N72-30425

SUMMARY OF WORK PERFORMED UNDER

CONTRACT NO. NAS8-26348

SOLENOID VALVE, TYPE 1

NASA P/N 20M32258-1

(Carleton P/N 2426-0001-1)

PREPARED BY M. L. Baczkowski	6/15/72	CARLETON CONTROLS CORPORATION	EAST AURORA, NEW YORK 14052	
APPROVED PROJ. ENGR. M. L. Baczkowski	16 JUNE 72	CODE IDENT. NO. 04577	CR 150	REV.
APPROVED Q.C. ENGR. E. Smolarek	6-16-72	CONTRACT NO. NAS8-263[illegible]	SHEET 1 OF 24	

REVISION STATUS OF SHEETS

Current Sheets of This Document are Listed Below

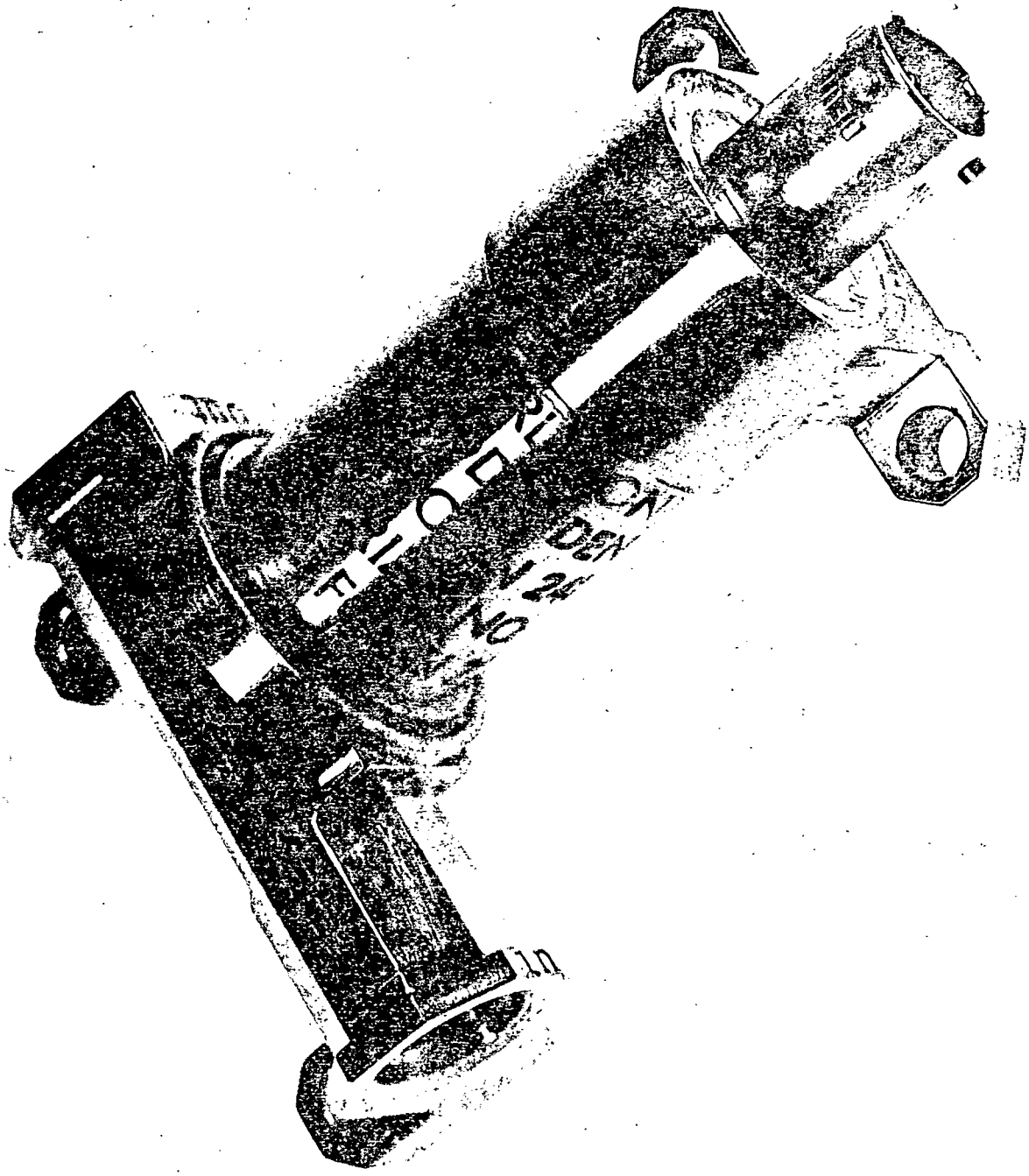
SHEET NO.	REV. LTR	SHEET NO.	REV. LTR	SHEET NO.	REV. LTR	SHEET NO.	REV. LTR

TEXT OF REVISION

REV.	PAGE	DESCRIPTION OF CHANGE	BY	DATE

SCOPE

The purpose of this report is to document and summarize the results of Carleton's work on the Valve Assembly, Solenoid, 2-Way Normally closed, manufactured in accordance with MSFC drawing 20M32258, contract No. NAS8-26348, Carleton Controls PN 2426-0001-1. The intended use of the valve was as a control element in the metabolic analyzer of biomedical experiment M-171 on the Skylab vehicle.



20M32258-1 Solenoid Valve, Type 1

CARLETON CONTROLS CORP. EAST AURORA, NEW YORK 14052	CODE IDENT. 04577	CR 150	REV.	
			SHEET 5	

HISTORY OF UNIT

The history of the unit will be covered in four steps:

1) Design Phase

2) Development Phase

3) Qualification Phase

4) Production Hardware

DESIGN PHASE

The design and development of this solenoid valve, MFSC PN 20M32258-1, presented several unique challenges which were successfully met in completing the order.

As in all spacecraft, minimization of equipment size and weight were important criteria. Page 26 of MSFC drawing 20M32258 (Exhibit A of Appendix) was used as a guide.

Looking at Carleton Controls drawing 2426-0002 (Exhibit B of Appendix) it is obvious that the specification goals were met and even bettered in the size and weight category.

To achieve this goal, extensive use was made of precision machined components optimized in size by design pressure requirements. In addition, the use of welding as an attachment and pressure retention device was utilized. See Carleton Controls drawing and parts list 2426-0001 (Exhibit C of Appendix). This eliminated the need for threaded fastenings to hold items (1) and (3) of drawing 2426-0001 together, and, as these are pressure boundary parts, it also eliminated the need for an "O" Ring Seal at their

interface.

Examination of item (6) Poppet and Plate Assembly on CCC drawing 2426-0001 will reveal two key features of the unit. One is the seat and seat retainer. The seat is retained in the core by a barbed metal center piece. This centers the seat in its cavity and by virtue of a slight undercut in the core piece creates a snap-in assembly. The need for thread retainers is eliminated making the design miniaturized and highly reliable. Another feature of this assembly is the centering effect the belleville spring, item (2) , has on the poppet and plate assembly, item (6.) This guides the assembly when the coil is energized and eliminates any sliding metal-to-metal contact.

DEVELOPMENT PHASE

The development phase of the contract consisted of testing during the assembly of the development unit, and after assembly, full fledged development testing.

During the pre-development testing, while the unit was being assembled, extensive work was done on the bifilar coil winding. Sample coils were wound, as below:

a) Conventionally

b) Conventionally on insulated copper spool

c) Bifilar coil on insulated copper spool

Voltage traces were taken with the results showing the bifilar coil on the insulated copper spool to have the lowest back EMI. The purpose

of this testing was to insure that the unit would meet the requirements of the "Orbital Workshop System (OWS) Electromagnetic Compatibility Control Plan No. 50M13087", particularly paragraph 5.4.5.2, Section d. This section states "transient levels on D.C. power busses do notexceed 50% of nominal bus voltage". Examining Exhibits E, F, and G, it is evident that the bifilar wound coil on the copper spool meets that requirement.

The development test procedure, CCC DTP 2426, was submitted to MSFC on 9 Sept. 1970. It was subsequently approved and the unit was then tested. The testing was successfully completed on 26 Feb. 1971 and results forwarded to MSFC under separate cover. A list of test sequences (Exhibit H) is enclosed in this report for reference.

QUALIFICATION PHASE

Two production units, serial no. 16 and 17 were selected to go through qualification testing per contract requirements. The qualification test procedure, CCC QTP 2426, was submitted to MSFC on 24 Sept. 1970, and subsequently approved.

The successful completion of qualification testing and submittal of qualification report QTR 2426 to MSFC was accomplished on 19 Nov. 1971.

PRODUCTION HARDWARE

Twenty eight (28) pieces of production hardware were shipped to MSFC to satisfy contract requirements. The program ran smoothly at Carleton for several reasons. One important one is the high level of technical

competence exhibited at all levels in the Carleton organization. As an aid to assembly and testing of the valves, several documents were generated by Carleton Engineering personel. They proved to be invaluable during this phase of the contract. Exhibit J and K valve shimming set up sheets are an example of one of these documents. These sheets were used to set up each unit to acheive specified performance.

The critical assembly check list, Exhibit L, accompanied each valve through the assembly phase and provided Quality Control with a check list of operations performed.

Each valve was tested to and passed the requirements of CCC ATP 2426. This document met the testing requirements of MSFC Spec. 20M32258 and was approved by MSFC. This acceptance testing insured that the performance of the solenoid valves met design requirements. A sample set of data sheets has been included in this report as Exhibit M.

One failure occured during the production phase of the program. CFA 191 (Exhibit N) contains the analysis and corrective action required.

One failure occured during acceptance testing at MSFC. This is documented in CFA 222 (Exhibit P).

CONCLUSION

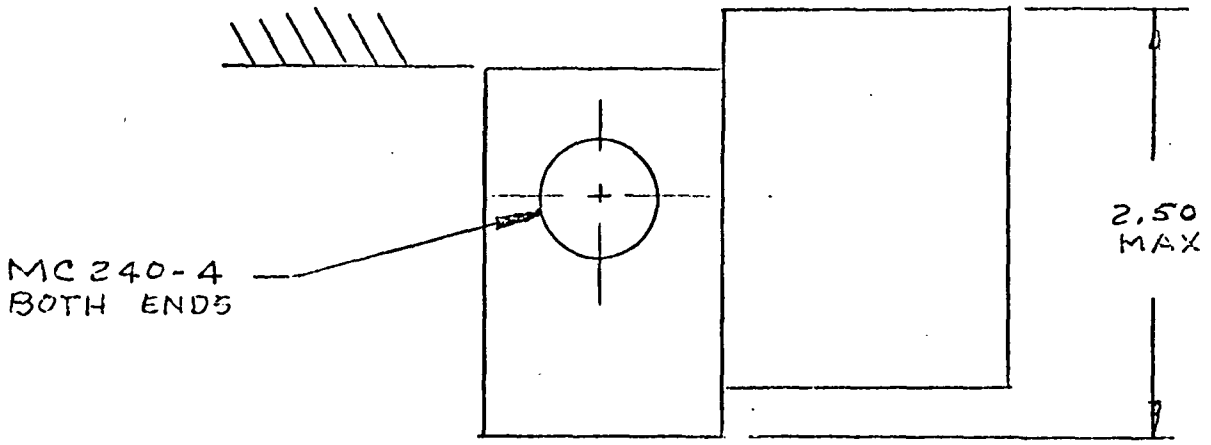
It is the opinion of Carleton Controls that all work performed under this contract was done in the best possible manner by the most expeditious route and at the most economical price. The cooperation exhibited by NASA personel during this program was at all times of the highest degree.

Carleton further believes that the solenoid valve performance exceeds specification requirements, specifically in the areas of size, weight, and low leakage. This bonus was achieved by a combination of conscientious engineering, fabrication, inspection, and assembly.

APPENDIX 1

Exhibits

REVISIONS			
SYM	DESCRIPTION	DATE	APPROVAL
A	Changed		



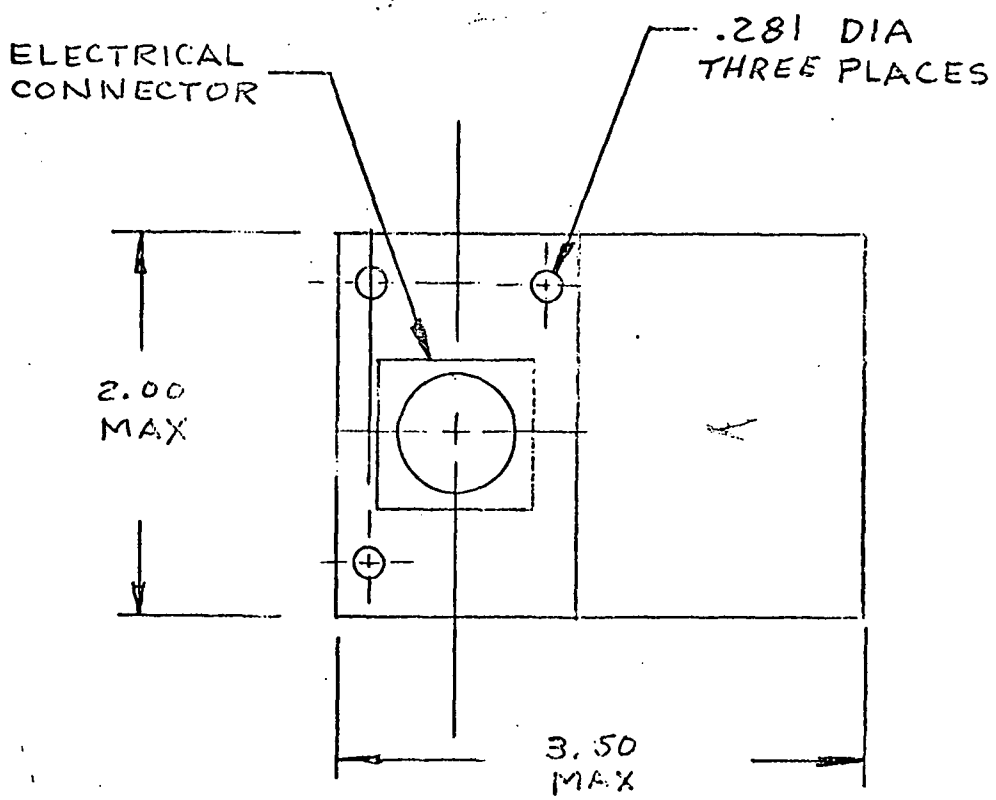


FIGURE 1 - Configuration

CODE IDENT NO	DWG SIZE	20M32258
	A	SHEET 26 of 26

REVISIONS

LTR.	E. O.	BY	DATE
A	2426-13	M.L.B.	12/7/70
B	2426-27	M. BACZ	11 JAN 71
C	2426-30	M. BACZ	5 FEB 71
D	2426-33	M. BACZ	5 MARCH 71
E	2426-35	M. BACZ	16 MARCH 71

LTR.	E. O.	BY	DATE

LTR.	E. O.	BY	DATE

REV. STATUS OF SHEETS																	
REV.	E	D	B														
SHEET	1	2	3														

USE WITH DRAWING 2426-0001, REV. E

		DRAWN BY M. Baczkowski	31 JULY 70
		DESIGN	
		CHECK	
		PROJ. ENGR.	
		R. CUMMINS SEPT 22, 1970 APPROVAL DESIGN ACTIVITY	
NEXT ASSY.	USED ON		
APPLICATION		APPROVAL OTHER	

CARLETON CONTROLS CORPORATION
EAST AURORA, NEW YORK 14052

PARTS LIST

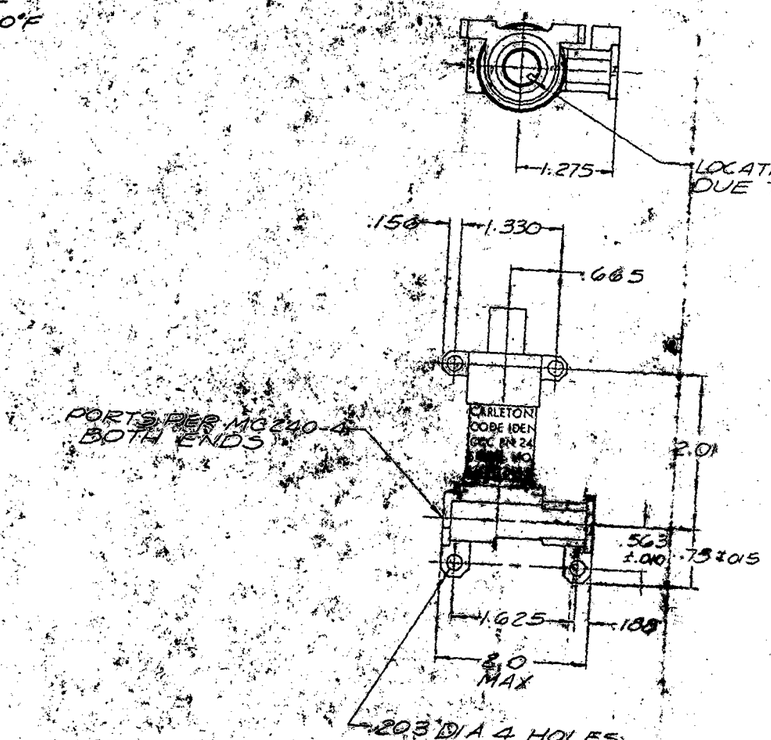
VALVE SOLENOID, 2-WAY NORMALLY CLOSED

SIZE	CODE IDENT NO.		REV.
A	04557	PL 2426-0001-1	E

SHEET 1 OF 3

ZONE	LTR	REVISIONS DESCRIPTION	DATE	APPROVED
	A	E.O. 2426-20	4-22-86	

SERVICE MEDIA:
AIR
GASEOUS O_2
GASEOUS N_2
MIXTURES OF O_2 & N_2
2. SYSTEM VOLTAGE
24 TO 32 VDC WITH 28VDC NOM
(A) 3. INTERNAL OPERATING PRESS:
0 TO 210 PSIG
4. EXTERNAL OPERATIONAL PRESS:
0 TO 35 PSIG
(A) 5. INTERNAL PROOF PRESS:
420 PSIG
6. EXTERNAL PROOF PRESS:
70 PSIG
(A) 7. BURST PRESS:
840 PSIG
8. COLLAPSE PRESS.
140 PSIG
9. TEMPERATURES:
OPERATING: +59°F TO +95°F
NON-OPERATING: -40°F TO +160°F



FIND NO.	QTY	PART NUMBER	NOMENCLATURE	CODE IDENT	MATERIAL	SPECIFICATION	FINISH PROTECTIVE FINISH
		2426-0001-1	VALVE, SOLENOID TWO WAY N.C.				

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
ALL DIMENSIONS AFTER PLATING
ALL SURFACES TO BE 63 PER USAS B46.1-62
ALL DIAMETERS TO BE CONCENTRIC WITHIN .005 T.I.R.
ALL INTERNAL AND EXTERNAL FILLET RADII .015 MAX
BREAK SHARP EDGES .015 - .045 MAX
ALL TOLERANCES ±.010 UNLESS OTHERWISE SPECIFIED
FRACTIONAL ±1/64
DECIMAL
ANGULAR ±1°

CONTRACT NO. NAS8-36313
DRAWN BY M. BARMANN
DESIGN
CHECK
PROJ. ENGR.
APPROVALS
R. COMMINS

CARLETON CONTROLS CORPORATION
EAST AURORA, NEW YORK

TITLE
INSTALLATION
VALVE, SOLENOID
TWO WAY N.C.

SIZE | CODE IDENT NO. | DRAWING

2426-0001-1
NEXT ASSY
USED ON
APPLICATION

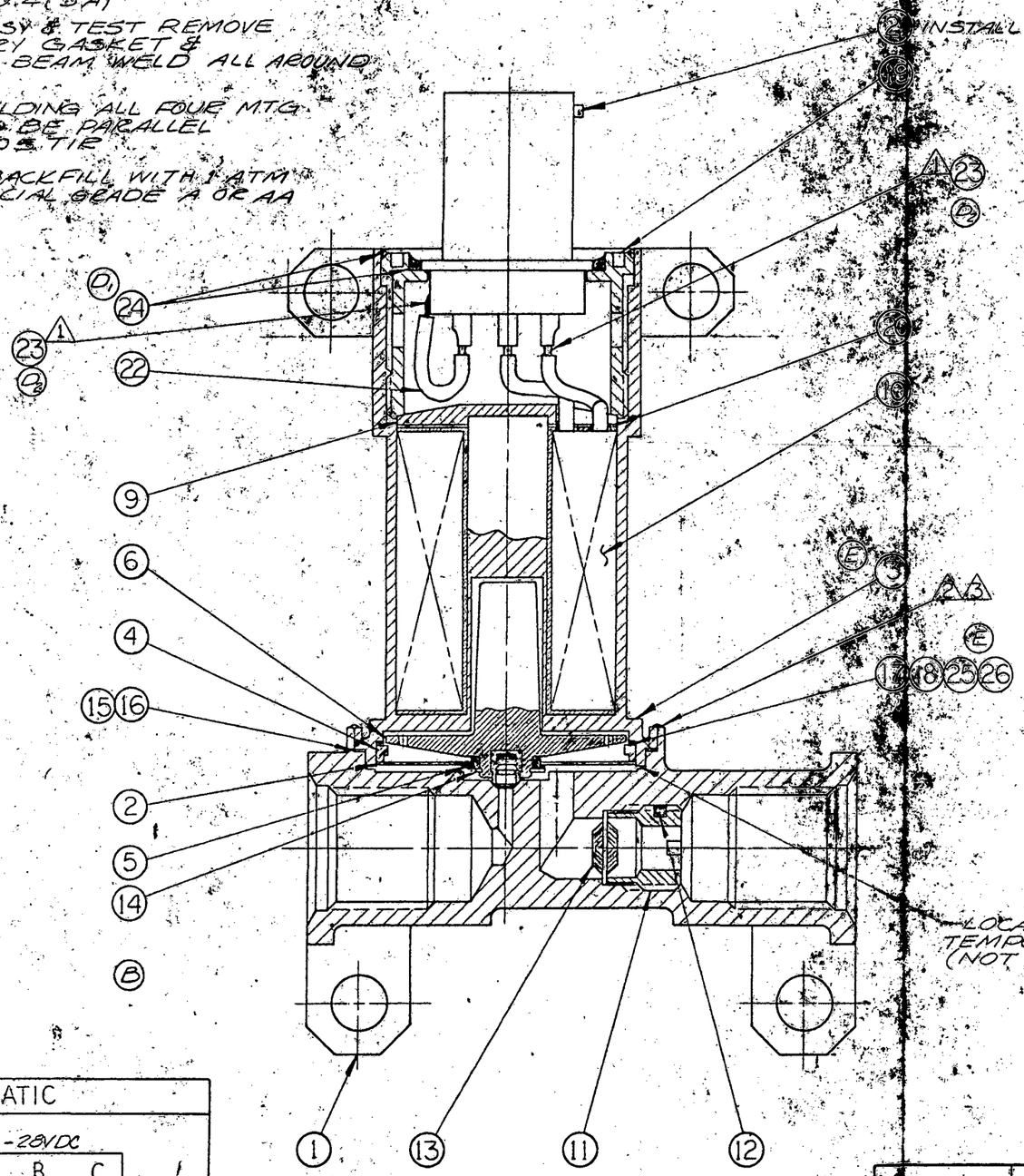
CR 150
Exhibit C

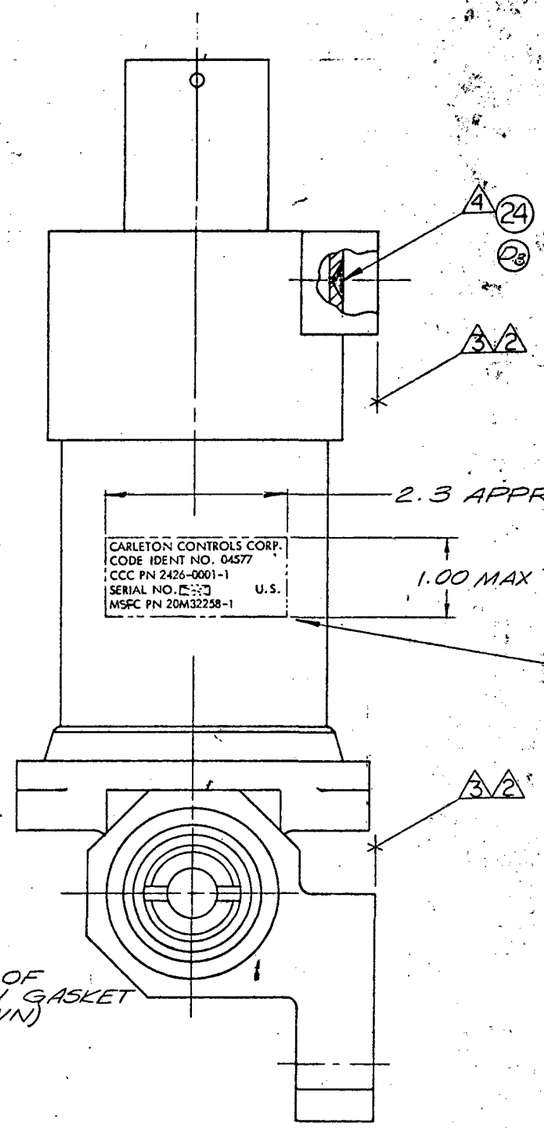
Sheet 14

NOTES:

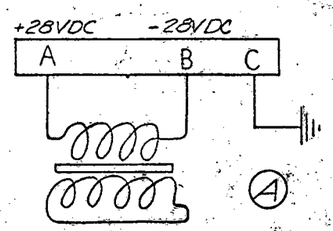
1. SOLDER PER NASA PUBLICATION NHB 5303.4(5A)
2. AFTER ASSY & TEST REMOVE TEMPORARY GASKET & ELECTRON BEAM WELD ALL AROUND
3. AFTER WELDING ALL FOUR MTG. FACES TO BE PARALLEL WITHIN .005 TIR
4. PURGE & BACKFILL WITH 1 ATM OF COMMERCIAL GRADE A OR AA HELIUM

ZONE	LTR	REVISIONS DESCRIPTION	DATE	APPROVED
7A	A	E.O. 2426-7	6/10/70	mcd
7B	B	E.O. 2426-18	6/25/70	mcd
8D	C	E.O. 2426-27	7/24/70	mcd
INC.	D	E.O. 2426-30	9/28/70	mcd
4B 5C	E	E.O. 2426-33	9/28/70	mcd





SCHEMATIC



SEE SEPARATE PARTS LIST

FIND NO	QTY	PART NUMBER	NOMENCLATURE
		2426-0001-1	VALVE, SOLENOID TWO WAY N.C.

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
ALL DIMENSIONS AFTER PLATING
ALL SURFACES TO BE 63 PER USAS B46.1-62
ALL DIAMETERS TO BE CONCENTRIC WITHIN .005 T.I.R.
ALL INTERNAL AND EXTERNAL FILLET RADII .010 MAX.
BREAK SHARP EDGES .015 x 45° MAX.
ALL THREADS PER MIL-S-7742
FRACTION ± 1/64 | DECIMAL .XX ± .02 .XXX ± .005 | ANGLE ± 1/2°

CONTRACT NO. NAS8-26328
DRAWN BY M. BACZKOWSKI 7/24/70
DESIGN
CHECK
PROJ ENGR
R. CUMMINS SEPT 22
APPROVAL DESIGN ACTIVITY 1970
APPROVAL OTHER

CODE IDENT: 04577 | MATERIAL | SPECIFICATION | FINAL PROTOTYPE SUBMIT

CARLETON CONTROLS CORPORATION
EAST AURORA, NEW YORK 14052

TITLE
ASSEMBLY
VALVE, SOLENOID
TWO WAY N.C.

SIZE	CODE IDENT NO.	DRAWING NUMBER	REV
D	04577	2426-0001	E

SCALE FULL | WT. | SHEET

PART NUMBER	NEXT ASSY	USED ON
	APPLICATION	

PARTS LIST

CARLETON CONTROLS CORP.
EAST AURORA, NEW YORK 14052

CONTRACT NO. NAS8-26348 | CODE IDENT. 04577 | PL 2426-0001 | REV. LTR. D

LIST TITLE: VALVE SOLENOID, 2-WAY NORMALLY CLOSED

AUTHENTICATION: M. Baczkowski | DATE: 7/31/70 | REV. AUTHORIZATION NO.: C.O 2426-13

FIND NO.	QTY. REQ'D. -1				SYMBOL	CODE IDENT.	PART NUMBER	DESCRIPTION	REMARKS
							2426-0001	Assembly, Valve Solenoid	
							2426-0002	Installation, Valve Solenoid	
1	1						2426-0010-1	Body	
2	1						2426-0011-1	Belleville	
3	1						2426-0037-1	Solenoid Housing	
4	1						2426-0014-1	Spring Bearing Ring Outer	
5	1						2426-0015-1	Spring Bearing Ring Inner	
6	1						2426-0030-1	Poppet & Plate Assembly	(1)
7							NOT USED		
8							NOT USED		
9	1						2426-0023-1	Top Plate	
10	1						2426-0038-1	Solenoid Coil Assembly	(1)
11	1						2426-0026-1	Filter Retainer	
12	1						1030-0010-2	Lock Plug	
13	1				PP	14834	F-4173-41-10	Filter Disc	Microporous Filter Division
14	1				PP		MS 16624-18	Ring Retaining Ext.	
15	A/R						2426-0027-1	Shim	
16	A/R						2426-0027-3	Shim	
17	A/R						2426-0027-5	Shim	
18	A/R						2426-0027-7	Shim	
19	1						2426-0028-1	Coil Retaining Sleeve	
20	A/R						2426-0029-1	Spacer	
21	1				PP	11139	DBA53H-8-98PN	Receptacle, Connector	The Deutsch Company

SYMBOLS:
BI - Bulk Item
PP - Purchased Part
SCD - Spec or Source Control Drawing

(1) See Separate Parts List
(2) Vendor Item - See Spec or Source Control Drawing

PARTS LIST

CARLETON CONTROLS CORP.
EAST AURORA, NEW YORK 14052

CONTRACT NO. NAS8-26348 | CODE IDENT. 04577 | PL 2426-0001-1 | REV. LTR. B

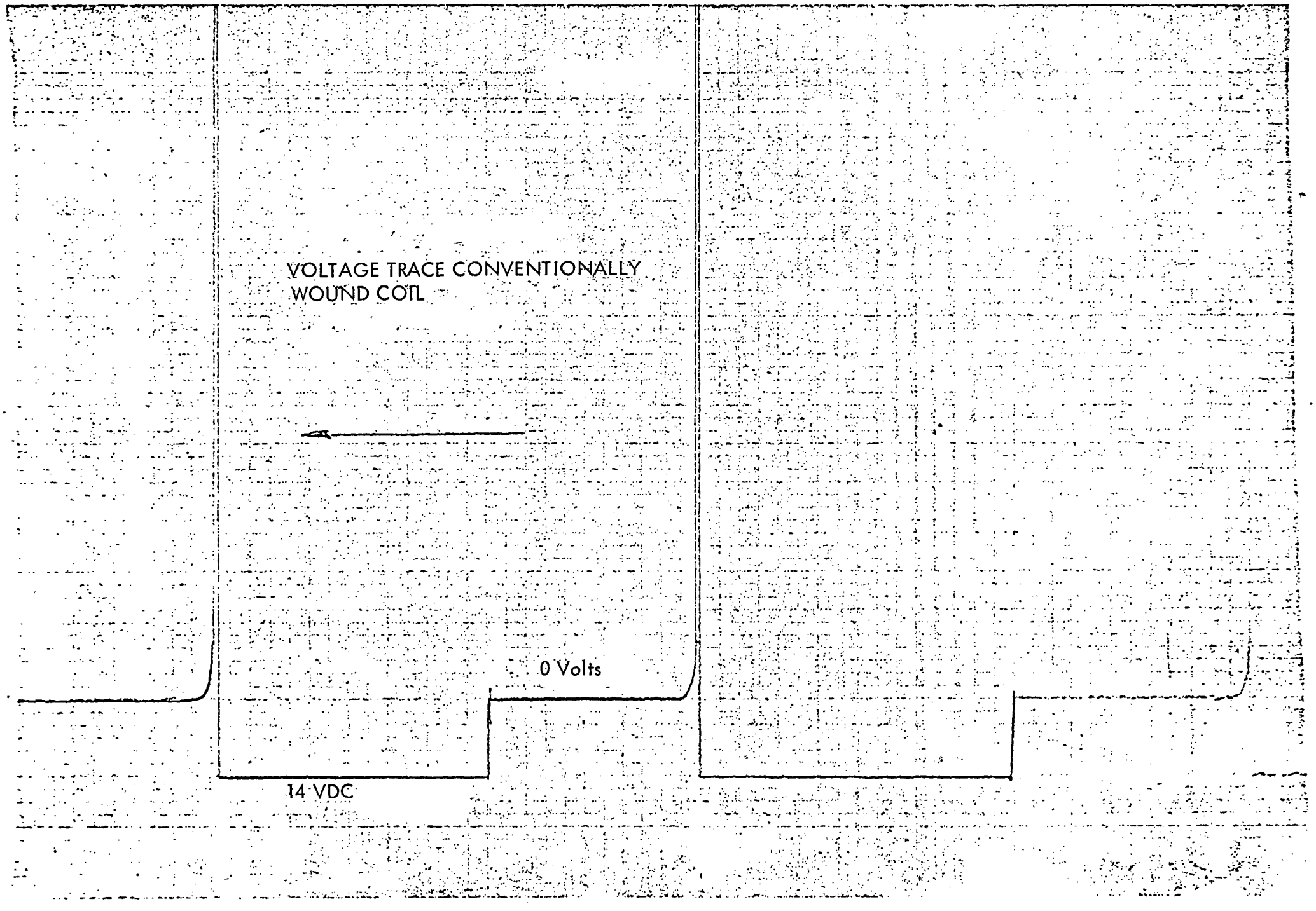
LIST TITLE: VALVE SOLENOID, 2-WAY NORMALL CLOSED .

AUTHENTICATION: M. Baczkowski | DATE: 7/31/70 | REV. AUTHORIZATION NO. | SHEET 3 OF 3

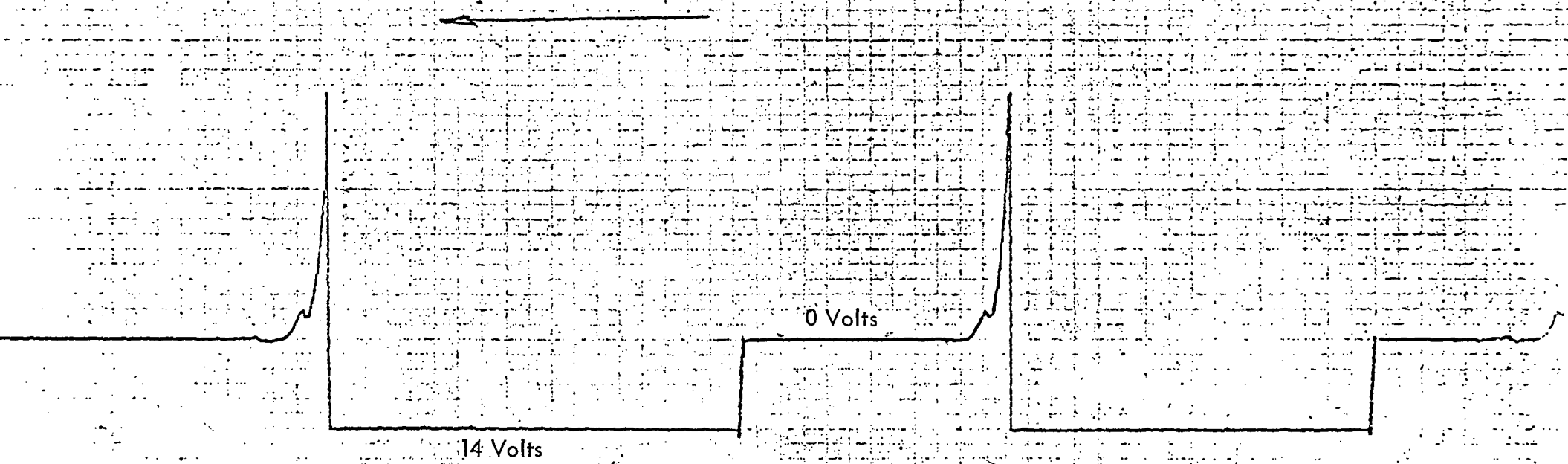
FIND NO.	QTY. REQ'D. -1				SYMBOL	CODE IDENT.	PART NUMBER	DESCRIPTION	REMARKS
22	A/R				BI		26 GA	Ground Wire	MIL-W-16878 TYPE E
23	A/R				BI			Solder	QQ-S-571 Type SN60-W-RA-P-2
24	A/R				BI			SOLDER	QQ-S-571 TYPE SN50-W-S
25	A/R						2426-0027-9	SHIM	
26	A/R						2426-0027-11	SHIM	

SYMBOLS:
BI - Bulk Item
SCD - Spec or Source Control Drawing
PP - Purchased Part

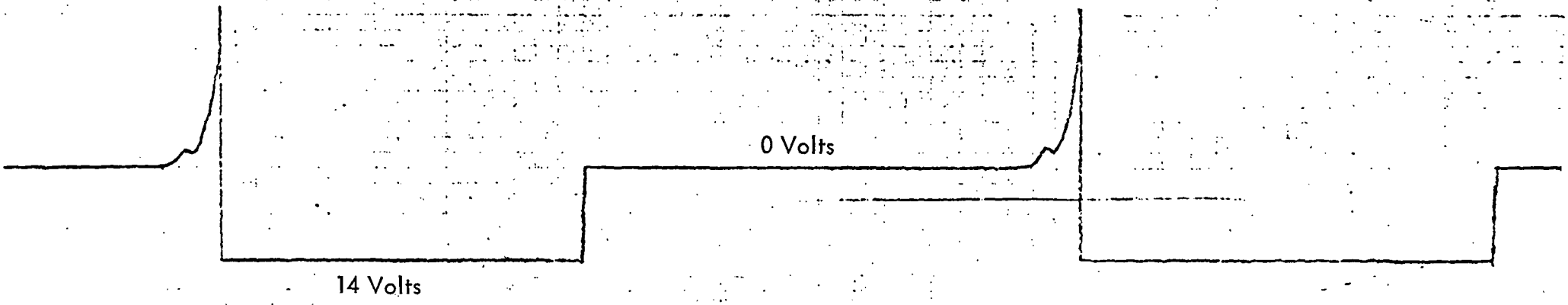
(1) See Separate Parts List
(2) Vendor Item - See Spec or Source Control Drawing


VOLTAGE TRACE CONVENTIONALLY WOUND COIL
0 Volts
14 VDC

VOLTAGE TRACE CONVENTIONALLY WOULD COIL ON INSULATED COPPER SPOOL



VOLTAGE TRACE BIFILAR WOUND COIL ON INSULATED COPPER SPOOL, THREE WIRE SIZE DIFFERENCE



CARLETON CONTROLS CORPORATION

SPEC. NUMBER	REVISION LETTER	
DTR 2426		PAGE 7

4.0 TEST SEQUENCE

4.1 Development Tests:

Carleton DTP 2426 Ref. Para.	NASA 20M32258 Ref. Para.	Test Description
5.1	4.3.2	Examination of Product
5.2	4.3.3.1 a & b	Internal Proof Pressure
5.3	4.3.3.2 a & b	External Proof Pressure
5.4	4.3.3.3 a 1 & 2	Internal Leakage Check
5.5	4.3.3.3 b	External Leakage Check
5.6	4.3.3.4	Pull In, Drop Out Voltages
5.7	4.3.3.5	Insulation Resistance
5.8	4.3.3.6	Operating Current
5.9	4.3.4.5	Low Temperature
5.10	4.3.3	Functional Tests
5.11	4.3.4.4	High Temperature
5.12	4.3.3	Functional Tests
5.13	4.3.4.8	Vibration
5.14	4.3.3	Functional Tests
5.15	4.3.4.10	Equivalent Orifice
5.16	4.3.4.11	Duty Cycle
5.17	4.3.3	Functional Tests
5.18	4.3.4.12 (a)	Life Cycle - High Pressure
5.19	4.3.3	Functional Tests
5.20	4.3.4.13	Burst Pressures
5.21	4.3.4.14	Collapse Pressures

2426

SOLENOID VALVE

(1) A
-B

=C

(1a) E
-F

=G

(2) D
-G

=H

(3) C
-H

=In = POSSIBLE STROKE WITHOUT SPACERS

(4) .010 = DESIRED STROKE
-In

=Is = THICKNESS OF SPACERS REQUIRED FOR DESIRED STROKE

(5) J
-E

=K

(6) K
+.010

=L

(7) A
-M

=N

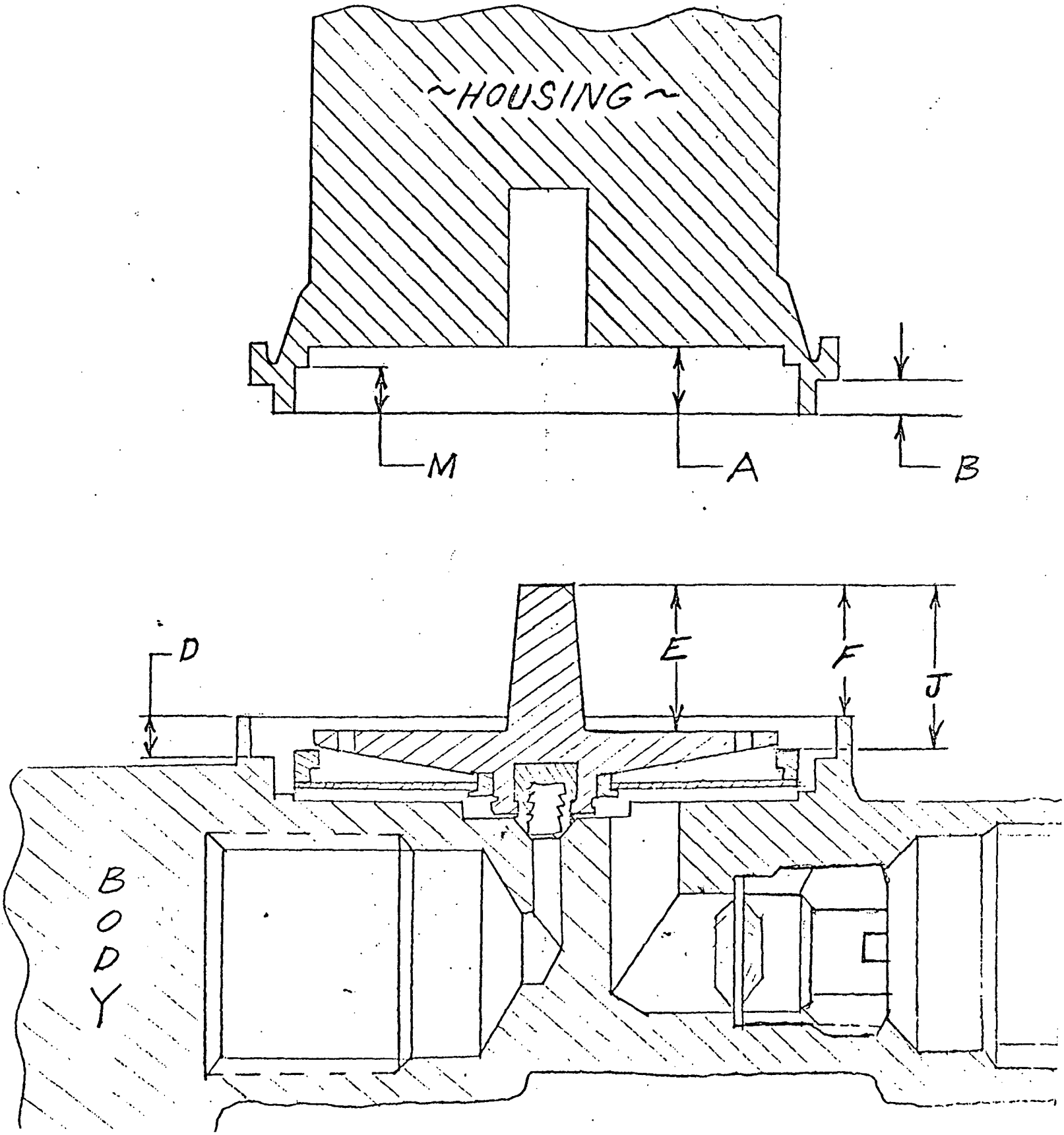
(8) N
-L

=Pn = BELLEVILLE DEFLECTION WITHOUT SPACERS

(9) .020
-Pn

Ps = THICKNESS OF SPACERS REQUIRED FOR DESIRED BELLEVILLE DEFLECTION

2426 SOLENOID VALVE



CRITICAL ASSEMBLY CHECK LIST FOR 2426

UNIT_____ S/N_____

OPERATION	INSPECTION
1) Install teflon into poppet	
2) Check required stroke shimming	
3) Check required belleville deflection shimming	
4) Verify installation of filter	
5) Tighten welding fixture screws	
6) Verify coil removal prior to welding	
7) Verify operation after welding	
8) Use only a CCC NASA card holder for soldering	
9) Perform post back filling leak check	

CARLETON CONTROLS CORPORATION

SPEC. NUMBER	REVISION LETTER	
ATP 2426		PAGE A1

ACCEPTANCE TEST DATA

FOR

2426-0001-1 2-WAY SOLENOID VALVE

S/N 2

CARLETON CONTROLS CORPORATION

SPEC. NUMBER	REVISION LETTER	PAGE
ATP 2426		A2

Customer NASA - MSFC
Specification
P/N

Test Time (hrs.)
Total Operating Hrs.
Operating Cycles/Test
Total Operating Cycles
Test Facility C. C. C.

CCC P/N 2426 0001-1
S/N 2
Date 3-9-71
Test No.
Ref. Paragraph
Schematic Figure
Temperature N/A
Barometer/Pressure N/A
Test Fluid N/A

DESCRIPTION OF TEST Examination of Product (4.3.2)

Ref. Para. 5.1

Examine the unit for conformance to:

CCC drawing 2426-0002 — CONFORMS

Workmanship — ACCEPTABLE

Identification — CONFORMS

REMARKS:

Passed
Failed

Customer or Rep.	Date	Test Engineer	Date
	Date	Quality Control	3-9-71 Date

CARLETON CONTROLS CORPORATION

SPEC. NUMBER	REVISION LETTER															PAGE
ATP 2426	A	B														A3

Customer NASA - MSFC
Specification
P/N

CCC P/N 2426 0001-1
S/N 2
Date 3-9-71
Test No.
Ref. Paragraph
Schematic Figure
Temperature ROOM
Barometer/Pressure LOCAL AMBIENT
Test Fluid N2

Test Time (hrs.)
Total Operating Hrs.
Operating Cycles/Test
Total Operating Cycles
Test Facility C. C. C.

DESCRIPTION OF TEST Internal Proof Pressure (4.3.3.1)

Ref. Para. 5.2

(a) Housings - Apply 420 PSIG to the inlet with the outlet port capped and the unit in the open position for 5 minutes. (A)

(b) Inlet - With the unit in the closed position and the outlet open, apply 420 PSIG to the inlet for 5 minutes. (A) (B)

REMARKS:

Passed ✓
Failed

		J. Wallenhaupt	3-9-71
Customer or Rep.	Date	Test Engineer	Date
	Date	Quality Control	Date

CARLETON CONTROLS CORPORATION

SPEC. NUMBER	REVISION LETTER	PAGE
ATP 2426		A4

Customer NASA - MSFC
Specification
P/N

CCC P/N 2426 0001-1
S/N 2
Date 3-9-71
Test No.
Ref. Paragraph
Schematic Figure
Temperature Room
Barometer/Pressure LOCAL AMBIENT
Test Fluid N2

Test Time (hrs.)
Total Operating Hrs.
Operating Cycles/Test
Total Operating Cycles
Test Facility C. C. C.

DESCRIPTION OF TEST External Proof Pressure (4,3,3,2)

Ref. Para. 5.3.

(a) Housing - With the unit inlet and outlet ports capped, apply 70 PSIG to the chamber and hold for 5 minutes.

(b) Outlet - With the inlet port capped and the outlet open, apply 70 PSIG to the chamber for 5 minutes.

REMARKS:

Passed ✓
Failed

Customer or Rep.	Date	J. Wallenhaus Test Engineer	3-9-70 Date
	Date	(QA) Quality Control	Date

CARLETON CONTROLS CORPORATION

SPEC. NUMBER	REVISION LETTER	PAGE
ATP 2426	A	A5

Customer NASA-MSFC
Specification
P/N

Test Time (hrs.)
Total Operating Hrs.
Operating Cycles/Test
Total Operating Cycles
Test Facility C.C.C.

CCC P/N 2426 0001-1
S/N 2
Date 3-9-71
Test No.
Ref. Paragraph
Schematic Figure
Temperature ROOM
Barometer/Pressure LOCAL AMBIENT
Test Fluid N2

DESCRIPTION OF TEST Internal Leakage (4.3.3.3 (a) 1 & 2)

Ref. Para. 5.4.2

Apply 1, 15, 20 and 210 PSIG to the inlet of the unit. At each pressure the unit shall be checked for leakage 3 times with a minimum of 1 cycle between checks. (A)

Ref. Para. 5.4.3

At 1 and 15 PSIG the maximum allowed leakage is .001 sccs. (A)

Ref. Para. 5.4.5

At 20 and 210 PSIG the maximum allowed leakage is .01 sccs. (A)

Inlet PSIG	Max. Allowed Leakage	Actual Leakage #1	#2	#3
1	.001 sccs	<.0001	<.0001	<.0001
15	.001 sccs	<.0001	<.0001	<.0001
20	.01 sccs	<.001	<.001	<.001
210	.01 sccs	<.001	<.001	<.001

(A)

REMARKS:

Passed X
Failed

Customer or Rep. Date

J. Wallenhaupt 3-9-71
Test Engineer Date

Date

Quality Control Date

CARLETON CONTROLS CORPORATION

SPEC. NUMBER	REVISION LETTER	
ATP 2426	A	PAGE A6

Customer NASA - MSFC
Specification
P/N

CCC P/N 2426 0001-1
S/N 2
Date 3-10-71
Test No.
Ref. Paragraph
Schematic Figure
Temperature
Barometer/Pressure
Test Fluid He

Test Time (hrs.)
Total Operating Hrs.
Operating Cycles/Test
Total Operating Cycles
Test Facility C.C.C.

DESCRIPTION OF TEST External Leakage (4.3.3.3 (b)

Ref. Para. 5.5.2

Apply 210 PSIG to the inlet and outlet of the unit. Let stabilize and monitor leakage (A)

Maximum allowable leakage 0.000001 sccs. (A)

Actual Leakage $< 1 \times 10^{-9}$ sccs.

DESCRIPTION OF TEST Pull In, Drop Out Voltages (4.3.3.4)

Ref. Para. 5.6.2

Apply 210 PSIG to the inlet of the unit. On increasing voltage, the unit must open before 18 VDC. On decreasing voltage the unit must close before 2 VDC. (A)

	Open	Closed
Inlet	16.8 VDC	6.2 VDC
210 PSIG	16.8 VDC	6.4 VDC
	16.8 VDC	6.3 VDC

(A)

REMARKS:

Passed ✓
Failed

Customer or Rep. — Date — J. Wallenwein — Test Engineer — 3-10-71 — Date

Date — Quality Control — Date

CARLETON CONTROLS CORPORATION

SPEC. NUMBER	REVISION LETTER	PAGE
ATP 2426		A7

Customer MDAC-MSFC
Specification
P/N

CCC P/N 2426 0001-1
S/N 2
Date 3-10-71
Test No.

Test Time (hrs.)
Total Operating Hrs.
Operating Cycles/Test
Total Operating Cycles
Test Facility C.C.C.

Ref. Paragraph
Schematic Figure
Temperature Room
Barometer/Pressure Local Ambient
Test Fluid N/A

DESCRIPTION OF TEST Insulation Resistance (4.3.3.5)

Ref. Para. 5.7.1

Apply 500 VDC to ungrounded terminal pins and unit body for 60 seconds.

The resistance shall be greater than 50 megohms.

Actual 80,000 meghoms

REMARKS:

Passed X
Failed

Customer or Rep.	Date	J. Wallenhaupt Test Engineer	3-10-71 Date
	Date	Quality Control	Date

CARLETON CONTROLS CORPORATION

East Aurora, New York

FAILURE ANALYSIS REPORT

REPORT S/N CFA 191

DATE September 17, 1971

CUSTOMER NASA Marshall Space Flight Center

P.O. NO. NAS8-26348

CUSTOMER P/N 20M32258 Rev. _____ S/N _____

C.C.C. P/N 2426-0001-1 Rev. E S/N 10

CUSTOMER REJECTION NOTICE NO. N/A

DATE OF RECEIPT AT C.C.C. N/A

DATE OF ORIGINAL MANUFACTURE 7/71

COMPONENT SPECIFICATION 20M32258

PERSONNEL CONDUCTING ANALYSIS: M. Hulse

E. Smolarek

ANALYSIS APPROVAL:

Q.C. DEPT. [signature] 9/17/71

ENG. DEPT. [signature]

... DESCRIPTION OF DISCREPANCY:

Failure while at ATP (2426 ref. para. 5.6), unit failed to open before the 18 VDC allowed - Actual pull in voltage was 18.2 VDC.

RETEST OR VERIFICATION TEST RESULTS:

The unit was re-energized several times and the voltage remainedr on the border line.

ANALYSIS OF FAILURE CAUSE:

It was found that the coil in this particular unit was wound to the high limit of B/P requirements.

REPAIR/REWORK DATA:

A new coil was installed in the unit and functioned perfectly thru all phases of testing.

CONCLUSION:

In preliminary testing and set up the unit functioned satisfactorily, however additional stabilization occured and the coil required more voltage to operate - With the installation of a new coil (less amp. turns) voltage was reduced for actuation of the unit.

CORRECTIVE ACTION:

Coil winding has been controlled to keep resistance to a lower level to preclude a reoccurance of this condition.

CARLETON CONTROLS CORPORATION

East Aurora, New York

FAILURE ANALYSIS REPORT

REPORT S/N CFA 222

DATE 4/24/72

CUSTOMER M.S.F.C.

P.O. NO. NAS8-26348

CUSTOMER P/N 20M 32258-1 Rev. --- S/N 8

C.C.C. P/N 2426-0001-1 Rev. E S/N 8

CUSTOMER REJECTION NOTICE NO. M 12829

DATE OF RECEIPT AT C.C.C. 3-27-72

DATE OF ORIGINAL MANUFACTURE 4/71

COMPONENT SPECIFICATION 20M 32258

PERSONNEL CONDUCTING ANALYSIS: M. Baczkowski

E. Smolarek

P. Hartwell

ANALYSIS APPROVAL:

Q.C. DEPT. [signature]

ENG. DEPT. [signature]

CUSTOMER DESCRIPTION OF DISCREPANCY:

Unit shorting out both coil leads to case.

RETEST OR VERIFICATION TEST RESULTS:

Rejection confirmed - Unit exhibited insulation on coils wires burned or melted off. Both leads shorting out to case. Upon installation of new coil with proper electrical characteristics, the unit exhibited a high pull in voltage of 22 VDC. (18 VDC Max. Spec. value).

ANALYSIS OF FAILURE CAUSE:

Possible incorrect application of power during testing of insulation resistance at customer facility. This would generate an excessive amount of heat in the unit, which could alter Solenoid Air Gap by changing Seat Footprint or warping gap adjustment shims. This would cause a high pull in voltage.

REPAIR/REWORK DATA:

Unit must be cut apart at Body/Coil Housing junction and seat examined for possible defects and replaced if necessary. Air Gap must be reset, unit re-welded, new coil installed and retested to ATP 2426.

CONCLUSION:

Incorrect application of power in excess of design limits (2 to 18 VDC Operating) will cause overheating of coil and breakdown of wire insulation, plus possible change in Air Gap by altering Seat Footprint and/or gap adjustment shims. The investigation of the unit indicated that this was the cause of failure.

CORRECTIVE ACTION:

Personnel connected with testing of unit to be re-instructed in proper method of performing Insulation Resistance Check.