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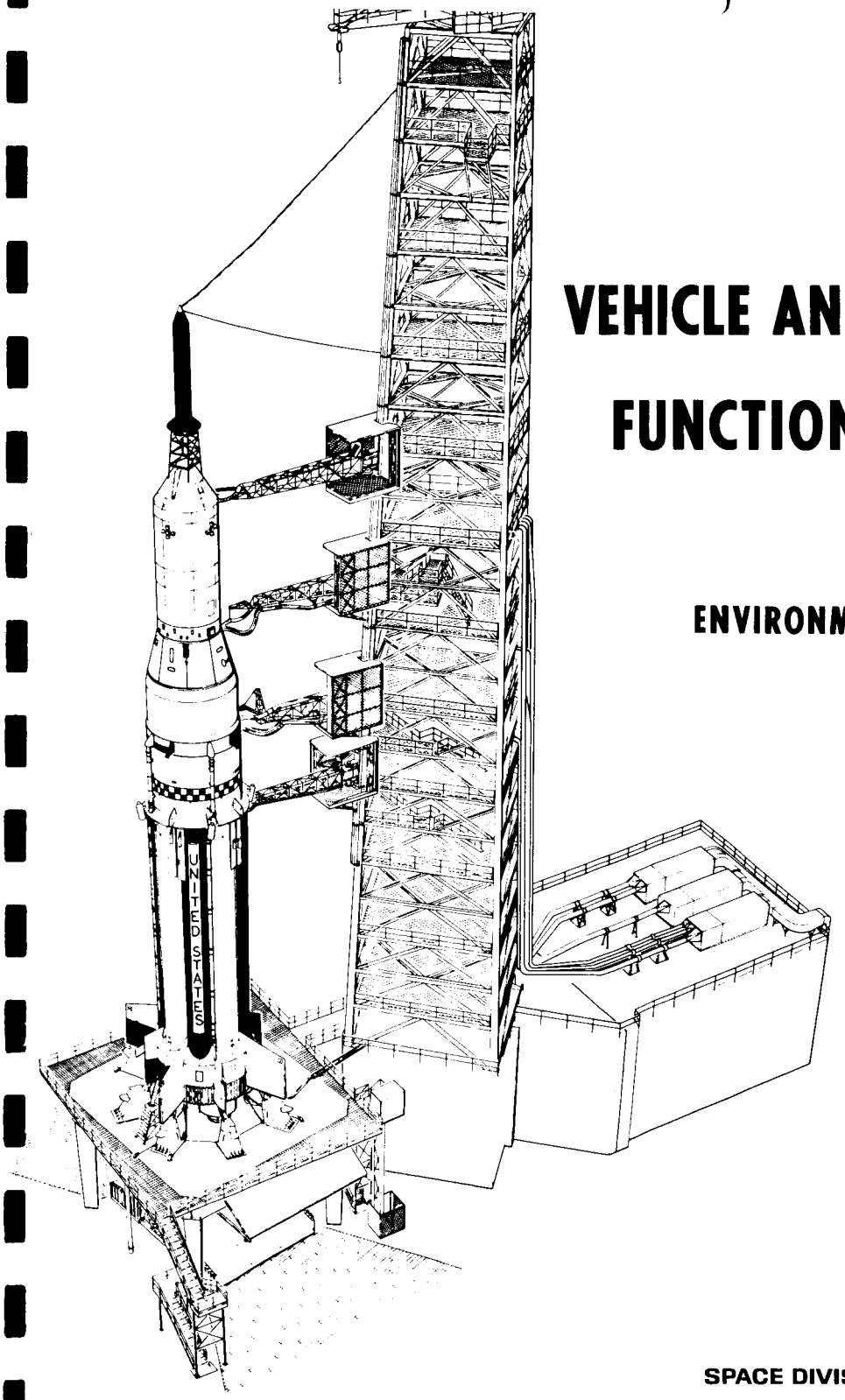

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VEHICLE AND LAUNCH COMPLEX
FUNCTIONAL DESCRIPTION

ENVIRONMENTAL CONTROL SYSTEM

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SPACE DIVISION CHRYSLER CORPORATION

HUNTSVILLE OPERATIONS

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VOLUME VI

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MAY 1964

ENGINEERING COMMUNICATIONS DEPARTMENT

SPACE DIVISION CHRYSLER CORPORATION

HUNTSVILLE OPERATIONS

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FOREWORD

This volume has been prepared for the Functional Integration Section, Systems Integration and Operations Branch, Vehicle Systems Division, Propulsion and Vehicle Engineering Laboratory, by the Engineering Communications Department, Chrysler Corporation Space Division, under contract number NAS8-4016.

The following series, of which this volume is a part, functionally describes the mechanical and electromechanical systems of Saturn I SA-9 space vehicle and Launch Complex 37:

Volume I.	RP-1 Fuel System
Volume II.	LOX System
Volume III.	LH_2 System
Volume IV.	Nitrogen and Helium Storage Facility
Volume V.	Pneumatic Distribution System
Volume VI.	Environmental Control System
Volume VII.	Launch Pad Accessories
Volume VIII.	H-1 Engine and Hydraulic System
Volume IX.	RL10A-3 Engine and Hydraulic System
Volume X.	Separation and Flight Termination Systems
Volume XI.	Supplement: Legend and Composite Schematic

Each volume contains mechanical schematics and a list of applicable finding numbers.

Volume VI describes those components that are active during launch operations: it specifically excludes maintenance procedures, checkout procedures, and payload servicing. Only information available by January 1, 1964, has been included.

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1. ENVIRONMENTAL CONTROL SYSTEM

The environmental control system (ECS) of Launch Complex 37B supplies conditioned air or gaseous nitrogen (GN_2) to the launcher and SA-9 vehicle compartments to maintain a controlled environment within the compartments during prelaunch operations. Also associated with the ECS hardware is a deluge purge and a water quench system which provide fire protection within the S-I engine compartment, if a vehicle malfunction occurs that creates a fire hazard or necessitates shutdown after engine ignition.

Three conditioning units and associated control units on the automatic ground control station (AGCS) roof (figure 1, page 15) supply dehumidified air or GN_2 at controlled temperature levels through launcher and umbilical tower ducts to the launcher and vehicle for distribution within the various compartments. GN_2 from the nitrogen storage facility (described in Volume IV of this series) is used for conditioning any time an inert compartment atmosphere is required. The remote air intake facility, sufficiently removed from the launch area to avoid intake of contaminant vapors, inducts, filters, and supplies ambient air to the units for conditioning. The conditioning units cool the air or GN_2 flowing through them, thereby removing excess moisture. The control units reheat the dehumidified air or GN_2 to the required temperature levels and distribute the medium(s) through umbilical tower or launcher ducts to the compartments. The conditioning units are basically identical in configuration and operation. The control units operate in a similar manner but differ in configuration because of the number of compartments each control unit serves and the temperature requirements of each compartment. Because of the high temperature requirements of the S-I and S-IV engine compartments and of the instrument unit, the control units supplying these compartments contain auxiliary electric duct heaters.

The cooling tower facility supplies the water needed for conditioning unit operation and cools and recirculates the water returned from the conditioning units.

Control panels on the AGCS roof, in conjunction with similar panels in the launch control center (LCC), initiate, monitor, and control the operation of the ECS.

Figures 2 and 3, pages 49 and 51, represent the ECS and should be used in conjunction with the following text.

2. ENVIRONMENTAL CONDITIONING AND CONTROL UNITS

The three environmental conditioning units ("A1", "A2", and "A3") and their associated control units ("B", "C", and "D") are basically identical in their operation. The only differences in the conditioning modules is that control unit "B" supplies five outlet ducts, one of which contains an auxiliary duct heater; control unit "C" supplies only one outlet duct, which contains an auxiliary duct heater; and control unit "D" supplies two outlet ducts, one of which contains an auxiliary duct heater. Because the operation of each of the conditioning modules is basically the same, only the operation of conditioning unit "A2" and control unit "C" is described in detail. The fact that passage A of conditioning unit "A2" is inoperative is ignored in this description.

Each environmental control system module is divided into two subsystems: the air-GN_2 subsystem and the refrigerant subsystem.

2.1. Air-GN_2 Subsystem

Either air or GN_2 can be supplied to the vehicle compartment.

Air, supplied by the remote air intake facility, enters the conditioning unit through Washable Filters A4146 and A4148 and flows through Spherical Ball Dampers A4255, (passage A) and A4254 (passage B). Blowers A4144 and A4142, driven by Motor A4143, force the air over externally-finned Evaporator Coils A4149 and A4369. Air flowing over the coils is cooled to approximately 40°F by transferring heat to vaporizing freon (type R-22) refrigerant flowing through the evaporator coils. Cooling of the air condenses excess moisture from the air. The water that has been condensed collects in a condensate trap and drains from the evaporator. The dehumidified air flows to the control unit and is heated by Reheat Coil A4216. If the air is not sufficiently heated to satisfy the vehicle compartment requirements, Duct Heater A4245 is actuated. The duct heater is controlled by Air Temperature Regulator A4217, described in Paragraph 2.2.8. If the air or GN_2 leaving the duct heater is overheated and the heater is still activated, Over Temperature Cut-Out Switch A4350 will take power off the heater.

The heated and dehumidified air flows from the conditioning unit through Orifice A4303, remotely operated Butterfly Valve A4304, and Check Valve A4353 to the umbilical tower facility for transfer to the S-IV engine compartment.

Differential Pressure Switch A4302 actuates to shut the conditioning unit down when the flow is insufficient. Differential Pressure Transducer A4305 monitors the air flow through the duct and sends an indication signal to the LCC and AGCS. Remotely operated Butterfly Valve A4304 controls the air or GN_2 flow rate to the vehicle compartment.

GN_2, used for compartment conditioning, is supplied to the ECS by the nitrogen storage facility (described in Volume IV). The GN_2 enters the system through Manual Valve A4271 and is then filtered by Filter A4334. Pressure Switches A4333 and A4377 actuate to provide LCC indication, when the GN_2 pressure is either too low or too high, and Temperature Switches A4334 and A4378 actuate to provide an indication at the nitrogen storage facility when the GN_2 temperature is either too high or too low. The 50-psig GN_2 enters the conditioning unit through GN_2 Flow Control Regulators A4141 and A4140 and is admitted to the system at approximately 3 in. H_2O static pressure. The GN_2 is conditioned in the same manner as air.

To select air for conditioning, normally open Solenoid Valves A4145 and A4147 are actuated remotely. These valves close and vent the 8 psig control pressure from Spherical Ball Dampers A4255 and A4254, allowing air to enter the conditioning unit. Simultaneously, GN_2 supply control solenoid valves A4139 and A4138 are actuated, allowing 20-psig control pressure to act on Pressure Controllers A4252 and A4253. The pressure controllers, preset to maintain a static pressure of 57 in. of H_2O downstream of the blower, sense an overpressure. The controllers then open Volume Boosters A4323 and A4324, allowing 20-psig GN_2 control pressure to close GN_2 Flow Control Regulators A4141 and A4140, preventing GN_2 from entering the conditioning unit.

To select GN_2 for conditioning, air supply Solenoid Valves A4145 and A4147, and GN_2 supply Solenoid Valves A4139 and A4138 are deactuated. Deactuation of the air-supply solenoids allows 8 psig GN_2 control pressure to inflate spherical Ball Dampers A4255 and A4254, preventing air from entering the conditioning unit. Deactuation of GN_2 supply Solenoid Valves A4139 and A4138 applies downstream blower pressure, rather than the 20 psig control pressure, to Pressure Controllers A4252 and A4253. Since the pressure controllers are preset to maintain a static pressure of 57 in. of H_2O downstream of the blower, a lower pressure will cause the pressure controllers to position Volume Boosters A4323 and A4324 to decrease to amount of control pressure applied to the actuators of GN_2 Flow Control Regulators A4141 and A4140. A decrease in control pressure opens the GN_2 flow control regulators, allowing GN_2 to enter the conditioning unit. In this way, the combination of pneumatic controllers and volume boosters act as a pneumatic amplifier. A decrease in downstream blower pressure will cause a corresponding increase in GN_2 flow through the regulators. The GN_2 flow will increase until the downstream blower pressure reaches its normal static pressure of 57 in. H_2O. Should a blower fail while operating in the GN_2 mode, the GN_2 flow control regulators would open fully, providing a GN_2 flow sufficient to compensate for the lost blower.

To alleviate repetition of "air or GN_2," only air will be mentioned as the conditioning medium in the following descriptions.

2.2. Refrigerant Subsystem

High-pressure liquid freon (Type R-22) expands through Primary Thermal Expansion Valve A4134 and Secondary Thermal Expansion Valve A4151 into Evaporator Coils A4369 and A4149. Liquid freon at low pressure circulates through

the evaporator coils and absorbs heat from air passing over the coils and vaporizes. The vaporized freon flows through Evaporator Pressure Regulator A4127, Heat Exchanger A4590, Compressor Suction Service Valve A4129 and into Compressor A4126. The hot, compressed freon gas, discharged from the compressor through Compressor Discharge Service Valve A4128, can flow in three possible directions. The quantity of freon flowing through each path depends on conditioning unit and control unit requirements. The three freon flow paths are as follows: (1) The compressed freon flows through Hot Gas Bypass Regulator A4123 and into the compressor suction line. (2) The compressed freon flows through Differential Pressure Regulator A4122, Condenser Inlet Service Valve A4113, and into Condenser-Receiver A4117. (3) The freon flows through Reheat Coil Service Valves A4277 and A4229 into Reheat Coil A4216. The hot, compressed freon circulates through the reheat coil, transferring heat to the air passing over the coils, and flows out of the reheat coil through Air Temperature Regulator A4217, through Reheat Coil Service Valves A4230 and A4276, through Condenser Inlet Service Valve A4113, and into Condenser-Receiver A4117. The freon gas circulates through the condenser-receiver and is cooled and condensed by water flowing through coils within the condenser-receiver. The cooling water is supplied by the cooling tower facility and its flow rate is controlled by Water Regulation Valve A4111. The condensed freon flows from Condenser-Receiver A4117 through Condenser Outlet Service Valve A4116, Filter-Drier Service Valve A4121, Filter-Drier A4118, and Filter-Drier Service Valve A4120 and into Heat Exchanger A4390. The condensed freon is further cooled in the heat exchanger by freon flowing in the compressor suction line before flowing through Sight Glass A4136 to Thermal Expansion Valves A4134 and A4151, completing the cycle, or through Desuperheating Valve A4125 into the compressor suction line. The quantity of refrigerant flowing through the desuperheating valve is dependent on conditioning unit requirements.

The following paragraphs describe the major components and assemblies that comprise the refrigerant subsystem.

2.2.1. Thermal Expansion Valves A4134 and A4151. These valves regulate the flow of freon through Primary Evaporator Coil A4369 and Secondary Evaporator Coil A4149. The flow is regulated to superheat the gaseous freon leaving the evaporator a specified amount (approximately 9°F). The thermal expansion valve opening is controlled by a thermal sensing bulb attached to the evaporator discharge line and an evaporator discharge pressure sensing line. Should the evaporator discharge temperature increase, the pressure in the thermal sensing bulb and capillary tube would increase and move the expansion valve positioner to equalize this pressure with the evaporator discharge pressure, thus increasing the thermal expansion valve opening. Conversely, a decrease in evaporator discharge temperature will cause the valve opening to decrease.

During low flow conditions, the thermal expansion valves lose their accurate flow control capabilities. When the air intake temperature drops too low (below approximately 75°F), Thermal Switch A4363, located downstream of Blower A4142, deactuates and takes power off evaporator coil cutoff Solenoid Valve A4137. Deactuation of this solenoid causes the sensing line of Thermal Expansion Valve A4151 to sense high evaporator inlet pressure rather than the low evaporator discharge pressure. The higher pressure applied to the

actuating mechanism closes the valve, causing an increased freon flow rate through Thermal Expansion Valve A4134 and Primary Evaporator Coil A4369.

2.2.2. Evaporator Pressure Regulator A4127. The regulator controls the pressure within Evaporator Coils A4369 and A4149. The amount of heat absorbed from the air flowing over the evaporator coils is dependent on the temperature differential between the freon gas within the coil and the air flowing over the coil, and on the vapor pressure of the freon within the coils. Freon temperature is regulated by the thermal expansion valves and freon vapor pressure is controlled by the evaporator pressure regulator. Thermistor A4080, located downstream of the evaporator coils in the conditioning duct, senses the temperature of the air leaving the evaporator and signals Pressure Controller A4132 to increase or decrease the pneumatic pressure applied to the positioning mechanism of the evaporator pressure regulator. The regulator will be opened when the thermistor senses a temperature increase. Opening of the regulator reduces the vapor pressure within the evaporator, thus increasing the amount of heat absorbed from the air during freon vaporization. Conversely, the regulator closes when the control thermistor senses a temperature decrease. The regulator and its associated controls are designed to maintain the air discharge from the evaporator at approximately 40°F.

2.2.3. Heat Exchanger A4390. This liquid to gas heat exchanger transfers heat from the hot liquid freon in the condenser discharge line to the gaseous (or partially gaseous) freon in the compressor suction line. This lessens the possibility of liquid freon reaching the compressor and increases the efficiency of the refrigerant subsystem by further cooling the liquid freon flowing to the thermal expansion valves.

2.2.4. Compressor A4126. Gaseous freon flowing from Heat Exchanger A4390 is compressed so that it can be cooled to the liquid state more easily. (The compressor can be isolated for maintenance by closing Compressor Suction Service Valve A4129 and Compressor Discharge Service Valve A4128.)

A High-Low Pressure Switch A4279 cuts off the compressor if the compressor discharge pressure becomes too high or the compressor suction pressure drops below a prescribed value. Should the compressor be cut off, Suction Pressure Switch A4393 would deactuate, allowing Liquid Stop Solenoid Valve A4195 and Hot Gas Bypass Solenoid Valve A4124 to close, preventing the flow of liquid freon to lower parts of the system while the compressor is inoperative.

Visual indication of compressor suction and discharge pressure is given by Pressure Gages A4336 and A4278, respectively. (Manual Valves A4131 and A4130 are used to isolate the pressure gages when necessary.)

2.2.5. Hot Gas Bypass Regulator A4123. This regulator controls the flow of hot compressed gaseous freon into the compressor suction line, maintaining a constant load on the compressor and vaporizing any liquid freon that might be in the line.

A pressure-operated pilot valve, part of the regulator assembly, regulates the amount of control pressure applied to the main valve. The normally-open

pilot valve is closed by compressor suction pressure, decreasing the amount of opening control pressure supplied to the normally-closed main valve of the regulator assembly; therefore, when the compressor suction pressure decreases, the pilot valve opens, allowing compressed freon to open the main valve. Opening of the main valve allows hot, compressed freon from the compressor discharge line to flow directly into the compressor suction line, essentially short circuiting the rest of the system to maintain a constant load on the compressor.

2.2.6. Differential Pressure Regulator A4122. A constant pressure differential between the reheat coil inlet and outlet is maintained by this regulator to induce freon flow through the coil. The freon flowing through the pressure regulator flows directly into Condenser-Receiver A4117.

2.2.7. Reheat Coil A4216. The coil, located in control unit "C", is a heat exchanger that allows hot compressed freon gas to transfer heat to the cool air flowing across the coil. (Reheat Coil Service Valves A4277, A4229, A4230, and A4276 are used to isolate the conditioning and control unit refrigerant subsystem when the units are being transported, installed, or maintained.)

2.2.8. Air Temperature Regulator A4217. The regulator controls the freon flow rate through the reheat coil, thus controlling the temperature of the air leaving the coil. The air temperature regulator is controlled by Temperature Controller A4215 and S-IV engine compartment Thermistor E59. The thermistor senses the compartment temperature and signals temperature controller to position Air Temperature Regulator A4217 accordingly. If the compartment temperature is too low (below approx. 210°F) the air temperature regulator opens, allowing more hot, gaseous freon to flow through the reheat coil. If the compartment temperature is too high, the regulator closes to restrict freon flow through the coil.

When the regulator is opened fully, it actuates a cam motor. The cam motor rotates to put power on one of the three heater banks in the Auxiliary Duct Heater A4245. As the air temperature increases, the air temperature regulator returns to a modulating position. If the compartment temperature is still too low and the regulator remains fully open or becomes fully open again, the cam motor will rotate to energize the second bank of heaters. The third bank is energized in the same manner. The heaters will be deenergized in the same manner but in reverse sequence when the compartment temperature is high enough to fully close the valve.

If Thermistor E59 or Temperature Controller A4215 should fail, the air temperature regulator can be controlled manually from the LCC or the AGCS; however, the LCC control overrides the AGCS control.

2.2.9. Condenser-Receiver A4117. This condenser-receiver is a shell and tube type condenser with sufficient capacity to serve as a receiver should system pumpdown be necessary. (Condenser service valves A4113 and A4116 isolate the condenser when necessary.) Relief Valve A4115 relieves at 350 psig, preventing condenser damage. Cooling water flowing through the condenser tubes

is supplied by the cooling tower facility and regulated by Water Regulation Valve A4111. The quantity of cooling water flowing through the tubes is directly proportional to condenser pressure. Pressure Controller A4372 senses the condenser pressure through Condenser Purge Valve A4114 and regulates the control pressure supplied to the closing side of the water regulation valve. Increasing condenser pressure will proportionally close the pressure controller, lowering the control pressure supplied to the closing side of the regulation valve, allowing 20-psig GN_2 control pressure to open the regulation valve; thereby increasing the cooling water flow rate through the condenser tubes. A decrease in condenser pressure will allow the pressure controller to open, increasing the amount of control pressure applied to the closing side of the Water Regulation Valve; thereby closing the water regulation valve.

A Flow Balancing Orifice, A4112, installed between the condenser inlet line and the water regulation valve (in parallel with the condenser tubes), provides an alternate flow path when required flow through the condenser is less than full flow from the cooling tower.

2.2.10. Filter-Drier A4118. The filter-drier removes moisture and contaminant particles from the refrigerant charge. (Should replacement of the filter-drier element be necessary during system operation, opening of Filter-Drier Bypass Valve A4119 and closing of Filter-Drier Service Valves A4121 and A4120 allows removal of the element without shutting the system down or losing refrigerant.)

2.2.11. Desuperheating Valve A4125. The desuperheating valve allows high pressure liquid freon to flow into the compressor suction line, upstream of Heat Exchanger A4390, to prevent compressor overheating and to keep the compressor inlet temperature relatively constant. The valve is controlled by a temperature-sensing bulb at the compressor inlet. An increase in compressor suction temperature will cause the medium within the thermal sensing bulb and its capillary tube to expand, opening the desuperheating valve, thus allowing high pressure liquid freon to expand into the compressor suction line and vaporize. In vaporizing, the freon absorbs heat from the gaseous freon, thus lowering the compressor inlet temperature.

2.2.12. Refrigerant Inspection Devices. Moisture Indicator A4396 and Sight Glass A4136 allow visional inspection of the refrigerant charge moisture content and the refrigerant charge level.

3. REMOTE AIR INTAKE FACILITY

The remote air intake facility supplies air to the ECS conditioning units. Fan A4211 draws air in through a screen, Filter A4209, and Damper A4210 and forces it through a duct to the conditioning units.

Pneumatic Controller A4088 senses the fan outlet pressure and the atmosphere pressure and positions Damper A4210 to maintain a constant outlet static

pressure of 3 in. H_2O. Pressure Switches A4358 and A4367 actuate to give an indication at the LCC when the intake air pressure is too high or too low.

4. COOLING TOWER FACILITY

The cooling tower receives heated water from the condenser of each conditioning unit. The water, admitted at top of the tower, falls in droplets through a series of trays. Blower A4053 forces ambient air through the tower to cool the water. Pump A4054 circulates the water through the condensers and the cooling tower. The water flows from the pump through Check Valve A4320 to the condenser coils of each unit, where it absorbs heat from the compressed freon flowing through the condenser. The heated water then flows back to the cooling tower to be cooled and recirculated.

The water level in the cooling tower is controlled by Float-Operated Valve A4052. As water is lost to the atmosphere and by condenser blow-down, the float-operated valve opens and allows the supply to be replenished through Make-up Water Valve A4050. (The tower can be drained through Drain Valve A4051.)

Blow-Down Valve A4150 is left open during tower operation to prevent deposits from accumulating in the condensers during system operation.

5. PNEUMATIC CONTROL PRESSURE SYSTEM

The pneumatic control pressure used for valve actuation and spherical ball damper inflation is supplied by valve panel 5. The GN_2 at 50 psig is filtered through Filter A4317, regulated to 20 psig by Regulator A4269, and supplied to the ECS conditioning units for valve actuation. Also, the 50-psig GN_2 is filtered by Filter A4316, regulated to 8 psig by Regulator A4270, and supplied to the ECS conditioning units for spherical ball damper inflation. The 20 psig and the 8 psig control pressure is monitored by Pressure Gages A4318 and A4319, respectively.

6. ENVIRONMENTAL CONTROL SYSTEM CONTROLS

6.1. Launch Control Center Control Panels

The following panels in the LCC are used to initiate, monitor, and control the operation of the ECS.

a. System Control Panel.

1. ON-OFF Switch - Provides dc power for the electrical control system.

2. POWER ON Indicator - Indicates position of dc power ON-OFF Switch.

3. START Switch (push-button) - Sends signal to a panel on the cooling tower to initiate the system start sequence.

4. STOP Switch (push-button) - Terminates system operation.

5. SYSTEM RUNNING Indicator - Indicates system starting sequence has been completed.

6. AIR-GN_2 Switches - Select the conditioning medium supplied to each compartment.

7. NITROGEN SUPPLY PRESSURE (HIGH-NORMAL-LOW) Indicators- Indicate GN_2 supply pressure.

8. AIR SUPPLY PRESSURE (HIGH-NORMAL-LOW) Indicators - Indicate air supply pressure.

b. Compartment Temperature Control Panels. There is a panel for each compartment, consisting of the following:

1. LCC-AGCS Switch - Selects location of temperature selector operation, LCC or AGCS.

2. LCC-AGCS Indicator - Indicate location of temperature selector operation, LCC or AGCS.

3. MANUAL-AUTO Switch - Selects the method of air temperature regulator control (manual or automatic)

4. MANUAL-AUTO Indicator - Indicates position of MANUAL-AUTO Switches.

5. INCREASE-DECREASE Temperature Switch - Controls position of the air temperature regulator.

6. Temperature Control Valve Position Indicator - Indicates air temperature regulator opening.

7. COMPARTMENT TEMPERATURE Gage - Indicates temperature in the vehicle compartment or in the duct leading to the compartment in degrees Fahrenheit.

8. TEMP. SELECTOR - Selects vehicle compartment temperature when operating automatically.

9. FLOW CONTROL Indicator - Indicates flow rate of air or GN_2 into each compartment in lbs/min.

10. FLOW CONTROL INCREASE-DECREASE Switch - Controls the opening of air-GN_2 flow control valve.

11. HEATER BANK ON Indicators - Indicate the operating state of control unit electrical heaters. (On S-I and S-IV engine compartment panels only.)

12. OVERHEAT LIMIT SW ACTUATED Indicator - Indicates when the over-temperature cut out switch has actuated. (On S-I and S-IV engine compartment panels only.)

c. Conditioned Gas Temperature - Evaporator Discharge Panel. This panel indicates the temperature of conditioned air or GN_2 in each duct leaving the conditioning unit evaporators.

d. Intake Air - Nitrogen Purge Panel.

1. SLOW Switch (push-button) - Initiates slow speed operation of the remote air intake blower.

2. FAST Switch (push-button) - Initiates high speed (normal) operation of the blower.

3. SLOW Indicator - Indicates when the remote air intake blowers are operating at slow speed.

4. FAST Indicator - Indicates when the remote air intake blower is operating at fast (normal) speed.

5. PURGE ON Indicators - Indicate when the control panels on the AGCS roof are adequately purged.

e. Distributor Panels.

6.2. Automatic Ground Control Station Roof Control Panels

a. Sequence Control Panel.

1. START Switch (push-button) - Initiates system start sequence.

2. STOP Switch (push-button) - Terminates system operation.

3. CIRCUIT BREAKER MAIN COOLING TOWER (handle) - Allows manual reset of main cooling tower circuit breaker.

b. Conditioning Unit Control Panels. Each panel (one for each conditioning unit) contains the following:

1. CONDITIONED GAS TEMP.-EVAPORATOR DISCH. Gages - Indicate temperature (^{o}F) of the air or GN_2 in each duct leaving the conditioning unit evaporator.

2. REFRIGERANT PRESSURE Gages - Indicate compressor suction and discharge pressure.

3. CIRCUIT BREAKER MAIN (handle) - Allows manual reset of main conditioning unit circuit breaker.

4. CIRCUIT BREAKER BLOWER (handle) - Allows manual reset of blower circuit breaker.

5. BLOWER Switch (AUTO-OFF-MAN) - AUTO position allows automatic operation from the LCC. MAN position allows local operation of conditioning unit blowers.

6. COMPRESSOR CIRCUIT BREAKER (handle) - Allows manual reset of compressor circuit breaker.

7. COMPRESSOR Switch (AUTO-OFF-MAN) - AUTO position allows automatic operation from the LCC. MAN position provides for local operation of conditioning unit compressor.

c. Control Unit Control Panel. Each panel (one for each control unit) contains the following:

1. COMPARTMENT TEMPERATURE Indicator(s) - Indicate(s) compartment temperature (or duct temperature) in degrees Fahrenheit.

2. TEMPERATURE SELECTOR(s) - Provide(s) control of compartment temperature.

3. AGCS Indicator(s) - Indicate(s) that the compartment temperatures may be selected from the AGCS roof.

4. LCC Indicator(s) - Indicate(s) that desired compartment temperatures can only be selected at the LCC.

5. FLOW Indicator(s) - Indicate(s) flow rate in lbs/min to the related vehicle compartment.

6. FLOW CONTROL INCREASE-DECREASE Switch(es) - Control(s) the position of the air-GN_2 flow control valve(s) in the duct(s) leaving control unit.

7. MAIN CIRCUIT BREAKER (handle) - Allows manual reset of main circuit breaker in control unit heater circuit.

8. CIRCUIT BREAKERS, HEATER BANK A, B, AND C (handles) - Allow manual reset of the individual heater bank circuit breakers.

6.3. Cooling Tower Control Panel

1. MAIN CIRCUIT BREAKER (handle) - Allows manual reset of main cooling tower circuit breaker.

2. PUMP CIRCUIT BREAKER (handle) - Allows manual reset of pump circuit breakers.

3. PUMP SWITCH (MANUAL-OFF-AUTO) - MANUAL position allows local operation of the cooling tower pump. AUTO position allows automatic operation from the LCC.

4. FAN CIRCUIT BREAKER (handle) - Allows manual reset of fan circuit breaker.

5. FAN SWITCH (MANUAL-OFF-AUTO) - MANUAL position allows local operation of the cooling tower fan. AUTO position allows automatic operation from the LCC.

7. LAUNCHER AND VEHICLE COMPARTMENT CONDITIONING

7.1. Launcher Compartments

The launcher compartments are conditioned with air supplied by control unit "D" through Check Valve A4351. The air is ducted through a torus around the launcher (not shown). Manual valves on the torus can be opened to allow conditioning of the desired compartments. If no compartments require conditioning the air is vented to the atmosphere.

Just prior to launch, the launcher compartments are pressurized with GN_2 to a minimum of 3 in. H_2O. Thermistor A4226 in the control unit duct provides a temperature measurement for LCC and AGCS compartment temperature indication and air temperature regulation.

7.2. S-I Engine Compartment

The air used to condition the S-I engine compartment is supplied by control unit "D". The conditioned air flows through Check Valve A4352 and Butterfly Valve A4342 into launcher distribution ducts (figure 3, page 51). The conditioned air flows to one side of the launcher through normally open Pneumatic Ball Valve A4903 where the duct branches, routing the flow into the engine compartment through Manual Butterfly Valve A4339 and Quick Disconnect

Couplings A4393 and B502; and through Manual Butterfly Valve A4340 and Quick Disconnect Couplings A4344 and B502. The air, routed to the other side of the launcher through Pneumatic Ball Valve A4908, flows into the engine compartment through Manual Butterfly Valve A4348 and Quick Disconnect Couplings A4346 and B502, and through Manual Butterfly Valve A4347 and Quick Disconnect Couplings A4345 and B502.

Also, associated with the ECS hardware used to condition the S-I engine compartment is a deluge purge and a water quench system.

The deluge purge, supplied by the deluge purge panel in AGCS, is a 50-psig GN_2 purge that is initiated in the event of vehicle malfunction requiring launch abort.

GN_2, at 3000 psig from the pneumatic control distributor, enters the deluge purge panel and flows to Dome-Loaded Regulator A2255; and through preset Regulator A2252, Solenoid Valve A2254, and Orifice A2253 to the dome of Regulator A2255. When normally closed Solenoid Valve A2254 is actuated, 50-psig GN_2 from Regulator A2252 flows through the solenoid valve and Orifice A2253 to dome-load Regulator A2255, allowing 50-psig GN_2 to flow from Regulator A2255 into the S-I engine compartment conditioning ducts and be distributed in the same manner as the conditioned air. Pressure Gage A2251 monitors the purge panel inlet pressure; Pressure Gage A2258, the outlet pressure; and Pressure Gage A2261, the control pressure. When the deluge purge is initiated, Pressure Switch A2256 in the panel outlet actuates, energizing normally open Solenoid Valve A4388 and normally closed Solenoid Valve A4387. Energizing these solenoid valves removes 750-psig opening pressure and applies 750-psig closing pressure to Butterfly Valve A4342; thereby closing the valve to prevent the deluge purge from backing up into the environmental control unit. The purge panel is protected by Relief Valve A2257 in the panel outlet line. The conditioning duct is protected by Burst Disc A4341.

The deluge purge can be initiated manually at any time, but it is automatically initiated when any conax valve fires after the ignition command has been given.

Should the LCC receive an indication from the fire-detection temperature sensors in the engine compartment that a fire has developed within the compartment, a water quench operation will be manually initiated. The initiation signal actuates normally-open, solenoid-operated Pneumatic Valves A4903 and A4908, allowing 750-psig GN_2 to close the valves. The signal also actuates normally-closed, solenoid-operated Pneumatic Valves A4901 and A4909, allowing 750 psig GN_2 to open these valves. Opening of these valves allows water at 125 psig to flow into the engine compartment through the ECS conditioning ducts.

7.3. S-I Instrument Containers

The instrument containers are conditioned by air supplied by conditioning unit "A1" and control unit "B". The conditioned air flows from the control unit through Check Valve A4304 (figure 2) and is ducted up the umbilical tower and across swing arm number one to Transition Assembly A3058 (figure 3). Thermistor

A4212 in the transition assembly provides a temperature measurement for compartment temperature indication on the LCC compartment temperature control panel and the AGCS control unit panel and for air temperature regulator positioning. The conditioned air flows through the umbilical housing and into the vehicle through Precooling Check Valve Assembly B320, where it is ducted to the instrument containers and distributed by conical manifolds. The air flows out of the instrument containers and is discharged from the vehicle through Precooling Check Valve Assembly B321 and the umbilical housing. Orifice B322 provides continuous venting of the containers to prevent an excessive pressure buildup during flight.

7.4. S-IV Engine Compartment

Air for compartment conditioning is supplied by conditioning unit "A2" and control unit "C". The conditioned air flows into the compartment through Transition Assembly A4398, located on the swing arm number two connector plate, and is distributed within the compartment. The air flows out of the compartment through hinged panels. Thermistor E59 monitors the compartment temperature and provides a temperature measurement for indication on the LCC compartment temperature control panel and AGCS control unit panel and for air temperature regulation.

7.5. Instrument Unit and S-IV Forward Interstage

The GN_2 used to purge and cool the instrument unit components and to condition the instrument unit and interstage area is supplied by control unit "B". The GN_2 flowing through the instrument unit distribution duct from Transition Assembly A3282 and the swing arm three umbilical housing is distributed to the individual instrument unit components and the measuring racks in the S-IV forward interstage. The GN_2 flowing through Transition Assembly A3281, the umbilical housing, and the S-IV forward interstage distribution duct maintains a controlled environment within the instrument unit and interstage area. The GN_2 vents through four outlet ports in the vehicle skin.

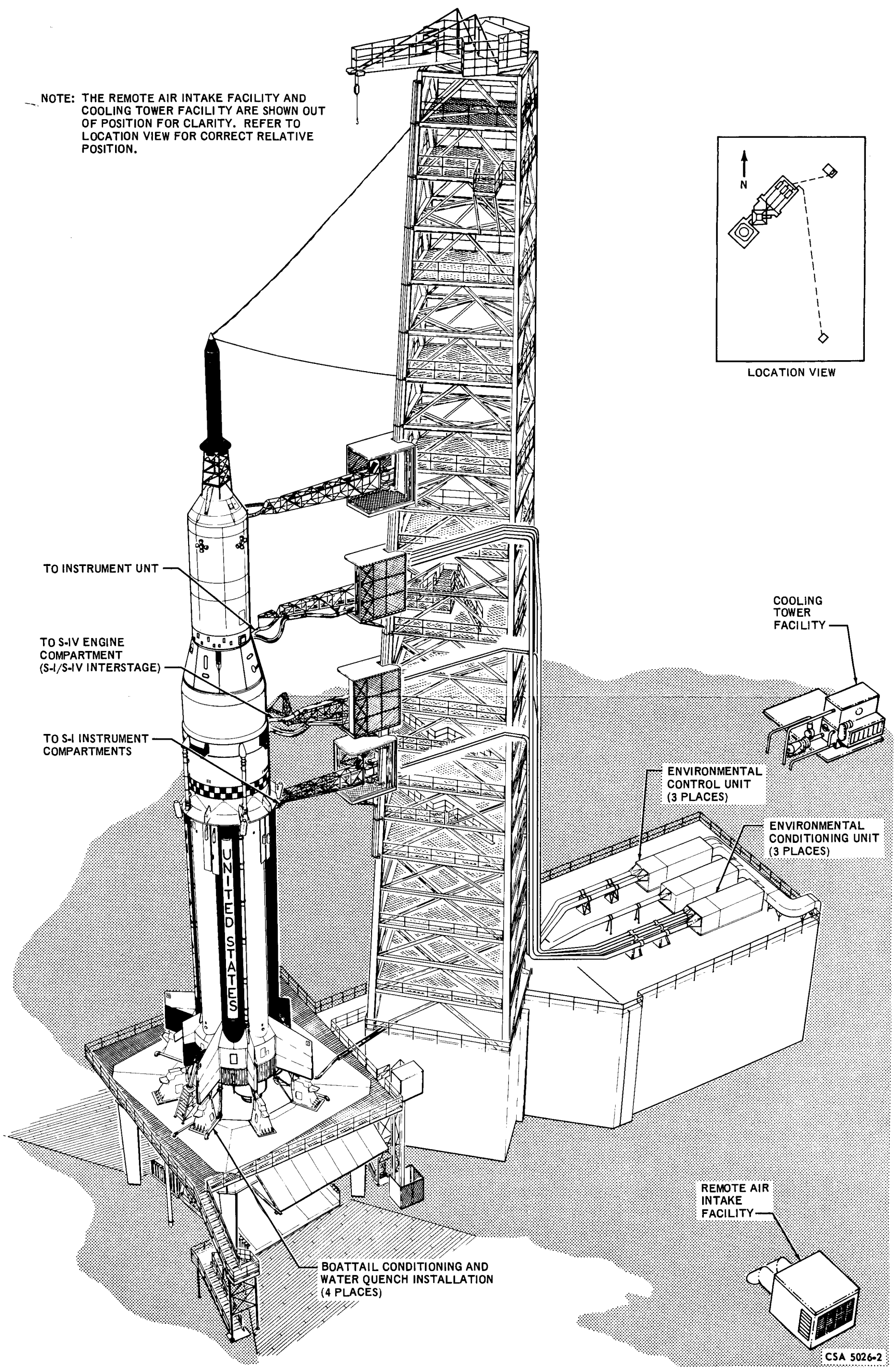

FIGURE 1. ENVIRONMENTAL CONTROL SYSTEM LOCATION DRAWING

LIST OF FINDING NUMBERS

* FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A2251	1	Gage, Pressure	0-5000 psi Range	Marsh PN 210 3SSFMH	75M50147-15	
A2252	1	Regulator, Internally Loaded	3150 ± 50 psi Inlet, 50 ± 5 psi Outlet	Wallace O. Leonard PN 146050-34	10437835	
A2253	1	Orifice	0.031 (+0.002, -0.001) in. diameter	Rocketdyne PN 9504-45062	10430000	
A2254	1	Valve, Solenoid	N.C.	Marotta PN 202873-113 (MV-74)	75M01351	55A4A1
A2255	1	Regulator, Dome Loaded	3150 ± 50 psi Inlet, 50 ± 5 psi Outlet	Grove PN 10977A087B	75M50341-3	
A2256	1	Switch, Pressure	Actuates at 20 ± .5 psi, Deactuates at 1.5 psi Below Actuation Pressure	Southwestern PN PS3704-20	10434297-5	
A2257	1	Valve, Relief	Relieves at 100 ± 5 psi, Reseats at 85 psi	Fluid Mechanics PN 2-1084	10430216-9	
A2258	1	Gage, Pressure	0-160 psi - Range	Marsh PN 210-CSFMH	75M50147-5	
A2259						
A2260						
A2261	1	Gage, Pressure	0-160 psi - Range	Marsh PN 210-CSFMH	75M50147-5	
A2262	1	Valve, Manual	1/4 in., Vent	Robbins PN SSNA-250-4T-787	75M01305-1	

* Location: A=Ground; B=S-I Stage; E=S-IV Stage; G=Instrument Unit; H=Payload

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A2263 through A2266 are not functionally applicable to this system.						
A2267	1	Valve, Relief	Cracking Pressure 140 ± 5 psi Reseat Pressure 126 psi	James, Pond, and Clark PN 5159T1-4TB-140	10430079	
A2268 through A3057 are not functionally applicable to this system.						
A3058	1	Transition Assembly			75M02015	
A3059 through A3280 are not functionally applicable to this system.						
A3281	1	Transition Assembly			75M06696	
A3282	1	Transition Assembly			75M07028	
A3283 through A4049 are not functionally applicable to this system.						
A4050	1	Valve, Manual	Make-up Water Valve 1-1/2 in.	Lunkenheimer PN 123		
A4051	1	Valve, Manual	3 in., Drain	Lunkenheimer PN 123		
A4052	1	Valve, Float		Baltimore Aircoil PN 50-390SA		
A4053	1	Blower W/Motor		Baltimore Aircoil PN TM175		182B2

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4054	1	Pump W/Motor	10 hp, 1740 rpm	Allis Chalmers PN 5X4-L-C3		181B1
A4055	1	Valve, Manual	1/4 in., Vent	Lunkenheimer PN 123		
A4056	1	Valve, Manual				
A4057	1	Valve, Manual				
A4058	1	Valve, Manual	1/4 in., Vent	Lunkenheimer PN 123		
A4059	1	Valve, Pneumatic, Flow Control	Condenser Water Flow Control Valve 3-Way 4"	Minneapolis-Honeywell PN V5013A		
A4060	1	Orifice	Load Balancing Orifice			
A4061	1	Condenser, Shell and Tube		Trane Co. Part of PN CDS-153		
A4062	1	Valve, Manual	Condenser Inlet Service Valve 2-1/8 in. O.D.F.	Mueller Brass PN A15168		
A4063	1	Valve, Manual	Condenser Purge Valve 1/2 MPT x 1/2	Superior Valve & Fitting Co. PN 605-8D		
A4064	1	Valve, Relief	Condenser Pressure Relief Valve	Trane Co. Part of PN CDS-153		
A4065	1	Valve, Manual	Condenser Outlet Valve	Trane Co. Part of PN CDS-153		

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4066	1	Valve, Manual	Refrigerant Charge Valve 1/4 in.	Kero-Test Mfg. Co. PN R-224-X1		
A4067	1	Valve, Manual	Filter-Drier Service Valve 1-5/8 in. O.D.F.	Superior Valve & Fitting Co. PN 193-15S		
A4068	1	Valve, Manual	Filter-Drier Service Valve 1-5/8 in. O.D.F.	Superior Valve & Fitting Co. PN 193-15S		
A4069	1	Valve, Manual	Filter-Drier Bypass Valve 1-5/8 in. O.D.F.	Superior Valve & Fitting Co. PN 193-15S		
A4070	1	Filter-Drier	1-5/8 in. Core	Sporlan Valve Co. PN C19213 W/RC-4864		
A4071	1	Valve, Solenoid	1-5/8 in. O.D.F.	Sporlan Valve Co. Type 100-S		181A3L2
A4072	1	Orifice	Blower Inlet Orifice			
A4073	1	Orifice	Blower Inlet Orifice			
A4074						
A4075	1	Regulator, Differential Pressure	3 in.	Fisher Governor Co. PN 644-AR		
A4076	1	Thermistor		Minneapolis-Honeywell L 7022A-1002		181A3RT8
A4077	1	Valve, Solenoid	115 V, 3/8 in. x 1/2 in.	Sporlan Valve Co. Type 10S		181A3L1

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4078	2	Flow Control Regulator Assembly	Hot Gas Bypass Regulator W/Pilot 0-80 psi Range Pilot 1-5/8 O.D.F.	Alco Valve Co. PN HGR-15H		
A4079	1	Compressor, Refrigerant	1750 rpm	Dunham-Bush PN B10-H, Type 61AU		181A3B22
A4080	1	Thermistor		Minneapolis-Honeywell PN L7022A-1002		181A2RT8
A4081	1	Valve, Manual	Compressor Discharge Valve	Dunham-Bush Part of PN B10-H, Type 61AU		
A4082	1	Valve, Manual	Compressor Suction Valve	Dunham-Bush Part of PN B10-H, Type 61AU		
A4083	1	Valve, Manual	Calibration Valve 1/4 in. O.D.F.	Mueller Brass PN A-14838		
A4084	1	Valve, Manual	Calibration Valve 1/4 in. O.D.F.	Mueller Brass PN A-14838		
A4085	1	Switch, Differential Pressure	High-Low Pressure Switch	Penn Controls PN 4DP2#271		181A3S50
A4086	1	Controller, Pressure		Minneapolis-Honeywell PN RP7904A MK IV		181A3TC9
A4087						
A4088	1	Controller, Pressure	Remote Air Pressure Controller			
A4089	1	Regulator, Pneumatic Flow Control	Refrigerant Boiling Pressure Regulator 4 in., 18 psig Closing Pressure	Minneapolis-Honeywell Series 800, Type 12		

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4090	1	Valve, Thermal Expansion	1-1/8 in. x 1-5/8 in. O.D.F.	Sporlan Valve Co. PN MVE-42		
A4091	1	Switch, Differential Pressure	Oil Pressure Failure Switch	Penn Controls PN 2D5-275A010		181A3S49
A4092						
A4093	1	Valve, Solenoid	3-Way, 115V, 60 Cycle	Sporlan Valve Co. PN Type 180		181A3L3
A4094	1	Valve, Thermal Expansion	1-1/8 in. x 1-5/8 in. O.D.F.	Sporlan Valve Co. PN MVE-34		
A4095	1	Valve, Solenoid	120 vac, 3-Way	Auto Switch Co. Cat. No. 83147		181A3A1L7
A4096	1	Valve, Solenoid	120 vac, 3-Way	Auto Switch Co. Cat. No. 83147		181A3A-1L5
A4097	1	Regulator, Flow Control	6 in.	Mason-Neilan, Model 137-3		
A4098	1	Regulator, Flow Control	4 in.	Mason-Neilan PN 137-3		
A4099	1	Blower	3100 scfm & 58-1/2" Static Pressure @ 3550 rpm	Buffalo-Forge Co. PN CB-40-4		
A4100	1	Motor	405 vdc 75 hp @ 3600 rpm	Buffalo-Forge Co.		181A3B21
A4101	1	Blower	1500 scfm & 58-1/2" Static Pressure @ 3550 rpm	Buffalo-Forge Co. PN CB40-3		

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4102	1	Valve, Solenoid	1/2-in. Pipe Connect, 3-Way	Auto Switch Co. PN 8300 A74-G		181A3A1L4
A4103	1	Valve, Solenoid	1/2-in. Pipe Connect, 3-Way	Auto Switch Co. PN 8300 A74-G		181A3A1L6
A4104	1	Sight Glass		Superior Valve & Fitting Co. PN 823-15ST		
A4105	1	Evaporator Coil		Dunham-Bush PN 10701		
A4106	1	Valve, Flow Control	Desuperheating Valve	Sporlan Valve Co. PN PVE-18-C		
A4107	1	Filter	16" x 36.5" x 1.87"	Farr Company PN B-20753 Type 44 Special		
A4108	1	Filter	16" x 36.5" x 1.87"	Farr Company PN B-20753 Type 44 Special		
A4109	1	Valve, Manual				
A4110	1	Valve, Manual	1/4 in.	Lunkenheimer PN 123		
A4111	1	Valve, Pneumatic Flow Control	Water Flow Control Valve 3-Way	Minneapolis-Honeywell PN V5013A		
A4112	1	Orifice				
A4113	1	Valve, Manual	Condenser Inlet Valve 2-1/8 in. O.D.F.	Mueller Brass PN A15168		

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4114	1	Valve, Manual	Condenser Purge Valve 1/2 MPT x 1/2	Superior Valve & Fitting Co. PN 605-8D		
A4115	1	Valve, Relief	Condenser Pressure Relief Valve	Trane Co. Part of PN CDS-153		
A4116	1	Valve, Manual		Trane Co. Part of PN CDS-153		
A4117	1	Condenser, Shell and Tube		Trane Co. Part of PN CDS-153		
A4118	1	Filter-Drier	Core 1-5/8 in.	Sporlan Valve Co. PN C-19213W/RC4864		
A4119	1	Valve, Manual	Filter-Drier Bypass Valve 1-5/8 in. O.D.F.	Superior Valve & Fitting Co. PN 193-15S		
A4120	1	Valve, Manual	Filter-Drier Service Valve 1-5/8 in. O.D.F.	Superior Valve & Fitting Co. PN 193-15S		
A4121	1	Valve, Manual Shut-off	Filter-Drier Service Valve 1-5/8 in. O.D.F.	Superior Valve & Fitting Co. PN 193-15S		
A4122	1	Regulator, Differential Pressure	3 in.	Fisher Governor Co. PN 644-AR		
A4123	1	Flow Control Regulator Assembly	Hot Gas Bypass Regulator W/Pilot 1-5/8 in. O.D.F. 0-80 psi Range Pilot	Alco Valve Co. PN HGR-15H		
A4124	1	Valve, Solenoid	115V, 3/8 in. x 1/2	Sporlan Valve Co. Type 10S		181A2L1
A4125	1	Valve, Flow Control	Desuperheating Valve	Sporlan Valve Co. PN PVE-18-C		

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4126	1	Compressor, Refrigerant	1750 rpm	Dunham-Bush PN B10-H, Type 61AU		181A2B22
A4127	1	Regulator, Pneumatic, Flow Control	Refrigerant Boiling Pressure Regulator 4 in. 18 psig closing pressure	Minneapolis-Honeywell Series 800, Type 12		
A4128	1	Valve, Manual	Compressor Discharge Valve	Dunham-Bush Part of PN B10-H, Type 61AU		
A4129	1	Valve, Manual	Compressor Suction Valve	Dunham-Bush Part of PN B10-H, Type 61AU		
A4130	1	Valve, Manual	Calibration Valve 1/4 in., O.D.F.	Mueller Brass PN A-14838		
A4131	1	Valve, Manual	Calibration Valve 1/4 in., O.D.F.	Mueller Brass PN A-14838		
A4132	1	Controller, Pressure		Minneapolis-Honeywell PN RP 7904A MK IV		181A2A1TC9
A4133						
A4134	1	Valve, Thermal Expansion	1-1/8 in. x 1-5/8 in. O.D.F.	Sporlan Valve Co. PN MVE-42		
A4135						
A4136	1	Sight Glass		Superior Valve & Fitting Co. PN 823-15ST		
A4137	1	Valve, Solenoid	3-Way, 60 Cycles, 115 V	Sporlan Valve Co. Type 180		181A2L3

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4138	1	Valve, Solenoid	3-Way, 120 vac	Auto Switch Co. Cat. No. 83147		181A2A1L7
A4139	1	Valve, Solenoid	3-Way, 120 vac	Auto Switch Co. Cat. No. 83147		181A2A1L5
A4140	1	Regulator, Flow Control	Nitrogen Purge Regulator 6 in.	Mason-Neilan Model 137-3		
A4141	1	Regulator, Flow Control	Nitrogen Purge Regulator 4 in.	Mason-Neilan PN 137-3		
A4142	1	Blower	3100 scfm & 58-1/2" Static Pressure @ 3550 rpm	Buffalo-Forge Co. PN CB-40-4		
A4143	1	Motor	405 vdc motor, 75 hp @ 3600 rpm	Buffalo-Forge Co. PN CB-40-3		
A4144	1	Blower	1550 scfm & 58-1/2" Static Pressure @ 3550 rpm	Buffalo-Forge Co. PN CB-40-3		
A4145	1	Valve, Solenoid	Ball Damper Solenoid Valve 3-Way, 1/2-in. Pipe Connect	Auto Switch Co. PN 8300 A74-G		181A2A1L4
A4146	1	Filter	Inlet Air Filter 16" x 36.5" x 1.87"	Farr Company		
A4147	1	Valve, Solenoid	Ball Damper Solenoid Valve 3-Way, 1/2-in. Pipe Connect	Auto Switch Co. PN 8300 A74-G		181A2A1L6
A4148	1	Filter	Inlet Air Filter 16" x 36.5" x 1.87"	Farr Company PN B-20753		
A4149	1	Coil, Evaporator		Dunham-Bush PN 10701		

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4150	1	Valve, Manual	Cooling Tower Blow-down Valve			
A4151	1	Valve, Thermal Expansion	1-1/8 x 1-5/8 in. O.D.F.	Sporlan Valve Co. PN MVE-34		
A4152	1	Valve, Manual	Condenser Drain Valve 1/4 in.	Lunkenheimer PN 123		
A4153	1	Valve, Manual	Condenser Water Service Valve			
A4154	1	Valve, Manual	Condenser Water Service Valve			
A4155	1	Valve, Manual	1/4 in.	Lunkenheimer PN 123		
A4156	1	Valve, Pneumatic Flow Control	Water Flow Control Valve 3-Way, 4"	Minneapolis-Honeywell PN V5013A		
A4157	1	Orifice				
A4158	1	Condenser, Shell & Tube		Trane Co. PN CDS-153		
A4159	1	Filter-Drier	1-5/8 in. Core	Sporlan Valve Co. PN C19213 W/RC-4864		
A4160	1	Valve, Manual	Condenser Inlet Service Valve 2-1/8 in. O.D.F.	Mueller Brass PN 15168		
A4161	1	Valve, Manual	Condenser Purge Valve 1/2 MPT x 1/2	Superior Valve & Fitting Co. PN 605-8D		

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4162	1	Valve, Relief	Condenser Pressure Relief Valve	Trane Co. Part of PN CDS-153		
A4163	1	Valve, Manual	Condenser Outlet Service Valve	Trane Co. Part of PN CDS-153		
A4164	1	Valve, Manual	Filter-Drier Service Valve 1-5/8 in. O.D.F.	Superior Valve & Fitting Co., PN 193-15S		
A4165	1	Valve, Manual	Filter-Drier Service Valve 1-5/8 in. O.D.F.	Superior Valve & Fitting Co., PN 193-15S		
A4166	1	Valve, Manual	Filter-Drier Service Valve 1-5/8 in. O.D.F.	Superior Valve & Fitting Co., PN 193-15S		
A4167	1	Valve, Flow Control	Desuperheating Valve	Sporlan Valve Co. PN PVE-18-C		
A4168	1	Compressor, Refrigerant	1750 rpm	Dunham-Bush PN B10-H, Type 61AU		181A1B22
A4169	1	Regulator, Differential Pressure	3 in.	Fisher Governor Co. PN 644-AR		
A4170	1	Flow Control Regulator Assembly	Hot Gas Bypass Regulator W/Pilot 0-80 psi Range Pilot W/1-5/8 in. O.D.F.	Alco Valve Co. PN HGR-15H		
A4171	1	Valve, Solenoid	115V, 3/8 in. x 1/2 in.	Sporlan Valve Co. Type 10S		181A1L1
A4172	1	Valve, Manual	Compressor Discharge Valve	Dunham-Bush Part of PN B10-H Type 61AU		
A4173	1	Valve, Manual	Compressor Suction Valve	Dunham-Bush Part of PN B10-H, Type 61AU		

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4174	1	Valve, Manual	Calibration Valve 1/4 in. O.D.F.	Mueller Brass PN A-14838		
A4175	1	Controller, Pressure		Minneapolis-Honeywell PN RP 7904A MK IV		181A1A1TC9
A4176						
A4177						
A4178						
A4179	1	Valve, Solenoid	3-Way, 115V, 60 Cycle	Sporlan Valve Co. Type 180		181A1L3
A4180						
A4181	1	Sight Glass		Superior Valve & Fitting Co. PN 823-15ST		
A4182	1	Valve, Thermal Expansion	1-1/8 in. x 1-5/8 in. O.D.F.	Sporlan Valve Co. PN MVE-34		
A4183	1	Valve, Solenoid	Nitrogen Purge Solenoid 120 vac, 3-Way	Auto Switch Co. Cat. No. 83147		181A1A1L7
A4184	1	Valve, Solenoid	120 vac, 3-Way	Auto Switch Co. Cat. No. 83147		181A1A1L5
A4185	1	Regulator, Flow Control	Nitrogen Purge Regulator 6 in.	Mason-Neilan Mod. 137-3		

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4186	1	Regulator, Flow Control	Nitrogen Purge Regulator 4 in.	Mason-Neilan PN 137-3		
A4187	1	Blower	3100 scfm & 58-1/2" Static Pressure @ 3550 rpm	Buffalo Forge Co. PN CB-40-4		
A4188	1	Blower	1550 scfm & 58-1/2" Static Pressure @ 3550 rpm	Buffalo Forge Co. PN CB-40-3		
A4189	1	Filter	16" x 36.5" x 1.87"	Farr Company PN B-20753, Type 44 Special		
A4190	1	Filter	16" x 36.5" x 1.87"	Farr Company PN B-20753, Type 44 Special		
A4191	1	Valve, Solenoid	Ball Damper Solenoid Valve 3-Way, 1/2-in. Pipe Connect	Auto Switch Co. PN 8300 A74-G		181A1A1L4
A4192	1	Valve, Solenoid	Ball Damper Solenoid Valve 3-Way, 1/2-in. Pipe Connect	Auto Switch Co. PN 8300 A74-G		181A1A1L6
A4193	1	Evaporator Coil		Dunham-Bush PN 10701		
A4194	1	Thermistor		Minneapolis-Honeywell PN L7022A-1002		181A1RT8
A4195	1	Valve, Solenoid	1-5/8 in. O.D.F. 115V, 60 Cycle	Sporlan Valve Co. Type 100S		181A2L2
A4196	1	Valve, Solenoid	1-5/8 in. O.D.F. 115V, 60 Cycle	Sporlan Valve Co. Type 100S		
A4197	1	Reheat Coil		Dunham-Bush PN 10705		

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4198	1	Controller, Temperature		Imperial Electronics PN 1146-100		181A4A2-TC4
A4199	1	Regulator, Motor Operated		Minneapolis-Honeywell Model 1407 W/M930B		181A4B7
A4200	1	Reheat Coil		Dunham-Bush PN 10705		
A4201	1	Controller, Temperature		Imperial Electronics PN 1146-100		181A4A2-TC5
A4202	1	Regulator, Motor Operated		Minneapolis-Honeywell Model 1407 W/M930B		181A4B13
A4203	1	Reheat Coil		Dunham-Bush PN 10705		
A4204	1	Controller, Temperature		Imperial Electronics PN 1146-100		181A4A2-TC6
A4205	1	Regulator, Motor Operated		Minneapolis-Honeywell Model 1407 W/M930B		
A4206	1	Reheat Coil		Dunham-Bush PN 10705		
A4207	1	Controller, Temperature		Imperial Electronics PN 1146-100		181A4A2-TC7
A4208	1	Regulator, Motor Operated		Minneapolis-Honeywell Model 1407 W/M930B		181A4B17
A4209	1	Filter	Remote Air Intake			

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4210	1	Damper	Remote Air Intake			
A4211	1	Fan	Remote Air Intake			
A4212	1	Thermistor				
A4213						
A4214						
A4215	1	Controller, Temperature		Imperial Electronics PN 1146-100		181A5A2-TC3
A4216	1	Reheat Coil		Dunham-Bush PN 10706		
A4217	1	Regulator, Motor Operated		Minneapolis-Honeywell Model 1407 W/M930B		181A5B6
A4218						
A4219						
A4220	1	Controller, Temperature		Imperial Electronics PN 1146-100		181A6A2-TC2
A4221	1	Reheat Coil		Dunham-Bush PN 10707		

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4222	1	Regulator, Motor Operated		Minneapolis-Honeywell Model 1407 W/M930B		
A4223	1	Reheat Coil		Dunham-Bush PN 10707		
A4224	1	Regulator, Motor Operated		Minneapolis-Honeywell Model 1407 W/M930B		181A6B2
A4225	1	Controller, Temperature		Imperial Electronics PN 1146-100		181A6A2-TC1
A4226	1	Duct Probe Assembly		Imperial Electronics PN 1151-100		181S12
A4227	1	Valve, Manual	Reheat Coil Service Valve			
A4228	1	Valve, Manual	Reheat Coil Service Valve			
A4229	1	Valve, Manual	Reheat Coil Service Valve			
A4230	1	Valve, Manual	Reheat Coil Service Valve			
A4231	1	Valve, Manual	Reheat Coil Service Valve			
A4232	1	Valve, Manual	Reheat Coil Service Valve			
A4233	1	Reheat Coil		Dunham-Bush		

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4234	1	Controller, Temperature		Imperial Electronics PN 1146-100		181A4TC8
A4235	1	Regulator, Motor-Operated	Air Temperature Regulator	Minneapolis-Honeywell Model 1407 W/M930B		181A4B24
A4236	1	Valve, Check				
A4237	1	Valve, Motor-Operated	Air Flow Damper 120 V	Minneapolis-Honeywell PN M630A Type MG-30A-T205-2		181B25
A4238	1	Orifice				
A4239	1	Transducer, Differential Pressure	Air Flow Transducer	Foxboro Co. PN 613 DL-LK2		181MT8
A4240	1	Switch, Differential Pressure		F.W. Dwyer Co. Model 1627-12		
A4241	1	Heater, Duct				181A4H-R20
A4242	1	Switch, Thermal	Over Temperature Switch			
A4243						
A4244	1	Motor	405 vdc Motor 75 hp, 3600 rpm	Buffalo-Forge Co.		181A1B21
A4245	1	Heater Duct	2667 Watt	Heat Engineering PN 1302-10		181A5HR1 181A5HR2 181A5HR3

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4246	1	Heater Duct		Heat Engineering PN 1302-10		
A4247						
A4248	1	Damper, Spherical, Ball		Air Factors, Inc. PN S-8-9000		
A4249	1	Damper, Spherical, Ball		Air Factors, Inc. PN S-8-9000		
A4250	1	Controller, Pressure		Mason-Neilan PN 2717		
A4251	1	Controller, Pressure		Mason-Neilan PN 2717		
A4252	1	Controller, Pressure		Mason-Neilan PN 2717		
A4253	1	Controller, Pressure		Mason-Neilan PN 2717		
A4254	1	Damper, Spherical, Ball		Air Factors, Inc. PN S-8-9000		
A4255	1	Damper, Spherical, Ball		Air Factors, Inc. PN S-8-9000		
A4256						
A4257						

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4258	1	Switch, Differential Pressure		Penn Controls Code 2D5, Type 275AP10		181A2A1-S49
A4259						
A4260	1	Controller, Pressure		Mason-Neilan PN 2717		
A4261	1	Controller, Pressure		Mason-Neilan PN 2717		
A4262	1	Damper, Spherical, Ball		Air Factors, Inc. PN S-8-9000		
A4263	1	Damper, Spherical, Ball		Air Factors, Inc. PN S-8-9000		
A4264						
A4265						
A4266						
A4267	1	Switch, Differential Pressure		Penn Controls Code 2D5, Type 275AP10		181A1A1-S49
A4268						
A4269	1	Regulator, Pressure	8 psi and 20 psi	Mason-Neilan Model 71		

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4270	1	Regulator, Pressure	8 psi and 20 psi	Mason-Neilan Model 71		
A4271	1	Valve, Manual	Nitrogen Supply Shutoff Valve 12 in., 150 psi W/Handwheel	Keystone Valve Co. Figure 100		
A4272	1	Valve, Manual	Reheat Control Service Valve 1-1/8 in. O.D.F.	Superior Valve & Fitting Co. PN 191-11ST		
A4273	1	Valve, Manual	Reheat Coil Service Valve 1-1/8 in. O.D.F.	Superior Valve & Fitting Co. PN 191-11ST		
A4274	1	Gage, Pressure	Compressor Discharge Pressure 4-1/2 in. Dial 0-400 Range	Marsh Instrument Co. PN 1 FMRB		
A4275	1	Gage, Pressure	Compressor Suction Pressure 4-1/2 in. Dial	Marsh Instrument Co. PN 3 FMRB		
A4276	1	Valve, Manual	Reheat Coil Service Valve 1-1/8 in. O.D.F.	Superior Valve & Fitting Co. PN 191-11ST		
A4277	1	Valve, Manual	Reheat Coil Service Valve 1-1/8 in. O.D.F.	Superior Valve & Fitting Co. PN 191-11ST		
A4278	1	Gage, Pressure	Compressor 4-1/2 in. Dial	Marsh Instrument Co., PN 1 FMRB		
A4279	1	Switch, Differential Pressure	High Low Pressure Switch	Penn Controls Code 4DB2, Type 271AP12AN		181A2A1-S50
A4280	1	Valve, Manual	Reheat Coil Service Valve 1-1/8 in. O.D.F.	Superior Valve & Fitting Co. PN 141-11ST		
A4281	1	Valve, Manual	Reheat Coil Service Valve 1-1/8 in. O.D.F.	Superior Valve & Fitting Co. PN 191-11ST		

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4282	1	Gage, Pressure	Compressor Discharge Pressure 4-1/2 in. Dial	Marsh Instrument Co. PN 1 FMRB		
A4283	1	Switch, Differential Pressure		Penn Controls, Code 4DB2, Type 271AP12AN		
A4284	1	Gage, Pressure	Compressor Suction Pressure 4-1/2 in. Dial	Marsh Instrument Co. PN 3 FMRB		
A4285	1	Valve, Manual	Calibration Valve 1/4 in. O.D.F.	Mueller Brass PN A-14838		
A4286	1	Regulator, Flow Control	Refrigerant Boiling Pressure Regulator 4 in. 18 psig Closing Pressure	Minneapolis-Honeywell Series 800, Type 12		
A4287	1	Thermistor (Indicator)		Imperial Electronics PN 1149-100		181A3RT6
A4288	1	Thermistor (Indicator)		Imperial Electronics PN 1149-100		181A3RT7
A4289	1	Valve, Thermal Expansion	1-1/8 in. x 1-5/8 in. O.D.F.	Sporlan Valve Co. PN MVE-42		
A4290						
A4291	1	Transducer, Differential Pressure	Air Flow Transducer	Foxboro Co. PN 613 DL-LK2		181MT4
A4292	1	Venturi				
A4293	1	Valve, Motor Operated	Air Flow Control Damper	Minneapolis-Honeywell PN M630 A, Type MG-30A-T205-2		181B16

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4294	1	Transducer, Differential Pressure	Air Flow Transducer	Foxboro Co., PN 613 DL-LK2		181MT3
A4295	1	Venturi				
A4296	1	Valve, Motor Operated	Air Flow Control Damper	Minneapolis-Honeywell PN M630 A, Type MG-30A-T205-2		181B14
A4297	1	Orifice				
A4298	1	Valve, Motor Operated	Air Flow Control Damper	Minneapolis-Honeywell PN M630 A, Type MG-30A-T205-2		181B11
A4299	1	Transducer, Differential Pressure	Air Flow Transducer	Foxboro Co. PN 613 DL-LK2		181MT5
A4300	1	Orifice				
A4301	1	Valve, Motor Operated	Air Flow Control Damper	Minneapolis-Honeywell PN M630 A, Type MG-30A-T205-2		181B12
A4302	1	Transducer, Differential Pressure	Air Flow Transducer	Foxboro Co. PN 613 DL-LK2		181MT7
A4303	1	Orifice				
A4304	1	Valve, Motor Operated	Air Flow Control Damper	Minneapolis-Honeywell PN M630 A, Type MG-30A-T205-2		181B4
A4305	1	Transducer, Differential Pressure	Air Flow Transducer	Foxboro Co. PN 613 DL-LK2		181MT2

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4306	1	Transducer, Differential Pressure	Air Flow Transducer	Foxboro Co. PN 613 DL-LK2		181MT6
A4307	1	Valve, Motor Operated	Air Flow Control Damper	Minneapolis-Honeywell PN M630 A, Type MG-30A-T205-2		181B9
A4308	1	Venturi				
A4309	1	Orifice				
A4310	1	Valve, Motor Operated	Air Flow Control Damper	Minneapolis-Honeywell PN M630 A, Type MG-30A-T205-2		181B1
A4311	1	Transducer, Differential Pressure	Air Flow Transducer	Foxboro Co. PN 613 DL-LK2		181MT1
A4312	1	Thermistor (Indicator)		Imperial Electronics		181A3RT6
A4313	1	Thermistor (Indicator)		Imperial Electronics		181A3RT7
A4314	1	Thermistor (Indicator)		Imperial Electronics		181A2RT6
A4315	1	Thermistor (Indicator)		Imperial Electronics		181A2RT7
A4316	1	Filter	3/8" NPT	Mason-Neilan 61 Series		
A4317	1	Filter	3/8" NPT	Mason-Neilan 61 Series		

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4318	1	Gage, Pressure	5-60 psi Range	Mason-Neilan Model 71		
A4319	1	Gage, Pressure	5-60 psi Range	Mason-Neilan Model 71		
A4320	1	Valve, Check	4 in.	Lunkenheimer PN 1790		
A4321	1	Volume Booster		Mason-Neilan PN 972142-4 Cat. No. 20113		
A4322	1	Volume Booster		Mason-Neilan PN972142-4 Cat. No. 20113		
A4323	1	Volume Booster		Mason-Neilan PN 972142-4 Cat. No. 20113		
A4324	1	Volume Booster		Mason-Neilan PN 972142-4 Cat. No. 20113		
A4325	1	Volume Booster		Mason-Neilan PN 972142-4 Cat. No. 20113		
A4326	1	Volume Booster		Mason-Neilan PN 972142-4 Cat. No. 20113		
A4327	1	Env. Control Unit B				181A4
A4328	1	Env. Cond. Unit A-1				181A1
A4329	1	Env. Control Unit C				181A5

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4330	1	Env. Cond. Unit A-2				181A2
A4331	1	Env. Control Unit D				181A6
A4332	1	Env. Cond. Unit A-3				181A3
A4333	1	Switch, Pressure		Minneapolis-Honeywell PN P668A-1038-1		181S21a
A4334	1	Filter		Filter Corp. PN 18394-5		
A4335	1	Switch, Temperature		Minneapolis-Honeywell PN T675A-1029		181S18a
A4336	1	Gage, Pressure	Compressor Discharge Pressure 4-1/2 in., Dial	Marsh Instrument Co. PN 3 FMRB		
A4337	1	Valve, Manual	Refrigerant Charge Valve 1/4 in.	Kero-Test Mfg. Co. PN R-224-XL		
A4338	1	Valve, Manual	Refrigerant Charge Valve 1/4 in.	Kero-Test Mfg. Co. PN R-224-XL		
A4339	1	Valve, Manual, Butterfly				
A4340	1	Valve, Manual, Butterfly				
A4341	1	Disc, Burst	Burst Pressure 105-150 psig @ 80°F-100°F	Black, Sivalls & Bryson, PN 77-BSB-189 Lot# 165808		

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4342	1	Valve, Pneumatic	12 in.	Keystone Valve Corp. Figure 100		
A4343	1	Coupling, Disconnect			75M-02200	
A4344	1	Coupling, Disconnect			75M-02200	
A4345	1	Coupling, Disconnect			75M-02200	
A4346	1	Coupling, Disconnect			75M-02200	
A4347	1	Valve, Manual, Butterfly				
A4348	1	Valve, Manual, Butterfly				
A4349	1	Switch, Temperature				181A6A2S8
A4350	1	Switch, Temperature				181A5A2S20
A4351	1	Valve, Check		Lunkenheimer PN 1790		
A4352	1	Valve, Check		Lunkenheimer PN 1790		
A4353	1	Valve, Check		Lunkenheimer PN 1790		

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4354	1	Valve, Check		Lunkenheimer PN 1790		
A4355	1	Valve, Check		Lunkenheimer PN 1790		
A4356	1	Valve, Check		Lunkenheimer PN 1790		
A4357	1	Valve, Check		Lunkenheimer PN 1790		
A4358	1	Switch, Pressure		Minneapolis-Honeywell PN C645A-1006-1		181S19a
A4359	1	Valve, Manual	Condenser Water Drain 1/4 in.	Lunkenheimer PN 123		
A4360	1	Valve, Manual	Condenser Water Service Valve			
A4361	1	Switch, Temperature		Minneapolis-Honeywell PN T675A-1060		181A3A1-S51
A4362						
A4363	1	Switch, Temperature		Minneapolis-Honeywell PN T675A-1060		181A2A1-S51
A4364						
A4365	1	Switch, Temperature		Minneapolis-Honeywell PN T675A-1060		181A1A1-S51

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4366						
A4367	1	Switch, Pressure		Minneapolis-Honeywell PN C645A-1006-1		181S19b
A4368	1	Evaporator Coil		Dunham-Bush PN 10701		
A4369	1	Evaporator Coil		Dunham-Bush PN 10701		
A4370	1	Evaporator Coil		Dunham-Bush PN 10701		
A4371	1	Controller, Pressure	0-300 psi Capacity	Black, Sivalls & Bryson Type 72-24-2		
A4372	1	Controller, Pressure	0-300 psi Capacity	Black, Sivalls & Bryson Type 72-24-2		
A4373	1	Controller, Pressure	0-300 psi Capacity	Black, Sivalls & Bryson Type 72-24-2		
A4374	1	Valve, Manual	Refrigerant Line Purge Valve	Mueller Brass Co. PN A15802		
A4375	1	Valve, Manual	Refrigerant Line Purge Valve	Mueller Brass Co. PN A15802		
A4376	1	Valve, Manual	Refrigerant Line Purge Valve	Mueller Brass Co. PN A15802		
A4377	1	Switch, Pressure	Range 5-150 psig	Minneapolis-Honeywell PN 444R		181S21b

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4378	1	Switch, Temperature		Minneapolis-Honeywell PN T675A-1060		181S18b
A4379	1	Cooling Tower		Baltimore Aircoil PN TMA175		182A1
A4380	1	Switch, Differential Pressure		F. W. Dwyer Co. Model 1627-12		181S12
A4381	1	Switch, Differential Pressure		F. W. Dwyer Co. Model 1627-12		181S3
A4382	1	Switch, Differential Pressure		F. W. Dwyer Co. Model 1627-12		181S13
A4383	1	Switch, Differential Pressure		F. W. Dwyer Co. Model 1627-12		181S38
A4384	1	Switch, Differential Pressure		F. W. Dwyer Co. Model 1627-12		181S36
A4385	1	Switch, Differential Pressure		F. W. Dwyer Co. Model 1627-12		181S34
A4386	1	Switch, Differential Pressure		F. W. Dwyer Co.		181S25
A4387	1	Valve, Solenoid		Marotta Valve Co. PN MV123C		181L1
A4388	1	Valve, Solenoid		Marotta Valve Co. PN MV123C		181L2
A4389	1	Heat Exchanger				

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4390	1	Heat Exchanger				
A4391	1	Heat Exchanger				
A4392	1	Switch, Pressure				181A1A1-S53
A4393	1	Switch, Pressure				181A2A1-S53
A4394	1	Switch, Pressure				181A3A1-S53
A4395	1	Indicator, Moisture				
A4396	1	Indicator, Moisture				
A4397	1	Indicator, Moisture				
A4398	1	Transition Assembly				
A4399 through A4900 are not functionally applicable to this system.						
A4901	1	Valve, Solenoid-Operated Pneumatic				
A4902						

FINDING NUMBER	NO. REQD	COMPONENT	REMARKS	VENDOR	DRAWING NUMBER	ELEC SYM
A4903	1	Valve, Solenoid-Operated Pneumatic				
A4904 through A4907 are not functionally applicable to this system.						
A4908	1	Valve, Solenoid-Operated Pneumatic				
A4909	1	Valve, Solenoid-Operated Pneumatic				
A4910 through B319 are not functionally applicable to this system.						
B320	1	Precooling Check Valve Assembly		Calmec Mfg. Co. PN 319	20M40000	
B321	1	Precooling Check Valve Assembly		Calmec Mfg. Co. PN 319	20M40000	
B322	1	Orifice			20M40117	
B323 through B501 are not functionally applicable to this system.						
B502	4	Quick Disconnect		Calmec Mfg. Co.	20M30450	
B503 through E58 are not functionally applicable to this system.						
E59	1	Thermistor				

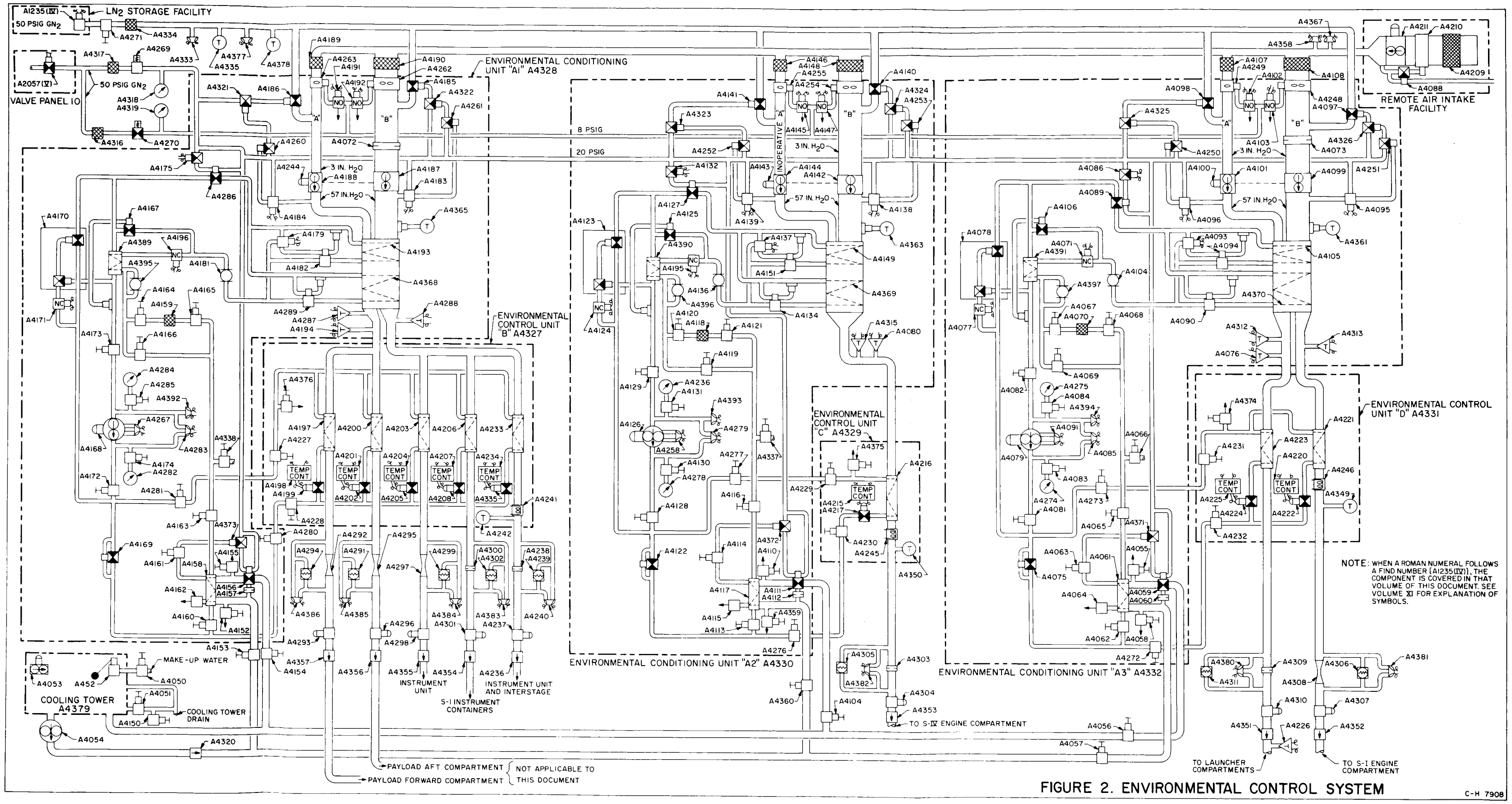

FIGURE 2. ENVIRONMENTAL CONTROL SYSTEM

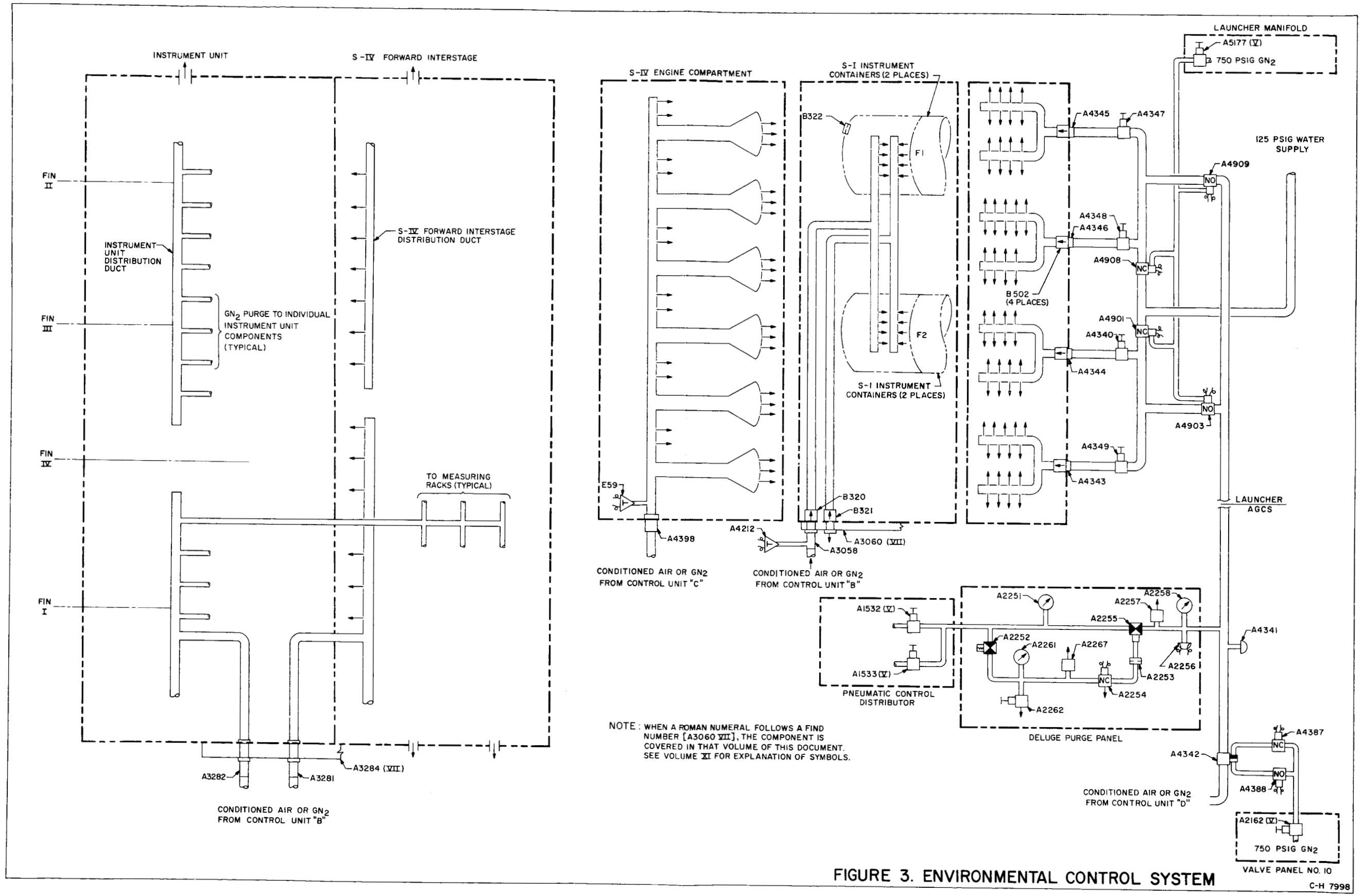

FIGURE 3. ENVIRONMENTAL CONTROL SYSTEM

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CCSD-NO (Dept. 2714), BEAMER, W. (14)
CCSD-NO (Dept. 2240), SIMMONS, F. (2)
DAC (Dept. A2-857), BELWOOD, H.
DAC, KEATING, J.
DAC, HOLLISTER, R. (Dept. A3-770)
I-I/IB-SI, CHAMBERS, J.
I-I/IB-SIV, FERGUSON, W.
I-I/IB-SIVH, LEAGUE, R.
I-I/IB-SIVL/DAC, STOOPS, G.
I-I/IB-SIVL-NASA/DAC-SACTO, TYSON, O.
I-I/IB-SIVL-NASA/DAC-SANTA MONICA, WEAVER, E.
I-MICH-OA, STEVENSON, H.
I-MICH-OA, QUINTON, H.
KN-BS27, WHISENANT, R.
KN-DA, POPPEL, T.
KN-DE2, HAHN, R.
KN-DE2, GRIFFIN, F.
KN-DE2, DZIADON, E. (2)
KN-DE2, REID, R.
KN-DE2, MOORE, R.
KN-DE2, STAHLEY, S.
KN-DE2, CHAPPLE, E.
KN-DE4, DOWNS, J.
KN-DE5, GRIFFIN, F.
KN-DF2, CAREY, T.
KN-DL2, BUCHANAN, D.
KN-DP2, MIMS, W.
KN-DP2, MINTON, C.
KN-DP2, SPARKMAN, O.
KN-DP2, WASILESKI, C.
KN-DP4, NELSON, R.
KN-DP5, WRIGHT, R.
KN-DR2, HOOKER, J. (5)
KN-DS232, BUNCH, M.
KN-ET, BRIDEWELL, C.
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KN-GT44, HAWKINS, G.
KN-L, GORMAN, R.
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KN-M, PICKETT, A.
KN-P, PETRONE, R.
KN-PA, MATTHEWS, E.
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KN-V, O'HARA, A.
KN-VG, RIGELL, I. (2)
KN-VG2, GREENFIELD, T.
KN-VG22, DOWLING, C. (4)
KN-VG23, ROUSE, C. (4)
KN-VL, GREENE, D. (5)
KN-VL, WHISENANT, E. (2)
KN-VM, PICKETT, A.
KN-VM2, ROBINSON, G.
KN-VM2, RAINWATER, W.
KN-VM3, PANTOLIANO, T. (3)
KN-VM22, DeLaROSA, H.
KN-VM22, FANNIN, L. (8)
KN-VM23, SCOVILLE, D.
KN-VM24, HILL, L.
LVO-DIR, WILLIAMS, M.
LVO-AD, ZEILER, A.
LVO-L, BELLAMY, E. (5)
R-ASTR-E, FICHTNER, H.
R-ASTR-EA, SMITH, R. (5)
R-ASTR-EAA, PASCHAL, L.
R-ASTR-ES, ADEN, R. (3)
R-ASTR-ESI, MILNER, R.
R-ASTR-I, HOBERG, O.
R-ASTR-IM, POWELL, J.
R-ASTR-TR, WAGNON, W.
R-ME-A, NOWAK, M.
R-P&VE-AV, NEIGHBORS, W.
R-P&VE/DAC, MEZO, C.
R-P&VE-PA, REED, K.
R-P&VE-PEM, HOLMES, J. (2)
R-P&VE-PM, FUHRMANN, H. (2)
R-P&VE-PP, HEUSINGER, B.
R-P&VE-PT, WOOD, C.
R-P&VE-V, PALAORO, H.
R-P&VE-VA, HOFFMAN, C.
R-P&VE-VAS, MOON, O.
R-P&VE-VF, ROTHE, K.
R-P&VE-VI, FAULKNER, W. (2)
R-P&VE-VK, BOONE, C.
R-P&VE-VM, BECK, M.
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R-P&VE-VO, KISTLER, W. (20)
R-P&VE-VS, SCHULZE, W.
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R-P&VE-VSI, HURT, W. (2)
R-P&VE-VSI, KRAUS, G. (2)

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R-QUAL-PI, CONAWAY, J.
R-TEST-CF, FORBIS, M.
R-TEST-I, SIEBER, W.
R-TEST-S, DRISCOLL, D.

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