLTAGE REG. 12V Neg.
OEM No. 5-67

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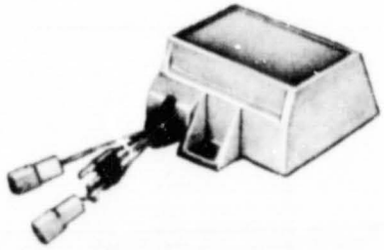

IPM NO. 1F-6009
VOLTAGE REG. 12V N/P
Former No. 05-6005
OEM No. 5-28

wabash ipm
200 E. Daniels Road
Palatine, Illinois 60067
(312) 359-4710



IPM NO. 1F-6011
VOLTAGE REG. 12V
OEM No. 5-87