FINAL TEST REPORT
FOR
PULSE OPERATED FLOW PATH SELECTOR VALVE ASSEMBLY

Hydraulic Research P/N 39000750
NASA/MSFC P/N 20M42517, Rev. C.

Contract No. NAS 8-30075

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Addenda

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ABSTRACT

Two (2) Pulse Operated Flow Path Selector Valve Assemblies were subjected to a comprehensive series of tests to qualify their use on the ATM Thermal Control System. The valves were manufactured by Hydraulic Research and Mfg. Co.

The test program demonstrated that the test items satisfy all of the requirements of specification 20M42517 with exception of the Coil Transient Voltage (para. 4.3.4.15) requirement as written. However, when installed in an actual system, and operated with the NASA designed control circuits, the performance of the valve does satisfy the specified Coil Transient Voltage requirement. Noteworthy also is that the test items demonstrated significant performance margins beyond the minimum requirements of the procurement specification.

The two test items were subjected to the series of tests outlined below, with numerous functional tests before, during, or after environments.

1. Pre-Test Inspection
2. Cleaning
3. Acceptance Tests
4. Vibration
5. Transient Pulses
6. Life Cycling
7. Temperature
8. Full Flow
9. Temperature Cycling
10. Humidity
11. Collapse
12. Burst

Foreword

The formal preflight certification test program for the ATM Temperature Control System Flow Path Selector valve was conducted by the Space Subsystems Department, Avco Systems Division, Lowell, Massachusetts, 01851. The tests were witnessed by Avco SD Quality Control Personnel and by Air Force Quality Assurance Representatives. The testing period was from 20 May 1970 through 4 December 1970. The test was conducted in accordance with STP-SSD-1024 in compliance with the requirements of NASA/MSFC procurement specification 20M42517, Rev. C. This test program was authorized by Contract NAS8-30075.

1.0 Introduction

1.1 Scope

This report presents the results of the Preflight Certification Tests conducted on two Flow Diverter Valve Assemblies. The objective of the test was to qualify the valve design for use in the Apollo Telescope Mount Thermal Control System, by demonstrating conformance to NASA procurement specification 20M42517, Rev. C. The two specimens tested are defined as follows:

Test Sample	Vendor	P/N	S/N
1	Hydraulic Res. & Mfg.	39000750	007
2	" " "	"	008

1.2 Item Description

The Flow Diverter Valve is a two position latching valve. Flow is diverted from either of two inlet ports to a common outlet port. The valve is pulse actuated, and magnetically latched. Two microswitches are provided to indicate armature position. Overall size of the valve is approximately 4.6 x 5.2 x 4.1 inches. A complete description and functional schematic of the valve are included in Addendum A, pages 4, 5, 6, and 7. Photographs of the valve are located in Addendum E.

1.3 Applicable Documents

Applicable specifications, standards and drawings are listed on pages 1 and 2 of Addendum A.

2.0 Test Requirements

NASA/MSFC procurement specification, 20M42517, Rev. C (Addendum B) establishes the test requirements. Environmental Tolerances, Measurement Tolerances, Ambient Conditions, Failure Definition, Deviations, Data Recording and Test Facilities are listed in Addendum A, pages 2 through 4.

2.1 Test Summary

The test samples were subjected to the tests listed below

Test	Specification Para.	Sample Number 1	2
Pre-Test Inspection	4.3.2	x	x
Cleaning	3.5	x	x
Acceptance Tests	4.3.5	x	x
Vibration	4.3.4.9	x	x
Transient Pulses	4.3.4.12	x	x
Life Cycling	4.3.4.10	x	x
Temperature	4.3.4.6	x	x
Full Flow	4.3.4.5	x	x
Temperature Cycling	4.3.4.7	x	
Humidity	4.3.4.1		x
Collapse	4.3.4.13		x
Burst	4.3.4.14		x

Note: Numbers refer to paragraphs in specification 20M42517.

3.0 Test Procedure

The detailed procedures for the Pre-Flight Certification Tests are outlined in Test Procedure STP-SSD-1024 which is included in Addendum A to this report. This document includes both procedures and test schematics. Only those tests described herein and summarized in paragraph 2.1 were conducted.

4.0 Test Results

The actual test results described in this section are recorded in Addendum D, entitled Test Data.

4.1 Pre-Test Inspection

The results of the pre test inspection are recorded on addendum pages D-1 and D-2. Deviation Requests were made and approved for both valves via DAR #005 and 007, which are included as Addendum F. These involved loose threads on the flange mounting pads, and did not affect the performance of the test items. The Deviation Requests were approved by NASA/MSFC for test use only.

4.2 Cleaning

Both test items were cleaned to the requirements of Contamination Control Plan, QATP-SD-199. Both test items were cleaned to a level of 50 microns or less.

4.3 Acceptance Tests

4.3.1 Proof Pressure

A 75 psig proof pressure test with GN_2 was successfully conducted on both test items for more than the specified 5 minute period, without evidence of distortion, permanent set or leakage. The results are recorded on Addendum pages D-1 and D-2.

4.3.2 External Leakage

Both test items total leakage measurements were better than the specified 1.6 x 10^{-6} requirement, when pressurized with 100% helium at 50 psig. The results of these tests are recorded on pages D-1 and D-2.

4.3.3 Internal Leakage

The poppet leakage measurements for both test items over a pressure range of 0 to 20 psig, were less than two orders of magnitude below the allowable 0.20 sccs of the methanol/water service media. The leakage results for three cycles of operation are listed on addendum pages D-3 and D-4.

4.3.4 Acceptance Vibration

Both test items were subjected to a 2.7 g rms, overall, random vibration level without evidence of damage or external leakage. The valves were charged with GN_2 at 20 psig. Results of this test, including the random analysis plot, are recorded on Addendum pages D-3 and D-4.

4.3.5 Vacuum Internal

Both test items were subjected to 2 x 10^{-5} torr without evidence of deformation or permanent set. Results of these tests are recorded in pages D-5 and D-6.

4.3.6 Proof Pressure

A 75 psig proof pressure test with GN_2 was applied to the test specimens after Acceptance Vibration. There was no visual evidence of deformation or permanent set, or leakage. The data are recorded in the Addendum pages D-5 and D-6.

4.3.7 Leakage External, After Acceptance Vibration

Post vibration leakage was successfully completed on both test items. Leakage values were better than the allowable 1.6×10^{-6} sccs. The test data are recorded on Addendum pages D-5 and D-6.

4.3.8 Internal Leakage After Acceptance Vibration

Poppet leakage measurements for both test items were less than two orders of magnitude below the allowable 0.20 sccs of methanol/ water service media with pressures from 0 to 20 psig. The data are recorded on Addendum pages D-7 and D-8.

4.3.9 Circuit Resistance

Continuous circuits on both test items measured less than the 0.5 OHM allowable value. Coil resistance conformed to contractor drawing requirements of 27 $\pm$ 2 OHMS, and open circuits indicated infinitely high resistance. Test results are listed on Addendum pages D-7, D-8, D-9 and D-10.

4.3.10 Insulation Resistance

All insulation resistance measurements on each test item exceeded 20,000 megohms. The test requirement is 50 megohms minimum. These data are recorded on Addendum pages D-9, through D-16.

4.3.11 Minimum Operating Voltage (Unpressurized Assembly)

The minimum operating voltage for valve S/N 007 in the unpressurized condition ranges from 12.0 to 14.5 volts. For S/N 008, the voltage was between 12.8 and 17.0. The specified requirement is 18.0 volts maximum. These voltages were applied for 100 milliseconds. The results of each run are listed on Addendum pages D-15 and D-16.

4.3.12 Minimum Operating Voltage (Pressurized Assembly)

The minimum operating voltage for the valve pressurized to 50 psig with helium ranged from 10.0 to 12.8 volts for S/N 007, and from 12.4 to 16.0 for S/N 008. The requirements are the same as the unpressurized condition. The results of the tests are recorded on Addendum pages D-15 and D-16.

4.3.13 Minimum Pulse Duration (Pressurized Assembly)

The minimum pulse duration for valve S/N 007 in the pressurized condition (50 psig) ranged from 15.3 to 21.0 milliseconds. For S/N 008, the pulse duration was between 15.0 and 17.5 milliseconds. The specified requirement is 100 milliseconds maximum. These pulses were applied with a 28.0 volt amplitude. The data collected are recorded on Addendum page D-17 and D-18.

4.3.14 Minimum Pulse Duration (Unpressurized Assembly)

The minimum pulse duration for the test items in the unpressurized condition ranged from 16.5 to 22.0 milliseconds, for S/N 007, and from 16.5 to 18.0 for S/N 008. The requirements are the same as for the pressurized condition. Test results are recorded on Addendum pages D-17 and D-18.

4.3.15 Power Consumption

The room temperature power consumption at 28.0 volts d.c. was 27.44 watts maximum for valve S/N007, and 29.96 watts maximum for valve S/N 008. The allowable power consumption is 45 watts maximum. These measurements are recorded on Addendum pages D-17 and D-18.

4.4 Vibration

4.4.1 Vibration, Sinusoidal Excitation, Vehicle Dynamics

Both test samples were subjected to sinusoidal vibration excitation from 4 to 40 cps with 1.6 g peak alongthe longitudinal axis, and from 4 to 20 cps at 0.4 g's peak along the lateral axes. Continuity was maintained across pins A and E during the test and the valves were pressurized to 21.0 psig. There was no visual evidence of damage or leakage on either valve at the completion of the test. Accelerometers were mounted on the test items to sense acceleration along the three major axes. The output of each accelerometer was recorded on an oscillographic strip chart and is available at Avco in the test data file. The overall results of this test are recorded on Addendum pages D-19. and D-20.

4.4.2 Vibration, Sine Evaluation Criteria

A 1 g amplitude sine survey was conducted from 20 to 2000 cps along the major axes of both test units. Continuity was maintained across pins A & E during the test, and there was no evidence of external leakage or damage. The valves were pressurized to 21 psig with methanol/water. Accelerometers were mounted on the test items, as described in 4.4.1. These results are recorded on Addendum pages D-19 and D-20.

4.4.3 Vibration, Random Criteria, High Level

Both test items were subjected to a 5.3 grms (overall) random vibration test along each of the three major axes. Both valves were pressurized to 21.0 psig with the service media. Continuity was maintained across pins A and E during the test, and there was no evidence of external leakage, or damage. The test results are recorded on Addendum pages D-19 and D-20.

4.4.3 Vibration, Random Criteria, Low Level

Both test items were subjected to a 3.6 g rms (overall) random vibration test along each of the three major axes. Both valves were pressurized to 21.0 psig with the service media. Continuity was maintained across pins A and E during the test, and there was no evidence of external leakage, or damage. The test results are recorded on Addendum pages D-21 and D-22.

4.5 Post Vibration Functional Tests

4.5.1 Proof Pressure

A 75 psig proof pressure test with GN_2 was conducted on each test item. Neither valve exhibited any evidence of deformation or leakage. The results are recorded on Addendum pages D-21 and D-22.

4.5.2 Vacuum

The test items were subjected to less than 1×10^{-5} torr for more than 5 minutes. Neither valve exhibited any evidence of deformation or set. The data are recorded on Addendum pages D-21 and D-22.

4.5.3 External Leakage

External leakage measurements on both test items were less than the 1.6×10^{-6} sccs by greater than one order of magnitude, when pressurized with 100% helium at 50 psig. These measurements are recorded on Addendum pages D-23 and D-24.

4.5.4 Internal Leakage

Poppet leakage on each valve was less than two orders of magnitude below the allowable 0.2 sccs of the methanol/water service media, at pressures from 0 to 20 psig. The leakage values are recorded on Addendum pages D-23 and D-24.

4.5.5 Circuit Resistance

All resistance measurements on each test item were less than 0.5 OHMS (allowable) for closed circuits and infinity, for open circuit measurements. Coil resistances were within the manufacturer's specified limits. These measurements are recorded on Addendum pages D-25 and D-26.

4.5.6 Insulation Resistance

All insulation measurements on each test item exceeded 20,000 megohms. The specified requirement is for 50 megohms minimum. Insulation resistance data are recorded on Addendum pages D-27 through D-32.

4.5.7 Minimum Operating Voltage, Unpressurized

The minimum operating voltage, applied for 100 ms, ranged from 14.0 to 16.0 volts for valve S/N 007 and from 13.0 to 16.0 for S/N 008. The allowable limit is 18.0 volts. The data are recorded on Addendum pages D-31 and D-32.

4.5.8 Minimum Operating Voltage, Pressurized

The minimum voltage with the valves pressurized with 100% helium to 50 psig ranged from 13.0 to 14.5 for valve S/N 007, and from 13.0 to 14.0 volts for valve S/N 008. The data are recorded on Addendum pages D-33 and D-34.

4.5.9 Minimum Pulse Duration, Pressurized

The minimum pulse duration for the test items pressurized to 50 psig with 100% helium ranged from 34.0 to 39.0 ms for valve S/N 007 and from 34.0 to 36.0 for valve S/N 008. The pulse amplitude was 28.0 volts, and the allowable pulse width is 100 ms, maximum. These results are recorded on Addendum pages D-33 and D-34.

4.5.10 Minimum Pulse Duration, Unpressurized

The minimum pulse duration for the unpressurized condition ranged from 30.0 to 39.0 ms for valve S/N 007 and from 36.0 to 38.0 ms for valve S/N 008. Other conditions and limits as in para. 4.5.9. These results are listed on Addendum pages D-33 and D-34.

4.5.11 Power Consumption

The room temperature power consumption at 28.0 volts d.c. was 27.3 watts maximum for valve S/N 007, and 29.96 maximum for valve S/N 008. The allowable value is 45 watts. These measurements are recorded on Addendum pages D-35 and D-36.

4.6 Transient Pulses

4.6.1 Minimum Operating Voltage, Unpressurized

The minimum operating voltage measured during this test was within previously stated limits. The values ranged from 14.0 to 15.5 volts for valve S/N 007 and from 13.0 to 16.0 volts for valve S/N 008. Actual data for each cycle are recorded on Addendum pages D-35 and D-36.

4.6.2 Minimum Operating Voltage, Pressurized

The minimum operating voltage with the valve pressurized with 100% HE to 50 psig fell within previously stated limits, and compared favorably with the data obtained in the unpressurized condition. The values ranged from 14.0 to 15.0 volts for valve S/N 007 and from 13.0 to 14.0 for valve S/N 008. The data are recorded in Addendum pages D-35 and D-36.

4.6.3 Minimum Pulse Duration, Pressurized

The minimum pulse duration with the valve pressurized to 50 psig is within the previously specified limits. The values ranged from 30.0 to 38.0 ms for valve S/N 007 and from 36.0 to 38.0 ms for valve S/N 008. The results are listed on Addendum pages D-37 and D-38.

4.6.4 Minimum Pulse Duration, Unpressurized

The minimum pulse duration with the test item in the unpressurized condition is within previously specified limits, and compares favorably with the pressurized condition. The values range from 33.0 to 38.0 for valve S/N 007 and from 36.0 to 37.0 for valve S/N 008. The results are listed on Addendum pages D-37 and D-38.

4.6.5 Transient Pulses

This transient pulse test consisted of applying a steady state signal to one coil and a transient signal to the opposite coil. Acceptance criteria was that the valve would not change position when a transient signal was applied. Transient signals from +72 volts d.c., 5 microseconds, to -19 volts d.c., 9 milliseconds were applied to each coil of both valves. Microswitch pins A and E were monitored during all transient runs. Neither of the test items changed positions with the application of a voltage transient. The oscilloscope voltage traces from these tests are available in the test file.

Other transient pulse tests were run beyond the specification and test requirements. These involved applying a 72 volt d.c., 5 micro-second pulse one one valve coil and zero volts on the alternate coil. This test was performed on all coils without inducing the valve poppet to change position. These test results are recorded on Addendum pages D-37 and D-38.

4.6.6 Coil Transient Voltage

The coil transient voltage test was comprised of measuring the maximum peak inverse voltage when a 28.0 volt d.c. signal was removed from the coil. The peak inverse voltage is governed by the bifilar winding within the valve. The peak inverse voltage measured 50 volts for valve S/N007 and 52 volts for valve S/N008. The specified requirement is that the peak inverse voltage shall not exceed 150% of the applied voltage, or 42 volts for this test. Since the measured results exceeded the allowable value, a deviation request (form 847) was submitted to MSFC and approved. This request was numbered Avco - 010.

The performance of the valve when installed in the ATM Thermal Control System, however, is not discrepant, because the peak inverse voltage reflected back into the electrical control circuit has been reported as not exceeding 5 volts.

It was the intent of the specification, according to MSFC engineering, to measure the peak inverse voltage generated by the valve with the actual system control circuit. Since this system is complex, it is beyond the scope of the present contract. The peak inverse voltage data are recorded on Addendum pages D-39 and D-40.

4.7 Life Cycling

A total to 1050 cycles were applied to valve S/N 007 and 1020 cycles to valve S/N 008. Cycling was accomplished with the valve filled with methanol/water and the switches resistively loaded to 3 amperes. The life cycle requirement is for 1000 cycles of operation. Functional tests were performed after each 150 cycles. The results are summarized below.

4.7.1 Internal Leakage

After 150 cycles

The poppet liquid leakage for both test items measured 0.0 sccs.

After 300 cycles

The poppet liquid leakage for both test items measured 0.0 sccs.

After 500 cycles

The poppet liquid leakage for both test items measured 0.0 sccs.

After 750 cycles

The poppet liquid leakage for valve S/N 008 measured 0.0 sccs and varied from 0.0 to 0.0008 sccs for valve S/N007.

After 1000 cycles

The poppet liquid leakage measured 0.0 sccs for valve S/N 008 and 0.01 sccs for valve S/N 007. These data are recorded on Addendum pages D-41, D-42, D-53 and D-54. Test requirements have been listed previously.

4.7.2 Circuit Resistance

After 150 cycles

Circuit resistance measurements on both test items were between 0.0 and 0.2 ohms for continuous circuits, and infinity for open circuits. Coil resistances were within previously specified limits.

After 300 cycles

Same results as after 150 cycles.

After 500 cycles

Same results as after 150 cycles.

After 750 cycles

Same results as after 150 cycles.

After 1000 cycles

Same results as after 150 cycles. These data are recorded on Addendum pages D-43, D-44, D-55 and D-56.

4.7.3 Minimum Operating Voltage (Unpressurized)

The minimum operating voltage readings taken during life cycle testing with the test items unpressurized are summarized below. The readings represent the high and low measurements on each valve with a 100 ms pulse

After 150 cycles

Valve S/N	Low (volt d.c.)	High (volt d.c.)
007	12.0	14.5
008	12.5	13.5

After 300 cycles

Valve S/N	Low (volt d.c.)	High (volt d.c.)
007	12.0	14.5
008	14.0	14.5

After 500 cycles

Valve S/N	Low (volt d.c.)	High (volt d.c.)
007	14.0	16.0
008	14.0	15.0

After 750 cycles

Valve S/N	Low (volt d. c.)	High (volt d. c.)
007	14.5	17.0
008	15.0	16.0

After 1000 cycles

Valve S/N	Low (volt d. c.)	High (volt d. c.)
007	14.0	16.0
008	14.0	15.5

These results are recorded on Addendum pages D-45, D-46, D-61 and D-62. All readings are within specified limits, and do not indicate any degradation in performance of the valve as a result of life cycling.

4.7.4 Minimum Operating Voltage (Pressurized)

These tests are identical to the tests of 4.7.3 except that the test items were pressurized to 50 psig with 100% helium.

After 150 cycles

Valve S/N	Low (volt d. c.)	High (volt d. c.)
007	12.0	14.0
008	12.0	13.5

After 300 cycles

Valve S/N	Low (volt d. c.)	High (volt d. c.)
007	11.5	13.5
008	12.5	14.0

After 500 cycles

Valve S/N	Low (volt d. c.)	High (volt d. c.)
007	14.0	15.5
008	13.5	14.0

After 750 cycles

Valve S/N	Low (volt d.c.)	High (volt d.c.)
007	14.0	16.5
008	14.0	14.5

After 1000 cycles

Valve S/N	Low (volt d.c.)	High (volt d.c.)
007	14.0	16.0
008	14.0	14.5

The data are recorded on Addendum pages D-45, D-46, D-61 and D-62. All of the tests were within specified limits, and did not result in significant performance degradation.

4.7.5 Minimum Pulse Duration, Pressurized Assembly

The results of the periodic pulse duration tests performed during life cycling are summarized below. The tests were performed with the valve pressurized to 50 psig with 100% helium. The data represent the high and low readings for each valve independent of the coil being energized.

After 150 cycles

Valve S/N	Low (ms)	High (ms)
007	27.0	32.5
008	26.0	27.5

After 300 cycles

Valve S/N	Low (ms)	High (ms)
007	27.0	31.0
008	28.5	29.0

After 500 cycles

Valve S/N	Low (ms)	High (ms)
007	30.0	34.0
008	28.0	29.0

After 750 cycles

Valve S/N	Low (ms)	High (ms)
007	30.0	33.5
008	28.0	29.0

After 1000 cycles

Valve S/N	Low (ms)	High (ms)
007	27.5	32.0
008	28.0	28.5

The data are recorded on Addendum pages D47, D48, D63 and D-64.

4.7.6 Minimum Pulse Duration, Unpressurized Assembly

The results summarized below are identical to the tests of 4.7.5 except that the test items were unpressurized.

After 150 cycles

Valve S/N	Low (ms)	High (ms)
007	29.0	32.5
008	26.5	27.0

After 300 cycles

Valve S/N	Low (ms)	High (ms)
007	26.5	31.5
008	28.5	30.0

After 500 cycles

Valve S/N	Low (ms)	High (ms)
007	29.0	33.5
008	28.5	30.0

After 750 cycles

Valve S/N	Low (ms)	High (ms)
007	29.5	34.0
008	28.0	30.0

After 1000 cycles

Valve S/N	Low (ms)	High (ms)
007	27.0	31.5
008	28.0	28.5

The results of these tests are recorded on Addendum pages D-47, D-48, D-63 and D-64.

4.7.7 Power Consumption During Life Cycling

The periodic power measurements taken at 28.0 volts d.c. during life cycling tests are summarized below. Values are the maximum measurements for each valve.

Power (watts)

Valve S/N	After 150 cycles	After 300 cycles	After 500 cycles	After 750 cycles	After 1000 cycles
007	28.0	28.2	28.2	28.1	28.2
008	31.0	30.5	31.0	31.0	31.0

Results of these tests are recorded on Addendum sheets D-49, D-50, D-63 and D-64.

4.7.8 Proof Pressure After Life Tests

A 75.0 psig proof pressure test was applied to both test items for five minutes without evidence of distortion or permanent set. Test results are recorded on Addendum pages D-51 and D-52.

4.7.9 Vacuum After Life Tests

A five minute vacuum test of less than 1×10^{-5} torr was applied to both test items without evidence of distortion or permanent set. Test results are recorded on Addendum pages D-51 and D-52.

4.7.10 External Leakage After Life Tests

External leakage measurements on each test item with 50 psig, helium, were approximately two orders of magnitude better than the specified requirement. Test results are recorded on Addendum pages D-51 and D-52.

4.7.11 Insulation Resistance After Life Tests

All insulation resistance measurements on each test item exceeded the requirement by more than three orders of magnitude. These measurements are recorded on Addendum pages D-55 through D-62.

4.8 High Temperature Gaseous Tests

Both test items were placed in a chamber and allowed to stabilize at +165°F. Each coil was energized for 5 continuous minutes at 30 volts d.c. Current measurements were made at the beginning and end of the period, and the coil resistance computed. The valves were allowed to return to 165°F and the valve operated. This procedure was repeated for a total of 10 cycles on each test unit. Resistance measurements at the beginning of each cycle were 30.9 ohms for each coil of valve S/N 007 and 33.3 ohms for each coil of valve S/N 008. Resistance measurements at the end of the five minute period were 35.7 ohms for each coil of valve S/N 007 and 37.5 ohms for each coil of valve S/N 008. The maximum valve body temperature reached with 30 volts d.c. applied to the valve was 170°F for S/N 007 and 174°F for S/N 008. The time required for the valve to cool to 165°F was 15 minutes for S/N 007 and 20-25 minutes for S/N 008. Results of these tests are recorded on Addendum pages D-65 and D-66.

4.8.1 Internal Leakage After High Temp. Gaseous

With the test items stabilized at +100°F and pressurized as previously described with methanol/water, the measured poppet leakage for each unit was 0.0 sccs. Test results are recorded on Addendum pages D-67 and D-68.

4.8.2 <u>Circuit Resistance After High Temp. Gaseous</u>

Circuit measurements were made with the valve stabilized at +100°F. Continuous circuits on both test items, did not exceed 0.2 ohms and open circuits measured infinite resistance. Coil resistances were slightly higher than room temperature measurements. All of the data were within acceptable limits. Results are recorded on Addendum pages D-67, D-68, D-69 and D-70.

4.8.3 <u>Insulation Resistance After High Temp. Gaseous</u>

Insulation resistance measurements were made with the valves stabilized at +100°F. All measurements exceeded the minimum requirement of 50 megohms minimum. Most of the values exceeded the minimum requirement by three orders of magnitude or more, but a few were only slightly higher than minimum. The data are recorded on Addendum pages D-69 through D-76.

4.8.4 <u>Minimum Voltage After High Temp. Gaseous (Unpressurized)</u>

Minimum voltage measurements were made with the valve stabilized at +100°F. The values were slightly higher than at room temperature, but were all within previously specified limits. The minimum voltage varied from 16.5 to 18.0 volts d.c. for valve S/N 007 and from 16.0 to 17.0 volts for valve S/N 008. Results of the test are recorded on Addendum pages D-75 and D-76

4.8.5 Minimum Voltage After High Temp. Gaseous, Pressurized

The test described in 4.8.4 was repeated with the test items pressurized to 50 psig with helium. Test results were within previously specified requirements, and slightly lower than for the unpressurized condition. The voltage readings for S/N 007 varied from 14.5 to 16.5 volts d.c. and for unit S/N 008 from 15.5 to 16.0 volts d.c. Test data are recorded on Addendum pages D-77 and D-78.

4.8.6 Pulse Duration After High Temp. Gaseous, Pressurized

Minimum pulse duration tests were run with the valve stabilized at +100°F and pressurized to 50 psig with 100% helium. All results were well within the acceptable values. The results for valve S/N 007 ranged from 28.0 to 32.0 volts ms, and from 27.5 to 29.0 for valve S/N 008. Test data are recorded on Addendum pages D-77 and D-78.

4.8.7 Pulse Duration After High Temp. Gaseous, Unpressurized

The test described in 4.8.6 was performed with the test items in the unpressurized condition. Performance for both test items was acceptable. The minimum pulse duration for valve S/N 007 ranged from 27.5 to 32.5 v ms, and for S/N 008 from 28.5 to 30.0 volts d.c. Test data are recorded on addendum pages D-77 and D-78.

4.8.8 Power After High Temperature Gaseous

Power measurements were made with the valves stabilized at +100°F. The power consumption for both test items was slightly lower than the performance at room temperature, because of the increase coil resistance with temperature. The maximum value was 26.3 watts for

S/N 007 and 28.6 watts for S/N 008. Values for each coil are recorded on Addendum pages D-79 and D-80.

4.9.0 Low Temperature Gaseous

The two test items were placed in a cold chamber and allowed to stabilize at -65°F for a period exceeding 48 hours. After the cold soak, the functional tests listed below were performed.

4.9.1 External Leakage at -65°F

The external leakage measurement for both test units at -65°F was better than the allowable value by two orders of magnitude or more. The helium leakage rate was 0.7×10^{-8} sccs for S/N 007 and 1.44×10^{-8} for S/N 008. Results are recorded on Addendum pages D-79, D-80,

4.9.2 Internal Leakage at -65°F

Poppet leakage was measured with the test items stabilized at -65°F. Both valves were well within specified limits. Zero leakage was measured for valve S/N 008 and values ranging from 0 to 0.0033 sccs of the liquid service media for valve S/N 007. These data are recorded on addendum pgs. D-78, D-79, D-80 and D-81.

4.9.3 Circuit Resistance at -65°F

Circuit resistance measurements at -65°F did not vary significantly from measurements at room temperature, except for coil resistance measurements. Closed circuit measurements did not exceed 0.2 ohms. Open circuit measurements indicated infinite resistance. Coil resistance for S/N 007 was approximately 20 ohms and 17.9 ohms for S/N 008. All circuit resistance values were within acceptable limits. These measurements are recorded in Addendum pgs. D81 & D82

4.9.4 Insulation Resistance at -65°F

Insulation resistance measurements on both test items were somewhat degraded from the values recorded at room temperature, but all values exceed the specified requirement. The lowest insulation resistance measurement was 200 megohms. The data are recorded on Addendum pages D-83 through D-88.

4.9.5 Minimum Operating Voltage, at -65°F, Gaseous Unpressurized

The minimum operating voltages for both test items, unpressurized, at -65°F were significantly lower than at room temperature because of the higher current drain. Performance ranged between 12.0 and 13.0 volts d.c. for valve S/N 007 and 13.0 volts d.c. for all measurements made on S/N 008. Actual results are shown on Addendum pages D-89 and D-90.

4.9.6 Minimum Operating Voltage, at -65°F Gaseous Pressurized

The performance of both test items pressurized to 50 psig with 100% helium was comparable to the unpressurized condition. Valve S/N 007 operated at 12.0 volts d.c. and S/N 008 at 13.0 volts d.c. for all readings. Actual results are shown on Addendum pages D-89 and D-90.

4.9.7 Minimum Pulse Duration at -65°F, Gaseous, Pressurized

The minimum pulse duration readings of the test items stabilized at -65°F were significantly lower than they were at room temperature. The pulse measurements ranged from 14.0 to 16.0 ms. for valve S/N 007, and from 23.0 to 25.0 ms for valve S/N 008. These readings are shown on Addendum pages D-91 and D-92.

4.9.8 Minimum Pulse Duration at -65°F, Gaseous, Unpressurized

The minimum pulse duration readings at -65°F with the valve in the unpressurized condition were only slightly higher than in the pressurized condition, but well within acceptable limits. These measurements ranged from 15.0 to 20.0 ms for the S/N 007 valve, and from 25.0 to 26.0 ms for valve S/N 008. The readings are shown on Addendum pages D-91 and D-92.

4.9.9 Power, at -65°F

The highest power readings were encountered as a result of the lower coil resistance with the valve stabilized at -65°F. The maximum power consumption was 36.4 watts for S/N 007 and 40.9 watts for S/N 008. The allowable value is 45 watts maximum. Test results are shown on Addendum pages D-91 and D-92.

4.10 After High and Low Temperature Gaseous

At the conclusion of the cold temperature performance tests, the test items were returned to room temperature and the complete series of functional tests performed as described below:

4.10.1 External Leakage After High/Low Temp. Gaseous

External leakage measurements on both test items with 100% helium were well within tolerance. The value was 3.46×10^{-8} sccs for S/N 007 and 11.25×10^{-8} sccs for S/N 008. Records of this test are shown on Addendum page D-93 and D-94.

4.10.2 Internal Leakage After High/Low Temp. Gaseous

Internal leakage measurements with methanol/water service media were 0.0 sccs for both test items. Results of this test are recorded on Addendum pages D-93 and D- 94.

4.10.3 Circuit Resistance After High/Low Temp. Gaseous

Closed circuit resistance readings did not exceed 0.3 ohms for valve S/N 007 and 0.4 ohms for S/N 008. Open circuit readings indicated infinite resistance for both valves, and coil resistance readings were within acceptable limits. These readings are recorded on Addendum pages D-95 and D-96.

4.10.4 Insulation Resistance After High/Low Temp., Gaseous

All of the insulation resistance readings for each valve taken after high and low temperature testing were well in excess of 50 megohms, the minimum allowable value. These readings are recorded on Addendum pages D-97 through D-104.

4.10.5 Minimum Operating Voltage After High/Low Temp. Gaseous, Unpressurized

The minimum operating voltage after high and low temperature testing was comparable to previous room temperature results, and was within acceptable limits. The values were between 16.0 and 17.0 volts d.c. for valve S/N 007 and between 15.0 and 16.0 volts d.c. for valve S/N 008. Results of these tests are recorded on Addendum pages D-103 and D-104.

4.10.6 Minimum Operating Voltage After High/Low Temperature Gaseous, Pressurized.

The minimum operating voltage with the valve pressurized to 50 psig is slightly lower than in the unpressurized condition, and is comparable to previously obtained room temperature data. The values ranged from 15.0 to 15.5 volts d.c. for valve S/N 007 and from 15.0 to 15.5 volts d.c. for valve S/N 008. The data are recorded on Addendum pages D-103 and D-104.

4.10.7 Minimum Pulse Duration After High/Low Temp. Gaseous, Pressurized

The minimum pulse duration performance of either valuve did not seem to be changed as a result of the high and low thermal tests. The results were well within tolerance and ranged from 26.0 to 29.0 ms for both test items. The data are recorded on Addendum pages D-105 and D-106.

4.10.8 Minimum Pulse Duration After High/Low Temp. Gaseous Unpressurized

The minimum pulse duration for the valves in the unpressurized condition ranged from 25.0 to 29.0 ms for S/N 007 and from 27.5 to 30.0 for valve S/N 008. The data are recorded on Addendum pages D-105 and D-106.

4.10.9 Power After High/Low Temp. Gaseous

The power consumption of both test items showed negligible change as a result of the high and low thermal environment. The maximum power drain for valve S/N 007 was 27.72 watts, and for S/N 008 29.96 watts. These results are recorded on Addendum pages D-105 and D-106.

4.11 High Temperature Liquid, +100°F

Both test items were filled with the liquid service media, placed in a chamber, and allowed to stabilize at +100°F. The functional tests described below were then performed.

4.11.1 Internal Leakage at 100°F, Liquid

The poppet leakage test was identical to the internal leakage test of 4.8.1 and the results were essentially identical. Liquid leakage on valve S/N 007 ranged from 0.0 to 0.016 sccs of the service media, and was 0.0 sccs for valve S/N 008. Results of this test are recorded on Addendum pages D-107 and D-108

4.11.2 Circuit Resistance at +100°F, Liquid

Circuit resistance measurements with the valve filled with the liquid service media were within acceptable limits. The closed circuit values did not exceed 0.4 ohms for either test item. Open circuit resistance measurements indicated infinite resistance. Coil resistance readings basically the same as for the gaseous test at +100°F. Results are recorded on Addendum pages D-107, D-108, D-109 and D-110.

4.11.3 Insulation Resistance at +100°F, Liquid

Insulation resistance measurements on both valves were satisfactory during this test. All measurements were in excess of 50 megohms. The resistance readings are recorded on Addendum pages D-109 through D-116.

4.11.4 Minimum Voltage at +100°F, Liquid, Unpressurized

The minimum voltage readings for this test are approximately the same as for the gaseous condition at +100°F, para. 4.8.4, and fell within specified tolerances. The values ranged from 16.0 to 18.0 volts d.c. for valve S/N 007, and from 17.0 to 17.9 volts d.c. for valve S/N 008. These data are recorded on Addendum pages D-115 and D-116.

4.11.5 Minimum Voltage at 100°F, Liquid, Pressurized

The minimum voltage readings with the methanol/water pressurized to 50 psig is about the same as for the unpressurized condition. The values ranged from 16.5 to 17.5 volts d.c. for S/N 007 and from 17.5 to 17.9 volts d.c. for valve S/N 008. These data are recorded on Addendum pages D-115 and D-116.

4.11.6 Pulse Duration at +100°F, Liquid, Pressurized

The minimum pulse duration with the liquid service media pressurized to 50 psig, was slightly higher than the corresponding tests, para. 4.8.6 with gas pressure. Performance was still well within acceptable limits. The measurements ranged from 28.0 to 34.0 ms for valve S/N 007 and from 30.0 to 33.0 ms for valve S/N 008. Results of this test are recorded on Addendum pages D-117 and D-118.

4.11.7 Pulse Duration at +100°F, Liquid, Unpressurized

The test described in 4.11.6 was performed in the unpressurized condition. Results ranged from 26.5 to 28.0 ms for valve S/N 007 and from 28.0 to 34.0 for valve S/N 008. Test data are recorded on Addendum pages D-117 and D-118.

4.11.8 Power at +100°F, Liquid

Power measurements with the test items filled with methanol/water comparable to the same test under gaseous conditions. The maximum power consumption was 26.4 and 28.5 watts respectively for valve S/N 007 and 008. Actual readings are recorded on Addendum pages D-117 and D-118.

4.12 Low Temperature, Liquid, -65°F

Both test items, (filled with the liquid service media), were allowed to stabilize at -65°F and the functions tests listed below performed.

4.12.1 Internal Leakage at -65°F, Liquid

Both test items measured 0 sccs of the liquid service media after stabilization at -65°F. Test results are recorded on Addendum pages D-119 and D-120.

4.12.2 Circuit Resistance at -65°F, Liquid

Circuit measurements, made during this cold test were all within acceptable limits. Closed circuit resistances did not exceed 0.4 ohms. Open circuit measurements indicated infinite resistance. Coil resistances were significantly lower than room temperature and nearly identical to the previous -65°F test readings. Readings for this test are recorded on Addendum pages D-119, D-120, D-121 and D-122.

4.12.3 Insulation Resistance at -65°F, Liquid

None of the the insulation resistance readings taken during this cold test was below the permissable 50 megohms minimum. These readings are recorded on Addendum pages D-121 through D-128.

4.12.4 Minimum Operating Voltage at -65°F, Liquid, Unpressurized

The minimum operating voltage at cold temperature is lower than at room temperature due to the higher current drain. Performance of the test items filled with liquid is similar to the gaseous test run at -65°F. The readings ranged from 12.0 to 15.0 volts d.c. for valve S/N 007 to 11.0 to 12.0 volts d.c. for valve S/N 008. The data are recorded on Addendum pages D-127 and D-128.

4.12.5 Minimum Operating Voltage at -65°F, Liquid, Pressurized

The performance of the test items with the liquid service media pressurized to 50 psig was comparable to the unpressurized condition. The readings ranged from 12.0 to 14.0 volts d.c. for valve S/N 007 and from 12.0 to 13.0 for valve S/N 008. The data are recorded on Addendum pages D-127 and D-128.

4.12.6 Minimum Pulse Duration at -65°F, Liquid, Pressurized

The minimum pulse duration for this test was in the same range as previously obtained room temperature data and still within allowable limits. The measurements ranged from 31.0 to 37.0 ms for valve S/N 007 and from 30.0 to 32.0 ms for valve S/N 008. The readings are recorded on Addendum pages D-129 and D-130 .

4.12.7 Minimum Pulse Duration at -65°F, Liquid, Unpressurized

The pulse duration in the pressurized condition for both test items was somewhat lower than the pressurized case. These values ranged from 27.0 to 30.0 volts d.c. for valve S/N 007 and from 26.0 to 28.0 volts d.c. for valve S/N 008. The readings are recorded on Addendum pages D-129 and D-130 .

4.12.8 Power at -65°F, Liquid

The power consumption of both test items at 28 vdc, during this test was below the allowable 45 watts, and was nearly idential to the results of the previous test at -65°F. The maximum power drain was 37.5 watts for S/N 007 and 40.6 watts for S/N 008. The results are shown on Addendum pages D-129 and D-130.

4.13 After High and Low Temperature, Liquid

At the completion of the high and low thermal tests, a complete series of functional tests were conducted as outlined below.

4.13.1 External Leakage After High/Low Temp., Liquid

External leakage rates for both test items after thermal testing was within specified limits. The leakage was 1.69×10^{-7} sccs He for valve S/N 007, and 5.5 x 10^{-8} sccs He for S/N 008. Records of this test are shown on Addendum pages D-131 and D-132.

4.13.2 Internal Leakage After High/Low Temp., Liquid

Poppet liquid leakage at the completion of thermal testing was still well within acceptable limits. The values ranged from 0 to 0.02 sccs for valve S/N 007 and was 0 sccs for all measurements on Valve S/N 008. Records of this test are shown on Addendum pages D-131 and D-132.

4.13.3 Circuit Resistance After High/Low Temp., Liquid

The results of this test were equal to or better than previous room temperature circuit resistance measurements. The maximum closed circuit resistance on either test item was 0.1 ohm. Open circuit readings all indicated infinite resistance, and coil resistances were nearly equal to previous room temperature measurements. The test records are shown on Addendum pages D-133 and D-134.

4.13.4 Insulation Resistance, After High/Low Temp., Liquid

Insulation resistance measurements at 500 volts d.c. on both test items were well in excess of the 50 megohm minimum requirement. These readings are recorded on Addendum pages D-135 through D-142.

4.13.5 Minimum Voltage, After High/Low Temp., Liquid, Unpressurized

The minimum operating voltage performance of both valves in the unpressurized condition was consistent with previous room temperature performance. Voltage readings ranged from 16.0 to 17.0 volts d.c. for both test items. The data are shown on Addendum pages D-141 and D-142.

4.13.6 Minimum Voltage After High/Low Temp., Liquid Pressurized

Performance of the test items while pressurized to 50 psig with helium is similar to the unpressurized condition. The voltage readings ranged from 16.0 to 17.0 volts d.c. for the S/N 007 valve, and from 16.0 to 16.5 volts d.c. for S/N 008. The data are shown on Addendum pages D-141 and D-142.

4.13.7 Minimum Pulse Duration After High/Low Temp., Liquid, Pressurized

Minimum pulse duration performance of both items in the pressurized condition was slightly higher after than before thermal testing, but all readings are well within the specified values. The pulse width readings ranged from 31.0 to 34.0 ms for valve S/N 007, and from 32.0 to 34.0 for valve S/N 008. Actual measurements are shown on Addendum pages D-143 and D-144.

4.13.8 Minimum Pulse Duration, After High/Low Temp., Liquid, Unpressurized

The minimum operating pulse width in the unpressurized condition is consistent with the pressurized case. The pulse readings ranged from 31.0 to 35.0 ms for valve S/N 007, and from 33.0 to 34.0 for S/N 008. Actual measurements are recorded on Addendum pages D-143 and D-144.

4.13.9 Power After High/Low Temp., Liquid

The power drain of both test items at the conclusion of high/low thermal testing showed that the valve coils were not affected by previous testing. The maximum power consumption was 27.4 watts for S/N 007 and 29.9 watts for S/N 008. The results of these tests are listed on Addendum pages D-143 and D-144.

4.14 Full Flow

This test consisted of performing operational tests on both test items while flowing 900 lb/hr of the liquid media through the valve. The results of the functional tests are described below.

4.14.1 Pressure Drop

Pressure drop measurements were made with flow in both the forward and reverse directions through the valves. Overall results are listed below.

ΔP Range, PSI

Valve S/N	Port A-C	Port B-C	Port C-A	Port C-B
007	0.23-0.36	0.22-0.32	0.32-0.38	0.40-0.45
008	0.38-0.49	0.25-0.34	0.38	0.22-0.35

The specified limit for this test is 0.5 psi. The results of the test are recorded on Addendum pages D-145 and D-146.

4.14.2 Circuit Resistance During Full Flow

The circuit resistance readings during this test were comparable to data collected previously. The closed circuit readings ranged from 0.1 to 0.5 ohms. Open circuit readings indicated infinite resistance. Coil measurements ranged between 27.6 and 28.9 ohms. The data are recorded on Addendum pages D-145 and D-146.

4.14.3 Minimum Operating Voltage During Full Flow

The minimum operating voltage results were characteristic of previous performance with test items filled with gas. The values ranged from 15.0 to 16.0 volts d.c. for both test items. The data are recorded on Addendum pages D-147 and D-148.

4.14.4 Minimum Pulse Duration During Full Flow

The minimum pulse duration was also comparable to previous data under gaseous conditions. The values ranged from 30.0 to 36.0 ms for valve S/N 007 and from 30.0 to 35.0 ms for Valve S/N 008. The data are recorded on Addendum pages D-149 and D-150.

4.14.5 Power During Full Flow

The power drain with liquid flowing through the test items was nearly identical to previously collected data. The maximum power consumption was 27.2 watts for valve S/N 007 and 28.9 watts for S/N 008. Records of this test are shown on Addendum pages D-149 and D-150.

4.15 Humidity

Valve S/N 008 was subjected to 95% R.H. 243 hour humidity test. The test item was completely uncovered, and was not operated while exposed to the humidity environment. An exposure of 240 hours was required. At the conclusion of the test period, the valve was visually examined and no damage or corrosion found. Before one hour had elapsed at the conclusion of the humidity test, the functional tests outlined below were begun.

4.15.1 External Leakage After Humidity

Helium leakage with the valve pressurized to 50 psig was within specified limits. Test records are shown on Addendum page D-151.

4.15.2 Internal Leakage After Humidity

Poppet leakage rates with the liquid service media measured 0.0 sccs for each poppet position. Records are shown on Addendum page D-151.

4.15.3 Circuit Resistance After Humidity

Circuit resistance measurements were all within specified tolerances after being subjected to the humid environment. Closed circuit readings ranged from 0.1 to 0.5 ohms, and open circuit readings indicated infinite resistance. Actual readings are listed on addendum page D-152.

4.15.4 Insulation Resistance After Humidity

Circuit insulation remained in tact after humidity testing. All measurements exceeded the 50 megohm minimum requirement. Records of this test are shown on Addendum pages D-153 to D-156.

4.15.5 Minimum Voltage After Humidity, Unpressurized

The minimum operating voltage performance of the valve was unaffected by the humidity test. The values ranged from 15.0 to 16.0 volts d.c. Actual measurements are recorded on Addendum page D-156.

4.15.6 Minimum Voltage After Humidity, Pressurized

Performance of the valve in the pressurized condition was similar to the unpressurized condition. These values ranged from 14.0 to 16.0 volts d.c., and are recorded on Addendum page D-156.

4.15.7 Minimum Pulse Duration After Humidity, Pressurized

The minimum pulse width performance was also unaffected by humidity testing. The minimum pulse duration in the pressurized condition varied from 27.0 to 32.0 ms. The data are recorded on Addendum page D-157.

4.15.8 Minimum Pulse Duration after Humidity, Unpressurized

The unpressurized performance of the valve was comparable to that for the pressurized condition. Values varied from 28.0 to 32.0 ms and are recorded on Addendum page D-157.

4.15.9 Power After Humidity

The power consumption for the valve after the humidity test was not significantly different from previous measurements, and was well below the 45 watt maximum allowable. The maximum power readings was 29.9 watts, and is recorded on Addendum page D-157.

4.16 Collapse Pressure Test

A collapse pressure test was performed on valve S/N 008 by placing the valve in a chamber and pressurizing the chamber to 19.0 psig for 3 minutes. The internal pressure of the valve was monitored, and remained at 0 psig. There was no visual evidence of collapse or permanent deformation after application of pressure. The valve was successfully operated after visual examination. Records of this test are shown on Addendum page D-158.

4.17 Burst Pressure

A burst pressure test was conducted on valve S/N 008 by pressurizing the valve ports hydrostatically to 125 psig for 3 minutes. The test item was visually examined for deformation and then successfully operated. There was no evidence of distortion or permanent set.

The valve was subsequently pressurized to destruction. The suspension diaphragm failed at 450 psig, followed by the valve cover at 2000 psig. The suspension diaphragm developed cracks at the maximum stress point, which is at the inner radius. The cover failed at the weld joint with the valve body. Photographs of the failure points are included in Addendum E Results of the test are recorded on Addendum page D-158.

4.18 Thermal Cycling

Valve S/N 007 was subjected to 203 consecutive thermal cycles. One cycle consisted of heating the test item until it stabilized at +120°F, then cooling it until it stabilized at 0°F, and then returning it to +120°F. The length of a thermal cycle was approximately 55 minutes. The valve was not operated during the thermal cycles. At the conclusion of this test, the valve was returned to room temperature and functional tests performed.

4.18.1 External Leakage After Thermal Cycling

The helium leak rate of valve S/N 007 was well within specified limits after thermal cycling. The leak rate was $.72 \times 10^{-6}$ and is recorded on Addendum page D-160.

4.18.2 Internal Leakage After Thermal Cycling

Poppet liquid leakage was not affected by thermal cycling. The leak rate from both ports measured 0.0 sccs of the liquid service media. The data are recorded on Addendum page D-160.

4.18.3 Circuit Resistance After Thermal Cycling

Circuit resistance readings after thermal cycling were consistent with previously obtained data. Closed circuit resistance ranged from 0 to 0.5 ohms. Open circuit measurements indicated infinite resistance. Coil resistances averaged 27.9 ohms for one coil and 28.1 ohms for the other. These electrical measurements are recorded on Addendum pages D-161.

4.18.4 Insulation Resistance After Thermal Cycles

Circuit insulation did not exhibit any degradation as a result of thermal cycle testing. All insulation readings exceeded the specified 50 megohms minimum resistance. The data are recorded on Addendum pages D-162 to D-165

4.18.5 Minimum Voltage After Thermal Cycling Unpressurized

The minimum voltage in the unpressurized condition remained well within acceptable limits. The values ranged from 16.0 to 17.0 volts d.c. Results of the test are listed on Addendum page D-165.

4.18.6 Minimum Voltage After Thermal Cycling, Pressurized

The minimum voltage in the pressurized condition (50 psig) was satisfactory. The measurements were between 15.0 and 17.0 volts d.c. Test results are recorded on Addendum pages D-165.

4.18.7 Minimum Pulse Duration After Thermal Cycling, Pressurized.

The minimum pulse duration data after thermal cycling was representative. Values ranged from 30.0 to 33.0 ms. Results are shown on Addendum page D-166.

4.18.8 Minimum Pulse Duration After Thermal Cycling, Unpressurized

Minimum pulse duration in the unpressurized condition for the valve ranged from 30.0 to 32.0 ms. Results are shown on Addendum page D-166.

4.18.9 Power After Thermal Cycling

The power drain for valve S/N 007 did not change with thermal cycling. The maximum value was 27.4 watts, and is recorded recorded on Addendum page D-166.

STP-SSD-1024

QUALIFICATION TEST PROCEDURE FOR ATM TEMPERATURE CONTROL SYSTEM FLOW PATH SELECTOR VALVE

MSFC Spec. No. 20M42517
Hydraulic Research & Mfg. Dwg. No. 39000750

Contract NAS8-30075

Prepared for

National Aeronautics and Space Administration
George C. Marshall Space Flight Center
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4 December 1969

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1.0 Introduction

The purpose of this test program is to determine the ability of an Electrical Pulse Operated Flow Path Selector Valve, Hydraulic Research drawing 39000750, to meet the qualification requirements of NASA/MSFC specification number 20M42517.

1.1 Scope

This document establishes the qualification test procedure to qualify the Flow Path Selector Valve for use in the ATM thermal control system.

2.0 Applicable Documents

2.1 Applicability

The test program contained herein is based on the following documents of the issue indicated.

2.1.1 Specifications

NASA/MSFC Spec. 20M42517 - Valve Assembly Flow Path Selector, Electrical Pulse Operated Design Procurement Drawing.

MSFC Spec. 164 - Cleanliness of Components for use in Liquid Oxygen, Fuel and Pneumatic Systems, Specification For.

MSFC Dwg. 20M42501 - Methanol/Water ATM TCS.

NPC 200-2 - Quality Program Provisions for Space Systems Suppliers.

NPC 200-3 - Inspection Systems Provisions for Suppliers of Space Materials.

2.1.2 Standards

MIL-STD-810A - Environmental Test Methods for Aerospace and Ground Equipment.

MIL-STD-831 - Test Reports, Preparation Of.

2.1.3 Drawings

Hydraulic Research 39000750 - Valve Assembly-- Latching complete.

Hydraulic Research 39000751 - Valve Assembly-- Latching.

MSFC Dwg. 50M02408A - Environmental Design and Qualification Test Criteria for Apollo Telescope Mount Components.

3.0 Test Requirements

3.1 Tolerances

3.1.1 Environmental Tolerances

Unless otherwise indicated herein, the maximum allowable deviation from special environmental conditions are as follows:

a.	Temperature	$\pm$ 2°F
b.	Relative Humidity	$\pm$ 5%
c.	Flow	$\pm$ 1%
d.	Vibration Sine	
	Amplitude	$\pm$10%
	Frequency	$\pm$ 5%
	Test Duration	+10% - 0
e.	Vibration Random	
	Overall Root Mean Square Acceleration	$\pm$10%
	Acceleration Power Spectral Density	+100% - 30%
f.	Pressure	
	Static	$\pm$1.0%
	Dynamic	$\pm$3.0%

3.1.2 Measurement Tolerance

The maximum allowable equipment measurement errors shall be as follows:

a.	Temperature	$\pm$3°F
b.	Relative Humidity	2.5%
c.	Flow	$\pm$2.5%

d.	Vibration	
	Amplitude	±5%
	Frequency	±2%
e.	Pressure	
	Static	±1.0%
	Dynamic	±3.0%

3.1.3 Ambient Conditions

Unless otherwise specified, all tests shall be conducted at the ambient conditions defined below:

a.	Temperature	$77 \pm 18^{\circ}F$
b.	Relative Humidity	90% or less
c.	Pressure - Sea level to 24.05 in. Ag Abs.	

3.2 Failure Definition

The established specification shall be considered the operational requirements for the Qualification Program.

3.2.1 Whenever the test assembly deviates from the requirements of this procedure, failure determination shall be made.

3.2.2 In any case, where the test assembly is physically impaired from performing as required, the operational requirements shall be reviewed and a failure determination made. After incorporation of any changes or procurements of new specimens is complete, the specimen shall be subjected to as many parts of the qualification test procedure as deemed necessary. Additional tests are to be agreed upon in writing by R-P&VE-PM, R-P&VE-PEM, and Avco Applied Technology Division.

3.3 Deviations

No changes shall be made in the requirements of the test procedure without mutual agreement in writing by R-P&VE-PM, and R-P&VE-PEM, and Avco Applied Technology Division.

3.4 Final Report

Avco Applied Technology Div. shall be responsible for the preparation of the final report. The report shall be a complete and concise record of all phases of testing with applicable data obtained from the test program.

3.5 Data Recording

The results of inspection tests, discrepancies, and deviations shall be entered on the appropriate data sheets in the data section of this procedure. Each paragraph involving inspection or test has a corresponding paragraph in the data section for recording of comments and/or data.

3.6 Location of Test Facilities

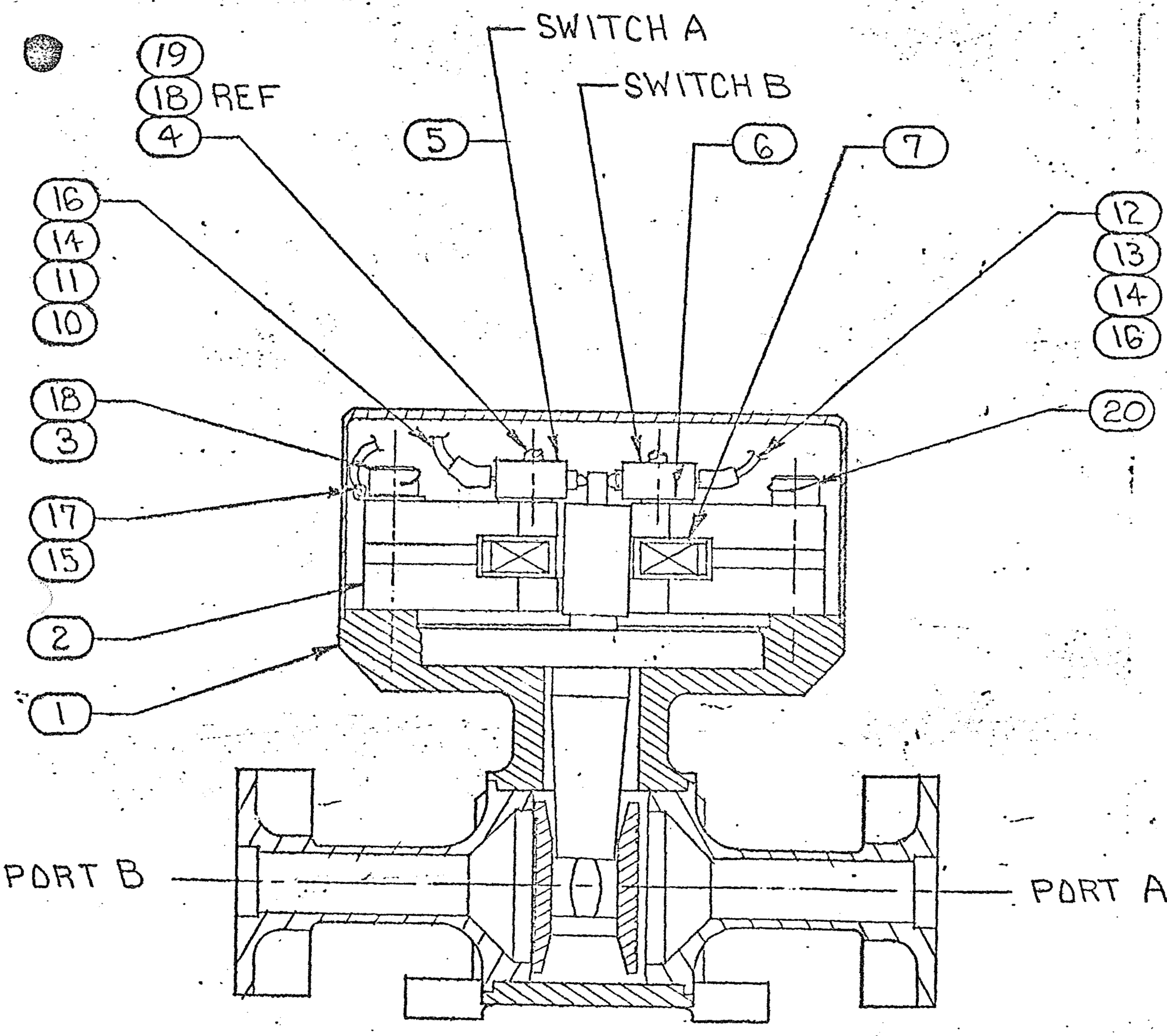
All of the testing will be performed at Avco's Lowell and Wilmington, Massachusetts, facilities with exception of the Acoustic Noise test which will be performed by Noise Unlimited of Sommerville, New Jersey.

4.0 Component Description

The flow path selector valve is a two position switching valve which diverts flow from either of two inlet ports to a common outlet port upon receipt of an electrical pulse. The flow valves are connected in a redundant network to direct flow to either the heating or cooling section of the Apollo Telescope Mount Temperature Control System. The redundant flow valves are operated by temperature controllers that modulate the diverter valves on the basis of inlet temperature to the portion of the system which is being controlled.

The valve is composed basically of an armature, two permanent magnet poles, a flapper type suspension member, a poppet, two micro-switches and a housing. The armature is located between the two permanent magnets, and separated from these magnets by a small air gap. The armature is composed of a metal core around which 3 coils are wound in a bifilar manner. The armature is structurally part of the flapper which is attached to the poppet. The poppet is held in either of two positions by virtue of the permanent magnets, and a pivot (suspension plate) located between the armature and the poppet.

When one of the bifilar windings is appropriately energized, a magnetic potential is developed across the armature which opposes and overcomes the permanent magnet potential to drive the poppet in the opposite direction. As the armature is unlatched, the opposite permanent magnet attracts the armature to switch the valve from one position to the other, and therefore close the opposite port. Due to the symmetry of construction, the secondary position is identical to the primary position. The third winding has the ends of the coil shorted and is used as an inverse voltage suppression winding for the two power windings.



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Pulse Operated Flow Diverter Valve
Assembly Drawing
Specification 20M42517

	DESCRIPTION OR TITLE
1	WELDED VALVE ASSY
2	POLE ASSY
3	SCREW, CAP
4	SCREW
5	SWITCH
6	SPACER
7	COIL ASSY
8	COVER
9	RECEPTACLE
10	LEADWIRE GRAY
11	LEADWIRE, ORANGE
12	LEADWIRE BLUE
13	LEADWIRE, YELLOW
14	LEADWIRE, BROWN
15	LEADWIRE, BLACK
16	TUBING, SHRINK
17	TERMINAL, RING
18	EPOXYLITE
19	LOCKWIRE
20	LOCKWIRE

Pulse Operated Flow Diverter Valve
Parts List

N71-21999

Two microswitches mounted above the permanent magnets are connected to an electrical indicator system which provides crewmembers with an indication of valve position. The switches are activated by an extension of the armature. When one of the valve ports opens, the affected microswitch closes to provide circuit continuity through the switch.

The microswitches are Honeywell 1HM25 single pole double throw hermetically sealed switches. The switch terminals are brought out to an ITT Cannon connector, P/N PV3A14B12SNS. The same connector also leads to the coil windings.

The valve operates with an 80% methanol 20% water medium at pressures from 0 to 50 psig. Proof and burst pressures are 75 and 125 psig respectively. Overall weight of the valve is approximately 5.5 pounds and its maximum dimensions are 4.6 x 5.2 x 4.1 inches. The valve body and all wetted components, including the valve poppet and seat, are constructed of 316L.

5.0 Procedure

5.1 Pre-Test Examination (Ref. Spec. 20M42517, Para. 3.4)

The items to be tested shall be visually inspected to verify conformance to NASA/MSFC drawing No. 20M42522 and to Hydraulic Research and Mfg. drawing No. 39000750.

5.1.1 Identification (Ref. Spec. 20M42517, Para. 3.4.5)

Examine each valve assembly for identification markings in accordance with Standard MIL-STD-130.

5.1.2 Workmanship (Ref. Spec. 20M42517, Para. 3.5.12)

Examine each valve assembly to verify that it is fabricated and finished in such a manner that the criteria of appearance, fit, and adherence to specific tolerances have been observed. Particular attention shall be given to the neatness and thoroughness of marking, plating, machine-screw assemblage, and freedom of parts from burrs and sharp edges.

5.1.3 Cleaning (Ref. Spec. 20M42517, Para. 3.5.1)

Each valve shall be cleaned to the requirements of the Contamination Control Plan, QATP-SD-199.

5.2 Test Summary

The test samples will be subjected to the following tests.

Test	Sample No. 1	Sample No. 2
Functional Tests - 4.3.5	X	X
Acoustic Noise - 4.3.4.11	X	X
Vibration - 4.3.4.9	X	X
Transient Pulses - 4.3.4.12	X	X
Life Cycling - 4.3.4.10	X	X
Temperature - 4.3.4.6	X	X
Full Flow - 4.3.4.5	X	X
Humidity - 4.3.4.1		X
Salt Fog - 4.3.4.2		X
Sand and Dust - 4.3.4.3		X
Fungus - 4.3.4.4		X
Collapse - 4.3.4.13		X
Burst - 4.3.4.14		X
Temperature Cycling - 4.3.4.7	X	
Compatibility - 4.3.4.8	X	

NOTE: Numbers refer to paragraphs in Specification 20M42517.

5.3 Functional Test

The following test shall be performed on each qualification test sample before the valve is subjected to the environmental tests.

5.3.1 Proof Pressure (Ref. Spec. 20M42517, Para. 4.3.3.1)

The proof pressure test shall be performed in a test setup as shown schematically in Figure 1 and shall be repeated several times after individual environmental tests as specified herein. The valve, port blocking plates, port adapters, "O"-Rings, tubing, and associated test hardware shall be cleaned in accordance with the approved valve cleaning procedure (QATP-SD-199) before the test. Ports A and B of the valve shall be covered with blocking plates sealed by "O"-Rings, and port C of the valve connected to the pressurizing circuit. The valve shall be pressurized with 100% helium to 75 psig and held for 5 minutes minimum. While pressurized, the valve shall be cycled twice to insure that full pressure is applied to all wetted portions of the valve. After the proof pressure test, the unit shall be visually examined for failure, distortion or permanent set.

5.3.2 Leakage, External (Ref. Spec. 20M42517, para. 4.3.3.3.1)

The valve shall be maintained in the setup shown in Figure 1. The Mass Spectrometer shall be calibrated using a leak standard, and background leaks eliminated from the apparatus. Port C of the valve shall be pressurized to 50 psig. The line upstream of the shut-off valve shall be disconnected after closing the shut-off valve. The valve shall be placed in a bell jar and the jar evacuated to 50 microns of mercury or less while the external leakage measurement is made. The leak rate shall be recorded only when the leakage approaches a stabilized reading. The maximum allowable leak rate is 1×10^{-7} STD cc He/Sec.

5.3.3 Leakage, Internal (Ref. Spec. 20M42517, para. 4.3.3.3.2)

This test shall be performed with a setup as shown schematically in Figure 2. The valve shall be energized to close Port A and closure verified by indicator lights on the test panel. Port A shall be pressurized to 5.0, 10.0 and 20.0 psig with the liquid service media, and the leakage measured at each pressure. The process shall be repeated with Port B closed, and pressurized. The leakage measurements shall be made 3 times on each port. The allowable leak rate shall not exceed 0.20 STD cc Sec, liquid service media.

5.3.4 Acceptance Vibration (Ref. Spec. 20M42517, para. 4.3.5(c))

The valve shall be mounted to a flat plate, utilizing the three mounting feet provided. Ports A and B shall be covered with the blocking plates, and Port C pressurized to 20 psig pneumatically. The valve shall be cycled twice to insure equal pressure distribution throughout the wetted portion of the valve. Pressure within the valve shall be monitored by means of a pressure gage. The test setup shall be as shown in Figure 3 with the exception of the output accelerometers.

The test samples shall be subjected to random vibration along the axis normal to the mounting plane to the levels listed below. An X-Y plot of spectral density versus frequency shall be provided with each run.

Frequency (Hz)	Power Spectral Density
20-46	+6.0 DB per octave
46-100	0.0357 g^2 per Hz
100-210	-9.0 DB per octave
210-750	0.00375 g^2 per Hz
750-1155	-12.0 DB per octave
1155-2000	0.000655 g^2 per Hz

5.3.5 Vacuum, Internal (Ref. Spec. 20M42517, Para. 4.3.3.2)

Ports A and B of the valve shall be capped with blocking plates and port C connected to a vacuum source as shown in Figure 4. The assembly shall be evacuated to 1.94×10^{-4} torr (while external pressure remains atmospheric) and the vacuum maintained for a period of five (5) minutes minimum. When the specified vacuum is achieved, the valve shall be cycled twice to insure equal pressure distribution throughout the wetted portion of the valve. The valve shall then be visually inspected for damage, deformation or permanent set.

5.3.6 Proof Pressure

The test described in paragraph 5.3.1 shall be performed with exception of the cleaning procedure which shall not be repeated.

5.3.7 Leakage External (Gaseous)

The leakage test described in paragraph 5.3.2 shall be performed.

5.3.8 Leakage Internal

The test described in paragraph 5.3.3 shall be performed.

5.3.9 Circuit Resistance (Ref. Spec. 20M42517, Para. 4.3.3.4)

5.3.9.1 Port A of the valve shall be placed in the open position by applying 28 volts d.c. to pins L(+) and J(-). The resistance between the pins listed on the data sheets under "Port A Open" paragraph 5.3.9.1 shall be measured.

5.3.9.2 Resistance measurements shall then be made with port B of the valve open (28 volts applied across M(+) and K(-)) between the pins listed on the data sheets under "Port B Open," paragraph 5.3.9.2.

All of the resistance measurements specified above shall be performed three (3) times.

5.3.10 Insulation Resistance (Ref. Spec. 20M42517, Para. 4.3.3.5)

5.3.10.1 Insulation resistance measurements shall be made with an applied voltage of 500 volts d.c. between the pins listed on the data sheets under paragraph 5.3.10.1.

5.3.10.2 Port A of the valve shall be opened by energizing pins L(+) and J(-) with 28 volts d.c. and insulation resistance measurements made with 500 volts d.c. applied between the pins listed in paragraph 5.3.10.2 of the data section.

5.3.10.3 Connector pins M(+) and K(-) shall be energized with 28 volts d.c. to open port B, and insulation resistance measurements made between the pins listed in paragraph 5.3.10.3 of the data section.

Insulation resistance measurements shall be recorded only if the value is stable or increasing.

5.3.11 <u>Minimum Operating Voltage, Unpressurized Assembly (Ref. Spec. 20M42517, Para. 4.3.3.7)</u>

This test shall be conducted with a pulse generator oscilloscope and test panel connected as shown in Figure 5. The pulse generator shall be set for a 100 millisecond pulse width. The minimum operating voltage shall be measured by slowly increasing the power supply voltage from zero until the valve actuates, as indicated by the indicator lights on the test panel. Photographs of the oscillographic traces are to be taken.

The procedure is to be repeated for port B by applying pulses to pins M(+) and K(-) and monitoring switch closure. These voltage measurements shall be performed at least three (3) times for each port. The minimum operating voltage is not to exceed 18 volts d.c.

5.3.12 <u>Minimum Operating Voltage, Pressurized Assembly (Ref. Spec. 20M42517, Para. 4.3.3.7)</u>

The valve shall be pressurized to 50 psig with 100% helium as shown on the pneumatic schematic of Figure 5. The minimum operating voltage test described in paragraph 5.3.11 shall be performed.

5.3.13 <u>Minimum Pulse Duration, Pressurized Assembly (Ref. Spec. 20M42517, Para. 4.3.3.8)</u>

The valve assembly shall be maintained in the test setup shown in Figure 5, and the valve pressurized to 50 psig. The power supply shall be adjusted to 28 volts d.c., and the pulse generator set to its minimum pulsed width. The minimum operating pulse width for the valve shall be measured by slowly increasing the generator pulse width until the valve actuates as evidenced by switch closure. Photographs of the oscilloscope trace shall be taken, and the pulse duration recorded. The minimum pulse duration shall be measured at least three (3) times for each port. The maximum allowable operating pulse is 100 milliseconds.

5.3.14 Minimum Pulse Duration, Unpressurized Assembly (Ref. Spec. 20M42517, Para. 4.3.3.8)

The valve assembly shall be left in the setup shown in Figure 5, and the test outlined in paragraph 5.3.13 repeated with the valve unpressurized. Tolerance-100 milliseconds maximum.

5.3.15 Power Consumption (Ref. Spec. 20M42517, Para. 4.3.3.9)

With the valve setup as shown in Figure 6 and with the power supply set at 28 volts, the current shall be measured and the power computed. Power measurements shall be made for each coil. The maximum allowable power consumption is 31.5watts. Current shall be measured immediately after applying power, since current will decrease when coil warms up.

5.4 Acoustic Noise (Ref. Spec. 20M42517, Para. 4.3.4.11)

The two qualification units shall be mounted on a plate and pressurized with the liquid service media by means of a gas bottle. The assembly shall be mounted in a reverberation chamber of sufficient dimensions to generate the sound pressure specified in Appendix E of specification 50M02408B. The sound pressure field levels shall be checked with the specimens mounted in the test chamber. Trial runs shall be made in accordance with paragraph 5.2.5.2.2 of specification 50M02408 until the lower limits of the acoustic spectrum have been exceeded. The upper level of the spectrum may be exceeded because of equipment limitations.

Two full level runs shall then be made. The first shall be with the dual port axis mounted parallel to the sound propagation direction and the second, mounted with the axis of the valve mounted parallel to the direction of sound propagation. The acoustic noise test will be performed under subcontract by Noise Unlimited of Sommerville, New Jersey.

Following the test, the valve shall be visually examined for damage and the following tests performed:

Proof Pressure	Para. 5.3.1
Vacuum	Para. 5.3.5
Leakage	Paras. 5.3.2, 5.3.3
Circuit Resistance	Para. 5.3.9
Insulation Resistance	Para. 5.3.10
Position Indicators	Para. 5.3.9
Minimum Operating Voltage	Paras. 5.3.11, 5.3.12
Pulse Duration	Paras. 5.3.13, 5.3.14
Power	Para. 5.3.15

5.5 Vibration (Ref. Spec. 20M42517, Para. 4.3.4.9)

Both qualification valves shall be bolted to a flat plate through the valve mounting holes. The valves shall be filled with the liquid service media and pressurized to 20 psig as shown schematically in Figure 3. The primary port shall be opened and the continuity monitored between connector pins A and E during the test.

A control accelerometer and three output accelerometers shall be used for sinusoidal vibration evaluation. The output accelerometers shall be mounted to sense acceleration along each of the three major axes of the valve. The output signals from the accelerometers shall be displayed on an oscillograph.

5.5.1 Sinusoidal Excitation, Vehicle Dynamics

The test units shall be subjected to the sinusoidal excitation schedule listed below at a scan rate of 3 octaves per minute along each of three mutually perpendicular axes. One of the axis shall coincide with the dual port axis.

Vehicle Dynamics Criteria (Port C Axis)
(3-40 HZ @ 3 oct. /min.)

Frequency	Level
3-7	0.59 D.A.
7-10	1.6g Peak
10-40	0.5g Peak

Lateral Axes
(2-20 HZ @ 3 oct. /min.)

Frequency	Level
2-4	0.48 D.A.
4-10	0.4 g's Peak
10-20	0.12 g's Peak

5.5.2 Sine Evaluation Criteria

The two test valves shall be subjected to the following sinusoidal scan at 1.0 octave per minute along each of three major axes.

Frequency (Hz)	Level
20-100	0.0020
100-2000	1.0 Peak (g)

5.5.3 Random Criteria, High Level

The valves shall be subjected to the random excitation levels shown below for a period of one (1) minute per axis. The valve shall be vibrated along each of the major axes.

High Level Longitudinal and Lateral Axes

Frequency (Hz)	Level
20	0.027 g^2/Hz.
20-46	Inc. at 6.0 DB/Octave
46-100	0.14 g^2/Hz
100-210	Dec. at 9.0 DB/Octave
210-750	0.015 g^2/Hz
750-1155	Dec. 12 DB/Octave
1155-2000	0.0026 g^2 / Hz
	Composite=5.5 grms.

5.5.4 Random Criteria, Low Level

The valves shall be subjected to the low level random vibration levels shown below for four (4) minutes along each of the 3 major axes.

Low Level Longitudinal and Lateral Axes

Frequency (Hz)	Level
20	0.012 g^2/Hz.
20-46	Inc. at 6.0 DB/Octave
46-100	0.064 g^2/Hz
100-210	Dec. at 9.0 DB/Octave
210-750	0.0067 g^2/Hz
750-1155	Dec. at 12.0 DB/Octave
1155-2000	0.00124 g^2/Hz
	Composite = 3.6 grms.

At the conclusion of all the vibration runs, the valves shall be visually examined for failure, and the following tests performed:

Proof Pressure	Para. 5.3.1
Vacuum	Para. 5.3.5
Leakage	Paras. 5.3.2, 5.3.3,
Circuit Resistance	Para. 5.3.9
Insulation Resistance	Para. 5.3.10
Position Indicators	Para. 5.3.9
Minimum Operating Voltage	Paras. 5.3.11, 5.3.12
Pulse Duration	Paras. 5.3.13, 5.3.14
Power	Para. 5.3.15

5.6 Transient Pulses (Ref. Spec. 20M42517, Para. 4.3.4.12)

This test is performed in five parts to measure the ability of the valve to withstand spurious transients as defined in Figure 3 of specification 20M42517.

5.6.1 Minimum Operating Voltage (Unpressurized) (Ref. Spec. 20M42517, Para. 4.3.3.7)

The test outlined in paragraph 5.3.11 shall be performed.

5.6.2 Minimum Operating Voltage (Pressurized) (Ref. Spec. 20M42517, Para. 4.3.3.7)

The test outlined in paragraph 5.3.12 shall be performed.

5.6.3 Minimum Pulse Duration (Pressurized) (Ref. Spec. 20M42517, Para. 4.3.3.8)

The test outlined in paragraph 5.3.13 shall be performed.

5.6.4 Minimum Pulse Duration (Unpressurized) (Ref. Spec. 20M42517, Para. 4.3.3.8)

The test outlined in paragraph 5.3.14 shall be performed.

5.6.5 Transient Pulses

The valve shall be setup in a test circuit as shown in Figure 8. Transient pulses shall be applied to one coil (B as shown in Figure 8) and a steady state signal applied to the opposite coil as shown in the table below. The valve shall be pressurized to 50 psig. Oscilloscope photographs of the signal on both coils shall be taken simultaneously. Reference photographs shall be made before the transient test of the standard

28 volt signal on each coil. After the transient signals have been applied to one coil the circuits shall be switched and the procedure repeated for the second coil. Application of the transient signal shall not cause the valve to actuate or switch from one position to the other.

Coil A		Coil B	
Amplitude (Volts)	Duration (Millisecs.)	Amplitude (Volts)	Duration (Millisecs.)
+28	Steady-State	+72	.005
+28	Steady-State	0	0
+28	Steady-State	-19	9
+72	.005	+28	Steady-State
0	0	+28	Steady-State
-19	9	+28	Steady-State

5.6.6 Coil Transient Voltage (No Spec. para.)

With the valve at room temperature, a 28 volt d.c. signal shall be applied to each active coil individually so as to actuate the valve. Before the coil has been energized for 10 seconds, the valve shall be de-energized and the coil transient measured with an oscilloscope using the circuit shown in Figure 7. An oscilloscope photograph of the closing voltage transient shall be made for each coil. The maximum allowable peak transient voltage shall not exceed 150 percent of the rated coil voltage. The transient voltage shall be measured a minimum of three (3) times on each active coil, and the largest transient value recorded as the actual value.

5.7 Life Cycling (Ref. Spec. 20M42517, Para. 4.3.4.10)

A minimum of 1000 cycles shall be applied to each valve by means of the test circuit shown in Figure 9. One cycle is defined as moving from the primary to the secondary position, and back to the primary position or vice versa. The cycling shall be performed with the valve filled with the liquid service media, 28 volts d.c. applied to the valve coils, and with the microswitches resistively loaded to 3 amperes at 28 volts d.c. The number of cycles shall be monitored by means of a pulse counter. Each cycle shall be approximately 5 seconds in duration.

After 150, 300, 500 and 750 cycles, the following tests shall be performed:

Leakage	Para. 5.3.3
Circuit Resistance	Para. 5.3.9
Position Indicators	Para. 5.3.9
Minimum Operating Voltage	Paras. 5.3.11, 5.3.12
Pulse Duration	Paras. 5.3.13, 5.3.14
Power	Para. 5.3.15

At the completion of the test, the valves shall be subjected to the following tests:

Proof Pressure	Para. 5.3.1
Vacuum	Para. 5.3.5
Leakage	Paras. 5.3.2, 5.3.3
Circuit Resistance	Para. 5.3.9
Insulation Resistance	Para. 5.3.10
Position Indicators	Para. 5.3.9

Minimum Voltage	Paras. 5.3.11, 5.3.12
Pulse Duration	Paras. 5.3.13, 5.3.14
Power	Para. 5.3.15

5.8 High and Low Temperature

5.8.1 High Temperature, Gaseous (Ref. Spec. 20M42517, Para. 4.3.4.6.1 (a))

The two valves shall be placed unfilled in a chamber and setup as shown in Figure 10. The temperature shall be raised to +165°F and the valves allowed to stabilize at this temperature. After stabilization, one coil shall be energized with 30 volts d.c. for 5 continuous minutes. During this period, the coil resistance shall be monitored by measuring the current drain. Thermocouples shall be bonded to the valve to monitor valve temperature. At the end of the 5 minute period, the valve shall be de-energized and the valve body allowed to return to +165°F. This cycle shall be performed 10 times, on each coil. The valve shall be operated between each temperature cycle. At the completion of the cycling the valve shall be allowed to stabilize at 100°F and the following tests performed:

Leakage	Para. 5.3.3
Circuit Resistance	Para. 5.3.9
Insulation Resistance	Para. 5.3.10
Position Indicators	Para. 5.3.9
Minimum Voltage	Paras. 5.3.11, 5.3.12
Pulse Duration	Paras. 5.3.13, 5.3.14
Power	Para. 5.3.15

5.8.2 Low Temperature, Gaseous

The two test valves shall be placed, unfilled, in a chamber and setup as shown in Figure 16 and the temperature lowered to -65°F. The valve temperature shall be allowed to stabilize at -65°F and held for a minimum of 48 hours. Thermocouples shall be bonded to the valve to indicate valve temperature. While stabilized at -65°F, the following tests shall be performed:

Leakage	Paras. 5.3.2, 5.3.3
Circuit Resistance	Para. 5.3.9
Insulation Resistance	Para. 5.3.10
Position Indicators	Para. 5.3.9
Minimum Operating Voltage	Paras. 5.3.11, 5.3.12
Pulse Duration	Paras. 5.3.13, 5.3.14
Power	Para. 5.3.15

5.8.3 After High and Low Temperature Gaseous

At the completion of gaseous temperature testing, the valve shall be returned to room temperature, visually examined for failure and tested to the requirements listed below:

Leakage	Paras. 5.3.2, 5.3.3
Circuit Resistance	Para. 5.3.9
Insulation Resistance	Para. 5.3.10
Position Indicators	Para. 5.3.9
Minimum Operating Voltage	Paras. 5.3.11, 5.3.12
Pulse Duration	Paras. 5.3.13, 5.3.14
Power	Para. 5.3.15

5.8.4 High Temperature, Liquid (Ref. Spec. 20M42517, Para. 4.3.4.6.2)

The two qualification valves shall be setup as in Figure 10 and filled with the liquid service media. The chamber temperature shall be increased and the valve allowed to stabilize at +100°F. After stabilizing as indicated on the recorder trace, the following tests shall be performed:

Leakage	Para. 5.3.3
Circuit Resistance	Para. 5.3.9
Insulation Resistance	Para. 5.3.10
Position Indicators	Para. 5.3.9
Minimum Voltage	Para. 5.3.11, 5.3.12
Pulse Duration	Para. 5.3.13, 5.3.14
Power	Para. 5.3.15

5.8.5 Low Temperature, Liquid

The valve shall be returned to the setup shown in Figure 16, filled with liquid service media and the tests of paragraph 5.8.4 repeated, except that the temperature shall be -65°F.

5.8.6 After High and Low Temperature Liquid

At the completion of the liquid temperature testing, the valve shall be returned to room temperature, visually examined for failure and tested to the requirements listed below:

Leakage	Para. 5.3.2, 5.3.3,
Circuit Resistance	Para. 5.3.9
Insulation Resistance	Para. 5.3.10
Position Indicators	Para. 5.3.9
Minimum Operating Voltage	Paras. 5.3.11, 5.3.12
Pulse Duration	Paras. 5.3.13, 5.3.14
Power	Para. 5.3.15

5.9 Full Flow (Ref. Spec. 20M42517, Para. 4.3.4.5)

The valve shall be connected to a positive pressure pump as shown in Figure 11. The pump flow rate shall be adjusted to 900 lb/hr (2.12 GPM) and the flow rate measured with a flow meter. The pressure drop across the valve shall be measured as the reading on the Δ P pressure gage. While the valve is passing full flow, the following tests will be performed:

Pressure drop, from Ports A to C, B to C, C to A and C to B.

Position Indicators	Para. 5.3.9
Minimum Voltage	Paras. 5.3.11, ~~5.3.12~~
Pulse Duration	Paras. ~~5.3.13~~, 5.3.14
Power	Para. 5.3.15

5.10 Humidity (Ref. Spec. 20M42517, Para. 4.3.4.1)

The valve shall be placed in a chamber conforming to the requirements of MIL-STD-810A. The temperature and relative humidity in the chamber shall be controlled as shown in Figure 15 over a period of 24 hours. The cycle shall be repeated 10 times for a minimum test period of 240 hours. At the conclusion of the humidity test, the following tests will be performed:

Leakage	Paras. 5.3.2, 5.3.3,
Circuit Resistance	Para. 5.3.9
Insulation Resistance	Para. 5.3.10
Position Indicators	Para. 5.3.9
Minimum Voltage	Paras. 5.3.11, 5.3.12
Pulse Duration	Paras. 5.3.13, 5.3.14
Power	Para. 5.3.15

5.11 Salt Fog (Ref. Spec. 20M42517, Para. 4.3.4.2)

One test valve shall be placed in a chamber and exposed to the salt fog atmosphere for a minimum of 48 hours in accordance with method 509.1 of MIL-STD-810A. At the end of the test period, the valve shall be wiped free of salt deposits, examined for failure, and the following tests performed:

Leakage	Paras. 5.3.2, 5.3.3
Circuit Resistance	Para. 5.3.9
Insulation Resistance	Para. 5.3.10
Position Indication	Para. 5.3.9
Minimum Voltage	Paras. 5.3.11, 5.3.12
Pulse Duration	Paras. 5.3.13, 5.3.14
Power	Para. 5.3.15

5.12 Sand and Dust (Ref. Spec. 20M42517, Para. 4.3.4.3)

A qualification unit shall be placed in a chamber, and a sand and dust composition conforming to MIL-STD-810A method 510.1 circulated throughout the chamber. The chamber will be maintained at 77°F for a period of 2 hours, and the air velocity through the test chamber at 100 to 500 feet per minute. After the 2 hour period, the temperature shall be raised and maintained at 160°F for 2 hours. At the end of the period, the valve shall be wiped free of dust, inspected for damage, and the following tests performed:

Leakage	Paras. 5.3.2, 5.3.3
Circuit Resistance	Para. 5.3.9
Insulation Resistance	Para. 5.3.10
Position Indicators	Para. 5.3.9
Minimum Voltage	Paras. 5.3.11, 5.3.12
Pulse Duration	Paras. 5.3.13, 5.3.14
Power	Para. 5.3.15

5.13 Fungus (Ref. Spec. 20M42517, Para. 4.3.4.4)

One valve shall be placed in a test chamber. The internal chamber temperature shall be raised to 86 $\pm$ 3.6°F and 95 $\pm$ 5 percent relative humidity, and maintained throughout the test period. A known nutrient material shall be placed near the valve to be used as a reference, and both the valve and the known nutrient material sprayed with fungus spores, prepared in accordance with MIL-STD-810A method 508.1. The test period shall be 28 days minimum. At the end of the period, the test item and the nutrient sample shall be removed from the chamber. The nutrient material shall be axamined to verify fungus growth, and the valve shall be visually examined for damage and evidence of fungus growth. At the conclusion of the fungus test, the tests listed below shall be performed:

Leakage	Paras. 5.3.2, 5.3.3
Circuit Resistance	Para. 5.3.9
Insulation Resistance	Para. 5.3.10
Position Indicators	Para. 5.3.9
Minimum Voltage	Paras. 5.3.11, 5.3.12
Pulse Duration	Paras. 5.3.13, 5.3.14
Power	Para. 5.3.15.

5.14 Collapse Pressure (Ref. Spec. 20M42517, Para. 4.3.4.13)

The valve shall be placed in a container with two ports blocked, and the third connected to a pressure gauge outside of the container as shown in Figure 12, so that the internal pressure of the valve can be monitored. The container pressure shall then be raised to 19 psig pneumatically and held for 3 minutes minimum before reducing to zero. After the test, the valve shall be visually examined for evidence of yielding cracks or rupture.

5.15 Burst Pressure (Ref. Spec. 20M42517, Para. 4.3.4.14)

NOTE: The burst pressure test shall be the last one performed.

Hydrostatic pressure shall be applied to the common port of the valve with the dual ports blocked as shown in Figure 13. The valve internal pressure shall be slowly increased to 125 psig and held for 3 minutes. The unit shall then be visually examined for evidence of yielding, cracks, rupture and operated for a few cycles to ascertain that the valve is still functioning. The pressure shall be gradually raised again until the assembly ruptures, and the rupture pressure recorded.

5.16 Temperature Cycling (Ref. Spec. 20M42517, Para. 4.3.4.7)

The valve shall be placed in a thermal chamber with the valve filled with the service media, and pressurized to 20 psig by means of a gas bottle. The valve will be placed in a methanol bath with thermocouples bonded to the base, mid-section and cover. A schematic of the test setup is included in Figure 10. The bath temperature will be controlled with liquid nitrogen on demand from an automatic temperature controller.

The upper limit of valve temperature shall be set by heating the bath with a hot plate, and controlling the plate automatically with separate temperature controller. A timer shall sequence the two temperature controllers to provide adequate dwell time at the temperature extremes.

The test sequence shall consist of cycling the valve temperature from +120°F to -0°F and back to +120°F for a total of 200 cycles. At the conclusion of the test, the valve assembly shall be returned to room temperature, examined for failure and subjected to the following tests:

Leakage	Paras. 5.3.2, 5.3.3
Circuit Resistance	Para. 5.3.9
Insulation Resistance	Para. 5.3.10
Position Indicators	Para. 5.3.9
Minimum Voltage	Paras. 5.3.11, 5.3.12
Pulse Duration	Paras. 5.3.13, 5.3.14
Power	Para. 5.3.15

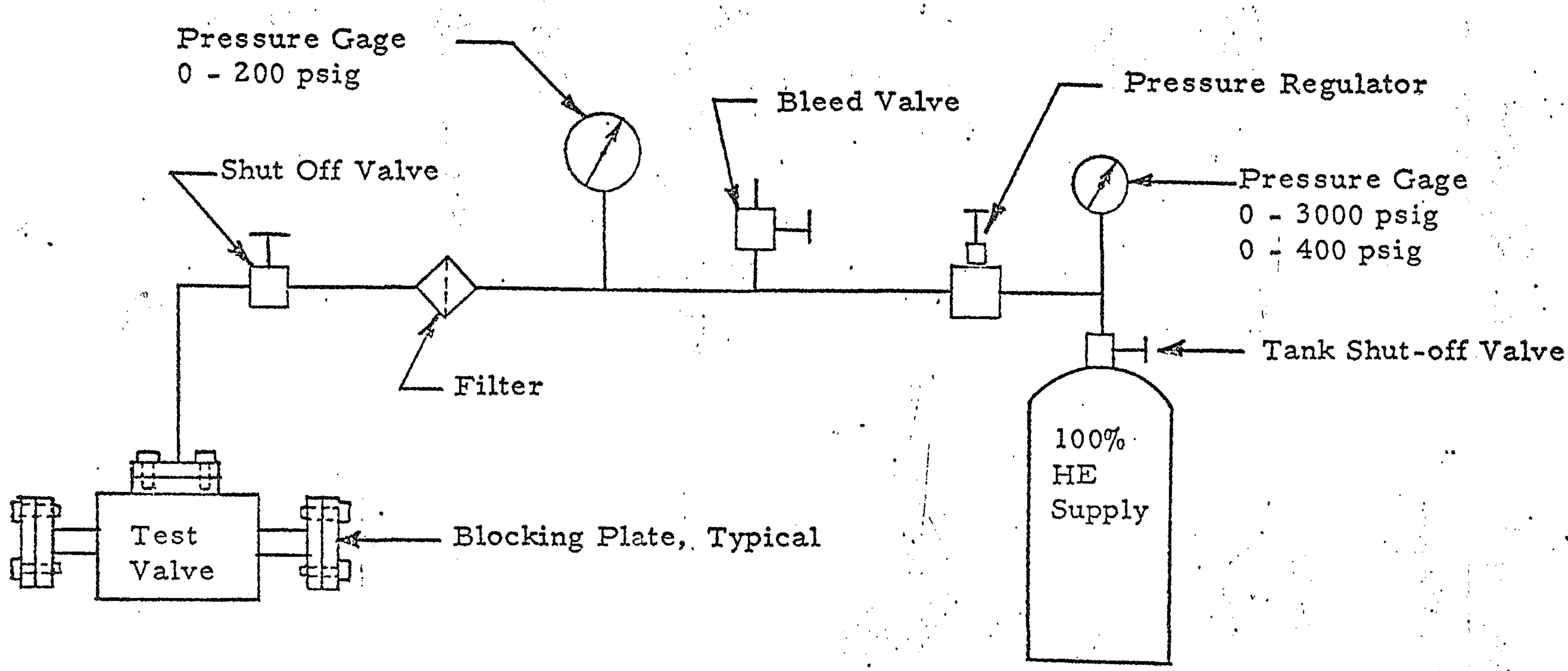
5.17 Compatibility (Ref. Spec. 20M42517, Para. 4.3.4.8)

The valve shall be filled with the liquid service media with the dual ports capped, and the inlet pressurized to 20 psig by means of a gas bottle. The valve and associated plumbing shall be thoroughly cleaned and flushed in accordance with SD-199 (Contamination Control Plan for the Hydraulic Research Latching Valve Assembly HR Dwg. No. 39000750) prior to use. The fluid medium shall be chemically analyzed before the test. The test apparatus shall then be installed in a bell jar as shown in Figure 14, and the bell jar evacuated to 1.0×10^{-6} torr. After 30, 60, 120 and 190 days the valve shall be removed from the bell jar, the fluid visually examined for discoloration or contamination, and chemically analyzed. At these intervals, the tests listed below shall be performed. When the test is resumed, the valve shall be filled with clean fluid.

Leakage	Paras. 5.3.2, 5.3.3
Circuit Resistance	Para. 5.3.9
Insulation Resistance	Para. 5.3.10
Position Indicators	Para. 5.3.9
Minimum Voltage	Paras. 5.3.10, 5.3.11
Pulse Duration	Paras. 5.3.12, 5.3.13
Power	Para. 5.3.15

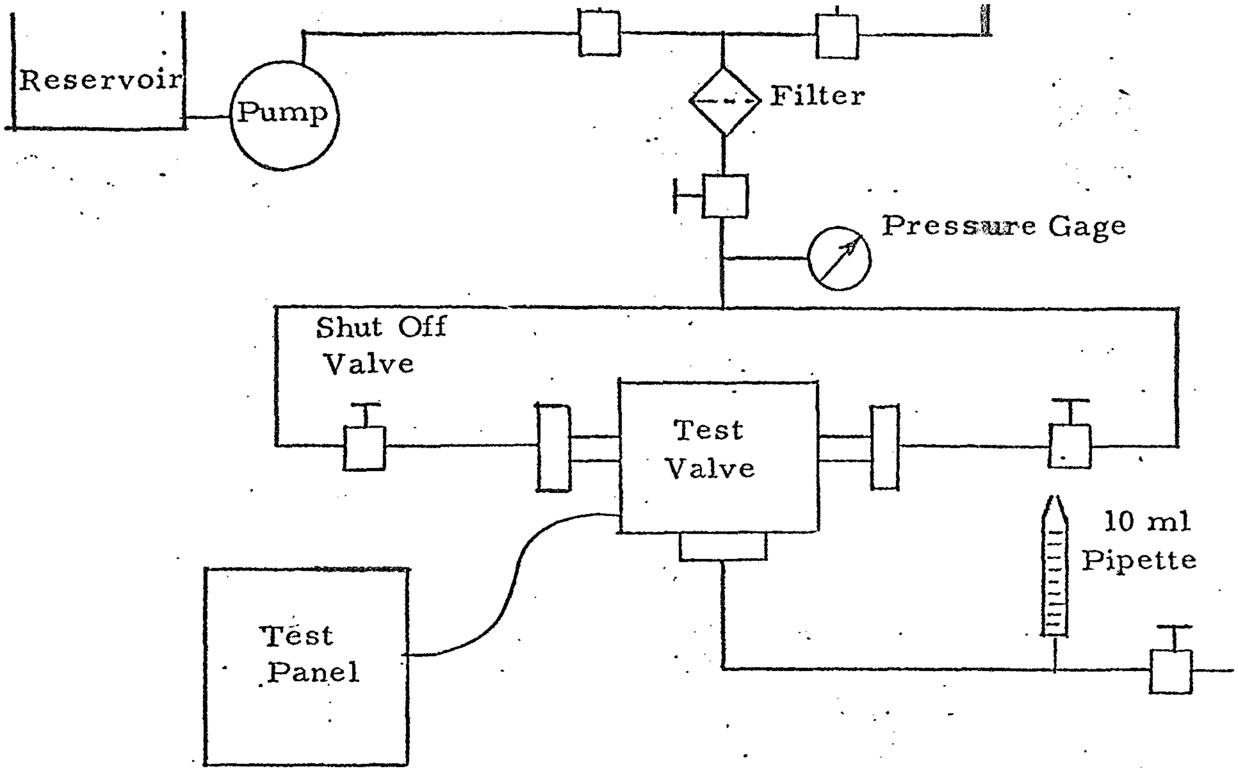
APPENDIX A

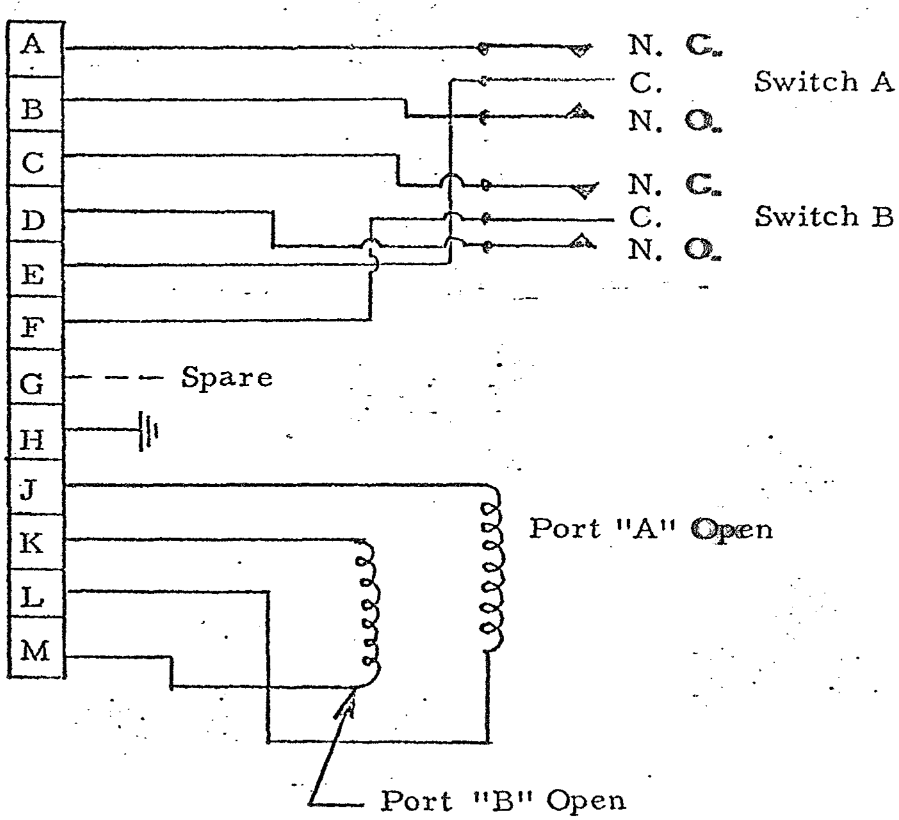
Test Schematics



Proof and External Leakage Test
Flow Diverter Valve Methanol/Water
Specification 20M42517

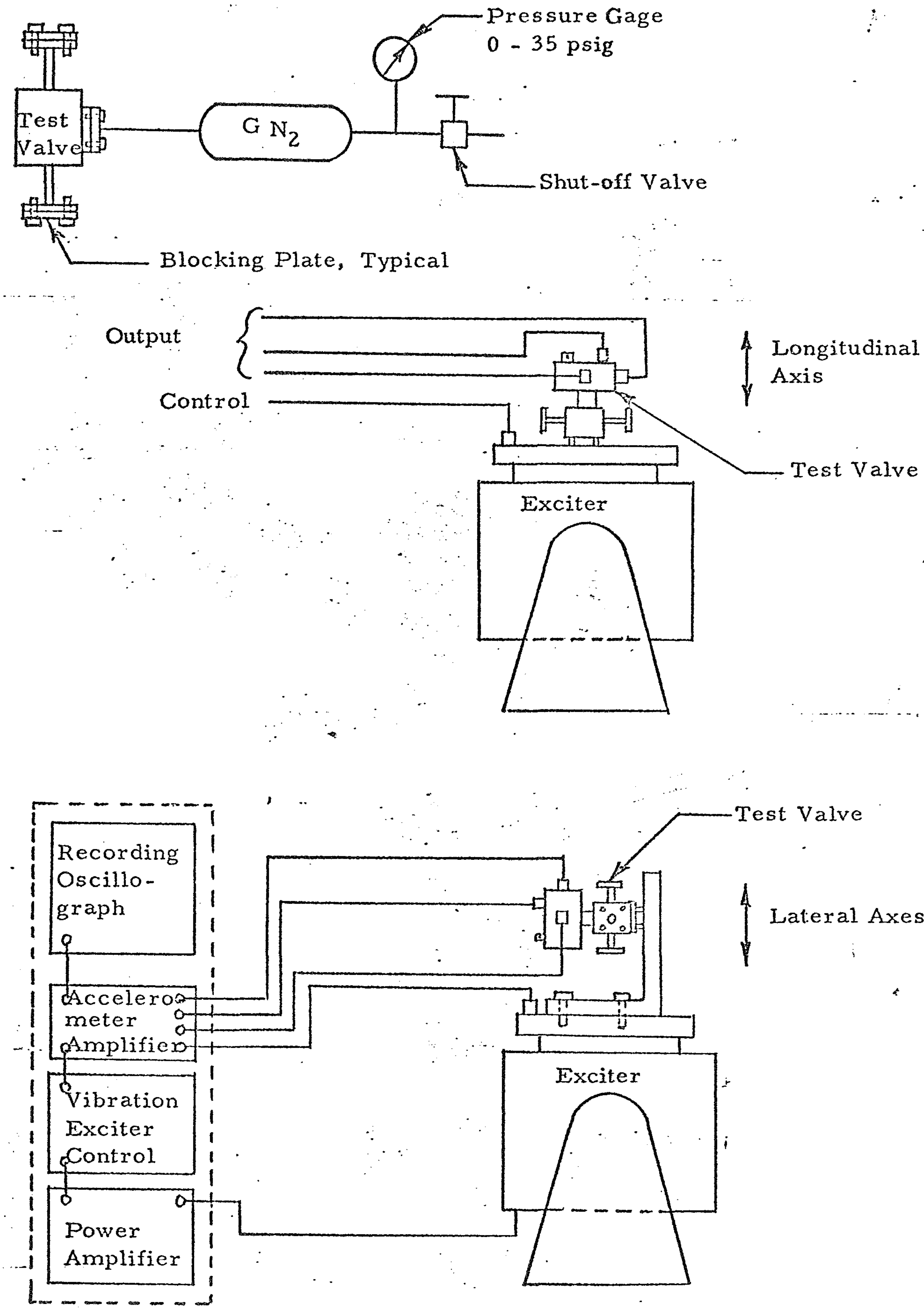
Figure 1





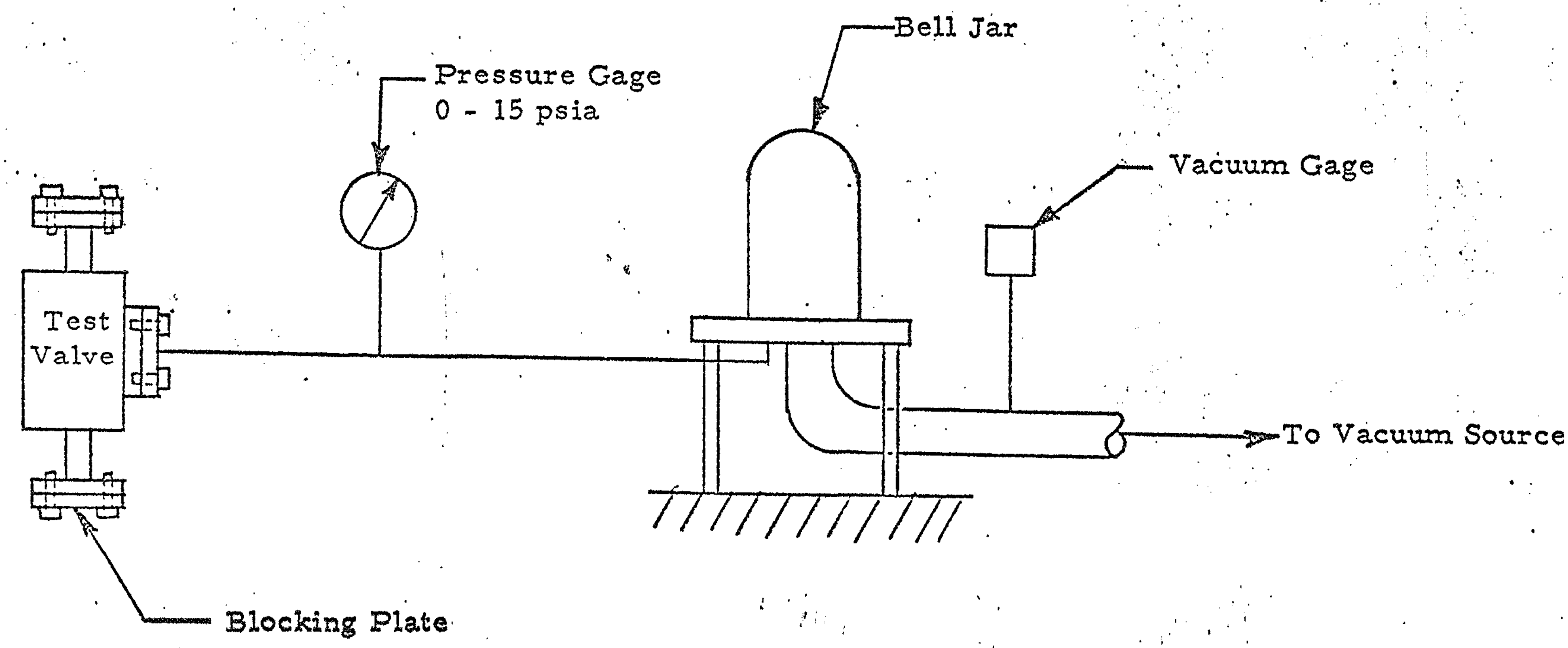
Internal Leakage Test
Flow Diverter Valve, Methanol/Water
Specification 20M42517

Figure 2.



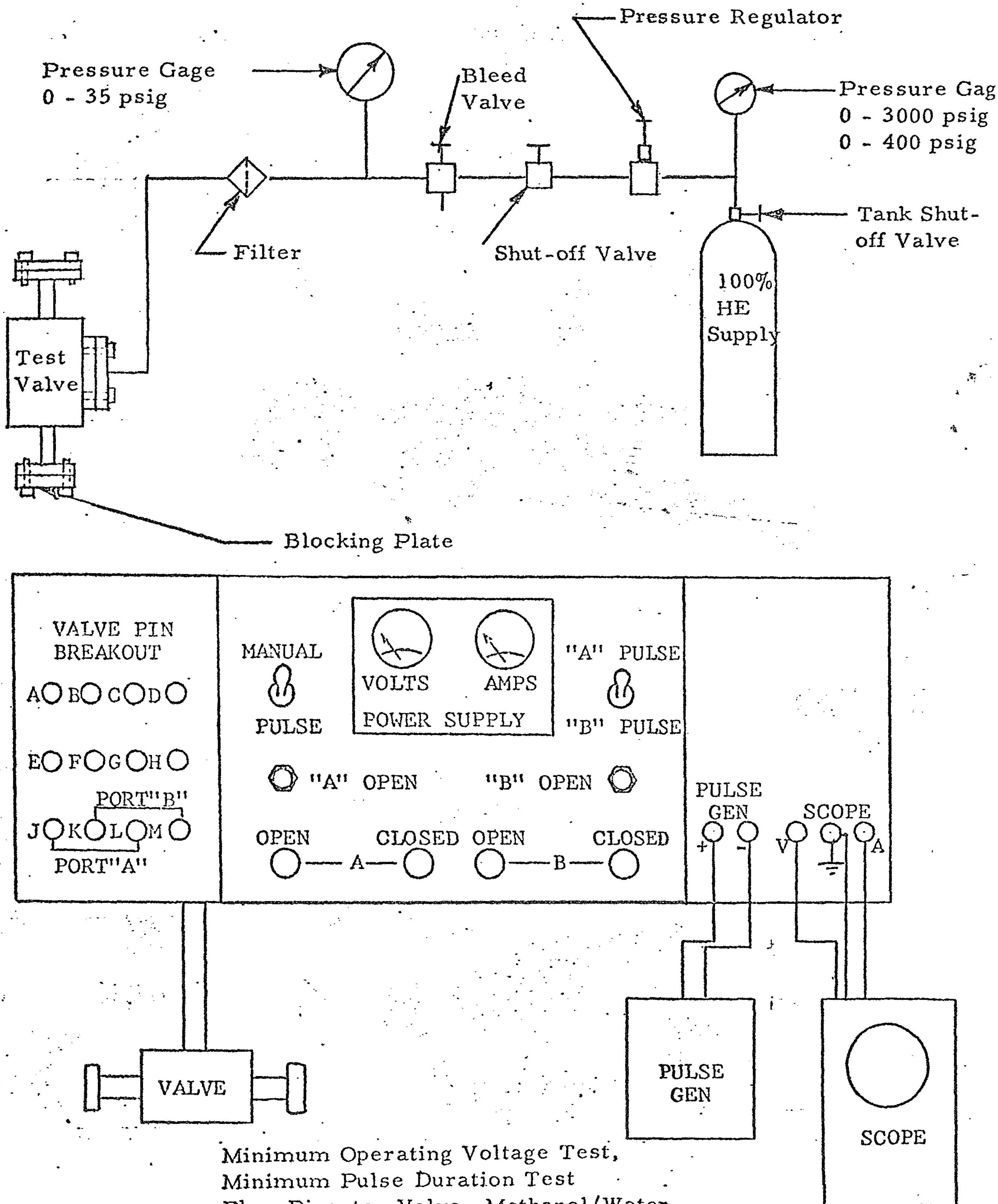
Vibration Test
Flow Diverter Valve, Methanol/Water
Specification 20M42517

Figure 3



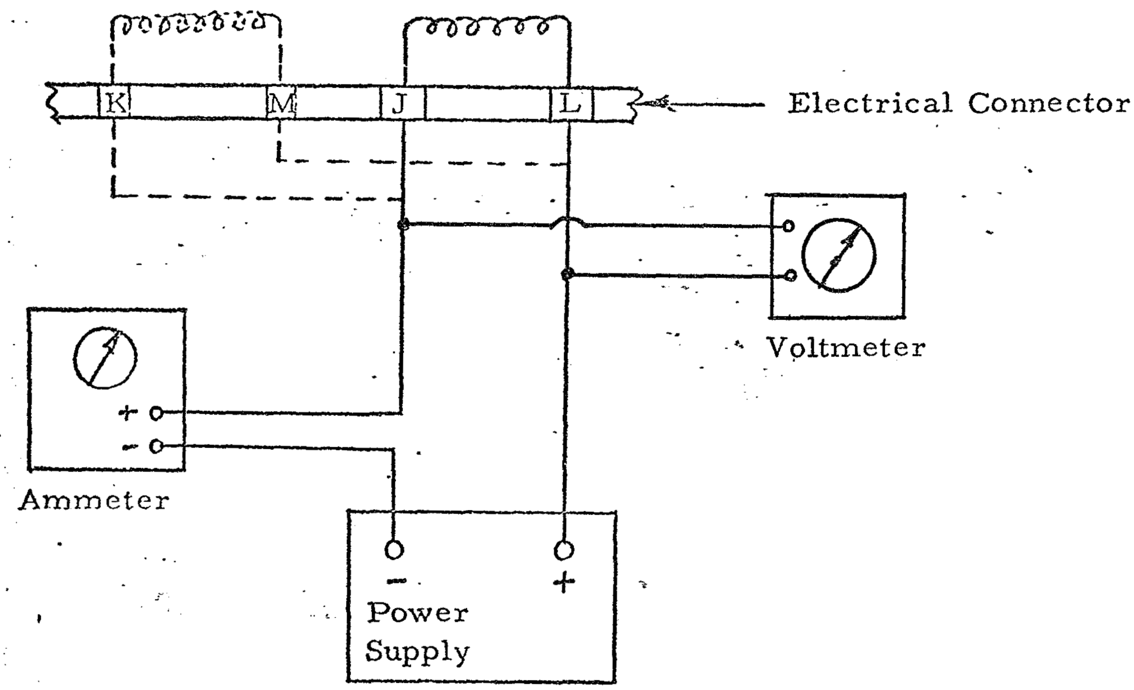
Vacuum Test
Flow Diverter Valve, Methanol/Water
Specification 20M42517

Figure 4



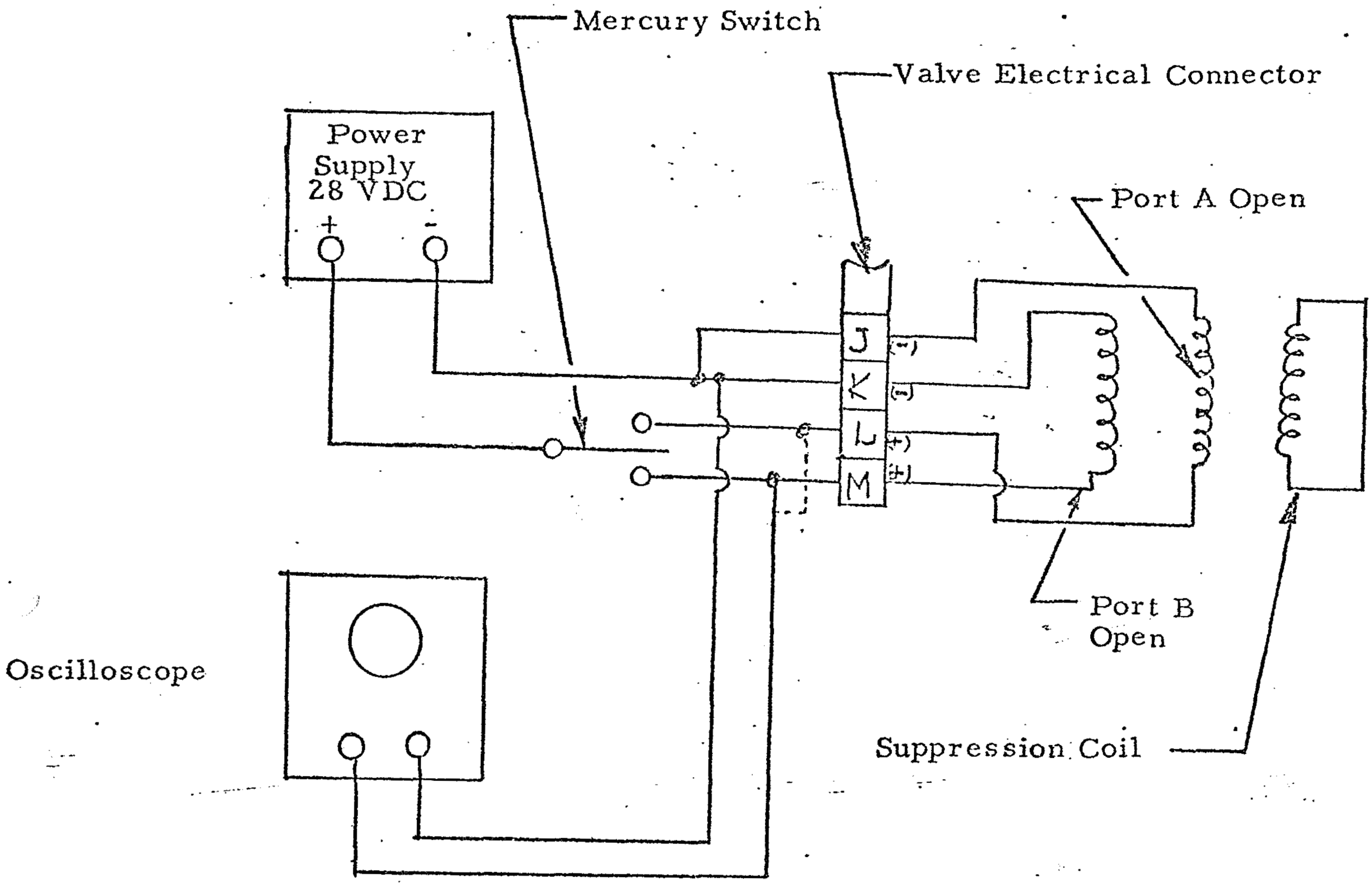
Minimum Operating Voltage Test,
Minimum Pulse Duration Test
Flow Diverter Valve, Methanol/Water
Specification 20M42517

Figure 5



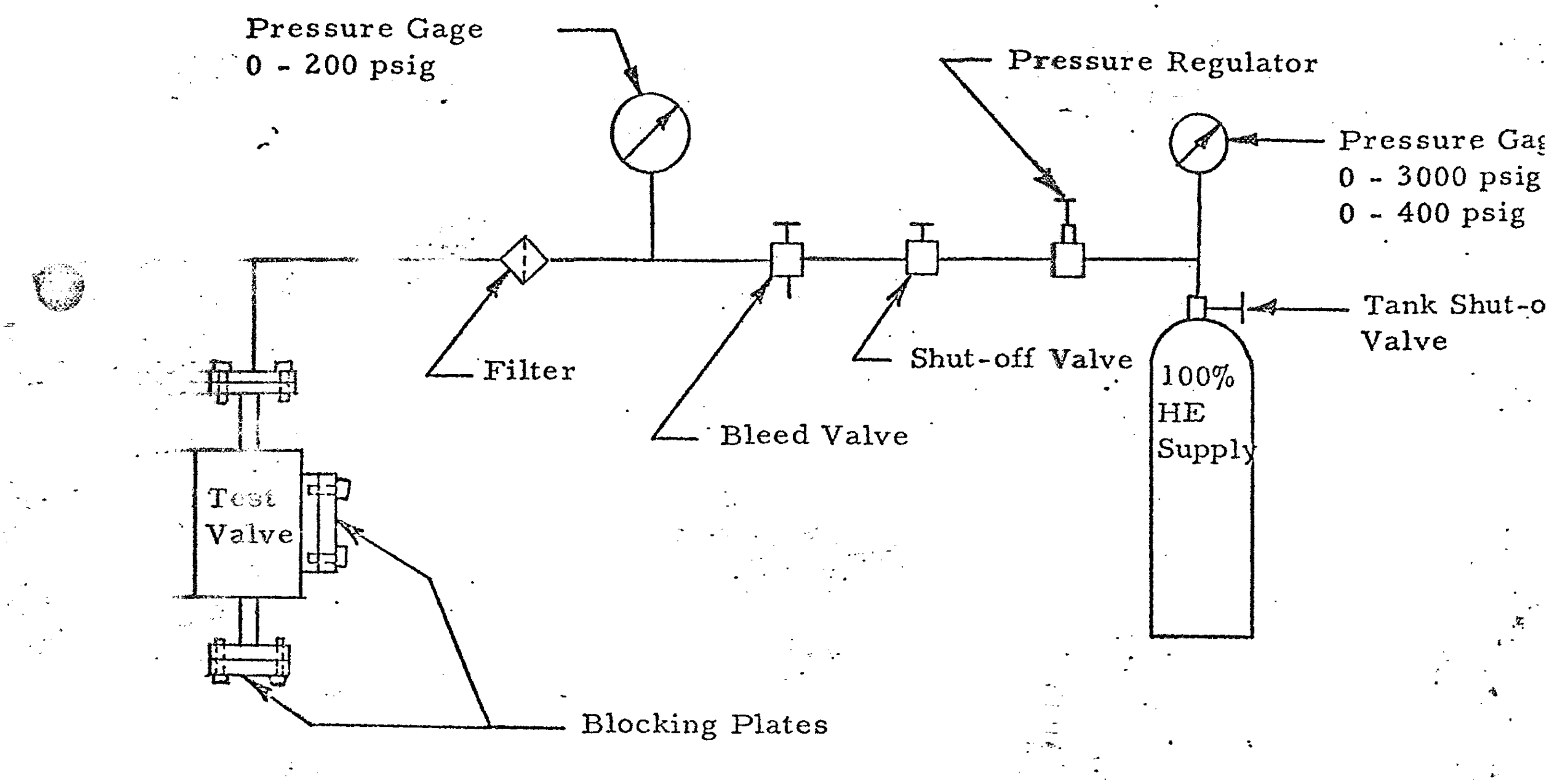
Power Consumption Test
Flow Diverter Valve, Methanol/Water
Specification 20M42517

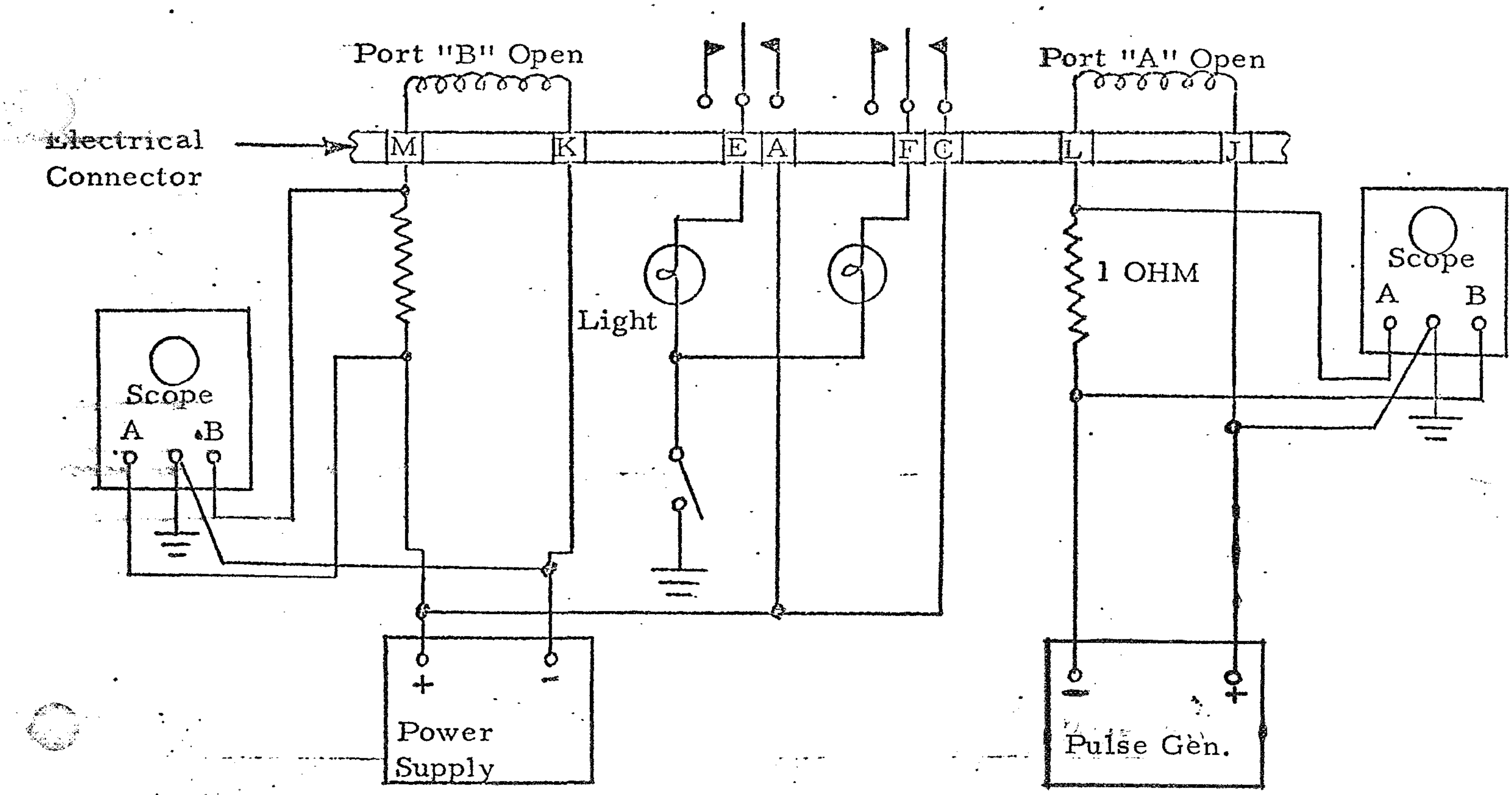
Figure 6



Coil Transient Voltage Test
Flow Diverter Valve, Methanol/Water
Specification 20M42517

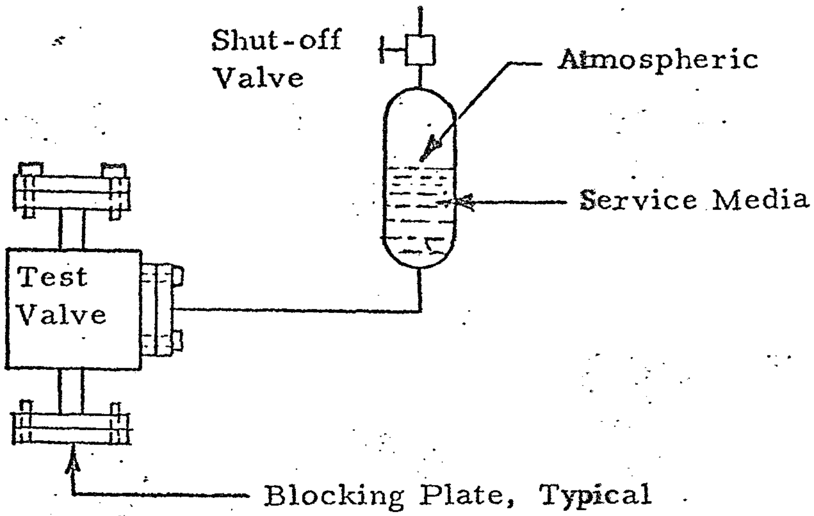
Figure 7.

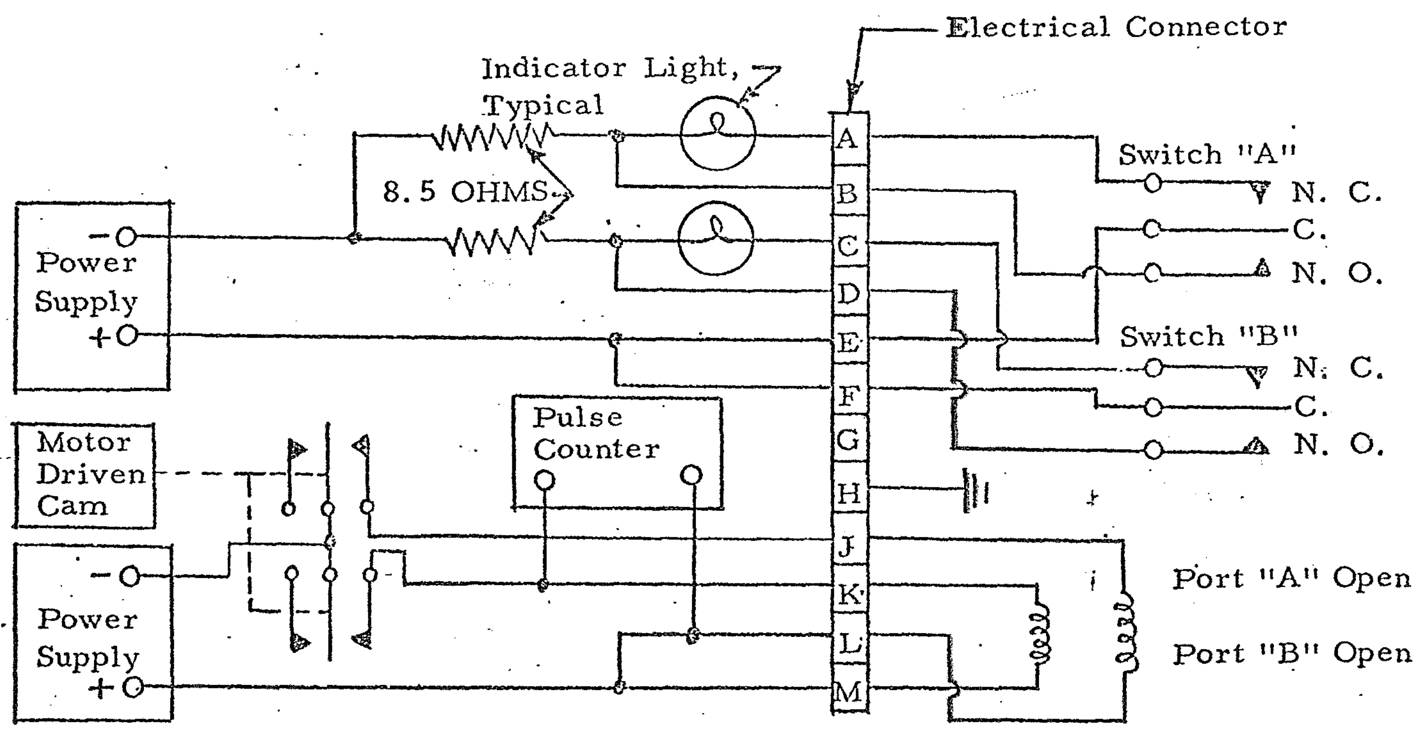




Transient Pulses
Flow Diverter Valve, Methanol/Water
Specification 20M42517

Figure 8



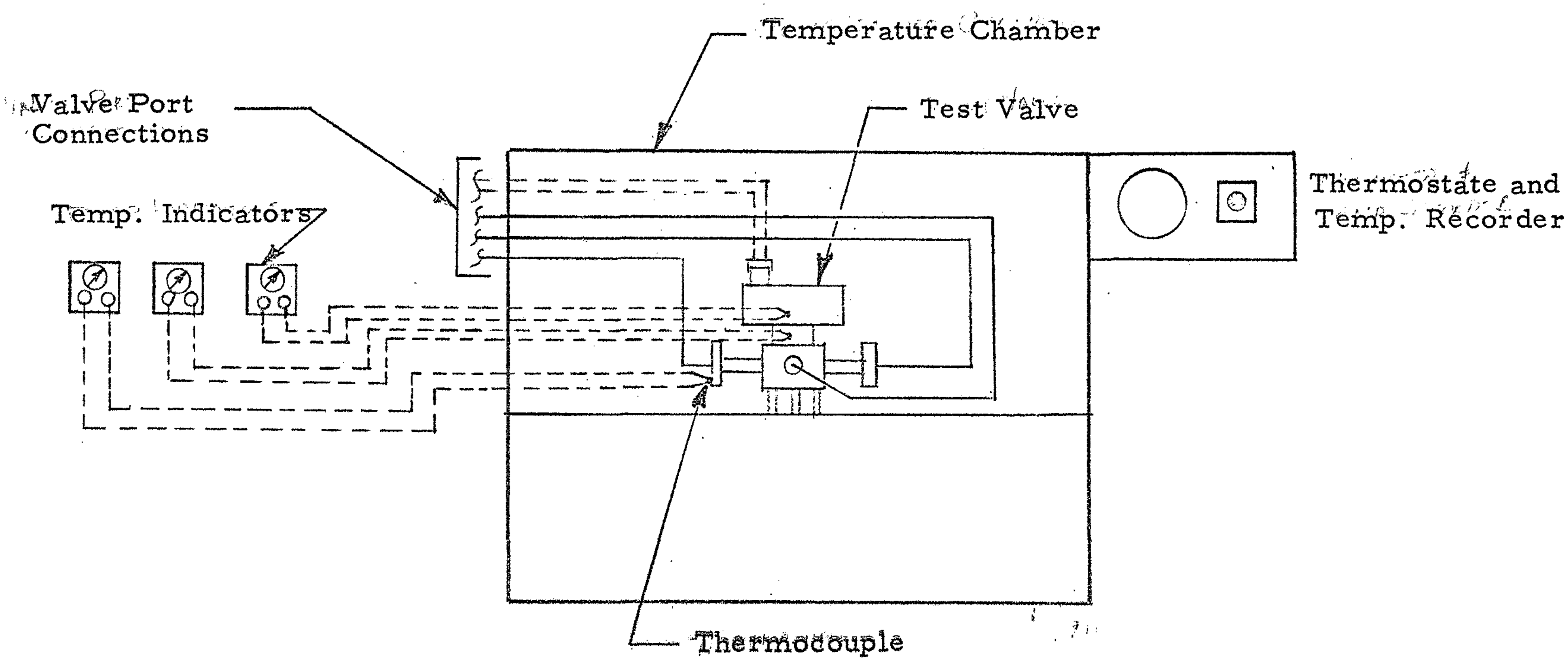


Life Cycling Test
Flow Diverter Valve, Methanol/Water
Specification 20M42517

Figure 9

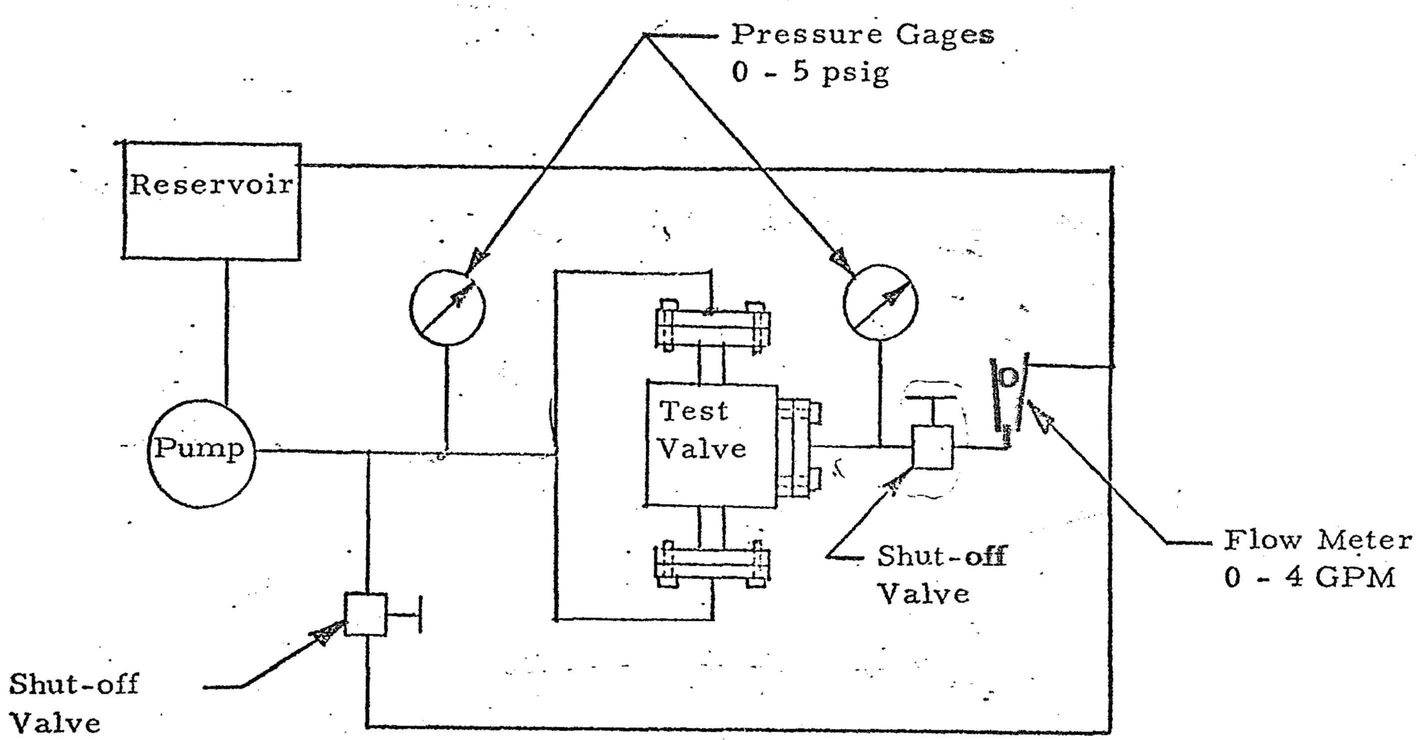
Note: Refer to Figures listed below for Functional Tests

Internal Leakage, Liquid - Figure 2
Minimum Voltage, - Figure 5
Pulse Duration, - Figure 5
Power, - Figure 6



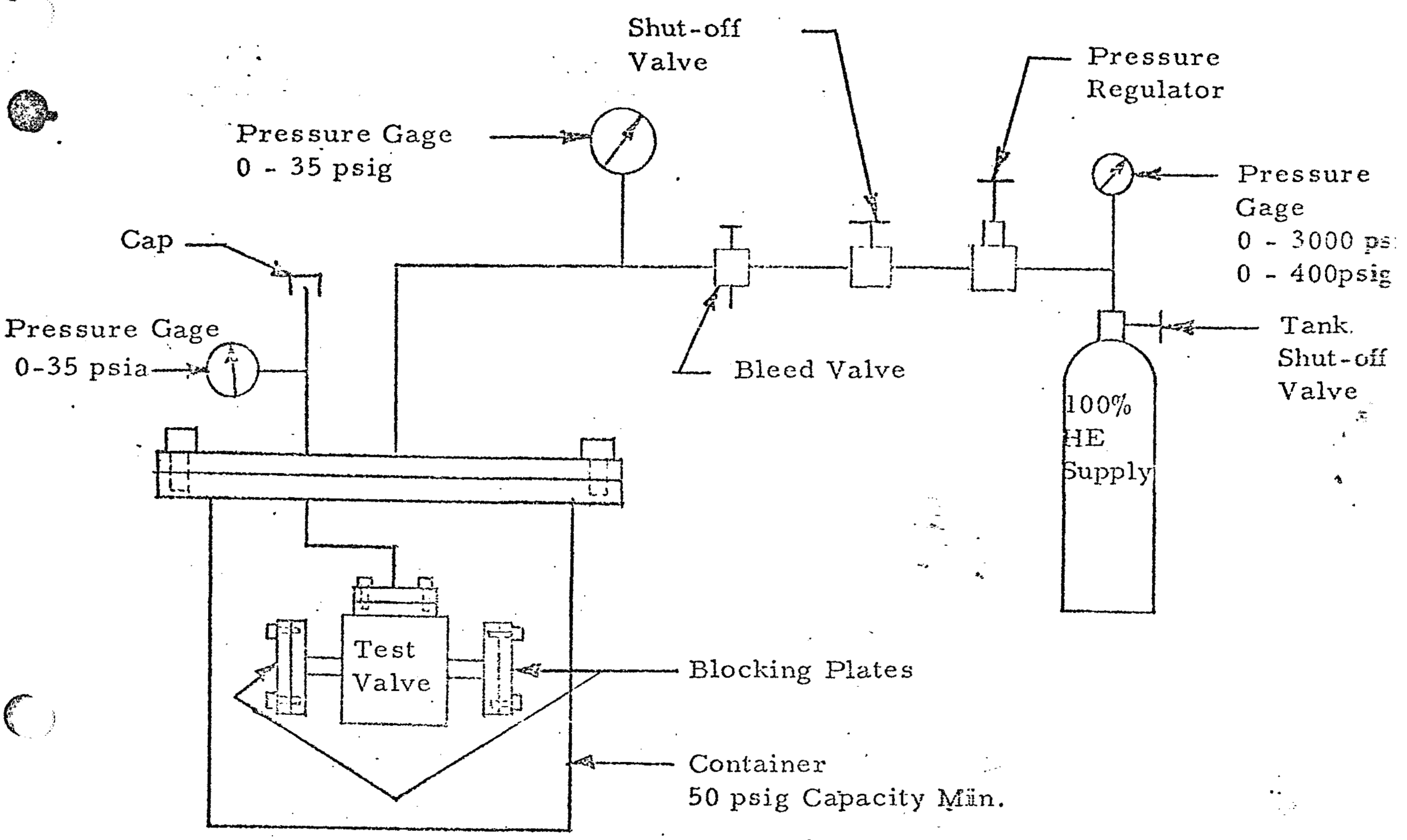
High Temperature Test
Flow Diverter Valve, Methanol/Water
Specification 20M42517

Figure 10



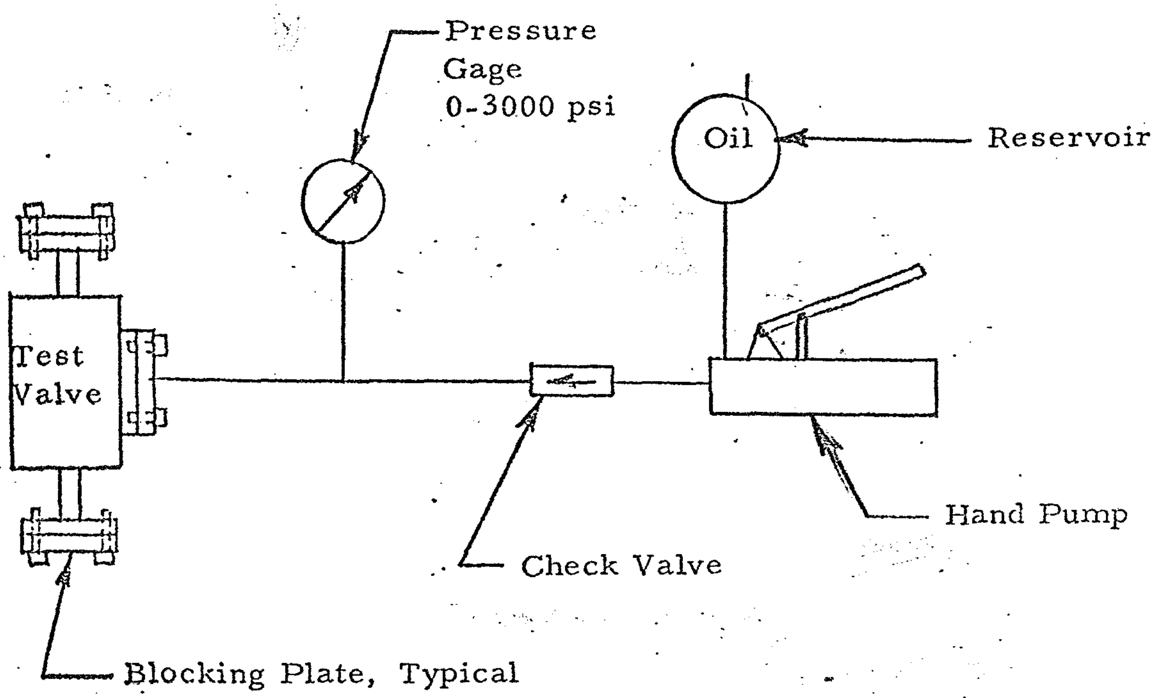
Full Flow Test
Flow Diverter Valve, Methanol/Water
Specification 20M42517

Figure 11



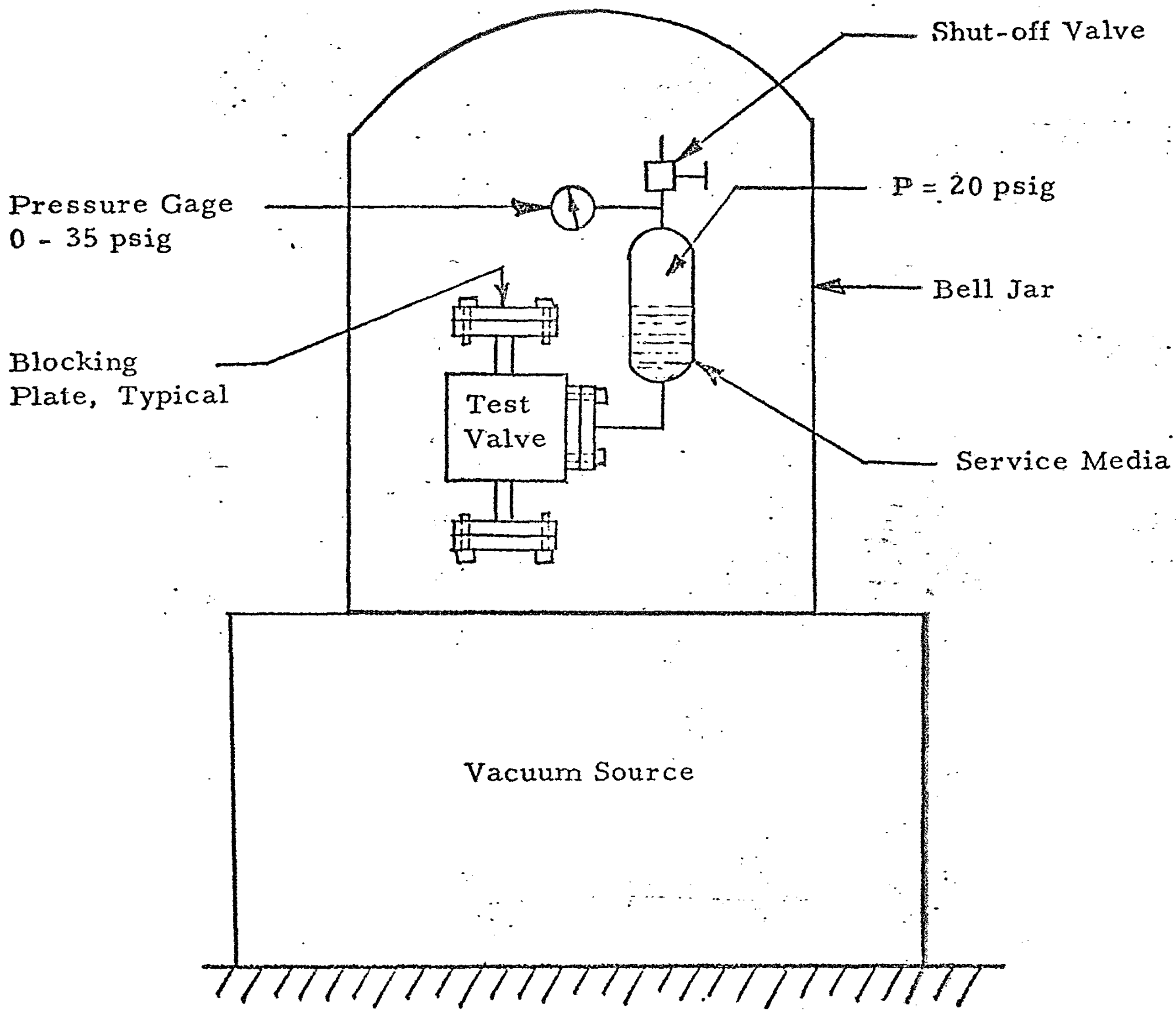
Collapse Pressure Test
Flow Diverter Valve, Methanol/Water
Specification 20M42517

Figure 12



Burst Pressure Test
Flow Diverter Valve, Methanol/Water
Specification 20M42517

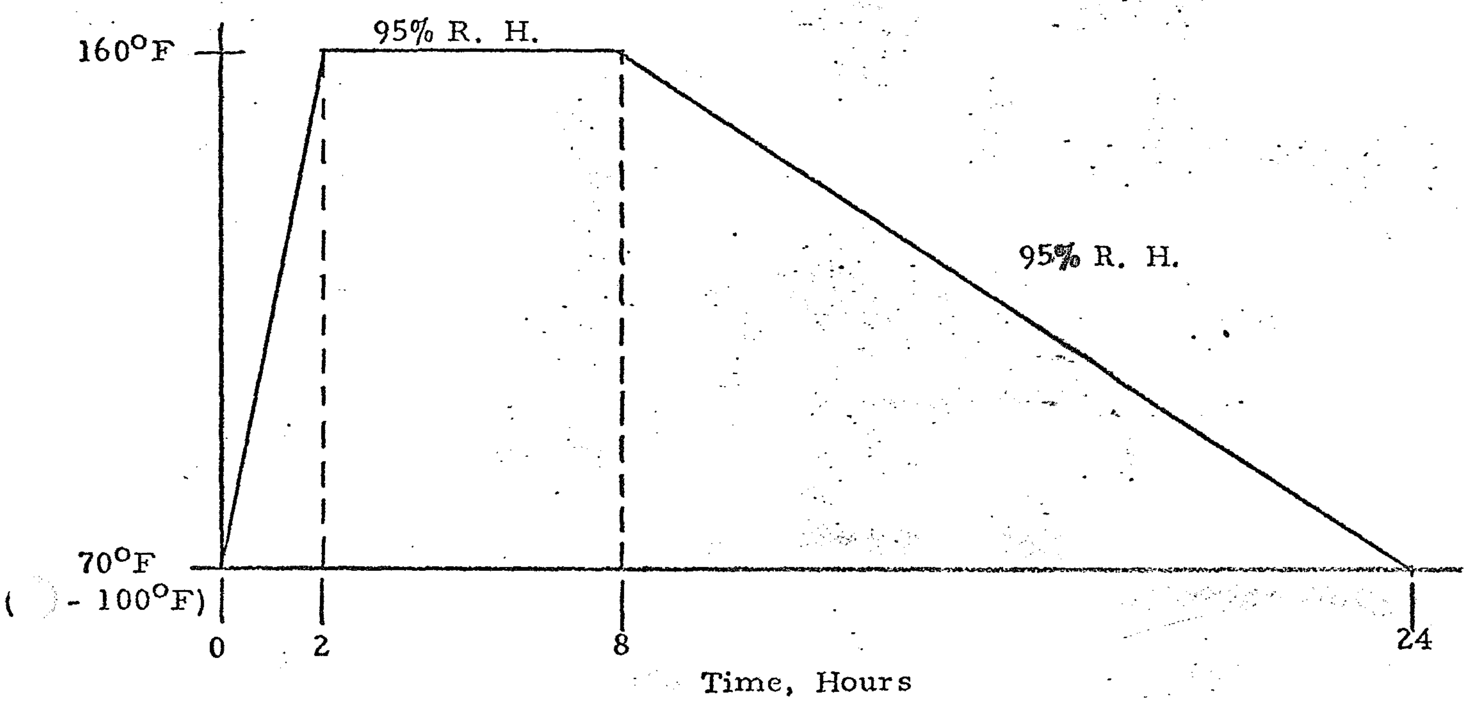
Figure 13



Compatibility Test
Flow Diverter Valve, Methanol/Water
Specification 20M42517

Figure 14

Humidity Cycle



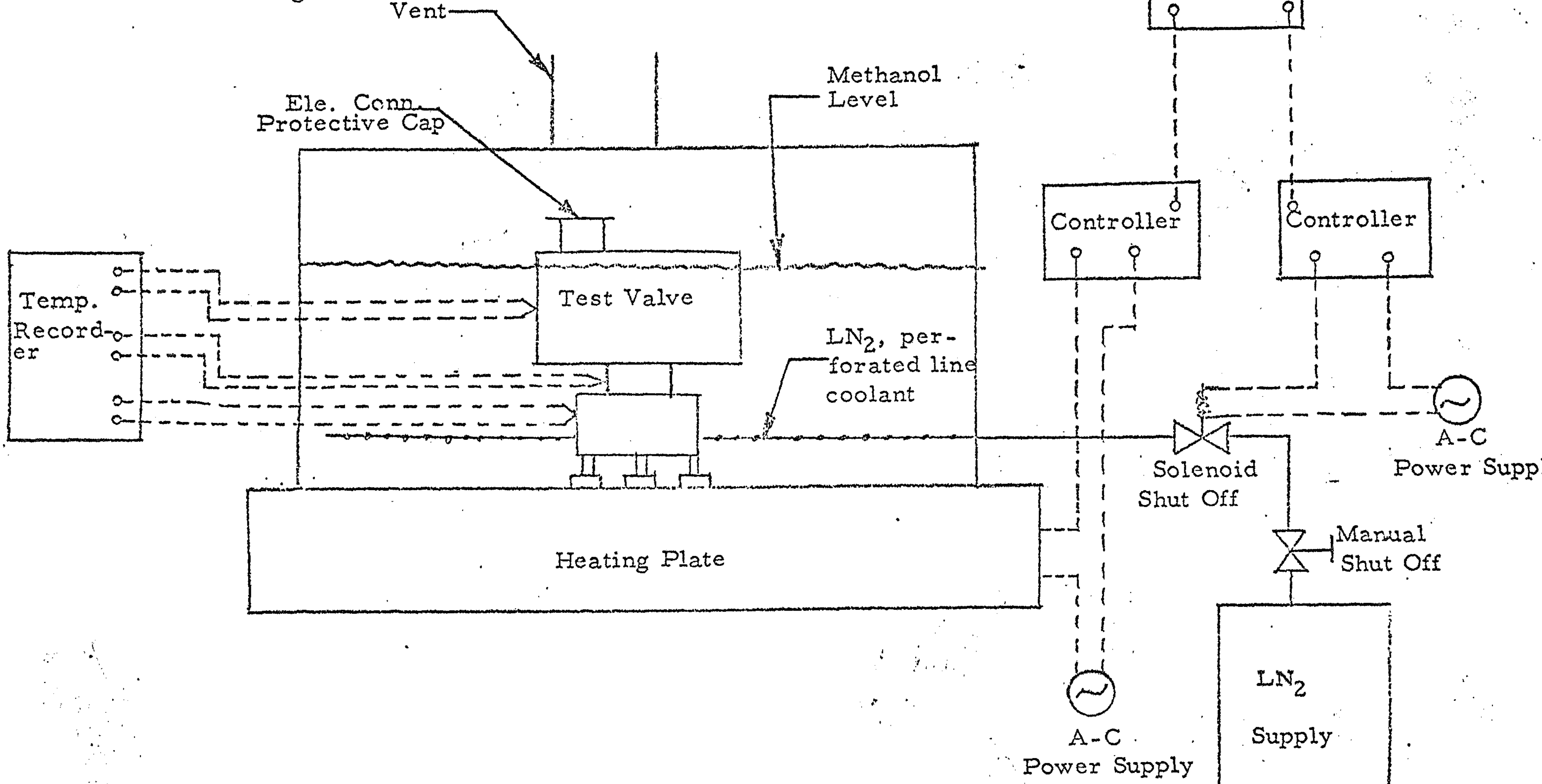
NOTE: 1. Relative humidity to be raised to 95% during first 2 hours
2. Required No. of cycles = 10

Humidity Test
Flow Diverter Valve, Methanol/Water
Specification 20M42517

Figure 15

Notes: Refer to figures listed below for functional tests.

Internal Leakage - Figure 2
Minimum Voltage - Figure 5
Pulse Duration - Figure 5
Power - Figure 6.



Low Temperature, and Temperature Cycling Test
Flow Diverter Valve, Methanol/Water
Specification 20M42517

Figure 16.

APPLICATION		PART No.	MF
NEXT ASSY	USED ON		

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C	Rewritten	11-14-69	F.W.

#, * Indicates change or new material

VALVE ASSEMBLY, FLOW PATH SELECTOR,
ELECTRICAL PULSE OPERATED
DESIGN PROCUREMENT DRAWING

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES ON: FRACTIONS DECIMALS ANGLES	ORIGINAL DATE OF DRAWING 2-5-68	VALVE ASSEMBLY, FLOW PATH SELECTOR, ELECTRICAL PULSE OPERATED DESIGN PROCUREMENT DRAWING	GEORGE C. MARSHALL SPACE FLIGHT CENTER NATIONAL AERONAUTICS AND SPACE ADMINISTRATION HUNTSVILLE, ALABAMA
MATERIAL	DRAFTSMAN / CHECKER TRACER / CHECKER ENGINEER / ENGINEER		
HEAT TREATMENT	SUBMITTED	SCALE	DWG SIZE A
FINAL PROTECTIVE FINISH	APPROVED 11/20/69	UNIT WT	20M42517 SHEET 1 OF 28

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1. SCOPE

1.1 Coverage.- This drawing covers an electrical pulse operated flow path selector valve assembly.

1.2 Intended use.- The valve assembly is intended to be used in the temperature control system (TCS) of the Apollo Telescope Mount (ATM).

2. APPLICABLE DOCUMENTS.

2.1 Listing.- The following documents, of the issue noted, form a part of this drawing to the extent specified herein. In those cases where the document issue is noted, the issue in effect on date of invitation for bids shall be applicable.

SPECIFICATIONS

Military

MIL-A-8625	Anodic Coatings for Aluminum and Aluminum Alloys
MIL-R-45774	Radiographic Inspection, Soundness Requirements for Fusion Welds in Aluminum and Magnesium Missile Components

George C. Marshall Space Flight Center

MSFC-SPEC-135	Welding, Fusion, Specification For
MSFC-SPEC-144	Aluminum Alloy Forgings, Premium Quality, Heat Treated, Specification For
MSFC-SPEC-164	Cleanliness of Components for use in Liquid Oxygen, Fuel and Pneumatic Systems, Specification For
MSFC-DWG-10509306	Radiographic Inspection Procedures and Acceptance Standards for Fusion Welded Joints in Stainless and Heat Resistant Steel, Specification For
MSFC-DWG-10509308	Welding, Carbon, Low Alloy, and Stainless Steel, Manual or Automatic, Specification For
MSFC-DWG-20M42501	Methanol/Water, ATM TCS
MSFC-DWG-40M39569	Connector, Electrical, Miniature, Circular, Environmental Resisting, 200°C.

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STANDARDS

Military

MIL-STD-130	Identification Marking of U.S. Military Property
MIL-STD-143	Specifications and Standards, Order of Precedence for the Selection of
MIL-STD-810A	Environmental Test Methods for Aerospace and Ground Equipment
MIL-STD-831	Test Reports, Preparation of
MS-33586	Metals, Definition of Dissimilar

George C. Marshall Space Flight Center

MSFC-DWG-10419909	Drill Data, Lockwire, Size and Method of Application, Standard for
MSFC-STD-100	Castings, Aluminum and Magnesium Alloy, Radiographic Inspection of, Acceptance Standard For
MSFC-STD-105	Synthetic Rubber, Age Control of, Standard For

DRAWINGS

George C. Marshall Space Flight Center

MSFC-DWG-20M30514	Reliability Engineering Requirements for Suppliers of ATM Components
MSFC-DWG-20M42522	Fitting End, ATM TCS
MSFC-DWG-50M02442	ATM Materials Control for Contamination Due to Outgassing
MSFC-DWG-50M12725	Apollo Telescope Mount Electromagnetic Compatibility Control Plan
MSFC-DWG-50M02408A	Environmental Design and Qualification Test Criteria for Apollo Telescope Mount Components

PUBLICATIONS

George C. Marshall Space Flight Center

MSFC Engineering Standards Manual

Identification for Traceability (Quality and Reliability Assurance Laboratory)

SR-QUAL-67-29	MSFC Supplement to NPC 200-4, Supplier Soldering Program

National Aeronautics and Space Administration

NPC 200-2	Quality Program Provisions for Space Systems Suppliers
NPC 200-3	Inspection Systems Provisions for Suppliers of Space Materials, Parts, Components, and Services
NPC 200-4	Quality Requirements for Hand Soldering of Electrical Connections

(Copies of Specifications, Standards, Procedures, Drawings, and Publications required by contractors in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer).

OTHER PUBLICATIONS

Consolidated Classification Committee

Uniform Freight Classification Rules

(Applications for copies should be addressed to the Consolidated Classification Committee, 1 Park Avenue at 33rd. Street, New York 16, N.Y.).

American Trucking Association

National Motor Freight Classification Rules

(Application for copies should be addressed to the American Trucking Association, 1616 P Street, N.W., Washington 6, D.C.)

2.2 Order of precedence.- Unless otherwise specified by the procuring activity, in the event of conflicts between documentation the order of precedence shall be as follows:

(a) Contractual documentation (purchase order)

(b) This Design Procurement Drawing

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(c) MSFC Standards, Specifications and Procedures

(d) NASA Publications

(e) Military Standards and Specifications

(f) Other Publications

Specifications and Standards for necessary commodities and service not provided in the procurement documentation shall be selected in accordance with MIL-STD-143.

3. DESIGN REQUIREMENTS

3.1 General description.- The assembly shall be a two position, electrical pulse operated valve. The schematic is shown in Figure 1. On the application of a pulse the valve assembly shall move from the primary to the secondary position.

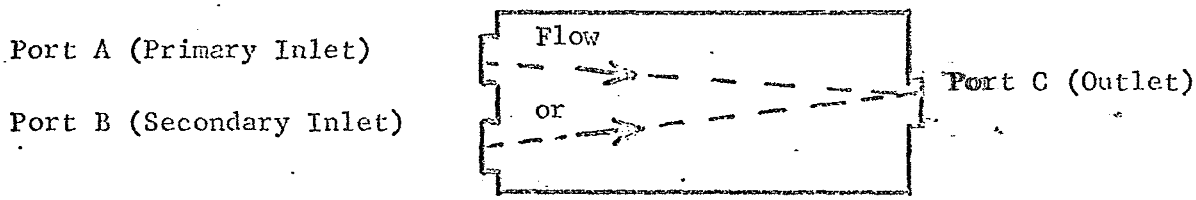

Figure 1. - Schematic

On the application of another pulse the valve assembly shall return to the primary position. The valve assembly shall provide a means to prevent inadvertent changes of position. The valve assembly shall have position indicating switches at both the primary and secondary positions.

3.1.1 Systems voltage.- The valve assembly shall operate from a 22 to 30 vdc system with 28 vdc nominal.

3.1.2. Service Media.- The service media shall be as follows:

(a) Air

(b) Helium (He)

(c) Gaseous Nitrogen (GN_2)

(d) Liquid service media.- Methanol/water mixture (80% by weight methanol; 20% by weight demineralized water) which is in accordance with Specification 20M42501. Maximum particle size shall not be greater than 400 microns.

3.1.3 The valve shall operate, and/or remain latched in the last position with a differential pressure of 20 psi from either inlet port to the other. The valve shall operate with a power pulse of 45 watts or less. The power pulse requirement shall not exceed 4 seconds duration. *

3.2 System configuration and parameters.

3.2.1. System configuration.- The valve assembly is to be installed in a temperature control system as shown in Figure 2. The final decision regarding the selection of the arrangements shown in details A and B has not been made.

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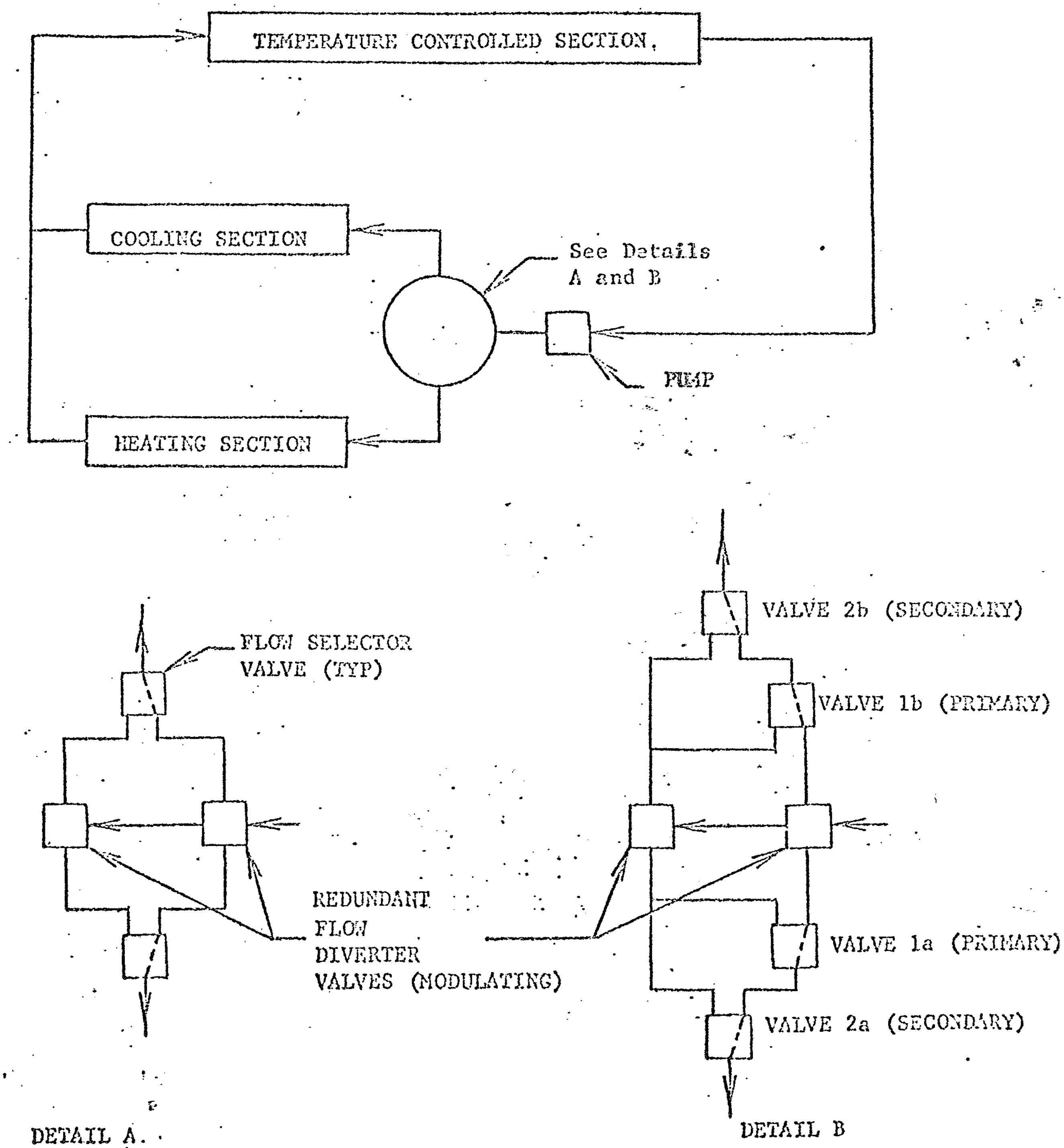

FIGURE 2.- SYSTEM CONFIGURATION

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3.2.2 System operation. - The redundant flow diverter valves are operated by redundant temperature controllers. The controllers modulate the diverter valves on the basis of the temperature of the inlet to the temperature controlled section. Only one set of controllers and diverter valves is energized at any time. When a change is made from one set to the other set the flow selector valves are actuated to the opposite position in the case of the system shown in Detail A. In the case of Detail B the primary valves would be actuated. The secondary valves would be actuated if one or both of the primary valves failed to actuate properly.

NOTE

In the case of the system shown in Detail B the primary flow selector valves may be mechanically linked with operation by one actuating mechanism. A similar situation exists for the secondary valves.

3.2.3 System mission. - The system mission is projected to be as follows:

(a) 42 days of ground operation

(b) 236 days operation in orbit

(c) 60 days storage in orbit, completely inactive

3.2.4 Criticality of failure modes. - The valve assembly is considered to be an engineering critical portion of the temperature control system. Possible failure modes of the valve assembly are listed in the order of decreasing criticality as follows:

(a) Failure which results in loss of structural integrity

(b) Failure which results in a inadvertant change of position

(c) Failure which prevents proper operation upon the application of an actuating pulse.

(d) Failure which results in excessive leakage.

3.3 Characteristics.

3.3.1 Pressure drop. - In either position the pressure drop across the valve assembly shall be 0.5 psi maximum at a flow rate of 900 pounds per hour of the liquid service media, and a inlet temperature of 50°F.

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3.3.2 Operating pressures.- The valve assembly shall operate without failure at internal pressures from zero to 50 psig.

NOTE

Failure shall consist of any damage, excessive permanent distortion, deterioration, nonconformance to specified requirements or change in characteristics that could in any way prevent the valve assembly from meeting the requirements specified herein.

3.3.3 Proof pressures.- The valve assembly shall withstand without failure an internal pressure of 75 psig.

3.3.4 Burst Pressure.- The valve assembly shall withstand without rupture an internal pressure of 125 psig.

3.3.5 Vacuum.- The valve assembly shall withstand without failure being evacuated to 0.01 psia or less while in a normal ground level atmosphere.

3.3.6 Collapse pressure.- The valve assembly shall withstand without collapse an external pressure of 19 psig with normal ground level atmospheric pressure as the internal pressure.

*3.3.7 Leakage.- Leakage shall be as follows:

(a) External.- The maximum allowable external leakage of the valve assembly including fitting interface with internal pressures from zero to 50 psig shall be as follows:

(1) Gaseous.- 1.6×10^{-6} sccs He

(2) Liquid.- None

(b) Internal - The maximum allowable internal leakage from one inlet port to the other at differential pressures from zero to 20 psi shall be as follows: *

(1) Liquid - 2×10^{-1} ccs of the liquid service media.

3.3.8 Insulation resistance.- Insulation resistance shall be 50 megohms minimum at 500 vdc as follows:

(a) From each terminal pin of the electrical connector(s) to the body of the valve assembly.

(b) Between terminal pins which are connected to position switches with the contacts fully open.

(c) Between the terminal pins which are not connected electrically.

3.3.9 Circuit resistance.- The resistance of the position switch circuits at the electrical connector(s) with the switch contacts closed shall be 0.5 ohm maximum.

3.3.10 Minimum operating voltage.- With inlet pressures from zero to 50 psig and flow rates of the liquid service media from zero to 900 pounds per hour the valve assembly shall move from the primary to the secondary position or vice versa when pulsed from a supply voltage of 18.0 vdc maximum. *

3.3.11 Pulse duration.- The pulse duration required for proper operation shall be minimized. The minimum pulse durations for proper operation correlated with supply voltages from 18 to 30 vdc and with the operating temperature range shall be submitted to and approved by the procuring activity.

3.3.12 Power.- Power requirements shall be minimized. Peak and steady state currents with tolerances correlated with supply voltages from 22 to 30 vdc and with the operating temperature range shall be submitted to and approved by the procuring activity.

3.3.1.3 Duty cycle.- The valve assembly shall withstand without failure being energized continuously with 30.0 vdc for 5 minutes followed by a return to the operating temperature. Duty cycle limitation characteristics (i.e. cycle rate and pulse duration versus number of cycles, etc.) shall be submitted to and approved by the procuring activity.

3.3.14 Life cycle.- The valve assembly shall withstand without failure a minimum of 1000 cycles of operation.

3.3.15 Temperature.- The valve assembly shall operate without failure at temperatures ranging from minus 65 to plus 165°F. #

3.3.16 Orbital vacuum.- The valve assembly shall operate without failure at external pressures down to 1.5×10^{-6} Torr. #

3.3.17 Transient pulses.- The valve assembly shall operate without failure with positive or negative pulses as defined in figure 3 present on the supply or return leads. #

3.4 Configuration.- The valve assembly shall be capable of being mounted to a flat plate with through bolts and nuts. The ports and the electrical connector(s) shall be above the mounting plane. All joints which could allow external leakage shall be semipermanently or permanently joined. The fitting ends of the valve assembly shall be in accordance to Drawing 20M42522.

3.4.1 Materials and part selection.

3.4.1.1 Materials.- Unless otherwise specified by the procuring activity, the selection of materials shall be made by the supplier. The supplier shall avoid the selection of materials which have not demonstrated their suitability for the environments or applications. A list of candidate materials and corresponding proposed applications shall be submitted to the procuring activity for review. All materials shall be approved by the procuring activity prior to use. Materials listed as not acceptable in Drawing 50M02442 shall not be used.

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3.4.1.1.1 Metals. - Metals shall be corrosion resistant alloys. Dissimilar metals, defined in Standard MS33586, shall not be used in combination unless they are suitably coated to prevent electrolytic corrosion. Metals which may contact the service media shall be 300 series corrosion resistant steel, 5000 or 6000 series aluminum alloy, or 356 aluminum alloy castings. Corrosion resistant steel, if used, shall not be susceptable to carbide precipitation during welding, brazing, and stress relieving.

3.4.1.1.2 Wire. - Electrical wire shall be approved by the procuring activity.

3.4.1.2 Standard parts. - Unless otherwise specified by the procuring activity, standard parts as specified in the MSFC Engineering Standards Manual shall be used wherever applicable. In those applications where no suitable standard parts exist in the Engineering Standards Manual on the date of invication for bids other parts may be used provided they are approved by the procuring activity.

3.4.2 Electrical connector. - The electrical connector(s) shall be in accordance with Specification 40M39569. The electrical connector shall be ITT Cannon part number PV7H14B12PNC or equivalent. Pin functions shall be as shown in Figure 4. A mating connector shall be supplied with each valve assembly.

3.4.3 Position indicating switches. - The position indicating switches shall have characteristics as follows:

(a) Hermetically sealed

(b) Single pole double throw

(c) Current rating: 3 amperes minimum resistive at 28 vdc

3.4.4 Lockwiring. - Threaded fasteners which can be lockwired shall be lockwired in accordance with standard 10419909. Threaded fasteners which cannot be lockwired shall be locked with another approved locking device.

3.4.5 Product marking. - Product marking shall be in accordance with Standard MIL-STD-130. Similarly, the ports shall be identified.

3.4.6 Bifilar windings. - Coils shall have bifilar suppression windings.

3.4.7 Weight. - The valve assembly shall weigh as little as practically possible

3.4.8 Envelope. - The envelope dimensions of the valve assembly shall be as small as practically possible.

3.5 Construction.

3.5.1 Cleaning. - The valve assembly shall be cleaned in accordance with Specification MSFC-SPEC-164, fuel service, except the maximum allowable particle size shall be 175 microns.

3.5.2 Anodizing. - Anodizing of aluminum alloy parts shall be in accordance with Specification MIL-A-8625.

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3.5.3 Welding.- Welding shall be in accordance with the documentation as follows:

(a) Aluminum alloy - Specification MSFC-SPEC-135

(b) Corrosion resistant steel - Specification 10509308

3.5.4 Weld inspection and acceptance.- Weld inspection and acceptance shall be in accordance with documentation as follows:

(a) Aluminum alloy - Specification MIL-R-45774

(b) Corrosion resistant steel - Specification 10509306

3.5.5 Lubrication.- Lubricants, if used, shall be approved by the procuring activity.

3.5.6 Soldering.- Soldering of electrical connections shall be in accordance with NASA Publication NPC 200-4 and MSFC Publication SR-QUAL-67-29.

3.5.7 Age control.- Age control of synthetic rubber, if used, shall be in accordance with Standard MSFC-STD-105.

3.5.8 Forgings.- Aluminum alloy forgings shall be in accordance with Specification MSFC-SPEC-144.

3.5.9 Castings.- Aluminum and magnesium alloy castings shall be in accordance with Standard MSFC-STD-100.

3.5.10 Grounding.- Grounding provisions shall be in accordance with Drawing 50M12725.

3.5.11 Manufacturing processes.- Critical detailed manufacturing processes used in the manufacture of the valve assembly shall be submitted to and approved in writing by the procuring activity.

3.5.12 Workmanship.- The valve assembly shall be free of cross threading, burrs, scratches, cracks, breaks, pits, dents, chips, sharp projections, sharp edges, loose parts, loose electrical components, loose solder or foreign material that may adversely affect performance, reliability, safety, endurance or wear.

3.6 Testing.- The valve assembly shall meet the requirements specified herein during the testing specified in Section 4. The valve assembly shall withstand the nondestructive tests without failure. Burst and collapse pressure testing shall be considered the only destructive tests.

3.7 Special environments.- The valve assembly shall withstand the following environmental conditions with failure. Unless otherwise specified by the procuring activity, tests to determine conformance to these requirements are not required.

(a) Transportation: Exposure to pressures ranging from 4.36 psia to 14.7 psia and simultaneous change in temperature from plus 165°F to minus 65°F.

(b) Storage: Minimum storage time of two years with ambient temperatures ranging from zero to plus 140 degrees F and relative humidity to 100 percent with condensation in the form of both water and frost.

3.8 Human engineering.- The principles of human engineering shall apply during manufacture, test, maintenance and all operations where personnel are involved. The design shall incorporate those human engineering features that minimize the possibility of degrading reliability through human error.

3.9 Design analysis.- A design analysis shall be submitted to and approved in writing by the procuring activity. This design analysis shall include but is not limited to the following:

(a) Operating stress levels for all environments

(b) Safety factors

This design analysis shall be revised and resubmitted to the procuring activity periodically incorporating all changes.

3.10 Detail design.- A detailed design shall be submitted to and approved in writing by the procuring activity. This detailed design shall include but is not limited to the following:

(a) Manufacturing drawings

(b) Parts list:

(1) Part or identification number

(2) Nomenclature or description

(3) Material

(4) Material specification

(5) Heat treat

(6) Finish specification

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3.11 Reliability.

3.11.1 Requirements. - The reliability requirements for the valve assembly shall be as specified in Drawing 20M30514.

3.11.2 Failure Mechanisms. - Any failure mechanism, which could result in a failure in a critical mode, as determined from the failure effect analysis, shall be eliminated from the valve assembly, or reduced to an insignificant probability of occurrence.

3.11.3 Certification. - The supplier of the valve assembly shall certify in an MSFC approved form that the valve assembly, in the configuration delivered, has met the specified requirements and is flight worthy.

3.12 Identification for traceability. - The supplier of the valve assembly shall establish an identification for traceability program. Publication "Identification for Traceability" shall be used as a guide in implementing this program. A list of the parts considered to be critical and the associated degree of traceability to be implemented shall be submitted to the procuring activity for review.

3.13 Requests for deviation. - Requests for deviation to any requirements shall be made by use of MSFC Form 847, Deviation Approval Request.

4.0 QUALITY ASSURANCE PROVISIONS

4.1 Quality assurance program. - The quality assurance program used by the supplier in the production of the valve assembly shall be in accordance with NASA Publication NPC 200-2 and NPC 200-3 as specified by the contractual documentation.

4.2 Changes to design and processes. - The detailed design and the associated manufacturing processes shall not be changed after they have been approved without the prior written approval or written direction of the procuring activity. Any changes shall be evaluated by the procuring activity to determine if additional testing is required.

4.3 Tests and examinations.

4.3.1 General requirements.

4.3.1.1 Responsibility. - Unless otherwise specified by the procuring activity, the supplier shall be responsible for the performance of all the examinations and tests specified herein. The supplier may use his own or any other facilities provided they are approved by the procuring activity. The procuring activity reserves the right to perform any of the examinations or tests specified herein.

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4.3.1.2 Documentation.

4.3.1.2.1 Test plans.- The acceptance test plan shall be submitted to and approved in writing by the procuring activity. The preflight certification test plan and the quality assurance sample test plan shall be submitted to and approved in writing by the procuring activity when these tests are required. These tests plans shall include but are not limited to the following:

(a) Testing agencies

(b) Location of test facilities

(c) Test schematics including instrumentation and control equipment

(d) Equipment list

(e) Test and measuring tolerances

(f) Detailed procedures

4.3.1.2.2 Test records.- Records of the examinations and tests shall be kept complete and available to the procuring activity.

4.3.1.2.3 Test status reports.- Periodic test status reports shall be submitted to and approved in writing by the procuring activity when required. These test status reports shall cover the preflight certification test and the quality assurance sample tests, as applicable. These reports shall include but are not limited to the following:

(a) Progress against the test schedules

(b) General results of accomplished tests

(c) Failures and corrective measures

(d) Changes pertinent to the test programs

(e) Scheduling of subsequent tests

4.3.1.2.4 Test reports.- Final test reports shall be submitted to and approved in writing by the procuring activity. These reports shall cover the preflight certification tests and the quality assurance sample tests, as applicable. These reports shall be in accordance with Standard MIL-STD-831. Any failures and corrective actions shall be included in the test reports.

4.3.1.2.5 Test data sheets.- Test data sheets for valve assemblies subjected to the acceptance tests for acceptance shall be submitted to the procuring activity. These test data sheets shall include but are not limited to the following:

(a) Name of supplier

(b) Part numbers of both the supplier and the procuring activity

(c) Serial numbers of the valve assemblies which were tested.

(d) Test procedures

(e) Acceptance requirements

(f) Actual observed test results

(g) Certification by the quality control inspector who represents the procuring activity.

4.3.1.3 Order of tests and examination.- The order of tests and examinations shall be at the discretion of the supplier except as otherwise specified herein.

4.3.1.4 Test and examination conditions.- Unless otherwise specified by the procuring activity, the tests and examinations shall be performed under conditions as follows:

(a) Temperature - Standard temperature, 77 (plus or minus 18) degrees F

(b) Relative humidity - 90 percent maximum

(c) Atmospheric pressure - 14.7 (plus or minus 0.7) pounds per square inch absolute (psia)

4.3.1.5 Failure.- The procuring activity shall be notified immediately of any failure during any test or examination. The procuring activity shall also be informed of the possible cause of the failure and the possible corrective actions. These may be the basis for changes to the detail design, manufacturing processes, and test plan. Any changes shall be approved in writing or be directed by the procuring activity.

4.3.2 Examinations.- The valve assemblies shall be examined to check for conformance to 3.1, 3.4, 3.5, 3.9 and 3.10.

4.3.3 Functional tests.- Valve assemblies shall have successfully completed the examinations of 4.3.2 prior to being subjected to these tests. The proof pressure and vacuum tests shall be performed first followed by the remainder of the functional tests.

4.3.3.1 Proof pressure.- Simultaneously, the 3 ports of the valve assembly shall be slowly, internally pressurized to 75 psig. This pressure shall be held for 5 minutes before reducing to zero. The valve assembly shall be checked for conformance to 3.3.3.

4.3.3.2 Vacuum.- The 3 ports of the valve assembly shall be simultaneously evacuated to 0.01 psia or less. The vacuum shall be maintained for 5 minutes before returning to atmospheric pressure. The valve assembly shall be checked for conformance to 3.3.5.

4.3.3.3 Leakage.

4.3.3.3.1 External.- The valve assembly shall be tested to check for conformance to 3.3.7(a)(1) with all 3 ports pressurized simultaneously to 50 psig with N_2.

4.3.3.3.2 Internal.- Internal leakage testing shall be as follows:

(a) Port A

(1) Liquid - with the valve assembly in the secondary position Port A shall be pressurized to 5.0, 10.0, 15.0, and 20 psig with the liquid service media. At each pressure valve assembly shall be checked for conformance to 3.3.7 (b) (1). The valve assembly shall then be cycled from the primary to the secondary back to the primary position a minimum of one time. This procedure shall be performed 3 times.

(2) Gaseous - not applicable.

(b) Port B.- Testing similier to 4.3.3.3.2(a) shall be performed with Port B pressurized.

4.3.3.4 Circuit resistance.- The valve assembly shall be tested to check for conformance to 3.3.9 through 3 cycles of operation minimum.

4.3.3.5 Insulation resistance.- The valve assembly shall be tested to check for conformance to 3.3.8.

4.3.3.6 Position indications.- The position switches shall be checked for proper indications throughout all the cycling during the functional tests.

4.3.3.7 Minimum operating voltage.- Simultaneously the 3 ports of the valve assembly shall be internally pressurized to 50 psig. Pulses of increasing amplitude shall then be applied until the position of the valve assembly changes. The valve assembly shall be checked for conformance to 3.3.10. The above shall be performed 3 times minimum with the valve assembly in the primary position and aslo 3 times minimum in the secondary position. The duration of the pulses shall remain constant during this test. The duration of the pulse with tolerances shall be included in the test plan (see 4.3.1.2.1). This test shall then be repeated with the valve assembly unpressurized.

4.3.3.8 Pulse duration.- Simultaneously the 3 ports of the valve assembly shall be internally pressurized to 50 psig. With a supply voltage of 20.0 vdc pulses of increasing duration shall then be applied until the position of the valve assembly changes. The valve assembly shall be checked for conformance to the minimum pulse duration requirements which were approved by the procuring activity (see 3.3.11). The above shall be performed 3 times minimum with the valve assembly in the primary position and also 3 times minimum in the secondary position. This test shall then be repeated with the valve assembly unpressurized.

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4.3.3.9 Power.- The valve assembly shall be tested with 28.0 vdc to check for conformance to the peak and steady stage current requirements which were approved by the procuring activity (See 3.3.12).

NOTE

All or parts of the functional tests may be combined into a continuous test procedure.

4.3.4 Preflight certification tests.- A preproduction sample shall be subjected to the preflight certification tests. The preproduction sample shall consist of valve assemblies which:

(a) Have been made in accordance with the detail design which was approved by the procuring activity.

(b) Have sucessfully completed the examinations of 4.3.2 and

(c) Have successfully completed the acceptance tests of 4.3.5.

The number of valve assemblies in the preproduction sample shall be as specified by the procuring activity. Testing shall be performed in accordance with Table I. Disposition of the valve assemblies which have been subjected to the preflight certification tests shall be as specified by the procuring activity.

TABLE I - Preflight Certification Tests

Preflight Certification Test Paragraph	Number of Valve Assemblies to be Tested	Comments
4.3.4.1, 4.3.4.2, 4.3.4.3, 4.3.4.4, 4.3.4.7, and 4.3.4.8	Minimum of one	Testing required unless otherwise specified by the procuring activity.
4.3.4.6, 4.3.4.9, 4.3.4.10, 4.3.4.11 and 4.3.4.12.4.3.4.15	Entire sample	Testing required
4.3.4.5 and 4.3.4.14	Minimum of one	Testing required
4.3.4.13	Minimum of one	Testing not required unless otherwise specified by the procuring activity.

4.3.4.1 Humidity.- The valve assembly shall be tested in accordance with method 507.1 of Standard MIL-STD-810A. After this the valve assembly shall be examined for failure, tested in accordance with 4.3.3 except 4.3.3.1 and 4.3.3.2, and checked for conformance to 3.6.

4.3.4.2 Salt fog.- The present valve assembly shall be tested in accordance with method 509.1 of Standard MIL-STD-810A. After this the valve assembly shall be examined for failure, tested in accordance with 4.3.3 except 4.3.3.1 and 4.3.3.2, and checked for conformance to 3.6.

4.3.4.3 Sand and dust.- The valve assembly shall be tested in accordance with method 510.1 of Standard MIL-STD-810A. After this the valve assembly shall be examined for failure, tested in accordance with 4.3.3 except 4.3.3.1 and 4.3.3.2, and checked for conformance to 3.6.

4.3.4.4 Fungus resistance.- The valve assembly shall be tested in accordance with method 508.1 Procedure I, of Standard MIL-STD-810A. After this the valve assembly shall be examined for failure, tested in accordance with 4.3.3 except 4.3.3.1 and 4.3.3.2 and checked for conformance to 3.6.

4.3.4.5 Full flow.- The valve assembly shall be tested in accordance with 4.3.3.6, 4.3.3.7, 4.3.3.8, and 4.3.3.9 with a liquid service media flow rate of 900 pounds per hour. The valve assembly shall also be tested to check for conformance to 3.3.1. Conditions other than specified may be used provided an effective simulation can be achieved. These conditions shall be documented in the test plan. The test results and the data showing conversion from test conditions to specified conditions shall be supplied in the test report.

4.3.4.6 Temperature.

4.3.4.6.1 Gaseous.- Gaseous temperature testing shall be as follows:

(a) High.- The valve assembly shall be tested in accordance with method 501.1 of Standard MIL-STD-810A except that the temperature shall be plus 165°F. While at plus 165°F the valve assembly shall also be tested to check for conformance to 3.3.13 by subjecting it to 10 of the following cycles:

(1) Stabilize initially at plus 165°F

(2) Engegize for 5 continuous minutes with 30.0 vdc while maintaining a still air environmental temperature of plus 165°F.

(3) Allow the valve assembly to return to the stabilization temperature of plus 165°F.

The valve assembly shall then be stabilized at the maximum operating temperature of plus 100°F and tested in accordance with 4.3.3 except 4.3.3.1, 4.3.3.2, 4.3.3.3.1, and 4.3.3.2(a)(2).

After this the valve assembly shall be tested in accordance with the low temperature portion.

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(b) Low. - The valve assembly shall be tested in accordance with method 502.1, Procedure I, of Standard MIL-STD-810A, except the temperature shall be minus 65°F. While stabilized at minus 65°F, the valve assembly shall be tested in accordance with 4.3.3 except 4.3.3.1, 4.3.3.2 and 4.3.3.3.2 (a) (2) .

After gaseous temperature testing has been completed the valve assembly shall be returned to standard temperature, examined for failure and tested in accordance with 4.3.3 except 4.3.3.1 and 4.3.3.2.

4.3.4.6.2 Liquid. - Liquid service media testing shall be as follows:

(a) High. - The valve assemby shall be stabilized at plus 100°F. While at this temperature the valve assembly shall be tested in accordance with 4.3.3 except 4.3.3.1, 4.3.3.2, 4.3.3.3.1, and 4.3.3.3.2 (a) (1) using the liquid service media. After this the valve assembly shall be tested in accordance with the low temperature portion.

(b) Low. - The valve assembly shall be tested in accordance with method 502.1, Procedure I, of Standard MIL-STD-810A except the temperature shall be minus 65°F. While stabilized at minus 65°F, the valve assembly shall be tested in accordance with 4.3.3 except 4.3.3.1, 4.3.3.2, 4.3.3.3.1, and 4.3.3.3.2 (a) (1).

After liquid temperature testing has been completed the valve assembly shall be returned to standard temperature, examined for failure, and tested in accordance with 4.3.3 except 4.3.3.1 and 4.3.3.2.

4.3.4.7 Temperature cycle. - The valve assembly shall be subjected to 1500 cycles from plus 100 to minus 65 back to plus 100°F. During the cycles the valve assembly shall be filled with the liquid service media and all 3 ports pressurized to 20 psig. There shall be no flow. The temperature cycles shall be approximately sinusoidal. The duration of each cycle shall be 90 minutes maximum. After 300 and 900 cycles the valve assembly shall be tested in accordance with 4.3.3.3 while stabilized at plus 100°F. After 600 and 1200 cycles the valve assembly shall be tested in accordance with 4.3.3.3 while stabilized at minus 65°F. After 1500 cycles the valve assembly shall be returned to standard temperature, examined for failure, and tested in accordance with 4.3.3 except 4.3.3.1 and 4.3.3.2.

4.3.4.8 Compatibility. - The valve assembly shall be filled with the liquid service media and all 3 ports pressurized to 20 psig. The valve assembly shall remain under these conditions for 190 days. During this period the valve assembly shall be in a vacuum of 1.5×10^{-6} Torr or less. After 30, 60, 120, and 190 days the valve assembly shall be examined for failure and tested in accordance with 4.3.3 except 4.3.3.1 and 4.3.3.2.

4.3.4.9 Vibration. - The valve assembly shall be installed in a test setup which simulates the vehicle installation. The test setup shall be filled with the liquid service media and all 3 ports pressurized to 20 psig. Vibration testing shall be as follows:

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(a) Vehicle dynamics criteria.- The test setup shall be subjected to a sinusoidal scan at 3.0 octaves per minute along each of the 3 major axes. The levels and frequency ranges shall be as follows:

(1) Flight axis

a. 5 to 23 Hz at 0.089 inch double amplitude displacement *

b. 23 to 35 Hz at 2.4 G's peak *

(2) Lateral axes

a. 1.5 - 3.5 Hz at 0.5 inches double amplitude displacement *

b. 3.5 to 20 Hz at 0.31 G's peak *

(b) Sine evaluation criteria.- The test setup shall be subjected to a sinusoidal scan at 1.0 octave per minute along each of the 3 major axes. The level and frequency ranges shall be as follows:

(1) 20 to 45 Hz at 0.023 inch double amplitude displacement *

(2) 45 to 2000 Hz at 2.3 G's peak *

(c) High level random criteria.- The test setup shall be subjected to 1.0 minute of random vibration along each of the 3 major axes. The levels shall be as follows:

(1) 20 to 46 Hz at plus 6.0 db per octave *

(2) 46 to 100 Hz at 0.143 g^2 per Hz *

(3) 100 to 210 Hz at minus 9.0 db per octave *

(4) 210 to 750 Hz at 0.015 g^2 per Hz *

(5) 750 to 1155 Hz at minus 12 db per octave *

(6) 1155 to 2000 Hz at 0.00262 g^2 per Hz *

(d) Low level random criteria.- The test setup shall be subjected to 4.0 minutes of random vibration along each of the 3 major axes. The levels shall be as follows:

(1) 20 to 46 Hz at plus 6.0 db per octave *

(2) 46 to 100 Hz at 0.0644 g^2 per Hz *

(3) 100 to 210 Hz at minus 9 db per octave *

(4) 210 to 750 Hz at 0.0067 g^2 per Hz *

(5) 750 to 1155 Hz at minus 12 db per octave *

(6) 1155 to 2000 Hz at 0.00118 g^2 per Hz *

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t the conclusion of all vibration the valve assembly shall be examined for failure, and tested in accordance with 4.3.3.

4.3.4.10 Life Cycle.- The valve assembly shall be subjected to 1000 cycles of operation. Each cycle shall consist of moving the valve assembly from the primary to the secondary back to the primary position or vice versa. The cycling shall be performed at 28.0 vdc. During all the cycles the position switches shall be checked for proper operation and shall be loaded with a resistive load of 3.0 amperes at 28.0 vdc when the contacts are closed. The duration of the pulses and the rate of cycling shall be included in the test plan (See 4.3.1.2.1). After 150, 300, 500 and 750 cycles the valve assembly shall be tested in accordance with 4.3.3 except 4.3.3.1, 4.3.3.2, 4.3.3.3.1 and 4.3.3.5. After 1000 cycles the valve assembly shall be examined for failure and tested in accordance with 4.3.3.

4.3.4.11 Acoustical Noise.- The valve assembly shall be installed in a test setup which simulates the vehicle installation. The test setup shall be filled with liquid service media and all 3 ports pressurized to 20 psig. The valve assembly shall then be tested in accordance with paragraph 5.2.5.2 of Drawing 50M02408B using the levels of Appendix E of the same Drawing. At the conclusion of acoustic noise testing the valve assembly shall be examined for failure and tested in accordance with 4.3.3.

4.3.4.12 Transient pulses.- The valve assembly shall be tested in accordance with 4.3.3.7, 4.3.3.8 and 4.3.3.9 with the pulses present to check for conformance to 3.3.17.

4.3.4.13 Collapse pressure.- The valve assembly shall be slowly, externally pressurized to 19 psig. This pressure shall be held for 3 minutes before reducing to zero. The valve assembly shall be checked for conformance to 3.3.6.

NOTE

The burst pressure test shall be the last performed

4.3.4.14 Burst pressure.- Simultaneously the 3 ports of the valve assembly shall be slowly pressurized to 125 psig. This pressure shall be held for 3 minutes. The pressure shall then be slowly increased until the valve assembly ruptures. The valve assembly shall be checked for conformance to 3.3.4.

4.3.4.15 Coil Transient Voltage.- With the valve stabilized at room temperature, * the rated operating voltage shall be applied to the coil terminals. Before the valve has been energized for 10 seconds, the valve shall be de-energized and the coil transient voltage measured with an oscilloscope. The maximum allowable peak transient voltage shall not exceed a value equal to 50 percent above the rated coil voltage. The valves coil shall be connected directly to the power supply. The use of resistors, capacitors, inductors, or semi-conductor devices in series or parallel with the coil not inherent in the properly set up test circuit is forbidden. The transient voltage shall be measured a minimum of three times and the largest transient value recorded as the actual valve.

NOTE

It is recommended that the device used to de-energize the valve under test be a mercury switch or mercury wetted relay contact. When a mercury relay is used as the switching device, its coil should be operated

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from a separate source, isolated from the source used to operate the valve coil under test. The oscilloscope used should have a rise time equal to or less the 0.2 microsecond. Photographs of the oscilloscope traces are helpful in ascertaining precise voltage measurements of the transients, but are not required. In order to observe the maximum vertical excursion of the transient voltage, horizontal sweep times of from 100 microseconds per centimeter (CM) to 20 microseconds per cm may be necessary.

4.3.5 Acceptance tests.- All valve assemblies which are intended for acceptance by the procuring activity shall be subjected to the acceptance tests. Valve assemblies cannot be accepted until they have successfully completed the examinations of 4.3.2 prior to being subjected to these tests. The acceptance tests shall be performed using only gaseous test media. The acceptance tests shall be as follows in the order listed:

(a) Proof pressure - same as 4.3.3.1

(b) Leakage - same as 4.3.3.3.1 and the gaseous portion of 4.3.3.3.1

NOTE

The remainder of the functional tests, 4.3.3.2 and 4.3.3.4 through 4.3.3.9 may be performed prior to the acceptance vibration test upon the approval of the procuring activity.

(c) Acceptance vibration.- The valve assembly shall be installed in a test setup which simulates the vehicle installation. All three ports of the valve assembly shall be pneumatically pressurized to 20 psig. The test setup shall be subjected to 1.0 minute of random vibration along the axis normal to the mounting plane. The levels shall be as follows:

(1) 20 to 46 Hz at +6.0 db per octave *
(2) 46 to 100 Hz at 0.0357 g^2 per Hz *
(3) 100 to 210 Hz at -9.0 db per octave *
(4) 210 to 750 Hz at 0.00375 g^2 per Hz *
(5) 750 to 1155 Hz at -12.0 db per octave *
(6) 1155 to 2000 Hz at 0.000655 g^2 per Hz *

(d) Functional tests. - same as 4.3.3

(e) Coil transient voltage.- same as 4.3.4.15 *

4.3.6 Quality assurance sample tests.- A quality assurance sample shall be selected from production valve assemblies when so specified by the purchasing documentation. The quality assurance sample shall consist of valve assemblies which:

(a) Have been made in accordance with the detail design which was approved by the procuring activity.

(b) Have been selected at random from the valve assemblies which have been accepted by the procuring activity.

TABLE II - Quality Assurance Sample Test

Test Paragraph	Number of Valve Assemblies to be tested	Comments
4.3.4.1, 4.3.4.2, 4.3.4.3, 4.3.4.4, 4.3.4.5, 4.3.4.7, 4.3.4.8 and 4.3.4.13	Minimum of one	Testing not required unless otherwise specified by the procuring activity.
4.3.4.6, 4.3.4.9, 4.3.4.10, 4.3.4.11, 4.3.4.12 and 4.3.4.15	Entire sample	Testing Required
4.3.4.14	Minimum of one	Testing required

5. PREPARATION FOR DELIVERY

5.1 Preservation and packing shall be as specified by the applicable cleaning specification unless otherwise specified by the procuring activity. Packing and marking may be equivalent to the supplier's best commerical practice provided that this practice will be sufficient to protect the valve assemblies against damage and contamination during shipment. The supplier shall be held responsible for any damage to or contamination of the valve assemblies due to faulty packing. If the valve assemblies fail to meet the requirements of this specification because of such damage or contamination, an acceptable replacement shall be furnished by the supplier at no cost to the procuring activity. Exterior containers shall conform to the Uniform Freight Classification Rules or the National Motor Freight Classification Rules and to applicable container specifications.

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FIGURE 3. TRANSIENT PULSES

CODE IDENT NO	DWG SIZE A	20M42517
		SHEET 27 of [illegible]

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A.	-	Port A Open (Closed Contacts)
B.	-	Port A Open (Open Contacts)
E.	-	Common Port A Contacts
G.	-	Spare
C.	-	Port B Open (Closed Contacts)
D.	-	Port B Open (Open Contacts)
F.	-	Common Port B Contacts
J.	-	Minus 28 vdc Pulse, Port A Open (Primary Position)
K.	-	Minus 28 vdc Pulse, Port B Open (Secondary Position)
L.	-	Plus 28 vdc Pulse, Port A Open (Primary Position)
M.	-	Plus 28 vdc Pulse, Port B Open (Secondary Position)
H.	-	Case Ground

FIGURE 4. Pin Functions

EQUIPMENT LIST

Type Equipment	Manufacturer	Model #	Range	Accuracy	Tag #	Date Last Calibration
Oscilloscope	Tektronix	RM41A	---	---	AF715347	12/69
Plug-In	Tektronix	CA	.1-20 V/CM	---	AF715347-1	12/69
Ammeter	Simpson	1702	0-1.5A	.5% of F.S.	X28245	12/69
Voltmeter, Plug-In	Hickok	DP 100	1 V to	±1% F.S.	STE 001 014	3/70
Frame	Hickok	DMS 3200	1000 Volts	±1%	STE 001 013	3/70
Megger	Freed Xfmr Co.	1620 C	0-1000 Volts	———	S1759	8/70
Resist., Plug-In	Hickok	DP 170	Milliohms/Megohm	+2%	SC 1327	12/70
Leak Checker	Veeco	MS 90AB	3.4×10^{-8}	10%	S-2352	8/70
Leak Standard	Veeco	SC-4	Scc, HE/Sec		C-1384	6/70
Pressure Gage	Marsh Inst. Co.	AA	0-150 psig	3%	C1486	12/70
Pressure Gage	Ashcroft Co.	---	0-200 psig	3%	X 23965	8/70
Pipette	Fisher	10 ML	10 ML	≤5%	C 1571	12/69
Diff. Press. Gag.	Barton Inst.	---	0-2 psid	+2%	C1865	1/70
Power Supply	Trygon	SHR40-1.5	40 V - 1.5 Amp	Actual Reading Set with Voltmeter or Oscillocope.	S 2513-2	ANC*
Power Supply	Tektronix	160A		Actual Reading	S 0149	2/70
Pulse Generator	Tektronix	161	0-100 MS	Set & Measured	X24058	2/70
Waveform Gen.	Tektronix	162		w/Oscilloscope	X24059	2/70
Pulse Generator	Velonex	380-13	2.5-7.5 micro-seconds	Actual Reading Set & Measured w/Oscilloscope	S3535	ANC*
Temp. Meter	API		-75°F		MS 22002	8/70
"		429-	to	±2%	MS 22001	8/70
"		82927	+225°F		MS 22004	8/70
"					MS 22005	8/70
Temp. Controller	Cole-Parmer	2158	-100°F-	±.5°F	MS 22006	8/70
"		2158	+250°F		MS 22007	8/70
Graph Recorder	Beckman	Type R	10-500 MV/CM	±2%	S 2487-1 then S2487-22	8/70
Flow Meter	Fisher-Porter	10A2700	0-7.5 GPM	±1% F.S.	S 3586	10/70
Camera	Polaroid	---	---	---	No CAL	---
Ohmmeter	Simpson	260	0-2K	±3%	X15162	10/70
Pump	Aurora	D4	0-4 GPM	---	No CAL	---

*Ancillary Equipment

(con't.)

EQUIPMENT LIST

Type Equipment	Manufacturer	Model #	Range	Accuracy	Tag #	Date Last Calibration
Thermal Chamber (Hot)	Tenney	---	-25°F- +225°F	---	51904	3/70
Thermal Chamber (Cold).	Tenney	---	-100°F- +300°F	---	S1969	12/70
Tank Pressure Indicator	Mathieson	22025-1	0-3000	---	No Cal	---
Regulator Valve	Mathieson	---	0-400 psi	---	No Cal	---
Hand Pump	Enerpac	462	0-10,000	---	No Cal	---
Vibration System 1						
Exciter	MB Elecs.	G25HB C-25-HB-2	5-2000 CPS		AF 89 AF 308	
Console	"	UDAGC-RA-803	3500 lb.	$\leq$ 5%	AF 3518	10/70
Amplifier	"	MB T66-13			AF 290	
Accelerometer	Endevco	GR-12				

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Date: 6-4-70
Mech. Tech. REO Test Eng. RMR
Elect. Tech. —— Q. C. ~~Eng.~~ TECH. HPG

5.1 Pre-Test Examination

Discrepancies/Comments:
SEE DAR # AVCO 007

5.1.1 Identification

Discrepancies/Comments:
NONE

5.1.2 Workmanship

Discrepancies/Comments:
NONE

5.1.3 Cleaning

Discrepancies/Comments: 6-5-70
NONE

5.3.1 PROOF PRESSURE

5 MIN @ 75 ± 7.5 PSIG	ALLOWABLE	ACTUAL		O.K	REJECT	INITIAL
	NO DEFORMATION OR PERMANENT SET	TIME	PRESS			
		7 MIN	75.PSI	✓		[illegible]

COMMENTS: TEST > 5 MIN. CYCLES = 8 TOTAL 6-8-70
DATE: 6-5-70

5.3.2 LEAKAGE EXTERNAL

100% HELIUM @ 50 PSIG INTERNAL PRESSURE	ALLOWABLE	ACTUAL	O.K.	REJECT	INITIAL
	1.6×10^{-6} SCCS	$.75 \times 10^{-7}$	✓		[illegible]

COMMENTS STD LK = 1.26×10^{-7} S.S, STD LK. READING = 10, SCALE READING = 6.0
DATE 6-5-70 CYCLES = 8 TOTAL

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	008	Date:	6-8-70
Mech. Tech.	REO	Test Eng.	RMR
Elect. Tech.	—	Q. C. ~~Eng~~. TECH.	HPG

5.1 Pre-Test Examination

Discrepancies/Comments:

SEE DAR # AV20-008

5.1.1 Identification

Discrepancies/Comments:

NONE

5.1.2 Workmanship

Discrepancies/Comments:

NONE

5.1.3 Cleaning

Discrepancies/Comments: 6-8-70

NONE

5.3.1 PROOF PRESSURE

5 MIN @ 75 ± 7.5 PSIG	ALLOWABLE	ACTUAL		O.K.	REJECT	INITIAL
	NO DEFORMATION OR PERM. SET	TIME	PRESS			
		5½ MIN	75.0 PSIG	✓		HPG

COMMENTS TEST 5 MIN+ CYCLES = 10 6-8-70

DATE 6-8-70

5.3.2 LEAKAGE EXTERNAL

100% HE @ 50 PSIG INTERNAL PRESSURE	ALLOWABLE	ACTUAL	O.K.	REJECT	INITIAL
	1×10^{-6} SCCS	$.96 \times 10^{-7}$ SCCS	✓		HPG

COMMENTS STD LK = 1.25×10^{-7} SCCS, STD LK READING = 18, ACTUAL SCALE READING = 13

DATE 6-8-70

CYCLES = 10 TOTAL

6-8-70

D-2

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	007	Test Eng.	RMR
Mech. Tech.	REO	Q. C. Tech.	HPG
Elect. Tech.	—		

5.3.3 Leakage Internal

Port A Methanol/Water	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG
10.0 ± 1.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG
20.0 ± 2.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG

6-8-70

Date 6-8-70

Port B Methanol/Water	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG
10.0 ± 1.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG
20.0 ± 2.0 psig ΔP	0.20 sccs	.0017	.0006	.0017	✓		HPG

6-8-70

Photo Taken No
Date 6-8-70

Comments: CYCLES = 18 TOTAL

5.3.4 Acceptance Vibration

Random - Spectral Density per 5.3.4 Internal Pressure 20 ± 2.0 psig, GN2	Allowable	Actual	O. K.	Reject	Initial
	Overall ± 10% Density = +100% - 30%	> 100% AT 1500 CPS	SEE COMMENTS		KLD

Photo Taken No
Date 6-8-70

6-8 RM

Comments: CYCLE = 24 TOTAL
OVER TEST AT 1500 CPS
PRESSURE LEVEL CHECKED AFTER VIBRATION. NO LOSS OF PRESS. 6-9
DUE TO VIBRATION.

6-9-70

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. REO Q. C. Tech. HPG.
Elect. Tech. ——

5.3.3 Leakage Internal

Port A Methanol/Water	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG
10.0 ± 1.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG
20.0 ± 2.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG

6-8-70

Date 6-8-70

Port B Methanol/Water	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG
10.0 ± 1.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG
20.0 ± 2.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG

6-8-70

Photo Taken No
Date 6-8-70

Comments: CYCLES = 18 TOTAL

5.3.4 Acceptance Vibration

Random - Spectral Density per 5.3.4 Internal Pressure 20 ± 2.0 psig, GN2	Allowable	Actual	O. K.	Reject	Initial
	Overall ± 10% Density = +100% - 30%	> 100% AT 1500 CPS	SEE COMMENTS		VCB

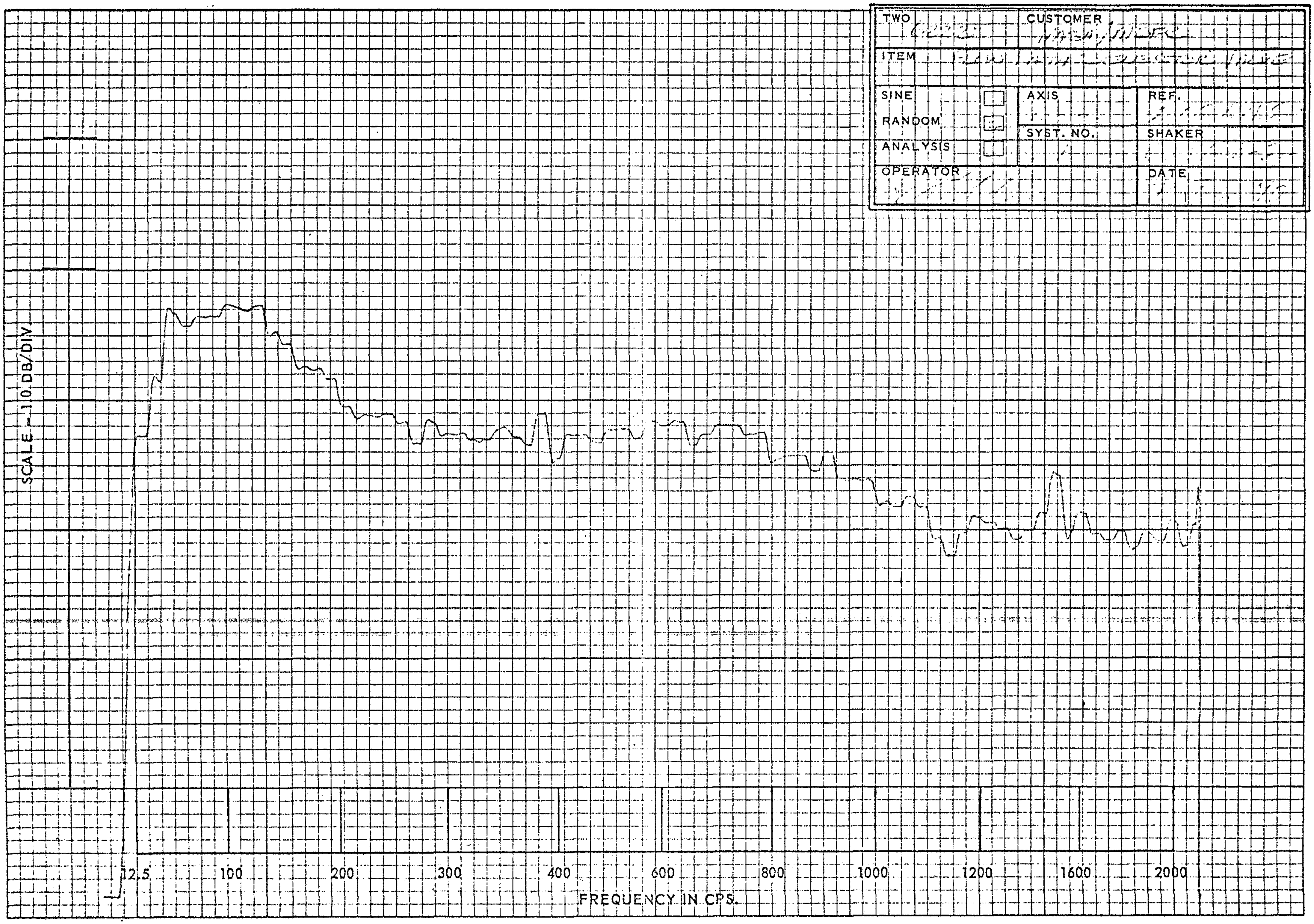
Photo Taken No
Date 6-8-70

Comments: CYCLES = 24 TOTAL
OVERTEST AT 1500 CPS

PRESSURE LEVEL CHECKED AFTER VIBRATION. NO LOSS OF PRESS. DUE TO VIBRATION. VALVE AGAIN CHARGED TO 20 PSIG AND VENTED INTO A PRESSURE GAGE. FINAL PRESSURE (15.5 PSIG) SAME AS POST VIBRATION PRESSURE LEVEL

6-9-70

D-4


TWO
CUSTOMER
ITEM
SINE
RANDOM
ANALYSIS
AXIS
REF.
SYST. NO.
SHAKER
OPERATOR
DATE
SCALE – 10 DB/DIV
12.5
100
200
300
400
600
800
1000
1200
1600
2000
FREQUENCY IN CPS.

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. REO Q. C. Tech. HPG
Elect. Tech. ——

5.3.5 Vacuum Internal

	Allowable	Actual	O. K.	Reject	Initial
1. Internal Pressure	1.94 x 10^{-4} torr min.	2x10^{-5}	✓		HPG
2. External Pressure	14.7 psia	14.87			HPG
3. Duration	5 minutes min.	5.5 MIN	✓		HPG
4. Visual Examination	no deformation or permanent set	NO DEFORMATION	✓		✓

Photo Taken No
Date 6-9-70

Comments: CYCLES = 31 TOTAL

6-9-70

5.3.6 Proof Pressure, After Acceptance Vibration

5 min. @ 75 ± 7.5 psig	Allowable	Actual Time	Actual Press	O. K.	Reject	Initial
	no deformation or permanent set	5 MIN 20 SEC	150 PSIG	✓		HPG

Date 6-9-70

Comments: CYCLES = 34 TOTAL

6-9-70

5.3.7 Leakage External (Gaseous), After Acceptance Vibration

100% Helium @ 50 psig internal pressure	Allowable	Actual	O. K.	Reject	Initial
	1.6X10^{-6} SCCS	2.06X10^{-7} SCCS	✓ SEE COMMENTS		HPG

Date 6-9-70 RMR

Comments: STD. LK = 1.25X10^{-7}SCCS. STD LK READING = 42, ACTUAL SCALE READING = 7.0
CYCLES = 39 TOTAL

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	008	Test Eng.	RMR
Mech. Tech.	REO	Q. C. Tech.	HPG
Elect. Tech.	—		

5.3.5 Vacuum Internal

	Allowable	Actual	O. K.	Reject	Initia
1. Internal Pressure	1.94×10^{-4} torr min.	2×10^{-5}	✓		HPG
2. External Pressure	14.7 psia	14.87			HPG
3. Duration	5 minutes min.	5.5 MIN	✓		HPG
4. Visual Examination	no deformation or permanent set	NO DEFORMATION	✓		

Photo Taken: No
Date: 6-9-70

Comments: CYCLES, TOTAL = 28

AD 16 — 376 6-9-70

5.3.6 Proof Pressure, After Acceptance Vibration

	Allowable	Actual Time	Actual Press	O. K.	Reject	Initial
5 min. @ 75 ± 7.5 psig	no deformation or permanent set	5 MIN 20 SEC	750 PSIG	✓		HPG

Date: 6-9-70

Comments: CYCLES = 32 TOTAL

AD 16 — 376 6-9-70

5.3.7 Leakage External (Gaseous), After Acceptance Vibration

	Allowable	Actual	O. K.	Reject	Initial
100% Helium @ 50 psig internal pressure	16×10^{-6} sccs	$.88 \times 10^{-7}$ sccs	✓		HPG

Date: 6-9-70

Comments: STD LK = 1.25×10^{-7} SCCS. STD LK READING = 50 (RMR) ACTUAL SCALE READING = 4.2

CYCLES = 37 TOTAL

AD 16 — 376 6-9-70

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. REO Q. C. Tech. HPG
Elect. Tech. REO

5.3.8 Leakage Internal (~~Gaseous~~), After Acceptance Vibration

Port A	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG
10.0 ± 1.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG
20.0 ± 2.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG

Date 6-9-70

6-9-70

Port B	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 sccs	0.0	0.0	.0008	✓		HPG
10.0 ± 1.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG
20.0 ± 2.0 psig ΔP	0.20 sccs	.0017	.0017	.0008	✓		HPG

Date 6-9-70

6-9-7

Comments: CYCLES = 45 TOTAL

5.3.9 Circuit Resistance

5.3.9.1

Port "A" Open Pins From	To	Limit	Actual 1	Actual 2	Actual 3
A	E	0.5 ohms max.	0.1	0.1	0.1
D	F	0.5 ohms max.	0.1	0.1	0.1
H	Case	0.5 ohms max.	0.2	0.1	0.1
L	J	25-29 OHMS	27.9	27.9	27.9
B	E	Open Circuit	OPEN	OPEN	OPEN
C	F	Open Circuit	OPEN	OPEN	OPEN

NASA 373 6-10-70

Accept ✓ Initial HPG
Reject Date 6-10-70

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	008	Test Eng.	RMR
Mech. Tech.	REO	Q. C. ~~Eng.~~ TECH.	HPG
Elect. Tech.	REO		

5.3.8 Leakage Internal ~~(Gaseous)~~, After Acceptance Vibration

Port A	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0 + .5 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG
10.0+ 1.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG
20.0+ 2.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG

Date ______

Port B	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0 + .5 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG
10.0+ 1.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG
20.0+ 2.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG

Date 6-9-70

Comments: CYCLES = 53 TOTAL

5.3.9 Circuit Resistance

5.3.9.1

Port "A" Open Pins From	To	Limit	Actual 1	2	3
A	E	0.5 ohms max.	0.1	0.1	0.1
D	F	0.5 ohms max.	0.1	0.1	0.1
H	Case	0.5 ohms max.	0.1	0.1	0.1
L	J	25-29 ohms	25.4	25.5	25.4
B	E	Open Circuit	OPEN	OPEN	OPEN
C	F	Open Circuit	OPEN	OPEN	OPEN

6-10-70

Accept ✓
Reject ______

Initial HPG
Date 6/10/70

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. RMR Q. C. ~~Eng.~~ TECH ALRT
Elect. Tech. RMR

5.3.9.2

Port "B" Open Pins		Limit	Actual		
			1	2	3
From	To				
A	E	Open Circuit	OPEN	OPEN	OPEN
D	F	Open Circuit	OPEN	OPEN	OPEN
H	Case	0.5 ohms max.	0.0	0.1	0.1
M	K	25-29 ohms	27.9	27.9	27.9
B	E	0.5 ohms max.	0.1	0.1	0.1
C	F	0.5 ohms max.	0.1	0.1	0.1

6-10-70

Accept ✓ Initial ALRT
Reject Date 6-9-70
Photo Taken NO

Comments: TOTAL CYCLES = 61

5.3.10.1 Insulation Resistance

500 Volts D. C. Pins			
From	To	Limit	Actual
A	C	50 meg. ohms min. ✓	>200 KMΩ
A	D	50 meg. ohms min. ✓	>200 KMΩ
A	F	50 meg. ohms min. ✓	>200 KMΩ
A	H	50 meg. ohms min.	200 KMΩ
A	J	50 meg. ohms min. ✓	>200 KMΩ
A	L	50 meg. ohms min. ✓	>200 KMΩ
A	M	50 meg. ohms min. ✓	>200 KMΩ
A	Case	50 meg. ohms min.	190 KMΩ
B	C	50 meg. ohms min. ✓	>200 KMΩ
B	D	50 meg. ohms min. ✓	
B	F	50 meg. ohms min. ✓	
B	A	50 meg. ohms min. ✓	
B	J	50 meg. ohms min. ✓	>200 KMΩ

6-10-70

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	008	Test Eng.	RMR
Mech. Tech.	RMR	Q. C. ~~Eng.~~ TECH	ALRT
Elect. Tech.	RMR		

5.3.9.2

Port "B" Open Pins		Limit	Actual		
			1	2	3
From	To				
A	E	Open Circuit	OPEN	OPEN	OPEN
D	F	Open Circuit	OPEN	OPEN	OPEN
H	Case	0.5 ohms max.	0.2	0.1	0.1
M	K	25-29 ohms	25.5	25.5	25.5
B	E	0.5 ohms max.	0.1	0.1	0.1
C	F	0.5 ohms max.	0.1	0.1	0.1

6-10-70

Accept	✓	Initial	ALRT
Reject		Date	6/10/70
Photo Taken	NO		

Comments: CYCLES = 59 TOTAL

5.3.10.1 Insulation Resistance

500 Volts D. C. Pins From	To	Limit	Actual
A	C	50 meg. ohms min. ✓	200 KMΩ
A	D	50 meg. ohms min. ✓	200 KMΩ
A	F	50 meg. ohms min.	200 KMΩ
A	H	50 meg. ohms min.	190 KMΩ
A	J	50 meg. ohms min.	>200 KMΩ
A	L	50 meg. ohms min.	>200 KMΩ
A	M	50 meg. ohms min.	>200 KMΩ
A	Case	50 meg. ohms min.	190 KMΩ
B	C	50 meg. ohms min.	>200 KMΩ
B	D	50 meg. ohms min.	>200 KMΩ
B	F	50 meg. ohms min.	>200 KMΩ
B	A	50 meg. ohms min.	>200 KMΩ
B	J	50 meg. ohms min.	>200 KMΩ

6-10-70

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. RMR Q. C. ~~Eng.~~ Tech [illegible]
Elect. Tech. RMR

Continued

From	To	Limit	Actual
B	K	50 meg. ohms min.	>200 KMΩ
B	L	50 meg. ohms min.	>200 KMΩ
B	M	50 meg. ohms min.	>200 KMΩ
B	Case	50 meg. ohms min.	150 KMΩ
C	E	50 meg. ohms min.	>200 KMΩ
C	H	50 meg. ohms min.	150 KMΩ
C	J	50 meg. ohms min.	>200 KMΩ
C	K	50 meg. ohms min.	
C	L	50 meg. ohms min.	
C	M	50 meg. ohms min.	>200 KMΩ
C	Case	50 meg. ohms min.	150 KMΩ
D	E	50 meg. ohms min.	>200 KMΩ
D	H	50 meg. ohms min.	190 KMΩ
D	J	50 meg. ohms min.	>200 KMΩ
D	K	50 meg. ohms min.	
D	L	50 meg. ohms min.	
D	M	50 meg. ohms min.	>200 KMΩ
D	Case	50 meg. ohms min.	190 KMΩ
E	F	50 meg. ohms min.	>200 KMΩ
E	H	50 meg. ohms min.	150 KMΩ
E	J	50 meg. ohms min.	>200 KMΩ
E	K	50 meg. ohms min.	
E	L	50 meg. ohms min.	
E	M	50 meg. ohms min.	>200 KMΩ
E	Case	50 meg. ohms min.	150 KMΩ
F	H	50 meg. ohms min.	150 KMΩ
F	J	50 meg. ohms min.	>200 KMΩ
F	K	50 meg. ohms min.	
F	L	50 meg. ohms min.	
F	M	50 meg. ohms min.	>200 KMΩ
F	Case	50 meg. ohms min.	150 KMΩ
G	A	50 meg. ohms min.	>200 KMΩ
G	B	50 meg. ohms min.	
G	C	50 meg. ohms min.	
G	D	50 meg. ohms min.	
G	E	50 meg. ohms min.	>200 KMΩ

6-10-?

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. RMR Q. C. ~~Eng.~~ [illegible]
Elect. Tech. RMR Tech

Continued

From	To	Limit	Actual
B	K	50 meg. ohms min.	>200 KMΩ
B	L	50 meg. ohms min.	>200 KMΩ
B	M	50 meg. ohms min.	>200 KMΩ
B	Case	50 meg. ohms min.	150 KMΩ
C	E	50 meg. ohms min.	>200 KMΩ
C	H	50 meg. ohms min.	150 KMΩ
C	J	50 meg. ohms min.	>200 KMΩ
C	K	50 meg. ohms min.	>200 KMΩ
C	L	50 meg. ohms min.	>200 KMΩ
C	M	50 meg. ohms min.	200 KMΩ
C	Case	50 meg. ohms min.	150 KMΩ
D	E	50 meg. ohms min.	>200 KMΩ
D	H	50 meg. ohms min.	190 KMΩ
D	J	50 meg. ohms min.	>200 KMΩ
D	K	50 meg. ohms min.	>200 KMΩ
D	L	50 meg. ohms min.	>200 KMΩ
D	M	50 meg. ohms min.	>200 KMΩ
D	Case	50 meg. ohms min.	190 KMΩ
E	F	50 meg. ohms min.	>200 KMΩ
E	H	50 meg. ohms min.	150 KMΩ
E	J	50 meg. ohms min.	>200 KMΩ
E	K	50 meg. ohms min.	>200 KMΩ
E	L	50 meg. ohms min.	>200 KMΩ
E	M	50 meg. ohms min.	>200 KMΩ
E	Case	50 meg. ohms min.	150 KMΩ
F	H	50 meg. ohms min.	150 KMΩ
F	J	50 meg. ohms min.	200 KMΩ
F	K	50 meg. ohms min.	200 KMΩ
F	L	50 meg. ohms min.	200 KMΩ
F	M	50 meg. ohms min.	200 KMΩ
F	Case	50 meg. ohms min.	150 KMΩ
G	A	50 meg. ohms min.	>200 KMΩ
G	B	50 meg. ohms min.	>200 KMΩ
G	C	50 meg. ohms min.	>200 KMΩ
G	D	50 meg. ohms min.	>200 KMΩ
G	E	50 meg. ohms min.	>200 KMΩ

6-10-70 978

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	007	Test Eng.	RMR
Mech. Tech.	RMR	Q. C. ~~Eng.~~ TECH	HLRT
Elect. Tech.	RMR		

Continued

From	To	Limit	Actual
G	F	50 meg. ohms min.	>200 KMΩ
G	H	50 meg. ohms min.	196 KMΩ
G	J	50 meg. ohms min.	>200 KMΩ
G	K	50 meg. ohms min.	>200 KMΩ
G	L	50 meg. ohms min.	>200 KMΩ
G	M	50 meg. ohms min.	>200 KMΩ
H	J	50 meg. ohms min.	100 KMΩ
H	K	50 meg. ohms min.	100 KMΩ
H	L	50 meg. ohms min.	100 KMΩ
H	M	50 meg. ohms min.	100 KMΩ
J	K	50 meg. ohms min.	150 MΩ
J	M	50 meg. ohms min.	150 MΩ
J	Case	50 meg. ohms min.	>200 KMΩ
K	L	50 meg. ohms min.	150 MΩ
K	Case	50 meg. ohms min.	>200 KMΩ
L	M	50 meg. ohms min.	150 MΩ
L	Case	50 meg. ohms min.	>20 KMΩ
M	Case	50 meg. ohms min.	>20 KMΩ

Accept ✓ Initial HLRT
Reject Date 6-10-70
Photo Taken No

Comments: CYCLES = 61

5.3.10.2 Insulation Resistance

Port "A" Open 500 Volts D. C. Pins From	To	Limit	Actual
B	E	50 meg. ohms min.	>200 KMΩ
B	A	50 meg. ohms min.	>200 KMΩ
C	D	50 meg. ohms min.	>200 KMΩ
C	F	50 meg. ohms min.	>200 KMΩ

Accept ✓ Initial HLRT
Reject Date 6/10/70

D-15

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 | Test Eng. RMR
Mech. Tech. RMR | Q. C. ~~Eng.~~ Tech MAT
Elect. Tech. RMR

Continued

From	To	Limit	Actual
G	F	50 meg. ohms min.	>200 KMΩ
G	H	50 meg. ohms min.	190 KMΩ
G	J	50 meg. ohms min.	>200 KMΩ
G	K	50 meg. ohms min.	>200 KMΩ
G	L	50 meg. ohms min.	>200 KMΩ
G	M	50 meg. ohms min.	>200 KMΩ
H	J	50 meg. ohms min.	>200 MΩ
H	K	50 meg. ohms min.	>20 KMΩ
H	L	50 meg. ohms min.	>20 KMΩ
H	M	50 meg. ohms min.	>20 KMΩ
J	K	50 meg. ohms min.	150 MΩ
J	M	50 meg. ohms min.	150 MΩ
J	Case	50 meg. ohms min.	>20 KMΩ
K	L	50 meg. ohms min.	150 MΩ
K	Case	50 meg. ohms min.	>20 KMΩ
L	M	50 meg. ohms min.	150 MΩ
L	Case	50 meg. ohms min.	>20 KMΩ
M	Case	50 meg. ohms min.	>20 KMΩ

6-10-

Accept ✓ | Initial MAT
Reject | Date 6/10/70
Photo Taken NO

Comments: CYCLES = 59 TOTAL

5.3.10.2 Insulation Resistance

Port "A" Open 500 Volts D. C. Pins From	To	Limit	Actual
B	E	50 meg. ohms min.	>200 KMΩ
B	A	50 meg. ohms min.	>200 KMΩ
C	D	50 meg. ohms min.	>200 KMΩ
C	F	50 meg. ohms min.	>200 KMΩ

6-10-

Accept ✓ | Initial MAT
Reject | Date 6/10/70

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007   Test Eng. BMR
Mech. Tech. LEO   Q. C. ~~Eng.~~ TECH ALRT
Elect. Tech. LEO

5.3.10.3 Insulation Resistance

Port "B" Open 500 Volts D. C. Pins From	To	Limit	Actual
A	B	50 meg. ohms min.	>200 KMΩ
A	E	50 meg. ohms min.	>200 KMΩ
D	C	50 meg. ohms min.	>200 KMΩ
D	F	50 meg. ohms min.	>200 KMΩ

6-10-70

Accept ✓   Initial ALRT
Reject   Date 6-10-70

Comments: CYCLES = 64 TOTAL

5.3.11 Minimum Operating Voltage (Unpressurized Assembly)

Minimum Operating Voltage 100 ms Pulse, Unpressurized	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initial
Port "A"	18 volts d.c. max.	12.0	12.0	13.0	✓		ALRT
Port "B"	18 volts d.c. max.	14.5	14.0	14.5	✓		ALRT

Photo Taken No
Date 6-10-70

Comments: PHOTO TAKEN ON 1ST PULSE ON PORT A
PHOTO TAKEN ON 1ST PULSE ON PORT B

6-10-70

5.3.12 Minimum Operating Voltage (Pressurized Assembly)

Minimum Operating Voltage 100ms Pulse 50 ± 5 psig, 100% Helium	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initial
Port "A"	18 volts d.c. max.	10.0	10.0	10.5	✓		ALRT
Port "B"	18 volts d.c. max.	12.8	12.5	12.0	✓		ALRT

6-10-70

Photo Taken No
Date 6-10-70

Comments: CYCLES = ~~85~~ 96 (IMC) TOTAL
PHOTOS TAKEN PORT A & B 1ST ACTUATION ONLY
2ND & 3RD ACTUATION MONITORED ON SCOPE

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	00E	Test Eng.	RMR
Mech. Tech.	REO	Q. C. ~~Eng.~~ TECH	ALRT
Elect. Tech.	REO		

5.3.10.3 Insulation Resistance

Port "B" Open 500 Volts D. C. Pins From	To	Limit	Actual
A	B	50 meg. ohms min.	>200 KMΩ
A	E	50 meg. ohms min.	>200 KMΩ
D	C	50 meg. ohms min.	>200 KMΩ
D	F	50 meg. ohms min.	>200 KMΩ

6-10-7

Accept ✓ Initial ALRT
Reject Date 6/10/70

Comments: CYCLES = 61 TOTAL

5.3.11 Minimum Operating Voltage (Unpressurized Assembly)

Minimum Operating Voltage 100 ms Pulse, Unpressurized	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initia
Port "A"	18 volts d.c. max.	13.5	12.1	12.8	✓		ALRT
Port "B"	18 volts d.c. max.	17.0	14.5	16.5	✓		ALRT

Photo Taken No
Date 6-10-70

Comments: PHOTOS 1ST ACTUATION ONLY, 2N & 3RD ACTUATION MINITORED ON SCOPE

5.3.12 Minimum Operating Voltage (Pressurized Assembly)

6-10-7

Minimum Operating Voltage 100ms Pulse 50 ± 5 psig, 100% Helium	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initia
Port "A"	18 volts d.c. max.	12.8	12.4	12.4	✓		ALRT
Port "B"	18 volts d.c. max.	16.0	16.0	16.0	✓		ALRT

6-10-70

Photo Taken No
Date 6-10-70

Comments: CYCLES = ~~84~~ 92 (RMR) TOTAL
SAME COMMENTS AS 5.3.11

<u>Test Data Sheet</u>
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	007	Test Eng.	RMR
Mech. Tech.	REW	Q. C. ~~Eng.~~ TECH	ALRT
Elect. Tech.	REW		

5.3.13 <u>Minimum Pulse Duration (Pressurized Assembly)</u>

Minimum Pulse Duration, 28 Volts D.C. 100% Helium, 50 ± 5 psig	Allowable	Actual 1	Actual 2	Actual 3	O.K.	Reject	Initial
Port "A"	100 ms. max.	15.3	15.9	17.0	✓		ALRT
Port "B"		21.0	21.0	20.0	✓		ALRT

6-10-70

Photo Taken: No
Date: 6-10-70

Comments: PHOTOS 1ST ACTUATION ONLY
CYCLES = 106 TOTAL

5.3.14 <u>Minimum Pulse Duration (Unpressurized Assembly)</u>

Minimum Pulse Duration, 28 Volts D.C. Zero Press	Allowable	Actual 1	Actual 2	Actual 3	O.K.	Reject	Initial
Port "A"	100 ms. max.	18.0	17.0	16.5	✓		ALRT
Port "B"		22.0	20.0	21.0	✓		ALRT

6-10-70

Photo Taken: No
Date: 6-10-70

Comments: PHOTOS 1ST ACTUATION ONLY
CYCLES = 117 TOTAL

5.3.15 <u>Power Consumption</u>

Power 28 Volts D.C. Steady State	Allowable	Actual		O.K.	Reject	Initial
Voltage	28 ± .5	28.0		✓		ALRT
Current	1.14 amps max.	.95	.98	✓		ALRT
Power	31.5 watts max.	26.6	27.44	✓		ALRT
		PORT A	PORT B			

6-11-70

Photo Taken: No
Date: 6-11-70

Comments: PORT B = 0.98 AMPS , PORT A = 0.95

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RHR
Mech. Tech. LEO Q. C. ~~Eng.~~ TECH ALRT
Elect. Tech. REO

5.3.13 Minimum Pulse Duration (Pressurized Assembly)

Minimum Pulse Duration, 28 Volts D. C. 100% Helium, 50 ± 5 psig	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initial
Port "A"	100 ms. max.	16.5	15.0	16.0	✓		ALRT
Port "B"		17.5	16.5	17.0	✓		ALRT

6-10-70

Photo Taken No
Date 6-10-70

Comments: CYCLES = 104 TOTAL
SAME COMMENTS AS 5.3.11

5.3.14 Minimum Pulse Duration (Unpressurized Assembly)

Minimum Pulse Duration, 28 Volts D. C. Zero Press	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initial
Port "A"	100 ms. max.	17.5	17.5	16.5	✓		ALRT
Port "B"		17.5	18.0	16.0	✓		ALRT

6-10-70

Photo Taken No
Date 6-10-70

Comments: SAME COMMENTS AS 5.3.11
CYCLES = 114 TOTAL

5.3.15 Power Consumption

Power 28 Volts D. C. Steady State	Allowable	Actual		O. K.	Reject	Initial
Voltage	28 ± .5	28.0		✓		ALRT
Current	1.14 amps max.	1.07	1.04	✓		ALRT
Power	31.5 watts max.	29.96	29.12	✓		ALRT
		PORT A	PORT B			

6-11-70

Photo Taken No
Date 6-11-70

Comments: PORT A = 1.07 PORT B = 1.04

Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. TPS Q. C. ~~Eng.~~ TECH HPG, RSH
Elect. Tech. —

5.5.1 Vibration, Sinusoidal Excitation, Vehicle Dynamics

Vehicle Dynamics per 5.5.1 Internal Pressure 20 ± 2 psig Methanol/Water	Allowable	Actual	O.K.	Reject	Initial
	Accel. ±10%	21.0 PSIG	✓		
Port C Axis	Freq. ±5%		✓		
Port A & B Axis	Duration +10% - 0%		*		

* LOWEST AVAILABLE FREQUENCY WAS 4CPS

CONTINUITY ACROSS PINS A-E O.K. DURING RUNS

Photo Taken YES
Date 6-22-70 & 6-23-70
Control Accelerometer No. GR12

Comments: VACUUM PULLED ON EACH VALVE (0.5 PSIA) AND THEN FILLED WITH 80% METHANOL/20% WATER BY SYPHONING 6-18-70
NO EVIDENCE OF EXTERNAL LEAKAGE DURING VIBRATION

5.5.2 Vibration, Sine Evaluation Criteria

Sine Eval. per 5.5.2 Internal Pressure 20 ± 2.0 psig Methanol/Water	Allowable	Actual	O. K.	Reject	Initial
		21.0 PSIG	✓		
Port C Axis	Accel. ±10%				
Port A & B Axis	Freq. ± 5%		✓		
Longitudinal Axis	Duration +10% - 0%		✓		

Date 6-22-70 & 6-23-70
Control Accelerometer No. GR12

Comments: CONTINUITY ACROSS PINS A-E O.K. DURING RUNS
NO EVIDENCE OF LEAKAGE DURING VIBRATION

5.5.3 Vibration, Random Criteria, High Level

Random per 5.5.3 Internal Pressure 20 ± 2.0 psig Methanol/Water	Allowable	Actual	O. K.	Reject	Initial
		21.0 PSIG	✓		
Port C Axis	Overall ±10%		✓		
Port A&B Axis	PSD +100%	SEE	SEE		
Longitudinal Axis	- 30%	COMMENTS	COMMENTS		

Date 6-22-70 & 6-23-70

Comments: CONTINUITY ACROSS PINS A-E O.K. DURING RUNS
PSD O.K. EXCEPT FOR ONE PEAK AT 1175 CPS, PORT C AXIS
HIGH LEVEL. NO EVIDENCE OF LEAKAGE DURING VIBRATION

Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. TPS Q. C. ~~Eng.~~ TECH HPG, RSH
Elect. Tech. —

5.5.1 Vibration, Sinusoidal Excitation, Vehicle Dynamics

Vehicle Dynamics per 5.5.1 Internal Pressure 20 ± 2 psig Methanol/Water	Allowable	Actual	O.K.	Reject	Initia
	Accel. ±10%	21.0 PSIG	✓		
Port C Axis	Freq. ±5%		✓		
Port A & B Axis	Duration +10% - 0%		✓?		

CONTINUITY ACROSS PINS A-E O.K. DURING RUNS

Photo Taken YES
Date 6-22-70 & 6-23-70
Control Accelerometer No. GR12

Comments: VACUUM PULLED ON EACH VALVE (.05 PSIA) AND THEN FILLED WITH METHANOL 80% / WATER 20% BY SYPHONING 6-18-70
NO EVIDENCE OF EXTERNAL LEAKAGE DURING VIBRATION

5.5.2 Vibration, Sine Evaluation Criteria

Sine Eval. per 5.5.2 Internal Pressure 20 ± 2.0 psig Methanol/Water	Allowable	Actual	O. K.	Reject	Initial
		21.0 PSIG	✓		
Port C Axis	Accel. ±10%				
Port A & B Axis	Freq. ± 5%		✓		
Longitudinal Axis	Duration +10% - 0%		✓		

Date 6-22-70 & 6-23-70
Control Accelerometer No. GR12

Comments: CONTINUITY ACROSS PINS A-E O.K. DURING RUNS
NO EVIDENCE OF LEAKAGE DURING VIBRATION

5.5.3 Vibration, Random Criteria, High Level

Random per 5.5.3 Internal Pressure 20 ± 2.0 psig Methanol/Water	Allowable	Actual	O. K.	Reject	Initial
		21.0 PSIG	✓		
Port C Axis	Overall ±10%		✓		
Port A&B Axis	PSD +100%	SEE	SEE		
Longitudinal Axis	- 30%	COMMENTS	COMMENTS		

Date 6-22-70 & 6-23-70

Comments: CONTINUITY ACROSS PINS A-E O.K. DURING RUNS.
PSD O.K. EXCEPT FOR ONE PEAK AT 1175 CPS, PORT C AXIS
HIGH LEVEL. NO EVIDENCE OF LEAKAGE DURING VIBRATION

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 — Test Eng. R. [illegible] RMR
Mech. Tech. TPS — Q. C. ~~Eng.~~ TECH HPG
Elect. Tech. —

5.5.4 Vibration, Random Criteria Low Level

Random per 5.5.4 Internal Press 20 ± 2.0 psig Methanol/Water	Allowable	Actual	O. K.	Reject	Initial
		21.0 PSIG	✓		[illegible]
Port C Axis	Overall ± 10%		✓		[illegible]
Port A&B Axis	PSD +100%		✓		[illegible]
Longitudinal Axis	- 30%		✓		[illegible]

Date 6-22-70 & 6-23-70

Comments: CONTINUITY O.K. ACCESS PINS A-E, DURING RUNS
CYCLES = 125 TOTAL

Proof Pressure After Vibration

	Allowable	Actual Time	Actual Press	O. K.	Reject	Initial
5 min @ 75 ± 7.5 psg	No Leakage or deformation	5 MIN.	75.5	✓		HPG

Date 6-30-70

Comments: 5MIN @ 75.5 PSIG + 2MIN @ 73 PSIG
CYCLES = 137 TOTAL

Vacuum After Vibration

	Allowable	Actual	O. K.	Reject	Initial
1. Internal Pressure	1.94×10^{-4} torr min.	$< 1 \times 10^{-5}$	✓		HPG
2. External Pressure	14.7 psia	29.72 IN Hg	✓		HPG
3. Duration	5 minutes min.	6.9 MIN	✓		HPG
4. Visual Examination	no deformation or permanent set	NONE	✓		HPG

Date 6-30-70

Comments: CYCLES = 143

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RHR
Mech. Tech. TPS Q. C. Eng. HPG
Elect. Tech. — TECH

5.5.4 Vibration, Random Criteria Low Level

Random per 5.5.4 Internal Press 20 ± 2.0 psig Methanol/Water	Allowable	Actual	O. K.	Reject	Initial
		21.0 PSIG	✓		
Port C Axis	Overall ± 10%		✓		
Port A&B Axis	PSD +100%		✓		
Longitudinal Axis	- 30%		✓		

Date 6-22-70 & 6-23-70

Comments: CONTINUITY O.K. ACROSS PINS A-E DURING RUNS
CYCLES = 122 TOTAL

Proof Pressure After Vibration

	Allowable	Actual Time	Actual Press	O. K.	Reject	Initial
5 min @ 75 ± 7.5 psg	No Leakage or deformation	5 MIN	75.5	✓		HPG

Date 6-30-70

Comments: 5 MIN. @ 75.5 PSIG + 2 MIN @ 73 PSIG
CYCLES = 134 TOTAL

Vacuum After Vibration

	Allowable	Actual	O. K.	Reject	Initial
1. Internal Pressure	1.94×10^{-4} torr min.	< 1x10⁻⁵	✓		HPG
2. External Pressure	14.7 psia	29.72 IN Hg	✓		HPG
3. Duration	5 minutes min.	6.9 MIN	✓		HPG
4. Visual Examination	no deformation or permanent set	NONE	✓		HPG

Date 6-30-70

Comments: CYCLES = 140 TOTALS

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. TPS Q. C. ~~Eng.~~ TECH HPG
Elect. Tech. —

Leakage After Vibration

100% helium @ 50 ± 5 psig Internal Press	Allowable	Actual	O. K.	Reject	Initial
	1.6×10^{-6} sccs	3.4×10^{-8}	✓		HPG

Date 7-2-70

Comments: STD LK = 3.4×10^{-8} scc He/sec, STD LK READING = 2.4
ACTUAL READING = 2.2
TOTAL CYCLES = 157

Port A Methanol/Water	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initial
5.0 +.5 psig ΔP	0.20 sccs	.0018	.0018	.0036	✓		HPG
10.0+1.0 psig ΔP	0.20 sccs	.018	.009	.0018	✓		HPG
20.0+2.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG

Date 7-2-70

Port B Methanol/Water	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initial
5.0+.5 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG
10.0+1.0 psig ΔP	0.20 sccs	0.0	0.0	.009	✓		HPG
20.0+2.0 psig ΔP	0.20 sccs	.0018	0.0	0.0	✓		HPG

Date 7-2-70

Comments: TOTAL CYCLES = 165

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008
Mech. Tech. TPS
Elect. Tech. —
Test Eng. RMR
Q. C. ~~Eng.~~ Tech NPG

Leakage After Vibration

100% helium @ 50 ± 5 psig Internal Press	Allowable	Actual	O. K.	Reject	Initial
	1.6×10^{-6} sccs	1.43×10^{-7}	✓		NPG

TOTAL CYCLES = 160

Date 7-2-70

Comments: STD LK = 3.4×10^{-8} SCCHE/SEC, STD LK READING = 2.4
ACTUAL READING = 10.5

Port A Methanol/Water	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initial
5.0 +.5 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		NPG
10.0+1.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		NPG
20.0+2.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		NPG

Date 6-30-70

Port B Methanol/Water	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initial
5.0+.5 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		NPG
10.0+1.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		NPG
20.0+2.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		NPG

Date 6-30-70

Comments: TOTAL CYCLES = 176

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007
Mech. Tech. TPS
Elect. Tech. TPS

Test Eng. RMR
Q. C. ~~Eng.~~ TECH H. CARPENITO

Circuit Resistance After Vibration

Port "A" Open Pins From	To	Limit	Actual 1	2	3
A	E	0.5 ohms max.	0.1	0.2	0.2
D	F	0.5 ohms max.	0.2	0.1	0.2
H	Case	0.5 ohms max.	0.1	0.3	0.2
L	J	25-29 ohms	27.2	28.2	28.2
B	E	Open Circuit	∞	∞	∞
C	F	Open Circuit	∞	∞	∞

Accept ______ Initial H.C.
Reject ______ Date 7/2/70

Port "B" Open Pins From	To	Limit	Actual 1	2	3
A	E	Open Circuit	∞	∞	∞
D	F	Open Circuit	∞	∞	∞
H	Case	0.5 ohms max.	0.1	0.2	0.1
M	K	25-29 ohms	28.2	28.2	28.1
B	E	0.5 ohms max.	0.2	0.2	0.2
C	F	0.5 ohms max.	0.2	0.2	0.2

Accept ______ Initial H.C.
Reject ______ Date 7/2/70

Comments:
TOTAL CYCLES = 167

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008
Mech. Tech. TPS
Elect. Tech. TPS

Test Eng. RMR
Q. C. ~~Eng.~~ TECH H. CARPENITO

Circuit Resistance After Vibration

Port "A" Open Pins From	To	Limit	Actual 1	2	3
A	E	0.5 ohms max.	0.1	0.2	0.2
D	F	0.5 ohms max.	0.2	0.2	0.1
H	Case	0.5 ohms max.	0.1	0.1	0.2
L	J	25-29 ohms	25.5	25.5	25.5
B	E	Open Circuit	∞	∞	∞
C	F	Open Circuit	∞	∞	∞

Accept ✓
Reject
Initial H.G.C.
Date 7/2/70

Port "B" Open Pins From	To	Limit	Actual 1	2	3
A	E	Open Circuit	∞	∞	∞
D	F	Open Circuit	∞	∞	∞
H	Case	0.5 ohms max.	0.1	0.2	0.2
M	K	25-29 ohms	25.5	25.5	25.5
B	E	0.5 ohms max.	0.1	0.1	0.2
C	F	0.5 ohms max.	0.2	0.2	0.2

Accept ✓
Reject
Initial H.G.C.
Date 7/2/70

Comments: TOTAL CYCLES = 178

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. TPS Q. C. ~~Eng.~~ Tech H. Carpenito
Elect. Tech. TPS

Insulation Resistance After Vibration

500 Volts D. C. Pins From	To	Limit	Actual
A	C	50 meg. ohms min.	> 200K Meg
A	D	50 meg. ohms min.	> 200K Meg
A	F	50 meg. ohms min.	> 200K Meg
A	H	50 meg. ohms min.	> 200K Meg
A	J	50 meg. ohms min.	> 200K Meg
A	L	50 meg. ohms min.	> 200K Meg
A	M	50 meg. ohms min.	> 200K Meg
A	Case	50 meg. ohms min.	> 200K Meg
B	C	50 meg. ohms min.	> 200K Meg
B	D	50 meg. ohms min.	> 200K Meg
B	F	50 meg. ohms min.	> 200K Meg
B	A	50 meg. ohms min.	> 200K Meg
B	J	50 meg. ohms min.	> 200K Meg
B	K	50 meg. ohms min.	> 200K Meg
B	L	50 meg. ohms min.	> 200K Meg
B	M	50 meg. ohms min.	> 200K Meg
B	Case	50 meg. ohms min.	> 200K Meg
C	E	50 meg. ohms min.	
C	H	50 meg. ohms min.	
C	J	50 meg. ohms min.	
C	K	50 meg. ohms min.	
C	L	50 meg. ohms min.	
C	M	50 meg. ohms min.	
C	Case	50 meg. ohms min.	> 200K Meg
D	E	50 meg. ohms min.	
D	H	50 meg. ohms min.	
D	J	50 meg. ohms min.	
D	K	50 meg. ohms min.	
D	L	50 meg. ohms min.	
D	M	50 meg. ohms min.	
D	Case	50 meg. ohms min.	> 200K Meg

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	008	Test Eng.	RMR
Mech. Tech.	TPS	Q. C. ~~Eng.~~ TECH	HFC
Elect. Tech.	TPS		

Insulation Resistance After Vibration

500 Volts D. C. Pins From	To	Limit	Actual
A	C	50 meg. ohms min.	>200K meg
A	D	50 meg. ohms min.	
A	F	50 meg. ohms min.	
A	H	50 meg. ohms min.	
A	J	50 meg. ohms min.	
A	L	50 meg. ohms min.	
A	M	50 meg. ohms min.	
A	Case	50 meg. ohms min.	>200K meg
B	C	50 meg. ohms min.	
B	D	50 meg. ohms min.	
B	F	50 meg. ohms min.	
B	A	50 meg. ohms min.	
B	J	50 meg. ohms min.	
B	K	50 meg. ohms min.	
B	L	50 meg. ohms min.	
B	M	50 meg. ohms min.	
B	Case	50 meg. ohms min.	>200K meg
C	E	50 meg. ohms min.	
C	H	50 meg. ohms min.	
C	J	50 meg. ohms min.	
C	K	50 meg. ohms min.	
C	L	50 meg. ohms min.	
C	M	50 meg. ohms min.	
C	Case	50 meg. ohms min.	>200K meg
D	E	50 meg. ohms min.	
D	H	50 meg. ohms min.	
D	J	50 meg. ohms min.	
D	K	50 meg. ohms min.	
D	L	50 meg. ohms min.	
D	M	50 meg. ohms min.	
D	Case	50 meg. ohms min.	>200K meg

Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. TPS Q. C. Eng. H.F.Carpenito
Elect. Tech. TPS

Continued

From	To	Limit	Actual
E	F	50 meg. ohms min.	>200K Meg
E	H	50 meg. ohms min.	
E	J	50 meg. ohms min.	
E	K	50 meg. ohms min.	
E	L	50 meg. ohms min.	
E	M	50 meg. ohms min.	
E	Case	50 meg. ohms min.	>200K Meg
F	H	50 meg. ohms min.	
F	J	50 meg. ohms min.	
F	K	50 meg. ohms min.	
F	L	50 meg. ohms min.	
F	M	50 meg. ohms min.	
F	Case	50 meg. ohms min.	>200K Meg
G	A	50 meg. ohms min.	>200K Meg
G	B	50 meg. ohms min.	
G	C	50 meg. ohms min.	
G	D	50 meg. ohms min.	
G	E	50 meg. ohms min.	
G	F	50 meg. ohms min.	>200K Meg
G	H	50 meg. ohms min.	200K Meg
G	J	50 meg. ohms min.	>200K Meg
G	K	50 meg. ohms min.	
G	L	50 meg. ohms min.	
G	M	50 meg. ohms min.	>200K Meg
H	J	50 meg. ohms min.	>20K Meg
H	K	50 meg. ohms min.	>20K Meg
H	L	50 meg. ohms min.	>20K Meg
H	M	50 meg. ohms min.	>20K Meg
J	K	50 meg. ohms min.	>200 Meg
J	M	50 meg. ohms min.	>200 Meg
J	Case	50 meg. ohms min.	250K Meg
K	L	50 meg. ohms min.	180 Meg
K	Case	50 meg. ohms min.	150K Meg
L	M	50 meg. ohms min.	200 Meg
L	Case	50 meg. ohms min.	150K Meg
M	Case	50 meg. ohms min.	150K Meg

Accept ✓ Initial O.F.C.
Reject Date 7/2/70

Comments:

Serial No. 008 — Test Eng. RMR

Mech. Tech. TPS — Q. C. ~~Eng.~~ TECH H. F. Carpenito

Elect. Tech. TPS

Continued

From	To	Limit	Actual
E	F	50 meg. ohms min.	>200K Meg
E	H	50 meg. ohms min.	
E	J	50 meg. ohms min.	
E	K	50 meg. ohms min.	
E	L	50 meg. ohms min.	
E	M	50 meg. ohms min.	
E	Case	50 meg. ohms min.	>200K Meg
F	H	50 meg. ohms min.	
F	J	50 meg. ohms min.	
F	K	50 meg. ohms min.	
F	L	50 meg. ohms min.	
F	M	50 meg. ohms min.	
F	Case	50 meg. ohms min.	>200K Meg
G	A	50 meg. ohms min.	
G	B	50 meg. ohms min.	
G	C	50 meg. ohms min.	
G	D	50 meg. ohms min.	
G	E	50 meg. ohms min.	
G	F	50 meg. ohms min.	
G	H	50 meg. ohms min.	
G	J	50 meg. ohms min.	
G	K	50 meg. ohms min.	
G	L	50 meg. ohms min.	
G	M	50 meg. ohms min.	>200K Meg
H	J	50 meg. ohms min.	150K Meg
H	K	50 meg. ohms min.	150K Meg
H	L	50 meg. ohms min.	150K Meg
H	M	50 meg. ohms min.	150K Meg
J	K	50 meg. ohms min.	200 Meg
J	M	50 meg. ohms min.	200 Meg
J	Case	50 meg. ohms min.	150K Meg
K	L	50 meg. ohms min.	190 Meg
K	Case	50 meg. ohms min.	190K Meg
L	M	50 meg. ohms min.	190 Meg
L	Case	50 meg. ohms min.	190K Meg
M	Case	50 meg. ohms min.	150K Meg

Accept ✓ — Initial H.F.C.

Reject — Date 7/7/70

7 Jul 70

Comments:

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. TPS Q. C. ~~Eng.~~ H. CARPENTO
Elect. Tech. TPS TECH

Port "A" Open 500 Volts D. C. Pins From	To	Limit	Actual
B	E	50 meg. ohms min.	>200K Meg
B	A	50 meg. ohms min.	>200K Meg
C	D	50 meg. ohms min.	>200K Meg
C	F	50 meg. ohms min.	>200K Meg

Accept ✓ Initial H.G.C.
Reject Date 7/7/70 July 70

Port "B" Open 500 Volts D. C. Pins From	To	Limit	Actual
A	B	50 meg. ohms min.	>200K Meg
A	E	50 meg. ohms min.	>200K Meg
D	C	50 meg. ohms min.	>200K Meg
D	F	50 meg. ohms min.	>200K Meg

Accept ✓ Initial H.G.C.
Reject - Date 7/7/70 July 70

Comments: TOTAL CYCLES = 170

Position Indicators After Vibration ~~Noise~~

Covered under circuit resistance.

Minimum Operating Voltage After Vibration

Minimum Operating Voltage100 ms Pulse, Unpressurized	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initia
Port "A"	18 volts d.c. max.	14.0	14.0	14.0	✓		H.G.C.
Port "B"	18 volts d.c. max.	16.0	16.0	15.5	✓		H.G.

Date 7/7/70

Comments: TOTAL CYCLES = 200

Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. TPS Q. C. ~~Eng.~~ Tech H.F.Carpenito
Elect. Tech. TPS

Port "A" Open 500 Volts D. C. Pins From	To	Limit	Actual
B	E	50 meg. ohms min.	>200KMEG
B	A	50 meg. ohms min.	>200KMEG
C	D	50 meg. ohms min.	>200KMEG
C	F	50 meg. ohms min.	>200KMEG

7 July 70

Accept ✓ Initial H.F.C.
Reject Date 7/7/70

Port "B" Open 500 Volts D. C. Pins From	To	Limit	Actual
A	B	50 meg. ohms min.	>200KMEG
A	E	50 meg. ohms min.	>200KMEG
D	C	50 meg. ohms min.	>200KMEG
D	F	50 meg. ohms min.	>200KMEG

7 July 70

Accept ✓ Initial H.F.C.
Reject - Date 7/7/70

Comments: TOTAL CYCLES = 180

Position Indicators After Vibration ~~Noise~~

Covered under circuit resistance.

Minimum Operating Voltage After Vibration

8 July 70

Minimum Operating Voltage 100 ms Pulse, Unpressurized	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Init
Port "A"	18 volts d.c. max.	14.0	13.0	13.0	✓		[illegible]
Port "B"	18 volts d.c. max.	16.0	16.0	14.0	✓		[illegible]

Date 7-8-70

Comments: TOTAL CYCLES = 199

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. TPS Q. C. ~~Eng.~~ TECH D. V. GUIDO
Elect. Tech. TPS

8 July 70

Minimum Operating Voltage 100 ms Pulse 50 ± 5 psig, 100% Helium	Allowable	Actual 1	2	3	O. K.	Reject	Initial
Port "A"	18 volts d.c. max.	13.5	13.5	13.0	✓		DVG
Port "B"	18 volts d.c. max.	14.5	14.5	14.5	✓		DVG

Date 7-7-70

Comments: TOTAL CYCLES = 225

Minimum Pulse Duration After Vibration

8 July 70

Minimum Pulse Duration, 28 Volts D.C. 100% Helium, 50 ± 5 psig	Allowable	Actual 1	2	3	O.K.	Reject	Initial
Port "A"	100 ms. max.	34.0	35.0	34.0	✓		DVG
Port "B"		38.0	39.0	39.0	✓		DVG

Date 7-8-70

Comments: VALVE CHANGES POSITION @ 15 MS BUT SWITCH DOES NOT ACTUATE UNTIL 34 MS.

8 Jul 7

Minimum Pulse Duration, 28 Volts D.C. Zero Press	Allowable	Actual 1	2	3	O.K.	Reject	Initial
Port "A"	100 ms. max.	30.0	34.0	33.0	✓		DVG
Port "B"		36.0	39.0	37.0	✓		DVG

Date 7-8-70

Comments: SAME COMMENT AS ABOVE
TOTAL CYCLES = 331

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. TPS Q. C. ~~Eng.~~ TECH D.V. GUIDO
Elect. Tech. TPS

8 July 70

Minimum Operating Voltage 100ms Pulse 50 ± 5 psig, 100% Helium	Allowable	Actual 1	2	3	O. K.	Reject	Initial
Port "A"	18 volts d.c. max.	14.0	13.0	13.0	✓		DVG
Port "B"	18 volts d.c. max.	14.0	13.0	13.0	✓		DVG

Date 7-8-70

Comments: TOTAL CYCLES = 211

8 July

Minimum Pulse Duration After Vibration

Minimum Pulse Duration, 28 Volts D. C. 100% Helium, 50 ± 5 psig	Allowable	Actual 1	2	3	O.K.	Reject	Initial
Port "A"	100 ms. max.	35.0	34.0	35.0	✓		DVG
Port "B"		35.0	35.0	36.0	✓		DVG

Date 7-8-70

Comments: TOTAL CYCLES = 232

8 July 70

Minimum Pulse Duration, 28 Volts D. C. Zero Press	Allowable	Actual 1	2	3	O.K.	Reject	Initial
Port "A"	100 ms. max.	37.0	32.0	32.0	✓		DVG
Port "B"		37.0	38.0	36.0	✓		DVG

Date 7-8-70

Comments: TOTAL CYCLES = 252

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 | Test Eng. RMR
Mech. Tech. TPS | Q. C. ~~Eng.~~ Tech H.F. Carpenito
Elect. Tech. TPS

Power After Vibration

8 July

Power 28 Volts D.C. Steady State	Allowable	Actual		O.K.	Reject	Initial
Voltage	28 ± .5	28.0	28.0	✓		DWH
Current	1.14 amps max	.975	.945	✓		DWH
Power	31.5 watts max.	27.3	26.46	✓		DWH
		Port A	Port B			

Date 7-8-70

Comments:

5.6.1 Transient Pulses, Minimum Operating Voltage Unpressurized

8 July 70

Minimum Operating Voltage 100 ms Pulse, Unpressurized	Allowable	Actual 1	2	3	O. K.	Reject	Init
Port "A"	18 volts d.c. max.	14.0	14.0	14.0	✓		DWH
Port "B"	18 volts d.c. max.	15.0	15.5	15.5	✓		DWH

Date 7-70-70

Comments: TOTAL CYCLES = 356

5.6.2 Transient Pulses, Minimum Operating Voltage Pressurized

Minimum Operating Voltage 100 ms Pulse 50 ± 5 psig, 100% Helium	Allowable	Actual 1	2	3	O. K.	Reject	Init
Port "A"	18 volts d.c. max.	14.0	14.0	14.0	✓		[illegible]
Port "B"	18 volts d.c. max.	15.0	14.5	14.5	✓		[illegible]

Date 7-7-70

Comments: TOTAL CYCLES = 368

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	008	Test Eng.	RMR
Mech. Tech.	TPS	Q. C. ~~Eng.~~ TECH	
Elect. Tech.	TPS		

Power After Vibration

8 Jul 70

Power 28 Volts D. C. Steady State	Allowable	Actual (1.07 AMPS / 1.065 AMPS)		O. K.	Reject	Initial
Voltage	28 ± .5	28.0	28.0	✓		
Current	1.14 amps max	~~.975~~	~~.945~~	✓		
Power	31.5 watts max.	29.96	29.82	✓		
		PORT A	PORT B			

Date

Comments:

5.6.1 Transient Pulses, Minimum Operating Voltage Unpressurized

8 July 70

Minimum Operating Voltage 100 ms Pulse, Unpressurized	Allowable	Actual 1	2	3	O. K.	Reject	Initial
Port "A"	18 volts d. c. max.	15.0	13.0	13.0	✓		
Port "B"	18 volts d. c. max.	16.0	14.0	14.0	✓		

Date 7-8-70

Comments: TOTAL CYCLES = 268

5.6.2 Transient Pulses, Minimum Operating Voltage Pressurized

8 July 70

Minimum Operating Voltage 100 ms Pulse 50 ± 5 psig, 100% Helium	Allowable	Actual 1	2	3	O. K.	Reject	Initial
Port "A"	18 volts d. c. max.	13.0	13.0	13.0	✓		
Port "B"	18 volts d. c. max.	14.0	13.0	13.0	✓		

Date 7-8-70

Comments: TOTAL CYCLES = 273

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. TPS Q. C. ~~Eng.~~ TECH D. V. GUIDO
Elect. Tech. TPS

5.6.3 Transient Pulses, Minimum Pulse Duration (Pressuriz

Minimum Pulse Duration, 28 Volts D. C. 100% Helium, 50 ± 5 psig	Allowable	Actual 1	2	3	O. K.	Reject
Port "A"	100 ms. max.	30.0	35.0	35.0	✓	
Port "B"		33.0	38.0	38.0	✓	

Date 7-8-70

Comments: VALVE ACTUATES AT 15 MS BUT SWITCH DOE
NOT ACTUATE UNTIL 34 MS
TOTAL CYCLES = 397

5.6.4 Transient Pulses, Minimum Pulse Duration (Unpressuri

Minimum Pulse Duration, 28 Volts D. C. Zero Press	Allowable	Actual 1	2	3	O. K.	Reject
Port "A"	100 ms. max.	34.0	34.0	33.0	✓	
Port "B"		37.0	37.0	37.0	✓	

Date 7-8-70

Comments: VALVE ACTUATES AT 18-20 MS BUT SWITCH
DOES NOT ACTUATE UNTIL 34 MS.
TOTAL CYCLES = 425

5.6.5 Transient Pulses

Coil A Condition Volts	Milliseconds	Coil B Condition Volts	Milliseconds	Allowable	O. K.	Rejec
+28	Steady State	+72	.005	Will not change	✓	
+28	Steady State	0	0	position	✓	
+28	Steady State	-19	9	"	✓	
+72	.005	+28	Steady State	"	✓	
0	0	+28	Steady State	"	✓	
-19	9	+28	Steady State	"	✓	

COMMENT: PINS A & E REMAINED CONTINUOUS DURING COIL "B" TRANSIENTS & REMAINED OPEN DURING COIL "A" TRANSIENTS 4 DEC

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. TPS Q. C. ~~Eng.~~ TECH D.V. GUIDO
Elect. Tech. TPS

8 July 70

5.6.3 Transient Pulses, Minimum Pulse Duration (Pressurized)

Minimum Pulse Duration, 28 Volts D.C. 100% Helium, 50 ± 5 psig	Allowable	Actual 1	Actual 2	Actual 3	O.K.	Reject	Initial
Port "A"	100 ms. max.	38.0	36.0	36.0	✓		DVG
Port "B"		38.0	36.0	36.0	✓		DVG

Date 7-8-70

Comments: TOTAL CYCLES = 290

8 July 70

5.6.4 Transient Pulses, Minimum Pulse Duration (Unpressurized)

Minimum Pulse Duration, 28 Volts D.C. Zero Press	Allowable	Actual 1	Actual 2	Actual 3	O.K.	Reject	Initial
Port "A"	100 ms. max.	36.0	36.0	36.0	✓		DVG
Port "B"		37.0	36.0	37.0	✓		DVG

Date 7-8-70

Comments: TOTAL CYCLES = 306

5.6.5 Transient Pulses

Coil A Condition Volts	Coil A Condition Milliseconds	Coil B Condition Volts	Coil B Condition Milliseconds	Allowable	O.K.	Reject	Initial
+28	Steady State	+72	.005	Will not change	✓		WRC
+28	Steady State	0	0	position	✓		WRC
+28	Steady State	-19	9	"	✓		WRC
+72	.005	+28	Steady State	"	✓		WRC
0	0	+28	Steady State	"	✓		WRC
-19	9	+28	Steady State	"	✓		WRC

COMMENT: PINS A & E REMAINED CONTINUOUS DURING COIL 'B' TRANSIENTS, & REMAINED OPEN DURING COIL 'A' TRANSIENTS

-4 DEC 70

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. PMR
Mech. Tech. TPS Q. C. ~~Eng.~~ TECH HPG
Elect. Tech. TPS

5.7 Life Cycling

	Allowable	O. K.	Reject	Initial
1000 Cycles @ 28VDC Methanol/Water 3 amperes through Switches				HPG
Examination	No failure or damage	✓		[illegible]

Photo Taken YES
Date 8/25/70

Comments: S/N 007 = 1050 CYCLES, S/N 008 = 1020
TOTAL CYCLES = 1487

5.6.6 Coil Transient Voltage

	Allowable	Actual Coil A 1	Actual Coil A 2	Actual Coil A 3	Actual Coil B 1	Actual Coil B 2	Actual Coil B 3	O.K	REJ.	INITIAL
28 VDC coil actuated <10 sec measure peak transient on "off" signal.	Max. transient voltage not to exceed 150% of applied voltage	50V	50V	50V	50V	50V	50V		[illegible] *	HPG

COMMENTS: * MSFC HAS VERBALLY DIRECTED ALCO TO CONTINUE WITH THE QUALIFICATION TEST PROGRAM

PHOTO TAKEN YES
DATE 7-22-70

TOTAL CYCLES = 1503

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	008	Test Eng.	RMR
Mech. Tech.	TPS	Q. C. ~~Eng.~~ Tech	HPG
Elect. Tech.	TPS		

5.7 Life Cycling

1000 Cycles @ 28VDC Methanol/Water 3 amperes through Switches	Allowable	O. K.	Reject	Initial
Examination	No failure or damage	✓		

Photo Taken ______
Date ______

Comments: LIFE CYCLES = 1020
TOTAL CYCLES = 1328

Coil Transient Voltage

	Allowable	Actual						O.K.	REJ.	INITIAL
		Coil A			Coil B					
		1	2	3	1	2	3			
28 VDC coil actuated 10 sec measure peak transient on "off" signal.	Max. transient voltage not to exceed 150% of applied voltage	52V	50V	50V	52V	50V	50V		*	

COMMENTS* MSFC HAS VERBALLY DIRECTED ANCO TO CONTINUE WITH QUALIFICATION TESTING

PHOTO TAKEN YES
DATE 7-22-70

TOTAL CYCLES = 1354

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007
Mech. Tech. TPS
Elect. Tech. TPS

Test Eng. RMR
Q. C. ~~Eng.~~ TECH HPG

D-4

Leakage Checks During Life Test

Port A Methane/Water	Allowable	150 Cycles Actual 1	2	3	O.K.	Rej.	Ini.	300 Cycles Actual 1	2	3	O.K.	Rej.	Ini.	500 Cycles Actual 1	2	3	O.K.	Rej.	Ini.	750 Cycles Actual 1	2	3	O.K.	Rej.	Ini.
0±5 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG	0.0	0.0	0.0	✓		HPG	0.0	0.0	0.0	✓		ALRT	0.0	0.0	0.0	✓		HPG
0±1.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG	0.0	0.0	0.0	✓		HPG	0.0	0.0	0.0	✓		ALRT	0.0	0.0	0.0	✓		HPG
0±2.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG	0.0	0.0	0.0	✓		HPG	0.0	0.0	0.0	✓		ALRT	0.0	0.0	0.0	✓		HPG

Date 7/27/70 7/30/70 8/11/70 8-17/70

Comments: TOTAL CYCLES = 1523

Port B Methane/Water	Allowable	150 Cycles Actual 1	2	3	O.K.	Rej.	Ini.	300 Cycles Actual 1	2	3	O.K.	Rej.	Ini.	500 Cycles Actual 1	2	3	O.K.	Rej.	Ini.	750 Cycles Actual 1	2	3	O.K.	Rej.	Ini.
0±5 psig ΔP	0.20 sccs	0.0	0.	0.0	✓	HPG	HPG	0.0	0.0	0.0	✓		HPG	0.0	0.0	0.0	✓		ALRT	0.0	0.0	0.0	✓		HPG
0±1.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓	HPG	HPG	0.0	0.0	0.0	✓		HPG	0.0	0.0	0.0	✓		ALRT	0.0	0.0	0.0	✓		HPG
0±2.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓	HPG	HPG	0.0	0.0	0.0	✓		HPG	0.0	0.0	0.0	✓		ALRT	0.0	0.0	0.0	✓		HPG

Date 7/27/70 7/30/70 8/11/70 8-17-70

Comments: TOTAL CYCLES = 1540

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

erial No. 008
ech. Tech. TPS
lect. Tech. TPS

Test Eng. RMR
Q. C. ~~Eng.~~ TECH HPG / ALRT

Leakage Checks During Life Test

ort A ethane/Water	Allowable	150 Cycles Actual 1	2	3	O.K.	Rej.	Ini.	300 Cycles Actual 1	2	3	O.K.	Rej.	Ini.	500 Cycles Actual 1	2	3	O.K.	Rej.	Ini.	750 Cycles Actual 1	2	3	O.K.	Rej.	Ini
0±5 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG	0.0	0.0	0.0	✓		HPG	0.0	0.0	0.0	✓		ALRT	0.0	0.0	0.0	✓		HPG
0±1.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG	0.0	0.0	0.0	✓		HPG	0.0	0.0	0.0	✓		ALRT	0.0	0.0	0.0	✓		HPG
0±2.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG	0.0	0.0	0.0	✓		HPG	0.0	0.0	0.0	✓		ALRT	0.0	0.0	0.0	✓		HPG

Date 7/25/70 7/30/70 8/11/70 8/17/70

Comments: TOTAL CYCLES = 1374

rt B ethane/Water	Allowable	150 Cycles Actual 1	2	3	O.K.	Rej.	Ini.	300 Cycles Actual 1	2	3	O.K.	Rej.	Ini.	500 Cycles Actual 1	2	3	O.K.	Rej.	Ini.	750 Cycles Actual 1	2	3	O.K.	Rej.	Ini
0±5 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG	0.0	0.0	0.0	✓		HPG	0.0	0.0	0.0	✓		ALRT	0.0	0.0	0.0	✓		HPG
0±1.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG	0.0	0.0	0.0	✓		HPG	0.0	0.0	0.0	✓		ALRT	0.0	0.0	0.0	✓		HPG
0±2.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HPG	0.0	0.0	0.0	✓		HPG	0.0	0.0	0.0	✓		ALRT	0.0	0.0	0.0	✓		HPG

Date 7/25/70 7/30/70 8/11/70 8/17/70

Comments: TOTAL CYCLES = 1400

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Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007
Mech. Tech. TPS
Elect. Tech. TPS

Test Eng. RMR
Q. C. ~~Eng.~~ TECH [illegible] / [illegible]

Circuit Resistance During Life Test

Port A Open Pins From	To	Limit	150 Cycles Actual 1	2	3	O.K.	Rej.	Ini.	300 Cycles Actual 1	2	3	O.K.	Rej.	Ini.	500 Cycles Actual 1	2	3	O.K.	Rej.	Ini.	750 Cycles Actual 1	2	3	O.K.	Rej.	Ini.
[illegible]	E	.5 ohms max.	[illegible]	0.1	[illegible]	✓		[illegible]	0.1	0.1	0.2	✓		[illegible]	0.0	0.1	0.1	✓		[illegible]	0.1	0.1	0.1	✓		[illegible]
[illegible]	F	.5 ohms max.	0.1	0.1	0.1	✓		[illegible]	0.1	0.1	0.1	✓		[illegible]	0.0	0.1	0.2	✓		[illegible]	0.1	0.1	0.1	✓		[illegible]
[illegible]	Case	.5 ohms max.	0.0	0.1	0.0	✓		[illegible]	0.0	0.1	0.0	✓		[illegible]	0.0	0.1	0.0	✓		[illegible]	0.0	0.0	0.0	✓		[illegible]
[illegible]	J	25-29 ohms	[illegible]	[illegible]	[illegible]	✓		[illegible]	[illegible]	[illegible]	[illegible]	✓		[illegible]	27.6	27.6	27.7	✓		[illegible]	[illegible]	[illegible]	[illegible]	✓		[illegible]
[illegible]	E	open circuit	∞	∞	∞			[illegible]	∞	∞	∞	✓		[illegible]	∞	∞	∞	✓		[illegible]	∞	∞	∞	✓		[illegible]
[illegible]	F	open circuit	∞	∞	∞	✓		[illegible]	∞	∞	∞	✓		[illegible]	∞	∞	∞	✓		[illegible]	∞	∞	∞	✓		[illegible]

Date 7/25/70 | 7/30/70 | 8/11/70 AEL | 8/17/70

Comments: TOTAL CYCLES = 1552

Port B Open Pins From	To	Limit	150 Cycles Actual 1	2	3	O.K.	Rej.	Ini.	300 Cycles Actual 1	2	3	O.K.	Rej.	Ini.	500 Cycles Actual 1	2	3	O.K.	Rej.	Ini.	750 Cycles Actual 1	2	3	O.K.	Rej.	Ini.
	E	open circuit	∞	∞	∞	✓		[illegible]	∞	∞	∞	✓		[illegible]	∞	∞	∞	✓		[illegible]	∞	∞	∞	✓		[illegible]
	F	open circuit	∞	∞	∞	✓		[illegible]	∞	∞	∞	✓		[illegible]	∞	∞	∞	✓		[illegible]	∞	∞	∞	✓		[illegible]
	Case	0.5 ohms max.	0.0	0.0	0.0	✓		[illegible]	0.0	0.1	0.2	✓		[illegible]	0.0	0.1	0.1	✓		[illegible]	0.1	0.1	0.1	✓		[illegible]
[illegible]	K	25-29 ohms	[illegible]	[illegible]	[illegible]	✓		[illegible]	27.1	27.2	27.7	✓		[illegible]	27.6	27.7	27.7	✓		[illegible]	[illegible]	[illegible]	[illegible]	✓		[illegible]
	E	0.5 ohms max.	0.1	0.1	0.1	✓		[illegible]	0.2	0.1	0.1	✓		[illegible]	0.1	0.1	0.1	✓		[illegible]	0.1	0.1	0.1	✓		[illegible]
	F	0.5 ohms max.	0.1	0.1	0.1	✓		[illegible]	0.1	0.1	0.1	✓		[illegible]	0.1	0.1	0.1	✓		[illegible]	0.1	0.1	0.1	✓		[illegible]

Date 7/25/70 | 7/30/70 | 8/11/70 AEL | 8/17/70

Comments: TOTAL CYCLES = 1564

Position Indicators During Life Cycling

Covered by circuit [illegible]sistance test.

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008
Mech. Tech. TPS
Elect. Tech. TPS

Test Eng. RMR
Q. C. ~~Eng.~~ TECH HRG/ALRT

Circuit Resistance During Life Test

t A Open Pins m	To	Limit	150 Cycles Actual 1	2	3	O.K.	Rej.	Ini.	300 Cycles Actual 1	2	3	O.K.	Rej.	Ini.	500 Cycles Actual 1	2	3	O.K.	Rej.	Ini.	750 Cycles Actual 1	2	3	O.K.	Rej.	Ini
	E	.5ohms max.	0.1	0.1	0.2	✓		HPY	0.1	0.1	0.1	✓		HPY	0.2	0.1	0.1	✓		ALRT	0.2	0.1	0.1	✓		HPY
	F	.5ohms max.	0.1	0.2	0.1	✓		HPY	0.1	0.1	0.1	✓		HPY	0.1	0.1	0.1	✓		ALRT	0.1	0.1	0.1	✓		HPY
	Case	.5ohms max.	0.0	0.0	0.0	✓		HPY	0.0	0.0	0.0	✓		HPY	0.2	0.0	0.1	✓		ALRT	0.0	0.0	0.0	✓		HPY
	J	25-29 ohms	25.5	25.5	25.5	✓		HPY	25.2	25.2	25.3	✓		HPY	25.3	25.3	25.3	✓		ALRT	25.3	25.3	25.2	✓		HPY
	E	open circuit	∞	∞	∞	✓		HPY	∞	∞	∞	✓		HPY	∞	∞	∞	✓		ALRT	∞	∞	∞	✓		HPY
	F	open circuit	∞	∞	∞	✓		HPY	∞	∞	∞	✓		HPY	∞	∞	∞	✓		ALRT	∞	∞	∞	✓		HPY

Date 7/28/70 7/30/70 8/11/70 8/17/70
Comments:
TOTAL CYCLES = 1412

t B Open Pins m	To	Limit	150 Cycles Actual 1	2	3	O.K.	Rej.	Ini.	300 Cycles Actual 1	2	3	O.K.	Rej.	Ini.	500 Cycles Actual 1	2	3	O.K.	Rej.	Ini.	750 Cycles Actual 1	2	3	O.K.	Rej.	Ini
	E	open circuit	∞	∞	∞	✓		HPY	∞	∞	∞	✓		HPY	∞	∞	∞	✓		ALRT	∞	∞	∞	✓		HPY
	F	open circuit	∞	∞	∞	✓		HPY	∞	∞	∞	✓		HPY	∞	∞	∞	✓		ALRT	∞	∞	∞	✓		HPY
	Case	0.5ohms max.	0.1	0.0	0.1	✓		HPY	0.0	0.0	0.0	✓		HPY	0.1	0.1	0.0	✓		ALRT	0.0	0.0	0.1	✓		HPY
	K	25-29 ohms	25.6	25.6	25.6	✓		HPY	25.3	25.3	25.3	✓		HPY	25.3	25.4	25.4	✓		ALRT	25.2	25.3	25.2	✓		HPY
	E	0.5ohms max.	0.1	0.2	0.1	✓		HPY	0.2	0.1	0.2	✓		HPY	0.1	0.1	0.1	✓		ALRT	0.1	0.1	0.1	✓		HPY
	F	0.5ohms max.	0.2	0.1	0.1	✓		HPY	0.1	0.1	0.1	✓		HPY	0.1	0.1	0.1	✓		ALRT	0.1	0.1	0.1	✓		HPY

Date 7/24/70 7/30/70 8/11/70 8/17/70
Comments:
TOTAL CYCLES = 1424

Position Indicators During Life Cycling

Covered by circuit resistance test.

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Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007
Mech. Tech. TPS
Elect. Tech. TPS

Test Eng. RMR
Q. C. ~~Eng.~~ TECH HPG/ALRT

Minimum Operating Voltage During Life Cycling (Unpressurized Assembly)

Minimum Operating Volt 100 ms. Pulse Unpressurized	Allowable	150 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	300 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	500 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	750 Cycles Actual 1	2	3	o.k.	Rej.	Ini
Port A	18 Volts D.C. max.	12.0	12.0	12.0	✓		HPG	12.0	12.5	12.0	✓		APG	14.0	14.0	14.0	✓		ALRT	15.0	15.0	14.5	✓		HPG
Port B	18 Volts D.C. max.	14.5	14.0	14.0			HPG	14.5	14.5	14.0	✓		APG	16.0	16.0	16.0	✓		ALRT	17.0	17.0	17.0	✓		HPG

Date 7/29/70 7/30/70 8/11/70 ALRT ocL 8/17/70

Comments: VALVE CHANGES POSITION .5-2 VOLTS LESS THAN REQ'D TO ACTUATE SWITCHES. TOTAL CYCLES = 1627

Minimum ~~Pulse Duration~~ OPERATING VOLTAGE During Life Cycling (Pressurized Assembly)

Minimum Operating Volt 100 ms. Pulse 50±psig, 100% He	Allowable	150 Cycles Actual 1	2	3	o.k.	Rej.	Int.	300 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	500 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	750 Cycles Actual 1	2	3	o.k.	Rej.	Ini
Port A	18 Volts D.C. max.	12.0	12.0	12.0	✓		HPG	11.5	11.5	11.5	✓		APG	14.0	14.0	14.0	✓		ALRT	15.0	14.0	14.0	✓		HPG
Port B	18 Volts D.C. max.	14.0	14.0	14.0	✓		HPG	13.5	13.5	13.5	✓		APG	15.0	15.5	15.0	✓		ALRT	16.5	15.5	15.5	✓		HPG

Date 7/29/70 7/30/70 8/11/70 ALRT ocL 8/17/70

Comments: TOTAL CYCLES = 1715

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008
Mech. Tech. TPS
Elect. Tech. TPS

Test Eng. RMR
Q. C. ~~Eng.~~ TECH HFG/ALLT/DG

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Minimum Operating Voltage During Life Cycling (Unpressurized Assembly)

inimum perating olt 100 ms. ılse ıpressurized	Allowable	150 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	300 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	500 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	750 Cycles Actual 1	2	3	o.k.	Rej.	In
ort A	18 Volts D.C. max.	13.0	12.5	12.5	✓		HPG	14.0	14.0	14.0	✓		APG	14.5	14.0	14.0	✓		DVG	15.0	15.0	15.0	✓		HPG
ort B	18 Volts D.C. max.	13.5	13.5	13.5	✓		HPG	14.5	14.5	14.5	✓		APG	15.0	15.0	15.0	✓		DVG	15.4	16.0	15.5	✓		HPG

Date 7/29/70 8/7/70 8-12-70 9/17/70
Comments: SWITCHES TRIP AT SAME MIN. VOLTAGE REQ'D TO ACTUATE VALVE
TOTAL CYCLES = 1479

Minimum ~~Pulse Duration~~ OPERATING VOLTAGE During Life Cycling (Pressurized Assembly)

nimum erating lt 100 ms. lse 50±psig, 0% He	Allowable	150 Cycles Actual 1	2	3	o.k.	Rej.	Int.	300 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	500 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	750 Cycles Actual 1	2	3	o.k.	Rej.	Ini
rt A	18 Volts D.C. max.	12.5	12.0	12.5	✓		APG	14.0	13.0	13.5	✓		APG	13.5	13.5	13.5	✓		DVG	14.0	14.0	14.0	✓		HPG
rt B	18 Volts D.C. max.	13.5	12.5	12.5	✓		APG	14.0	14.0	14.0	✓		APG	14.0	14.0	14.0	✓		DVG	14.5	14.5	14.5	✓		HPG

Date 7/29/70 8/4/70 8-12-70 8/18/70
Comments: TOTAL CYCLES = 1508

Serial No. 007
Mech. Tech. TPS
Elect. Tech. TPS

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Test Eng. RMR
Q. C. ~~Eng.~~ TECH HPG/DKG

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Minimum Pulse Duration During Life Cycling (Pressurized Assembly)

inimum Pulse iration, 28VDC 0% He, ±5.0 psig	Allowable	150 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	300 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	500 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	750 Cycles Actual 1	2	3	o.k.	Rej.	Ini.
rt A	100 ms max.	27.0	27.5	27.5	✓		HPG	27.5	27.5	27.4	✓		DKG	30.0	30.5	30.0	✓		[illegible]	30.0	30.0	30.0	✓		HPG
rt B	100 ms max.	32.0	32.0	32.5	✓		HPG	31.0	32.5	31.0	✓		DKG	32.5	34.0	33.5	✓		[illegible]	33.0	35.5	35.0	✓		HPG

Date 7-29-70 7-30-70 8/1/70 8/17/70

Comments: VALVE SWITCHES AT 15-18 MS BUT HIGHER PULSE WIDTH REQ'D TO ACTUATE SWITCHES. TOTAL CYCLES = 1848

Minimum Pulse Duration During Life Cycling (Unpressurized Assembly)

nimum Pulse ration, 28VDC pressurized	Allowable	150 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	300 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	500 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	750 Cycles Actual 1	2	3	o.k.	Rej.	Ini.
rt A	100 ms max.	30.0	27.0	31.0	✓		HPG	26.5	26.5	26.5			DKG	31.0	30	27.0	✓		DKG	30.0	30.0	31.5	✓		HPG
rt B	100 ms max.	31.0	32.0	30.0	✓		HPG	32.0	30.0	31.5			DKG	33.5	33.5	33.4	✓		DKG	33.5	33.5	34	✓		HPG

Date 7/29/70 7-30-70 8/12/70 8/17/70

Comments:

TOTAL CYCLES = 1939

Serial No. CCB
Mech. Tech. TPS
Elect. Tech. TPS

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Test Eng. RMR
Q. C. ~~Eng.~~ TECH HPG / DVG

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Minimum Pulse Duration During Life Cycling (Pressurized Assembly)

nimum Pulse ration, 28VDC 0% He, ±5.0 psig	Allowable	150 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	300 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	500 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	750 Cycles Actual 1	2	3	o.k.	Rej.	Ini
rt A	100 ms max.	27.0	26.0	26	✓		HPG	28.5	28.5	28.5	✓		HPG	28.5	28.5	29.0	✓		DVG	28.0	28.5	28.0	✓		HPG
rt B	100 ms max.	27.0	27.0	27.5	✓		HPG	29.0	28.5	29.0	✓		HPG	29.0	28.0	28.0	✓		DVG	29.0	29.0	29.0	✓		HPG

Date 7/29/70 8/7/70 8-12-70 8/18/70
Comments:
SAME PULSE WIDTH REQ'D TO ACTUATE SWITCH AS TO MOVE ARMATURE POSITION
TOTAL CYCLES = 1551

Minimum Pulse Duration During Life Cycling (Unpressurized Assembly)

nimum Pulse ration, 28VDC pressurized	Allowable	150 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	300 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	500 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	750 Cycles Actual 1	2	3	o.k.	Rej.	Ini.
t A	100 ms max.	26.5	27	27	✓		HPG	28.5	28.5	28.5			HPG	28.5	28.5	28.5	✓		DVG	30.0	28.0	28.0	✓		HPG
t B	100 ms max.	27.0	27	26.5	✓		HPG	29.0	30.0	28.5			HPG	30.0	29.0	30.0	✓		DVG	30.0	30.0	30.0	✓		HPG

Date 7/29/70 8/7/70 8/12/70 8/18/70
Comments:
TOTAL CYCLES = 1600

Serial No. 007
Mech. Tech. TPS
Elect. Tech. TPS

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Test Eng. RMK
Q. C. ~~Eng.~~ HPG/DKG
+ TECH

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Power Consumption During Life Cycling

Power 28 VDC Steady State	Allowable	150 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	300 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	500 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	750 Cycles Actual 1	2	3	o.k.	Rej.	Ini.
Voltage	28±.5	28.0	28.0	28.0	✓		HPG	28.0	28.0	28.0	✓		HPG	28.0	28.0	28.0	✓		DVM	28.0	28.0	28.0	✓		HPG
Current	1.14 amps	.995	1.0	1.0	✓		HPG	1.0	1.01	1.0	✓		HPG	1.01	1.01	1.01	✓		DVM	1.0	1.0	1.0	✓		HPG
Power	31.5 watts max.	28	28	28	✓		HPG	28.0	28.2	28.0	✓		HPG	28.2	28.2	28.2	✓		DVM	28	28	28	✓		HPG

		COIL A		COIL A		COIL A		COIL A
Date	Pins L-J	7/29/70		7-30-70		8/12/70		8/18/70

Comments:

	COIL B Pins M-K 1	2	3		Ini.	COIL B Pins M-K 1	2	3	O.K	REJ	Ini.	COIL B 1	2	3	O.K	REJ	Ini.	COIL B 1	2	3	O.K	REJ	Ini.
28±.5 VOLTS	28	28	28	OK	HPG	28.0	28.0	28.0	✓		HPG	28.0	28.0	28.0	✓		DVM	28.0	28.0	28.0	✓		HPG
1.14 AMPS MAX.	1.0	1.0	1.0	OK	HPG	.995	1.0	.995	✓		HPG	1.005	1.00	1.0	✓		DVM	1.0	1.005	1.0	✓		HPG
31.5 WATTS MAX.	28	28	28	OK	HPG	27.9	28.0	27.9	✓		HPG	28.1	28.1	28.0	✓		DVM	28	28	28	✓		HPG

8/12/70 OEL

8/17/70

rial No. CC8
ech. Tech. TPS
ect. Tech. TPS

Test Data Sheet
Pulse Cperated Flow Diverter Valve
Specification 20M42517

Test Eng. RMR
Q. C. ~~Eng.~~ + TECH HPG / DVG

Power Consumption During Life Cycling

er 'DC dy e	Allowable	150 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	300 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	500 Cycles Actual 1	2	3	o.k.	Rej.	Ini.	750 Cycles Actual 1	2	3	o.k.	Rej.	Ini.
age	28 ± .5	28	28	28	✓		HPG	28.0	28.0	28.0	✓		HPG	28.0	28.0	28.0	✓		DVG	28.0	28.0	28.0	✓		HPG
ent	- 1.14 amps	1.11	1.11	1.10	✓		HPG	1.09	1.05	1.07	✓		HPG	1.10	1.10	1.09	✓		DVG	1.11	1.10	1.09	✓		HPG
er	31.5 watts max.	31.0	31.0	31.0	✓		HPG	30.5	30.4	30.5	✓		HPG	31.0	30.0	30.5	✓		DVG	31.0	31.0	30.5	✓		HPG

Coil A 7/29/71 — Coil A 8/7/70 — 8/12/70 OK — Coil A 8/18/70

Date
Comments:

Coil B Allowable	1	2	3	OK	REJ	INI	1	2	3	O.K	REJ	INI	1	2	3	O.K	REJ	INI	1	2	3	O.K	REJ	INI
28 ± .5 volts	28	28	28	✓		HPG	28.0	28.0	28.0	✓		HPG	28.0	28.0	28.0	✓		DVG	28.0	28.0	28.0	✓		HPG
1.14 amps	1.09	1.09	1.09	✓		HPG	1.09	1.09	1.08	✓		HPG	1.09	1.08	1.08	✓		DVG	1.10	1.09	1.09	✓		HPG
31.5 watts max	30.5	30.5	30.5	✓		HPG	30.5	30.5	30.4	✓		HPG	30.5	30.4	30.4	✓		DVG	31.0	30.5	30.5	✓		HPG

Coil B — Coil B — Coil B 8/12/70 OK — Coil B 8/18/70

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	007	Test Eng.	RMR
Mech. Tech.	MEN	Q. C. ~~Eng.~~ TECH	HPG
Elect. Tech.	—		

Proof Pressure After Life Cycling

	Allowable	Actual		O. K.	Reject	Initial
		Time	Press			
5 min @ 75 ± 7.5 psg	No Leakage or deformation	5.0 MIN	75.0 psig	✓		HPG

Photo Taken: No
Date: 8/25/70

Comments: TOTAL CYCLES = 1944

Vacuum After Life Cycling

	Allowable	Actual	O. K.	Reject	Initia
1. Internal Pressure	1.94×10^{-4} torr min.	$<1 \times 10^{-5}$	✓		HPG
2. External Pressure	14.7 psia	29.9 in Hg	✓		HPG
3. Duration	5 minutes min.	5.0	✓		HPG
4. Visual Examination	no deformation or permanent set		✓		

Photo Taken: No
Date: 8/25/70

Comments: TOTAL CYCLES = 1949

Leakage After Life Cycling

100% helium @ 50 ± 5 pgg	Allowable	Actual	O. K.	Reject	Initial
Internal Press	1.6×10^{-6} sccs	$<3.4 \times 10^{-8}$	✓		HPG

Photo Taken
Date: 8/25/70

Comments: STD LK = 3.4×10^{-8}, STD LK IND. RD. = 3.2, ACTUAL ≈ 0
TOTAL CYCLES = 1954

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 — Test Eng. PMR
Mech. Tech. MEN — Q. C. ~~Eng.~~ TECH HPG
Elect. Tech. —

Proof Pressure After Life Cycling

		Actual				
	Allowable	Time	Press	O. K.	Reject	Initi
5 min @ 75 $\pm$ 7.5 psg	No Leakage or deformation	5.0 MIN	75.0 PSIG	✓		HPG

Photo Taken No
Date 8/25/70
Comments: TOTAL CYCLES = 1605

Vacuum After Life Cycling

	Allowable	Actual	O. K.	Reject	Init
1. Internal Pressure	1.94×10^{-4} torr min.	6.1×10^{-3}	✓		HPG
2. External Pressure	14.7 psia	29.9 IN Hg	✓		HPG
3. Duration	5 minutes min.	5.0	✓		HPG
4. Visual Examination	no deformation or permanent set		✓		

Photo Taken No
Date 8/25/70
Comments: TOTAL CYCLES = 1610

Leakage After Life Cycling

100% helium @ 50 $\pm$ 5 pgg	Allowable	Actual	O. K.	Reject	Initial
Internal Press	1.6×10^{-6} sccs	2.33×10^{-8}	✓		HPG

Photo Taken No
Date 8/25/70
Comments: STD LK = 5.4×10^{-8}, STD IND RD = 3.2, ACTUAL = 2.2
TOTAL CYCLES = 1615

Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 0007 Test Eng. PMR
Mech. Tech. MEN Q. C. ~~Eng.~~ TECH HPG
Elect. Tech. —

Port A Methanol/Water	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0±.5 psig ΔP	0.20 sccs	.01K	.01K	.01K	✓		HPG
10.0±1.0 psig ΔP	0.20 sccs	.01K	.01K	.01K	✓		HPG
20.0±2.0psig ΔP	0.20 sccs	.01K	.01K	.01K	✓		HPG

Date 8-26-70

Port B Methanol/Water	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0±.5 psig ΔP	0.20 sccs	.01K	.01K	.01K	✓		HPG
10.0±1.0 psig ΔP	0.20 sccs	.01K	.01K	.01K	✓		HPG
20.0±2.0 psig ΔP	0.20 sccs	.01K	.01K	.01K	✓		HPG

Photo Taken No
Date 8/26/70

Comments: TOTAL CYCLES = 1900

Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008
Mech. Tech. MEN
Elect. Tech. —

Test Eng. RMR
Q. C. ~~Eng.~~ TECH HPG

Port A Methanol/Water	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0±.5 psig ΔP	0.20 sccs	0.00	0.00	0.00	✓		HPG
10.0±1.0 psig ΔP	0.20 sccs	0.00	0.00	0.00	✓		HPG
20.0±2.0psig ΔP	0.20 sccs	0.00	0.00	0.00	✓		HPG

Date 8.26.70

Port B Methanol/Water	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0±.5 psig ΔP	0.20 sccs	0.00	0.00	0.00	✓		HPG
10.0±1.0 psig ΔP	0.20 sccs	0.00	0.00	0.00	✓		HPG
20.0±2.0 psig ΔP	0.20 sccs	0.00	0.00	0.00	✓		HPG

Photo Taken No
Date 8/26/70

Comments: TOTAL CYCLES = 1621

Serial No. 007 Test Eng. RMR
Mech. Tech. ——— Q. C. ~~Eng.~~ Tech HPG
Elect. Tech. MEN

Circuit Resistance After Life Cycling

Port "A" Open Pins From	To	Limit	Actual 1	2	3
A	E	0.5 ohms max.	.2	.2	.2
D	F	0.5 ohms max.	.1	.2	.1
H	Case	0.5 ohms max.	.1	.1	.1
L	J	25-29 ohms	27.6	27.6	27.6
B	E	Open Circuit	∞	∞	∞
C	F	Open Circuit	∞	∞	∞

Accept ✓ Initial HPG
Reject Date 8-26-70

Port "B" Open Pins From	To	Limit	Actual 1	2	3
A	E	Open Circuit	∞	∞	∞
D	F	Open Circuit	∞	∞	∞
H	Case	0.5 ohms max.	.1	.1	0
M	K	25-29 ohms	27.7	27.6	27.7
B	E	0.5 ohms max.	.1	.1	.1
C	F	0.5 ohms max.	.1	.1	.1

*

Accept ✓ Initial HPG
Reject Date 8-26-70
Photo Taken

Comments:
TOTAL CYCLES = 1966

Insulation Resistance After Life Cycling

500 Volts D. C. Pins From	To	Limit	Actual
A	C	50 meg. ohms min.	200 KM
A	D	50 meg. ohms min.	200 KM
A	F	50 meg. ohms min.	200 KM
A	H	50 meg. ohms min.	150 KM
A	J	50 meg. ohms min.	200 KM
A	L	50 meg. ohms min.	200 KM
A	M	50 meg. ohms min.	200 KM
A	Case	50 meg. ohms min.	150 KM
B	C	50 meg. ohms min.	200 KM
B	D	50 meg. ohms min.	190 KM
B	F	50 meg. ohms min.	200 KM
B	A	50 meg. ohms min.	200 KM

Serial No.	.008	Test Eng.	RMR
Mech. Tech.	—	Q. C. ~~Eng.~~ TECH	APG
Elect. Tech.	MEJ		

Circuit Resistance After Life Cycling

Port "A" Open Pins From	To	Limit	Actual 1	2	3
A	E	0.5 ohms max.	.1	.2	.2
D	F	0.5 ohms max.	.1	.1	.2
H	Case	0.5 ohms max.	0	0	0
L	J	25-29 ohms	25.3	25.3	25.2
B	E	Open Circuit	∞	∞	∞
C	F	Open Circuit	∞	∞	∞

Accept ✓ Initial [illegible]
Reject Date 8-26-70

Port "B" Open Pins From	To	Limit	Actual 1	2	3
A	E	Open Circuit	∞	∞	∞
D	F	Open Circuit	∞	∞	∞
H	Case	0.5 ohms max.	0	0	0
M	K	25-29 ohms	25.3	25.3	25.4
B	E	0.5 ohms max.	.2	.2	.1
C	F	0.5 ohms max.	.1	.1	.1

Accept ✓ Initial [illegible]
Reject Date 8-26-70
Photo Taken No

Comments: TOTAL CYCLES = 1627

Insulation Resistance After Life Cycling

500 Volts D. C. Pins From	To	Limit	Actual
A	C	50 meg. ohms min.	>200K MEG
A	D	50 meg. ohms min.	
A	F	50 meg. ohms min.	>200K MEG
A	H	50 meg. ohms min.	180K MEG
A	J	50 meg. ohms min.	>200 K MEG
A	L	50 meg. ohms min.	
A	M	50 meg. ohms min.	>200K MEG
A	Case	50 meg. ohms min.	180K MEG.
B	C	50 meg. ohms min.	>200K MEG
B	D	50 meg. ohms min.	
B	F	50 meg. ohms min.	
B	[illegible]	50 [illegible]	>200K MEG

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMF
Mech. Tech. ——— Q. C. ~~Eng.~~ Tech HPC
Elect. Tech. MEN

Continued

From	To	Limit	Actual
B	K	50 meg. ohms min.	200 km
B	L	50 meg. ohms min.	200 km
B	M	50 meg. ohms min.	200 km
B	Case	50 meg. ohms min.	100 km
C	E	50 meg. ohms min.	200 km
C	H	50 meg. ohms min.	100 km
C	J	50 meg. ohms min.	200 km
C	K	50 meg. ohms min.	200 km
C	L	50 meg. ohms min.	200 km
C	M	50 meg. ohms min.	200 km
C	Case	50 meg. ohms min.	100 km
D	E	50 meg. ohms min.	190 km
D	H	50 meg. ohms min.	120 km
D	J	50 meg. ohms min.	200 km
D	K	50 meg. ohms min.	200 km
D	L	50 meg. ohms min.	200 km
D	M	50 meg. ohms min.	200 km
D	Case	50 meg. ohms min.	150 km
E	F	50 meg. ohms min.	200 km
E	H	50 meg. ohms min.	100 km
E	J	50 meg. ohms min.	200 km
E	K	50 meg. ohms min.	200 km
E	L	50 meg. ohms min.	200 km
E	M	50 meg. ohms min.	200 km
E	Case	50 meg. ohms min.	100 km
F	H	50 meg. ohms min.	190 km
F	J	50 meg. ohms min.	200 km
F	K	50 meg. ohms min.	200 km
F	L	50 meg. ohms min.	200 km
F	M	50 meg. ohms min.	200 km
F	Case	50 meg. ohms min.	160 km
G	A	50 meg. ohms min.	190 km
G	B	50 meg. ohms min.	150 km
G	C	50 meg. ohms min.	200 km
G	D	50 meg. ohms min.	200 km
G	E	50 meg. ohms min.	200 km

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008
Mech. Tech. —
Elect. Tech. MEN
Test Eng. RMR
Q. C. ~~Eng.~~ TECH JHG

Continued

From	To	Limit	Actual
B	K	50 meg. ohms min.	180K MEG
B	L	50 meg. ohms min.	>200K MEG
B	M	50 meg. ohms min.	>200K MEG
B	Case	50 meg. ohms min.	120K MEG
C	E	50 meg. ohms min.	>200K MEG
C	H	50 meg. ohms min.	120K MEG
C	J	50 meg. ohms min.	>200K MEG
C	K	50 meg. ohms min.	
C	L	50 meg. ohms min.	
C	M	50 meg. ohms min.	>200K MEG
C	Case	50 meg. ohms min.	190K MEG
D	E	50 meg. ohms min.	120K MEG
D	H	50 meg. ohms min.	150K MEG
D	J	50 meg. ohms min.	>200K MEG
D	K	50 meg. ohms min.	
D	L	50 meg. ohms min.	
D	M	50 meg. ohms min.	>200K MEG
D	Case	50 meg. ohms min.	120K MEG
E	F	50 meg. ohms min.	>200K MEG
E	H	50 meg. ohms min.	120K MEG
E	J	50 meg. ohms min.	>200K MEG
E	K	50 meg. ohms min.	
E	L	50 meg. ohms min.	
E	M	50 meg. ohms min.	>200K MEG
E	Case	50 meg. ohms min.	100K MEG
F	H	50 meg. ohms min.	120K MEG
F	J	50 meg. ohms min.	150K MEG
F	K	50 meg. ohms min.	190K MEG
F	L	50 meg. ohms min.	190K MEG
F	M	50 meg. ohms min.	>200K MEG
F	Case	50 meg. ohms min.	100K MEG
G	A	50 meg. ohms min.	>200K MEG
G	B	50 meg. ohms min.	
G	C	50 meg. ohms min.	
G	D	50 meg. ohms min.	
G	E	50 meg. ohms min.	>200K MEG

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMP
Mech. Tech. —— Q. C. ~~Eng.~~ TECH Hey
Elect. Tech. MEW

Continued

From	To	Limit	Actual
G	F	50 meg. ohms min.	200 Km
G	H	50 meg. ohms min.	150 Km
G	J	50 meg. ohms min.	190 km
G	K	50 meg. ohms min.	200 km
G	L	50 meg. ohms min.	200 Km
G	M	50 meg. ohms min.	180 Km
H	J	50 meg. ohms min.	190 mg
H	K	50 meg. ohms min.	190 mg
H	L	50 meg. ohms min.	190 mg
H	M	50 meg. ohms min.	190 mg
J	K	50 meg. ohms min.	100 mg
J	M	50 meg. ohms min.	180 meg
J	Case	50 meg. ohms min.	190 meg
K	L	50 meg. ohms min.	100 meg
K	Case	50 meg. ohms min.	190 meg
L	M	50 meg. ohms min.	100 meg
L	Case	50 meg. ohms min.	190 meg
M	Case	50 meg. ohms min.	190 meg

Accept ✓ Initial Hey
Reject Date 9-26-70

Comments:

Port "A" Open 500 Volts D. C. Pins From	To	Limit	Actual
B	E	50 meg. ohms min.	200 Km
B	A	50 meg. ohms min.	200 Km
C	D	50 meg. ohms min.	190 km
C	F	50 meg. ohms min.	190 km

Accept ✓ Initial Hey
Reject Date 9-26-70

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	008	Test Eng.	PHP
Mech. Tech.	—	Q. C. Eng.	HG
Elect. Tech.	MEN	TELA	

Continued

From	To	Limit	Actual
G	F	50 meg. ohms min.	190K MEG
G	H	50 meg. ohms min.	120K MEG.
G	J	50 meg. ohms min.	7200K MEG
G	K	50 meg. ohms min.	"
G	L	50 meg. ohms min.	120K MEG
G	M	50 meg. ohms min.	7200K MEG
H	J	50 meg. ohms min.	100K MEG.
H	K	50 meg. ohms min.	90K MEG.
H	L	50 meg. ohms min.	100K MEG.
H	M	50 meg. ohms min.	90K MEG
J	K	50 meg. ohms min.	120.0 MEG
J	M	50 meg. ohms min.	100 MEG
J	Case	50 meg. ohms min.	190 MEG
K	L	50 meg. ohms min.	90 MEG.
K	Case	50 meg. ohms min.	200 MEG.
L	M	50 meg. ohms min.	100 MEG.
L	Case	50 meg. ohms min.	200 MEG.
M	Case	50 meg. ohms min.	200 MEG

Accept ✓ Initial HG
Reject Date

Comments:

Port "A" Open 500 Volts D. C. Pins			
From	To	Limit	Actual
B	E	50 meg. ohms min.	7200K MEG
B	A	50 meg. ohms min.	"
C	D	50 meg. ohms min.	"
C	F	50 meg. ohms min.	190K MEG

Accept ✓ Initial HG
Reject Date

Serial No. 007 Test Eng. RMR
Mech. Tech. MEN Q. C. ~~Eng.~~ TECH HPG
Elect. Tech. MEN

Port "B" Open 500 Volts D. C. Pins From	To	Limit	Actual	
A	B	50 meg. ohms min.	~~[illegible]~~	190 kmg
A	E	50 meg. ohms min.	~~[illegible]~~	190 kmg.
D	C	50 meg. ohms min.	190K MEG	
D	F	50 meg. ohms min.	~~200 K MEG~~	190 kmg.

Accept ✓ Initial HPG
Reject Date 8/26/70

Comments:

Position Indicators After Life Cycling

Covered by Circuit Resistance Measurements.

Minimum Voltage After Life Cycling

Minimum Operating Voltage 100ms Pulse, Unpressurized	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initia
Port "A"	18 volts d.c. max.	14.0	14.0	14.0	✓		HPG
Port "B"	18 volts d.c. max.	16.0	16.0	16.0	✓		HPG

Date 8-26-70

Comments: TOTAL CYCLES = 1976

Minimum Operating Voltage 100 ms Pulse 50 ± 5 psig, 100% Helium	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initia
Port "A"	18 volts d.c. max.	14.0	14.0	14.0	✓		HPG
Port "B"	18 volts d.c. max.	16.0	15.5	15.5	✓		HPG

Date 8.26.70

Comments:

TOTAL CYCLES = 1986

Serial No.	008	Test Eng.	RMR
Mech. Tech.	MEN	Q. C. ~~Eng.~~	HPG
Elect. Tech.	MEN	TECH	

Port "B" Open 500 Volts D. C. Pins From	To	Limit	Actual
A	B	50 meg. ohms min.	7200K MEG
A	E	50 meg. ohms min.	"
D	C	50 meg. ohms min.	1900K MEG
D	F	50 meg. ohms min.	2000K MEG

Accept ✓ Initial HPG
Reject Date 8-26-70

Comments:

Position Indicators After Life Cycling

Covered by Circuit Resistance Measurements.

Minimum Voltage After Life Cycling

Minimum Operating Voltage 100ms Pulse, Unpressurized	Allowable	Actual 1	2	3	O. K.	Reject	Init
Port "A"	18 volts d.c. max.	15.5	15.0	15.0	✓		HPG
Port "B"	18 volts d.c. max.	15.0	14.0	14.5	✓		HPG

Date 8/27/70

Comments: TOTAL CYCLES = 1647

Minimum Operating Voltage 100 ms Pulse 50 ± 5 psig, 100% Helium	Allowable	Actual 1	2	3	O. K.	Reject	Init
Port "A"	18 volts d.c. max.	14.5	14.0	14.0	✓		HPG
Port "B"	18 volts d.c. max.	14.5	14.0	14.5			HPG

Date 8/27/70

Comments:

TOTAL CYCLES = 1635

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	007	Test Eng.	RMR
Mech. Tech.	MEN	Q. C. ~~Eng.~~ TECH	HPG
Elect. Tech.	MEN		

Pulse Duration After Life Cycling

Minimum Pulse Duration, 28 Volts D. C. 100% Helium, 50 ± 5 psig	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initial
Port "A"	100 ms. max.	27.5	28.0	27.5	✓		HPG
Port "B"		31.5	32.0	31.5	✓		HPG

Photo Taken Date 8/27/70

Comments: TOTAL CYCLES = 2001

Minimum Pulse Duration, 28 Volts D. C. Zero Press	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initial
Port "A"	100 ms. max.	27.5	27.0	27.5	✓		HPG
Port "B"		31.5	30.4	31.5	✓		HPG

Photo Taken Date 8/27/70

Comments:
TOTAL CYCLES = 2018

Power After Life Cycling

Power 28 Volts D. C. Steady State	Allowable	Actual 1 (Coil A)	Actual 2 (Coil A)	Actual 3 (Coil A)	~~O.K.~~ 1 (Coil B)	2 (Coil B)	3 (Coil B)	O.K ~~Reject~~	Initial
Voltage	28 ± .5	28.0	28	28	28	28	28	✓	HPG
Current	- 1.14 amps	1.005	1.05	1.11	1.01	1.01	1.005	✓	HPG
Power	31.5 watts max.	28.1	28.1	[illegible]	28.2	28.2	28.1	✓	HPG

COIL A COIL B

Date 8/27/70

Comments:

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	008	Test Eng.	RMR
Mech. Tech.	MEN	Q. C. ~~Eng.~~ TECH	HG
Elect. Tech.	MEN		

Pulse Duration After Life Cycling

Minimum Pulse Duration, 28 Volts D. C. 100% Helium, 50 ± 5 psig	Allowable	Actual 1	Actual 2	Actual 3	O.K.	Reject	Initial
Port "A"	100 ms. max.	28.5	28.5	28.0	✓		HG
Port "B"		28.5	28.0	28.0	✓		HG

Photo Taken
Date 8/27/70

Comments: TOTAL CYCLES = 1645

Minimum Pulse Duration, 28 Volts D. C. Zero Press	Allowable	Actual 1	Actual 2	Actual 3	O.K.	Reject	Initial
Port "A"	100 ms. max.	28.5	28.5	28.0	✓		HG
Port "B"		28.0	28.5	28.0	✓		HG

Photo Taken
Date 8/27/70

Comments: TOTAL CYCLES = 1655

Power After Life Cycling

Power 28 Volts D. C. Steady State	Allowable	Actual 1	Actual 2	Actual 3	~~O.K.~~ 1	2	3	OK ~~Reject~~	Initial
Voltage	28 ± .5	28	28	28	28	28	28	✓	HG
Current	- 1.14 amps	1.10	1.10	1.095	1.10	1.10	1.10	✓	HG
Power	31.5 watts max.	31.0	31.0	30.6	28.3	31.0	31.0	✓	HG
		COIL A			COIL B				

Date 8/27/70

Comments:

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 808
Mech. Tech. JDS
Elect. Tech. JDS
Test Eng. RMK
Q. C. ~~Eng.~~ TECH APG

5.8.1 High Temperature Gaseous

alve @ 65°F oil Volt= 0VDC for Minutes	Allowable	Room Temp. Coil CURRENT/ Resis.	CURRENT/ 165°F Resistance																			
			1		2		3		4		5		6		7		8		9		10	
			start	fin.	start	fin.	start	fin.	start	fin.	start	fin.	start	fin.	start	fin.	start	fin.	start	fin.	start	fin.
oil "A"	Determine Max. Coil	1180	970	840	970	840	970	840	970	840	970	840	970	840	970	840	970	840	970	840	970	840
	Temp. 170°F	25.42	30.9	35.7	30.9	35.7	30.9	35.7	30.9	35.7	30.9	35.7	30.9	35.7	30.9	35.7	30.9	35.7	30.9	35.7	30.9	35.7
oil "B"	Determine Max. Coil	1180	970	840	970	840	970	840	970	840	970	840	970	840	970	840	970	840	970	840	970	840
	Temp. 170°F	25.42	30.9	35.7	30.9	35.7	30.9	35.7	30.9	35.7	30.9	35.7	30.9	35.7	30.9	35.7	30.9	35.7	30.9	35.7	30.9	35.7

Photo Taken YES
Date SEPT 1, 1970

Comments: 15 MINUTES BETWEEN EACH CURRENT TEST
TOTAL CYCLES = ~~2008~~ 1665

CURRENT ~ MILLIAMPERES
RESISTANCE ~ OHMS

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. .007
Mech. Tech. J.P.J
Elect. Tech. J.P.J
Test Eng. RHR
Q. C. ~~Eng.~~ TECH NBG

5.8.1 High Temperature Gaseous

alve @ 65°F oil Volt= 0VDC for Minutes	Allowable	Room Temp. Coil CURRENT/ Resis.	CURRENT/ 165°F Resistance 1 start	1 fin.	2 start	2 fin.	3 start	3 fin.	4 start	4 fin.	5 start	5 fin.	6 start	6 fin.	7 start	7 fin.	8 start	8 fin.	9 start	9 fin.	10 start	10 fin.
oil "A"	Determine Max. Coil	1080	900	800	900	800	900	800	900	800	900	800	900	800	900	800	900	850	900	850	900	800
	Temp. 174°F	27.8	33.3	37.5	33.3	37.5	33.3	37.5	33.3	37.5	33.3	37.5	33.3	37.5	33.3	37.5	33.3	37.5	33.3	37.5	33.3	37.5
oil "B"	Determine Max. Coil	1080	900	850	900	800	900	800	900	800	900	800	900	800	900	800	900	800	900	800	900	800
	Temp. 174°F	27.8	33.3	37.5	33.3	37.5	33.3	37.5	33.3	37.5	33.3	37.5	33.3	37.5	33.3	37.5	33.3	37.5	33.3	37.5	33.3	37.5

Photo Taken Yes
Date SEPT 1, 1970

Comments: ~~20~~ 25 MINUTES BETWEEN EACH CURRENT TEST
TOTAL CYCLES = ~~[illegible]~~ 2078

CURRENT ~ MILLIAMPERES
RESISTANCE ~ OHMS

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008
Mech. Tech. TPS
Elect. Tech. —
Test Eng. RMR
Q. C. ~~Eng.~~ TECH HRG

Leakage After High Temperature Gaseous

(Valve at 100°F)

Port A Methanol/Water	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0±.5 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HRG
10.0±1.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HRG
20.0±2.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HRG

Date 9-15-70

Port B Methanol/Water	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0 ±.5 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HRG
10.0 ±1.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HRG
20.0± 2.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		HRG

Date 9-15-70

Comments: TOTAL CYCLES= 1671

Circuit Resistance After High Temperature Gaseous

(Valve at 100°F)

Port "A" Open Pins From	To	Limit	Actual 1	2	3
A	E	0.5 ohms max.	.2	.2	.2
D	F	0.5 ohms max.	.2	.2	.2
H	Case	0.5 ohms max.	.1	.1	.1
L	J	—	26.7	26.7	26.70
B	E	Open Circuit	∞	∞	∞
C	F	Open Circuit	∞	∞	∞

Accept ✓
Reject
Initial HRG
Date 9/16/70

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. ~~008~~ 007 Test Eng. RMR
Mech. Tech. TPS Q. C. ~~Eng.~~ TECH H. F. CARPENITO
Elect. Tech. ——

Leakage After High Temperature Gaseous

(Valve at 100°F)

Port A Methanol/Water	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0±.5 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		H.F.C.
10.0±1.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		H.F.C.
20.0±2.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		H.F.C.

Date 9-15-70

Port B Methanol/Water	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0 ±.5 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		H.F.C.
10.0 ±1.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		H.F.C.
20.0± 2.0 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		H.F.C.

Date 9-15-70

Comments: TOTAL CYCLES = 2034

Circuit Resistance After High Temperature Gaseous

(Valve at 100°F)

Port "A" Open Pins From	To	Limit	Actual 1	2	3
A	E	0.5 ohms max.	0.2	0.2	0.2
D	F	0.5 ohms max.	0.1	0.2	0.2
H	Case	0.5 ohms max.	0.1	0.1	0.1
L	J	———	29.2	29.4	29.4
B	E	Open Circuit	OPEN	OPEN	OPEN
C	F	Open Circuit	OPEN	OPEN	OPEN

Accept ✓ Initial H.F.C.
Reject Date 9/15/70

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. ______ Q. C. Eng. H. F. Carpenito
Elect. Tech. TPS

Port "B" Open Pins		Limit	Actual		
			1	2	3
From	To				
A	E	Open Circuit	open	open	open
D	F	Open Circuit	open	open	open
H	Case	0.5 ohms max.	0.1	0.1	0.1
M	K	———	29.4	29.4	29.3
B	E	0.5 ohms max.	0.2	0.2	0.2
C	F	0.5 ohms max.	0.2	0.2	0.2

Accept ✓ Initial [illegible]
Reject ______ Date 9/15/70

Comments:
TOTAL CYCLES = 2040

Insulation Resistance After High Temperature Gaseous

(Valve at 100°F)

500 Volts D. C. Pins			
From	To	Limit	Actual
A	C	50 meg. ohms min.	>200 K MEG.
A	D	50 meg. ohms min.	↕
A	F	50 meg. ohms min.	>200 K MEG.
A	H	50 meg. ohms min.	130 K MEG.
A	J	50 meg. ohms min.	>200 K MEG.
A	L	50 meg. ohms min.	↕
A	M	50 meg. ohms min.	>200 K MEG
A	Case	50 meg. ohms min.	120 K MEG
B	C	50 meg. ohms min.	>200 K MEG
B	D	50 meg. ohms min.	↕
B	F	50 meg. ohms min.	
B	A	50 meg. ohms min.	
B	J	50 meg. ohms min.	>200 K MEG

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008
Mech. Tech. —
Elect. Tech. JPS
Test Eng. RMR
Q. C. ~~Eng.~~ TECH H. CARPENITO

Port "B" Open Pins		Limit	Actual		
			1	2	3
From	To		∞		
A	E	Open Circuit	∞	∞	∞
D	F	Open Circuit	∞	∞	∞
H	Case	0.5 ohms max.	.1	.1	.1
M	K	————	26.4	26.8	26.8
B	E	0.5 ohms max.	.2	.2	.2
C	F	0.5 ohms max.	.2	.2	.2

Accept ✓
Reject
Initial HPY
Date 9/16/70

Comments: TOTAL CYCLES = 1677

Insulation Resistance After High Temperature Gaseous

(Valve at 100°F)

500 Volts D. C. Pins			
From	To	Limit	Actual
A	C	50 meg. ohms min.	>200K MEG
A	D	50 meg. ohms min.	>190K MEG
A	F	50 meg. ohms min.	>190K MEG
A	H	50 meg. ohms min.	>60K MEG
A	J	50 meg. ohms min.	190K MEG
A	L	50 meg. ohms min.	190K MEG
A	M	50 meg. ohms min.	190K MEG
A	Case	50 meg. ohms min.	60K MEG
B	C	50 meg. ohms min.	>200K MEG
B	D	50 meg. ohms min.	>200K MEG
B	F	50 meg. ohms min.	>200K MEG
B	A	50 meg. ohms min.	150K MEG
B	J	50 meg. ohms min.	>200K MEG

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. — Q. C. ~~Eng.~~ TECH HPG
Elect. Tech. TPS

Continued

From	To	Limit	Actual
B	K	50 meg. ohms min.	190K MEG
B	L	50 meg. ohms min.	190K MEG
B	M	50 meg. ohms min.	190K MEG
B	Case	50 meg. ohms min.	60K MEG.
C	E	50 meg. ohms min.	200K MEG
C	H	50 meg. ohms min.	60K MEG.
C	J	50 meg. ohms min.	190K MEG.
C	K	50 meg. ohms min.	190K MEG
C	L	50 meg. ohms min.	190K MEG
C	M	50 meg. ohms min.	190K MEG.
C	Case	50 meg. ohms min.	60K MEG
D	E	50 meg. ohms min.	>200K MEG
D	H	50 meg. ohms min.	100K MEG.
D	J	50 meg. ohms min.	>200K MEG
D	K	50 meg. ohms min.	>200K MEG
D	L	50 meg. ohms min.	> 200K MEG
D	M	50 meg. ohms min.	>200K MEG
D	Case	50 meg. ohms min.	100K MEG
E	F	50 meg. ohms min.	>200K MEG
E	H	50 meg. ohms min.	200K MEG
E	J	50 meg. ohms min.	
E	K	50 meg. ohms min.	
E	L	50 meg. ohms min.	
E	M	50 meg. ohms min.	
E	Case	50 meg. ohms min.	200K MEG
F	H	50 meg. ohms min.	>200K MEG
F	J	50 meg. ohms min.	>200K MEG
F	K	50 meg. ohms min.	190K MEG
F	L	50 meg. ohms min.	200K MEG
F	M	50 meg. ohms min.	200K MEG
F	Case	50 meg. ohms min.	>200K MEG
G	A	50 meg. ohms min.	>200K MEG
G	B	50 meg. ohms min.	
G	C	50 meg. ohms min.	
G	D	50 meg. ohms min.	
G	E	50 meg. ohms min.	>200K MEG

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	008	Test Eng.	RMK
Mech. Tech.	——	Q. C. Eng.	H. Carenito
Elect. Tech.	TPS		

Continued

From	To	Limit	Actual
B	K	50 meg. ohms min.	> 200K Meg
B	L	50 meg. ohms min.	> 200K Meg
B	M	50 meg. ohms min.	> 200K Meg
B	Case	50 meg. ohms min.	100K Meg
C	E	50 meg. ohms min.	150K Meg
C	H	50 meg. ohms min.	70K Meg
C	J	50 meg. ohms min.	150K Meg
C	K	50 meg. ohms min.	150K Meg
C	L	50 meg. ohms min.	150K Meg
C	M	50 meg. ohms min.	150K Meg 100K Meg
C	Case	50 meg. ohms min.	190K Meg
D	E	50 meg. ohms min.	60K Meg
D	H	50 meg. ohms min.	150K Meg
D	J	50 meg. ohms min.	100K Meg
D	K	50 meg. ohms min.	120K Meg
D	L	50 meg. ohms min.	150K Meg
D	M	50 meg. ohms min.	60K Meg
D	Case	50 meg. ohms min.	180K Meg
E	F	50 meg. ohms min.	60K Meg
E	H	50 meg. ohms min.	120K Meg
E	J	50 meg. ohms min.	120K Meg
E	K	50 meg. ohms min.	150K Meg
E	L	50 meg. ohms min.	150K Meg
E	M	50 meg. ohms min.	60K Meg
E	Case	50 meg. ohms min.	60K Meg
F	H	50 meg. ohms min.	90K Meg
F	J	50 meg. ohms min.	70K Meg
F	K	50 meg. ohms min.	70K Meg
F	L	50 meg. ohms min.	100K Meg
F	M	50 meg. ohms min.	60K Meg.
F	Case	50 meg. ohms min.	90K Meg
G	A	50 meg. ohms min.	120K Meg
G	B	50 meg. ohms min.	120K Meg
G	C	50 meg. ohms min.	120K Meg
G	D	50 meg. ohms min.	120K Meg
G	E	50 meg. ohms min.	> 200K Meg

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007
Mech. Tech. —
Elect. Tech. TPS
Test Eng. RHR
Q. C. ~~Eng.~~ TECH HPG

Continued

From	To	Limit	Actual
G	F	50 meg. ohms min.	>200K MEG
G	H	50 meg. ohms min.	
G	J	50 meg. ohms min.	
G	K	50 meg. ohms min.	
G	L	50 meg. ohms min.	>200K MEG
G	M	50 meg. ohms min.	200K MEG
H	J	50 meg. ohms min.	>200K MEG.
H	K	50 meg. ohms min.	190K MEG.
H	L	50 meg. ohms min.	190K MEG.
H	M	50 meg. ohms min.	190K MEG.
J	K	50 meg. ohms min.	70 MEG.
J	M	50 meg. ohms min.	70 MEG.
J	Case	50 meg. ohms min.	40K MEG.
K	L	50 meg. ohms min.	70 MEG.
K	Case	50 meg. ohms min.	40K MEG.
L	M	50 meg. ohms min.	70 MEG.
L	Case	50 meg. ohms min.	40K MEG.
M	Case	50 meg. ohms min.	40K MEG.

Accept ✓
Reject
Initial HAY
Date 9/16/70

Comments:

Port "A" Open 500 Volts D. C. Pins From	To	Limit	Actual
B	E	50 meg. ohms min.	190K MEG.
B	A	50 meg. ohms min.	190K MEG.
C	D	50 meg. ohms min.	190K MEG.
C	F	50 meg. ohms min.	190K MEG.

Accept ✓
Reject
Initial HAY
Date 9/16/70

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. ——— Q. C. Eng. H. CARENITO
Elect. Tech. TPS

Continued

From	To	Limit	Actual
G	F	50 meg. ohms min.	>200KMEG
G	H	50 meg. ohms min.	120KMEG
G	J	50 meg. ohms min.	>200KMEG
G	K	50 meg. ohms min.	>200KMEG
G	L	50 meg. ohms min.	190KMEG
G	M	50 meg. ohms min.	>200KMEG
H	J	50 meg. ohms min.	20KMEG
H	K	50 meg. ohms min.	20KMEG
H	L	50 meg. ohms min.	20KMEG
H	M	50 meg. ohms min.	20KMEG
J	K	50 meg. ohms min.	55MEG
J	M	50 meg. ohms min.	55MEG
J	Case	50 meg. ohms min.	>20KMEG
K	L	50 meg. ohms min.	51MEG
K	Case	50 meg. ohms min.	>20KMEG
L	M	50 meg. ohms min.	51MEG
L	Case	50 meg. ohms min.	20KMEG
M	Case	50 meg. ohms min.	20KMEG

Accept ✓ Initial D.G.C.
Reject Date 9/16/70

Comments:

Port "A" Open 500 Volts D. C. Pins			
From	To	Limit	Actual
B	E	50 meg. ohms min.	120KMEG
B	A	50 meg. ohms min.	100KMEG
C	D	50 meg. ohms min.	100KMEG
C	F	50 meg. ohms min.	70KMEG

Accept ✓ Initial D.G.C.
Reject Date 9/16/70

<u>Test Data Sheet</u>
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 | Test Eng. RMR
Mech. Tech. | Q. C. ~~Eng.~~ HPG
Elect. Tech. TPS | TGG19

Port "B" Open 500 Volts D. C. Pins From	To	Limit	Actual
A	B	50 meg. ohms min.	7200K MEG
A	E	50 meg. ohms min.	7200K MEG
D	C	50 meg. ohms min.	7200K MEG
D	F	50 meg. ohms min.	7200K MEG

Accept ✓ | Initial HPG
Reject | Date 9/16/70

Comments:

<u>Position Indicators After High Temperature Gaseous</u>

(Valve at 100°F)

Covered by Circuit Resistance Test.

<u>Minimum Voltage After High Temperature Gaseous</u>

(Valve at 100°F)

Minimum Operating Voltage 100 ms Pulse, Unpressurized	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initi
Port "A"	18 volts d.c. max.	16.5	16.5	16.5	✓		
Port "B"	18 volts d.c. max.	18.0	18.6	17.0	✓		

Date 9/16/70

Comments: VALVE CHANGES POSITION 1-2 VOLTS BELOW LEVEL AT WHICH SWITCH CONTACT IS MADE

TOTAL CYCLES = 2052

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008
Mech. Tech. ——
Elect. Tech. JTS
Test Eng. RMR
Q. C. Eng. H. CARPENITO

Port "B" Open 500 Volts D. C. Pins From	To	Limit	Actual
A	B	50 meg. ohms min.	>200K MEG
A	E	50 meg. ohms min.	>200K MEG
D	C	50 meg. ohms min.	>200K MEG
D	F	50 meg. ohms min.	>200K MEG

Accept ✓ Initial
Reject Date 9/16/70

Comments:

Position Indicators After High Temperature Gaseous

(Valve at 100°F)

Covered by Circuit Resistance Test.

Minimum Voltage After High Temperature Gaseous

(Valve at 100°F)

Minimum Operating Voltage 100 ms Pulse, Unpressurized	Allowable	Actual 1	2	3	O. K.	Reject	Initi
Port "A"	18 volts d.c. max.	16.5	16.0	16.0	✓		
Port "B"	18 volts d.c. max.	16.5	17.0	17.0	✓		

Date 9/16/70

Comments: TOTAL CYCLES = 1689

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	007	Test Eng.	RHR
Mech. Tech.	TPS	Q. C. ~~Eng.~~ TECH	H. F. CARPENITO
Elect. Tech.	TPS		

Minimum Operating Voltage 100 ms Pulse 50 ± 5 psig, 100% Helium	Allowable	Actual 1	2	3	O. K.	Reject	Initi
Port "A"	18 volts d.c. max.	15.0	14.5	14.5	✓		
Port "B"	18 volts d.c. max.	16.5	16.0	16.0	—		

Date 9/16/70

Comments: TOTAL CYCLES = 2061

Pulse Duration After High Temperature Gaseous

(Valve at 100°F)

Minimum Pulse Duration, 28 Volts D.C. 100% Helium, 50 ± 5 psig	Allowable	Actual 1	2	3	O.K.	Reject	Initial
Port "A"	100 ms. max.	28.0	28.0	28.0	✓		
Port "B"		32.0	32.0	32.0	✓		

Date 9/16/70

Comments: VALVE ACTUATES AT ABOUT 22 MS, SWITCHES ACTUATE AT 28 MS
30 MS " " " 32 MS
TOTAL CYCLES = 2079

Minimum Pulse Duration, 28 Volts D.C. Zero Press	Allowable	Actual 1	2	3	O.K.	Reject	Initial
Port "A"	100 ms. max.	28.0	28.0	27.5	✓		
Port "B"		32.0	32.5	32.5	—		

Date 9/16/70

Comments: TOTAL CYCLES = 2094

Test Data Sheet

Pulse Operated Flow Diverter Valve

Specification 20M42517

Serial No. 008   Test Eng. RMR

Mech. Tech. —   Q. C. Eng. H. F. Carpenito

Elect. Tech. TPS

Minimum Operating Voltage 100 ms Pulse 50 ± 5 psig, 100% Helium	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initial
Port "A"	18 volts d.c. max.	16.0	15.5	15.5	✓		
Port "B"	18 volts d.c. max.	16.0	16.5	16.0	✓		

Date 9/16/70

Comments: TOTAL CYCLES = 1698

Pulse Duration After High Temperature Gaseous

(Valve at 100°F)

Minimum Pulse Duration, 28 Volts D.C. 100% Helium, 50 ± 5 psig	Allowable	Actual 1	Actual 2	Actual 3	O.K.	Reject	Initial
Port "A"	100 ms. max.	28.0	28.5	27.5	✓		
Port "B"		28.5	27.0	28.5	✓		

Date 9/16/70

Comments: TOTAL CYCLES = 1710

Minimum Pulse Duration, 28 Volts D.C. Zero Press	Allowable	Actual 1	Actual 2	Actual 3	O.K.	Reject	Initial
Port "A"	100 ms. max.	29.0	29.0	28.5	✓		
Port "B"		29.5	30.0	30.0	✓		

Date 9/16/70

Comments: TOTAL CYCLES = 1723

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	007	Test Eng.	RMF
Mech. Tech.		Q. C. ~~Eng.~~ TECH	H. CARPENTO
Elect. Tech.	TRS		

Power After High Temperature Gaseous

(Valve at 100°F)

Power 28 Volts D.C. Steady State	Allowable	COIL A Actual			O.K.	Reject	Initial
Voltage	28 ± .5	28.0	28.0	28.0	✓		D.J.C.
Current	1.14 amps	.940	.94	.940	✓		D.J.C.
Power	31.5 watts max.	26.3	26.3	26.3	✓		D.J.C.
COIL B	VOLT	28.0	28.0	28.0	✓		
	CURRENT	.940	.940	.950	✓		
	POWER	26.3	26.2	26.6	✓		

Date 9/17/70

Comments:

5.8.2 Low Temperature Gaseous

Leakage, Valve at -65°F (Gaseous)

100% helium @ 50 ± 5 pgg	Allowable	Actual	O. K.	Reject	Initial
Internal Press	1.6×10^{-6} sccs	7×10^{-8}	✓		[illegible]

Photo Taken
Date 9-23-70

Comments: TOTAL CYCLES = 2097

Port A Methanol/Water	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 sccs	0.0033	0	0	✓		BUN
10.0 ± 1.0 psig ΔP	0.20 sccs	0.0016	0	0.0016	✓		BUN
20.0 ± 2.0 psig ΔP	0.20 sccs	0.0016	0	0.0016	✓		BUN

Date 10/16/70

D-79

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMC
Mech. Tech. —— Q. C. ~~Eng.~~ TECH H CARPENITO
Elect. Tech. TPS

Power After High Temperature Gaseous

(Valve at $100^{\circ}F$)

Power 28 Volts D.C. Steady State	Allowable	Actual (COIL A)			O.K.	Reject	Initial
Voltage	28 ± .5	28.0	28.1	28.0	✓		N.T.C.
Current	1.14 amps	1.04	1.03	1.05	✓		N.T.C.
Power	31.5 watts max.	29.1	28.8	28.8	✓		N.T.C.
COIL B VOLTAGE		28.0	[illegible]	28.0	✓		
COIL B CURRENT		1.02	1.02	1.02	✓		
COIL B POWER		28.6	28.6	28.6	✓		

Date 9/17/70

Comments:

5.8.2 Low Temperature Gaseous

Leakage, Valve at $-65^{\circ}F$ (Gaseous)

100% helium @ 50 ± 5 psig Internal Press	Allowable	Actual	O. K.	Reject	Initial
	1.6×10^{-6} sccs	1.44×10^{-5}	✓		[illegible]

Photo Taken yes
Date 9-24-70

Comments: TOTAL CYCLES = 1732

Port A Methanol/Water	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 sccs	0	0	0	✓		SVJ
10.0 ± 1.0 psig ΔP	0.20 sccs	0	0	0	✓		SVJ
20.0 ± 2.0 psig ΔP	0.20 sccs	0	0	0	✓		SVJ

Date 10/16/70

Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. — Q. C. Eng. H. CARPENITO
Elect. Tech. REO

Port B Methanol/Water	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 sccs	0.0016	0	0	✓		DVH
10.0 ± 1.0 psig ΔP	0.20 sccs	0.0016	0.0016	0.0016	✓		DVH
20.0 ± 2.0 psig ΔP	0.20 sccs	0.0016	0.0016	0.0016	✓		DVH

Photo Taken ✓ YES
Date 10/16/70

Comments: TOTAL CYCLES = 2109

Circuit Resistance, Valve at -65°F (Gaseous)

Port "A" Open Pins From	To	Limit	Actual 1	Actual 2	Actual 3
A	E	0.5 ohms max.	0.2	0.1	0.1
D	F	0.5 ohms max.	0.2	0.1	0.1
H	Case	0.5 ohms max.	0.17	0.17	0.06
L	J	17.2 ohms min.	19.7	19.8	19.9
B	E	Open Circuit	OPEN	OPEN	OPEN
C	F	Open Circuit	OPEN	OPEN	OPEN

Accept ✓ Initial D.J.C.
Reject Date 9/25/70

Port "B" Open Pins From	To	Limit	Actual 1	Actual 2	Actual 3
A	E	Open Circuit	OPEN	OPEN	OPEN
D	F	Open Circuit	OPEN	OPEN	OPEN
H	Case	0.5 ohms max.	0.17	.07	0.18
M	K	17.2 ohms min.	19.7	19.9	20.0
B	E	0.5 ohms max.	0.17	0.18	0.17
C	F	0.5 ohms max.	0.16	0.17	0.18

Accept ✓ Initial D.J.C.
Reject Date 9/25/70
Photo Taken

Comments: TOTAL CYCLES = 2113

Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. [illegible] Q. C. Eng. A. CARPENITO
Elect. Tech. REO

Port B Methanol/Water	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 sccs	0	0	0	✓		[illegible]
10.0 ± 1.0 psig ΔP	0.20 sccs	0	0	0	✓		[illegible]
20.0 ± 2.0 psig ΔP	0.20 sccs	0	0	0	✓		[illegible]

Photo Taken YES
Date 10/16/70

Comments: TOTAL CYCLES = 1746

Circuit Resistance, Valve at -65°F (Gaseous)

Port "A" Open Pins From	To	Limit	Actual 1	Actual 2	Actual 3
A	E	0.5 ohms max.	0.1	0.1	0.1
D	F	0.5 ohms max.	0.1	0.1	0.1
H	Case	0.5 ohms max.	0.2	0.1	0.2
L	J	17.2 ohms min.	17.7	17.7	17.8
B	E	Open Circuit	OPEN	OPEN	OPEN
C	F	Open Circuit	OPEN	OPEN	OPEN

Accept ✓ Initial A.J.C.
Reject Date 9/25/70

Port "B" Open Pins From	To	Limit	Actual 1	Actual 2	Actual 3
A	E	Open Circuit	OPEN	OPEN	OPEN
D	F	Open Circuit	OPEN	OPEN	OPEN
H	Case	0.5 ohms max.	0.2	0.1	0.1
M	K	17.2 ohms min.	17.9	17.9	17.9
B	E	0.5 ohms max.	0.1	0.1	0.1
C	F	0.5 ohms max.	0.1	0.1	0.1

Accept ✓ Initial A.J.C.
Reject Date 9/25/70
Photo Taken

Comments: TOTAL CYCLES 1749

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	007	Test Eng.	RMR
Mech. Tech.	—	Q. C. Eng.	HC.
Elect. Tech.	REO		

Insulation Resistance, Valve at -65°F (Gaseous)

500 Volts D. C. Pins From	To	Limit	Actual
A	C	50 meg. ohms min.	750 K MEG
A	D	50 meg. ohms min.	
A	F	50 meg. ohms min.	
A	H	50 meg. ohms min.	
A	J	50 meg. ohms min.	
A	L	50 meg. ohms min.	
A	M	50 meg. ohms min.	
A	Case	50 meg. ohms min.	750 K MEG
B	C	50 meg. ohms min.	750 K MEG
B	D	50 meg. ohms min.	
B	F	50 meg. ohms min.	
B	A	50 meg. ohms min.	
B	J	50 meg. ohms min.	
B	K	50 meg. ohms min.	
B	L	50 meg. ohms min.	
B	M	50 meg. ohms min.	
B	Case	50 meg. ohms min.	750 K MEG
C	E	50 meg. ohms min.	750 K MEG
C	H	50 meg. ohms min.	
C	J	50 meg. ohms min.	
C	K	50 meg. ohms min.	
C	L	50 meg. ohms min.	
C	M	50 meg. ohms min.	
C	Case	50 meg. ohms min.	750 K MEG
D	E	50 meg. ohms min.	750 K MEG
D	H	50 meg. ohms min.	
D	J	50 meg. ohms min.	
D	K	50 meg. ohms min.	
D	L	50 meg. ohms min.	
D	M	50 meg. ohms min.	
D	Case	50 meg. ohms min.	750 K MEG
E	F	50 meg. ohms min.	750 K MEG
E	H	50 meg. ohms min.	
E	J	50 meg. ohms min.	
E	K	50 meg. ohms min.	
E	L	50 meg. ohms min.	750 K MEG

Test Data Sheet

Pulse Operated Flow Diverter Valve

Specification 20M42517

Serial No.	008	Test Eng.	RME
Mech. Tech.	—	Q. C. Eng.	H. Carpenito
Elect. Tech.	REO		

Insulation Resistance, Valve at -65°F (Gaseous)

500 Volts D. C. Pins From	To	Limit	Actual
A	C	50 meg. ohms min.	>200M
A	D	50 meg. ohms min.	>200M
A	F	50 meg. ohms min.	>200M
A	H	50 meg. ohms min.	>200M
A	J	50 meg. ohms min.	>200M
A	L	50 meg. ohms min.	>200M
A	M	50 meg. ohms min.	>200M
A	Case	50 meg. ohms min.	>200M
B	C	50 meg. ohms min.	>200M
B	D	50 meg. ohms min.	>200M
B	F	50 meg. ohms min.	>200M
B	A	50 meg. ohms min.	>200M
B	J	50 meg. ohms min.	>200M
B	K	50 meg. ohms min.	>200M
B	L	50 meg. ohms min.	>200M
B	M	50 meg. ohms min.	>200M
B	Case	50 meg. ohms min.	>200M
C	E	50 meg. ohms min.	>200M
C	H	50 meg. ohms min.	>200M
C	J	50 meg. ohms min.	>200M
C	K	50 meg. ohms min.	>200M
C	L	50 meg. ohms min.	>200M
C	M	50 meg. ohms min.	>200M
C	Case	50 meg. ohms min.	>200M
D	E	50 meg. ohms min.	>200M
D	H	50 meg. ohms min.	>200M
D	J	50 meg. ohms min.	>200M
D	K	50 meg. ohms min.	>200M
D	L	50 meg. ohms min.	>200M
D	M	50 meg. ohms min.	>200M
D	Case	50 meg. ohms min.	>200M
E	F	50 meg. ohms min.	
E	H	50 meg. ohms min.	
E	J	50 meg. ohms min.	
E	K	50 meg. ohms min.	
E	L	50 meg. ohms min.	>200M

H.F.C.

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	007	Test Eng.	RMR
Mech. Tech.	—	Q. C. Eng.	HPG
Elect. Tech.	REO		

Continued

From	To	Limit	Actual
E	M	50 meg. ohms min.	750 K MEG
E	Case	50 meg. ohms min.	750 K MEG
F	H	50 meg. ohms min.	750 K MEG
F	J	50 meg. ohms min.	
F	K	50 meg. ohms min.	
F	L	50 meg. ohms min.	
F	M	50 meg. ohms min.	
F	Case	50 meg. ohms min.	750 K MEG
G	A	50 meg. ohms min.	750 K MEG
G	B	50 meg. ohms min.	
G	C	50 meg. ohms min.	
G	D	50 meg. ohms min.	
G	E	50 meg. ohms min.	
G	F	50 meg. ohms min.	
G	H	50 meg. ohms min.	
G	J	50 meg. ohms min.	
G	K	50 meg. ohms min.	
G	L	50 meg. ohms min.	
G	M	50 meg. ohms min.	750 K MEG
H	J	50 meg. ohms min.	750 K MEG
H	K	50 meg. ohms min.	
H	L	50 meg. ohms min.	
H	M	50 meg. ohms min.	750 K MEG
J	K	50 meg. ohms min.	
J	M	50 meg. ohms min.	
J	Case	50 meg. ohms min.	750 K MEG
K	L	50 meg. ohms min.	
K	Case	50 meg. ohms min.	750 K MEG
L	M	50 meg. ohms min.	
L	Case	50 meg. ohms min.	
M	Case	50 meg. ohms min.	750 K MEG

Accept ✓ Initial HRY
Reject Date 9/27/70
Photo Taken

Comments:

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. ______ Q. C. Eng. H. CARPENITO
Elect. Tech. REO

Continued

From	To	Limit	Actual
E	M	50 meg. ohms min.	>200M
E	Case	50 meg. ohms min.	
F	H	50 meg. ohms min.	
F	J	50 meg. ohms min.	
F	K	50 meg. ohms min.	
F	L	50 meg. ohms min.	
F	M	50 meg. ohms min.	
F	Case	50 meg. ohms min.	>200M
G	A	50 meg. ohms min.	
G	B	50 meg. ohms min.	
G	C	50 meg. ohms min.	
G	D	50 meg. ohms min.	
G	E	50 meg. ohms min.	
G	F	50 meg. ohms min.	
G	H	50 meg. ohms min.	
G	J	50 meg. ohms min.	
G	K	50 meg. ohms min.	
G	L	50 meg. ohms min.	
G	M	50 meg. ohms min.	>200M
H	J	50 meg. ohms min.	
H	K	50 meg. ohms min.	
H	L	50 meg. ohms min.	
H	M	50 meg. ohms min.	
J	K	50 meg. ohms min.	
J	M	50 meg. ohms min.	
J	Case	50 meg. ohms min.	
K	L	50 meg. ohms min.	
K	Case	50 meg. ohms min.	
L	M	50 meg. ohms min.	
L	Case	50 meg. ohms min.	
M	Case	50 meg. ohms min.	>200M

Accept ✓ Initial [illegible]
Reject ______ Date 9/29/70
Photo Taken ______

Comments: ______

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	007	Test Eng.	RMR
Mech. Tech.		Q. C. Eng.	HPG
Elect. Tech.	REO		

Port "A" Open 500 Volts D. C. Pins From	To	Limit	Actual
B	E	50 meg. ohms min.	750 K MEG.
B	A	50 meg. ohms min.	↕
C	D	50 meg. ohms min.	
C	F	50 meg. ohms min.	750 K MEG

Accept ✓ Initial HPG
Reject Date 9/28/70

Port "B" Open 500 Volts D. C. Pins From	To	Limit	Actual
A	B	50 meg. ohms min.	750 K MEG.
A	E	50 meg. ohms min.	↕
D	C	50 meg. ohms min.	
D	F	50 meg. ohms min.	750 K MEG.

Accept ✓ Initial HPG
Reject Date 9/28/70

Comments: TOTAL CYCLES = 2115

Position Indicators, Valve at -65°F (Gaseous)

Covered by Circuit Resistance Test.

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. ______ Q. C. Eng. H. CARPENITO
Elect. Tech. RED

Port "A" Open 500 Volts D. C. Pins From	To	Limit	Actual
B	E	50 meg. ohms min.	>200M
B	A	50 meg. ohms min.	>200M
C	D	50 meg. ohms min.	>200M
C	F	50 meg. ohms min.	>200M

Accept ✓ Initial N.F.C.
Reject ______ Date 9/28/70

Port "B" Open 500 Volts D. C. Pins From	To	Limit	Actual
A	B	50 meg. ohms min.	>200M
A	E	50 meg. ohms min.	>200M
D	C	50 meg. ohms min.	>200M
D	F	50 meg. ohms min.	>200M

Accept ✓ Initial N.F.C.
Reject ______ Date 9/28/70

Comments: TOTAL CYCLES = 1750

Position Indicators, Valve at -65°F (Gaseous)

Covered by Circuit Resistance Test.

2789

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. REO Q. C. Eng. CARPENITO
Elect. Tech. REO

Minimum Operating Voltage, Valve at -65°F (Gaseous)

Minimum Operating Voltage 100 ms Pulse, Unpressurized	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initi
Port "A"	18 volts d.c. max.	13.0	13.0	13.0	✓		HI
Port "B"	18 volts d.c. max.	12.0	12.0	12.0	✓		HI

Photo Taken ✓
Date 10-14-70

Comments: TOTAL CYCLES = 2141

Minimum Operating Voltage 100 ms Pulse 50 ± 5 psig, 100% Helium	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initi
Port "A"	18 volts d.c. max.	12.0	12.0	12.0	✓		HI
Port "B"	18 volts d.c. max.	12.0	12.0	12.0	✓		HI

Photo Taken
Date 10-14-70

Comments: TOTAL CYCLES = 2159

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. REO Q. C. ~~Eng.~~ TECH APG
Elect. Tech. REO

Minimum Operating Voltage, Valve at -65°F (Gaseous)

Minimum Operating Voltage 100 ms Pulse, Unpressurized	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Init
Port "A"	18 volts d.c. max.	13.0	13.0	13.0	✓		HR
Port "B"	18 volts d.c. max.	13.0	13.0	13.0	✓		HR

Photo Taken ✓
Date 10/15/70

Comments: TOTAL CYCLES = 1781

Minimum Operating Voltage 100 ms Pulse 50 ± 5 psig, 100% Helium	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Init
Port "A"	18 volts d.c. max.	13.0	13.0	13.0	✓		HR
Port "B"	18 volts d.c. max.	13.0	13.0	13.0	✓		HR

Photo Taken ✓
Date 10/15/70

Comments: TOTAL CYCLES = 1797

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. REO Q. C. ~~Eng.~~ TECH HPG
Elect. Tech. REO

5.3.1

Minimum Pulse Duration, Valve at -65°F (Gaseous)

Minimum Pulse Duration, 28 Volts D. C. 100% Helium, 50 ± 5 psig	Allowable	Actual 1	2	3	O. K.	Reject	Initial
Port "A"	100 ms. max.	14.0	14.0	14.0	✓		HPG
Port "B"		16.0	16.0	16.0	✓		HPG

Photo Taken ✓
Date 10/14/70

Comments: TOTAL CYCLES = 2173

Minimum Pulse Duration, 28 Volts D. C. Zero Press	Allowable	Actual 1	2	3	O. K.	Reject	Initial
Port "A"	100 ms. max.	20.0	20.0	20.0	✓		HPG
Port "B"		15.0	15.0	15.0	✓		HPG

Photo Taken ✓
Date 10/14/70

Comments: TOTAL CYCLES = 2189

Power, Valve at -65°F (Gaseous)

Power 28 Volts D. C. Steady State	Allowable	PORT A Actual	PORT B Actual	O. K.	Reject	Initial
Voltage	28 ± .5	28.0	28.0	✓		HPG
Current	1.61 amps	1.3	1.3	✓		HPG
Power	45.0 watts max	36.4	36.4	✓		HPG

Photo Taken ✓
Date 10/14/70

Comments: TOTAL CYCLES = 2191

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. RED Q. C. ~~Eng.~~ TECH HPG
Elect. Tech. RED

5.3.1

Minimum Pulse Duration, Valve at -65°F (Gaseous)

Minimum Pulse Duration, 28 Volts D.C. 100% Helium, 50 ± 5 psig	Allowable	Actual 1	Actual 2	Actual 3	O.K.	Reject	Initial
Port "A"	100 ms. max.	23	23	23	✓		HPG
Port "B"		24	25	23	✓		HPG

Photo Taken ✓
Date 10/15/70

Comments: TOTAL CYCLES = 1813

Minimum Pulse Duration, 28 Volts D.C. Zero Press	Allowable	Actual 1	Actual 2	Actual 3	O.K.	Reject	Initial
Port "A"	100 ms. max.	25	25	25	✓		HPG
Port "B"		27	26	26	✓		HPG

Photo Taken ✓
Date 10/15/70

Comments: TOTAL CYCLES = 1830

Power, Valve at -65°F (Gaseous)

Power 28 Volts D.C. Steady State	Allowable	Actual Port A	Actual Port B	O.K.	Reject	Initial
Voltage	28 ± .5	28.0	28.0	✓		HPG
Current	1.61 amps	1.43	1.4	✓		HPG
Power	45.0 watts max.	40.9	39.2	✓		HPG

Photo Taken
Date 10/15/70

Comments: TOTAL CYCLES = 1832

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	007	Test Eng.	RMR
Mech. Tech.	RCO	Q. C. ~~Eng.~~ TECH	C. Wy
Elect. Tech.	RCO		

5.8.3 After High and Low Temperature, Gaseous

Leakage After High and Low Temperature (Gaseous)

100% helium @ 50 ± 5 pgg	Allowable	Actual	O. K.	Reject	Initial
Internal Press	1.6×10^{-6} sccs	3.46×10^{-8}	✓		CBW

Date 10/19/70

Comments: TOTAL CYCLES = 2199

Port A Methanol/Water	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 sccs	0	0	0	✓		CBW
10.0 ± 1.0psig ΔP	0.20 sccs	0	0	0	✓		CBW
20.0 ± 2.0psig ΔP	0.20 sccs	0	0	0	✓		CBW

Date 10/19/70

Port B Methanol/Water	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 sccs	0	0	0	✓		CBW
10.0 ± 1.0 psig ΔP	0.20 sccs	0	0	0	✓		CBW
20.0 ± 2.0psig ΔP	0.20 sccs	0	0	0	✓		CBW

Date 10/19/70

Comments: TOTAL CYCLES = 2116

Serial No.	008	Test Eng.	RMR
Mech. Tech.	REB	Q. C. ~~Eng.~~ Tech	C. Wy
Elect. Tech.	REB		

5.8.3 After High and Low Temperature, Gaseous

Leakage After High and Low Temperature (Gaseous)

100% helium @ 50 ± 5 pgg Internal Press	Allowable	Actual	O. K.	Reject	Initia
	1.6 x 10^{-6}sccs	~~3.75 x 10^{-8}~~ CBW 11.25 X 10^{-8}	✓		CBW

Date 10/19/70

Comments: TOTAL CYCLES = 1840

Port A Methanol/Water	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 sccs	0	0	0	✓		CBW
10.0 ± 1.0psig ΔP	0.20 sccs	0	0	0	✓		CBW
20.0 ± 2.0psig ΔP	0.20 sccs	0	0	0	✓		CBW

Date 10/19/70

Port B Methanol/Water	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 sccs	0	0	0	✓		CBW
10.0 ± 1.0 psig ΔP	0.20 sccs	0	0	0	✓		CBW
20.0 ± 2.0psig ΔP	0.20 sccs	0	0	0	✓		CBW

Date 10/19/70

Comments: TOTAL CYCLES = 1859

Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. Q. C. ~~Eng.~~ Tech C. [illegible]
Elect. Tech. REO

Circuit Resistance After High and Low Temperature (Gaseous)

Port "A" Open Pins From	To	Limit	Actual 1	2	3
A	E	0.5 ohms max.	0.1	0.0	0.3
D	F	0.5 ohms max.	0.0	0.0	0.3
H	Case	0.5 ohms max.	0.0	0.0	0.0
L	J	25-29 ohms	27.5	27.3	27.6
B	E	Open Circuit	INF.	INF.	INF.
C	F	Open Circuit	INF.	INF.	INF.

Accept ✓ Initial CBN
Reject Date 10/19/70

Port "B" Open Pins From	To	Limit	Actual 1	2	3
A	E	Open Circuit	INF.	INF.	INF.
D	F	Open Circuit	INF.	INF	INF.
H	Case	0.5 ohms max.	0.1	0.1	.03
M	K	25-29 ohms	27.6	27.7	27.4
B	E	0.5 ohms max.	0.4	0.4	0.2
C	F	0.5 ohms max.	0.3	0.4	0.2

Accept ✓ Initial CBN
Reject Date 10/19/70

Comments: TOTAL CYCLES = 2123

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. — Q. C. ~~Eng.~~ Tech. C. [illegible]
Elect. Tech. REO

Circuit Resistance After High and Low Temperature (Gaseous)

Port "A" Open Pins From	To	Limit	Actual 1	2	3
A	E	0.5 ohms max.	0.1	0.1	0.1
D	F	0.5 ohms max.	0.1	0.1	0.1
H	Case	0.5 ohms max.	0.0	0.0	0.0
L	J	25-29 ohms	25.2	25.1	25.2
B	E	Open Circuit	INF	INF	INF
C	F	Open Circuit	INF	INF	INF

Accept ✓ Initial CBW
Reject Date 10/19/70

Port "B" Open Pins From	To	Limit	Actual 1	2	3
A	E	Open Circuit	INF	INF	INF
D	F	Open Circuit	INF	INF	INF
H	Case	0.5 ohms max.	0.0	0.0	0.2
M	K	25-29 ohms	25.1	25.0	25.7
B	E	0.5 ohms max.	0.0	0.3	0.4
C	F	0.5 ohms max.	0.0	0.2	0.4

Accept ✓ Initial CBW
Reject Date 10/19/70

Comments: TOTAL CYCLES = 1866

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. —— Q. C. ~~Eng.~~ TECH C. Ny
Elect. Tech. RED

Insulation Resistance After High and Low Temperature (Gaseous)

500 Volts D. C. Pins From	To	Limit	Actual
A	C	50 meg. ohms min.	>50 Meg
A	D	50 meg. ohms min.	
A	F	50 meg. ohms min.	
A	H	50 meg. ohms min.	
A	J	50 meg. ohms min.	
A	L	50 meg. ohms min.	
A	M	50 meg. ohms min.	
A	Case	50 meg. ohms min.	
B	C	50 meg. ohms min.	
B	D	50 meg. ohms min.	
B	F	50 meg. ohms min.	
B	A	50 meg. ohms min.	
B	J	50 meg. ohms min.	

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. — Q. C. Eng. C. Wy
Elect. Tech. RSD TECH

Insulation Resistance After High and Low Temperature (Gaseous)

500 Volts D. C. Pins From	To	Limit	Actual
A	C	50 meg. ohms min.	> 50 Meg
A	D	50 meg. ohms min.	
A	F	50 meg. ohms min.	
A	H	50 meg. ohms min.	
A	J	50 meg. ohms min.	
A	L	50 meg. ohms min.	
A	M	50 meg. ohms min.	
A	Case	50 meg. ohms min.	
B	C	50 meg. ohms min.	
B	D	50 meg. ohms min.	
B	F	50 meg. ohms min.	
B	A	50 meg. ohms min.	
B	J	50 meg. ohms min.	

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. — Q. C. ~~Eng.~~ Tech C, Wy
Elect. Tech. REO

Continued

From	To	Limit	Actual
B	K	50 meg. ohms min.	750 Meg
B	L	50 meg. ohms min.	
B	M	50 meg. ohms min.	
B	Case	50 meg. ohms min.	
C	E	50 meg. ohms min.	
C	H	50 meg. ohms min.	
C	J	50 meg. ohms min.	
C	K	50 meg. ohms min.	
C	L	50 meg. ohms min.	
C	M	50 meg. ohms min.	
C	Case	50 meg. ohms min.	
D	E	50 meg. ohms min.	
D	H	50 meg. ohms min.	
D	J	50 meg. ohms min.	
D	K	50 meg. ohms min.	
D	L	50 meg. ohms min.	
D	M	50 meg. ohms min.	
D	Case	50 meg. ohms min.	
E	F	50 meg. ohms min.	
E	H	50 meg. ohms min.	
E	J	50 meg. ohms min.	
E	K	50 meg. ohms min.	
E	L	50 meg. ohms min.	
E	M	50 meg. ohms min.	
E	Case	50 meg. ohms min.	
F	H	50 meg. ohms min.	
F	J	50 meg. ohms min.	
F	K	50 meg. ohms min.	
F	L	50 meg. ohms min.	
F	M	50 meg. ohms min.	
F	Case	50 meg. ohms min.	
G	A	50 meg. ohms min.	
G	B	50 meg. ohms min.	
G	C	50 meg. ohms min.	
G	D	50 meg. ohms min.	
G	E	50 meg. ohms min.	

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. — Q. C. ~~Eng.~~ TECH C. [illegible]
Elect. Tech. REO

Continued

From	To	Limit	Actual
B	K	50 meg. ohms min.	> 50 Meg
B	L	50 meg. ohms min.	
B	M	50 meg. ohms min.	
B	Case	50 meg. ohms min.	
C	E	50 meg. ohms min.	
C	H	50 meg. ohms min.	
C	J	50 meg. ohms min.	
C	K	50 meg. ohms min.	
C	L	50 meg. ohms min.	
C	M	50 meg. ohms min.	
C	Case	50 meg. ohms min.	
D	E	50 meg. ohms min.	
D	H	50 meg. ohms min.	
D	J	50 meg. ohms min.	
D	K	50 meg. ohms min.	
D	L	50 meg. ohms min.	
D	M	50 meg. ohms min.	
D	Case	50 meg. ohms min.	
E	F	50 meg. ohms min.	
E	H	50 meg. ohms min.	
E	J	50 meg. ohms min.	
E	K	50 meg. ohms min.	
E	L	50 meg. ohms min.	
E	M	50 meg. ohms min.	
E	Case	50 meg. ohms min.	
F	H	50 meg. ohms min.	
F	J	50 meg. ohms min.	
F	K	50 meg. ohms min.	
F	L	50 meg. ohms min.	
F	M	50 meg. ohms min.	
F	Case	50 meg. ohms min.	
G	A	50 meg. ohms min.	
G	B	50 meg. ohms min.	
G	C	50 meg. ohms min.	
G	D	50 meg. ohms min.	
G	E	50 meg. ohms min.	

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	007	Test Eng.	RMR
Mech. Tech.		Q. C. ~~Eng~~.	C. Alley
Elect. Tech.	RSO		

Continued

From	To	Limit	Actual
G	F	50 meg. ohms min.	>50 Meg
G	H	50 meg. ohms min.	
G	J	50 meg. ohms min.	
G	K	50 meg. ohms min.	
G	L	50 meg. ohms min.	
G	M	50 meg. ohms min.	
H	J	50 meg. ohms min.	
H	K	50 meg. ohms min.	
H	L	50 meg. ohms min.	
H	M	50 meg. ohms min.	
J	K	50 meg. ohms min.	
J	M	50 meg. ohms min.	
J	Case	50 meg. ohms min.	
K	L	50 meg. ohms min.	
K	Case	50 meg. ohms min.	
L	M	50 meg. ohms min.	
L	Case	50 meg. ohms min.	
M	Case	50 meg. ohms min.	

Accept ✓ Initial CBW
Reject Date 10/19/70

Comments:

Port "A" Open 500 Volts D. C. Pins From	To	Limit	Actual
B	E	50 meg. ohms min.	>50 Meg
B	A	50 meg. ohms min.	
C	D	50 meg. ohms min.	
C	F	50 meg. ohms min.	

Accept ✓ Initial CBW
Reject Date 10/19/70

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	008	Test Eng.	RMR
Mech. Tech.	——	Q. C. ~~Eng.~~ Tech	C Hy
Elect. Tech.	REO		

Continued

From	To	Limit	Actual
G	F	50 meg. ohms min.	> 50 meg
G	H	50 meg. ohms min.	
G	J	50 meg. ohms min.	
G	K	50 meg. ohms min.	
G	L	50 meg. ohms min.	
G	M	50 meg. ohms min.	
H	J	50 meg. ohms min.	
H	K	50 meg. ohms min.	
H	L	50 meg. ohms min.	
H	M	50 meg. ohms min.	
J	K	50 meg. ohms min.	
J	M	50 meg. ohms min.	
J	Case	50 meg. ohms min.	
K	L	50 meg. ohms min.	
K	Case	50 meg. ohms min.	
L	M	50 meg. ohms min.	
L	Case	50 meg. ohms min.	
M	Case	50 meg. ohms min.	

Accept ✓ Initial CBN
Reject Date 10/19/70

Comments:

Port "A" Open 500 Volts D. C. Pins From	To	Limit	Actual
B	E	50 meg. ohms min.	> 50 meg
B	A	50 meg. ohms min.	
C	D	50 meg. ohms min.	
C	F	50 meg. ohms min.	

Accept ✓ Initial CBN
Reject Date 10/19/70

Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. ——— Q. C. ~~Eng.~~ Tech C. Wy
Elect. Tech. REO

Port "B" Open 500 Volts D. C. Pins From	To	Limit	Actual
A	B	50 meg. ohms min.	>50 Meg
A	E	50 meg. ohms min.	
D	C	50 meg. ohms min.	
D	F	50 meg. ohms min.	

Accept ✓ Initial CBW
Reject Date 10/19/70

Comments: TOTAL CYCLES = 2124

Position Indicators After High and Low Temperature (Gaseous)

Covered by Circuit Resistance Test.

Minimum Operating Voltage, After High and Low Temperature (Gaseous)

Minimum Operating Voltage100 ms Pulse, Unpressurized	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initi
Port "A"	18 volts d.c. max.	16	16	16	✓		H
Port "B"	18 volts d.c. max.	17	16	16	✓		H

Date 10/20/70

Comments: TOTAL CYCLES = 2158

Minimum Operating Voltage 100ms Pulse 50 ± 5 psig, 100% Helium	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initi
Port "A"	18 volts d.c. max.	15	15	15	✓		H
Port "B"	18 volts d.c. max.	15	15.5	15			H

Date 10/20/70

Comments: TOTAL CYCLES = 2188

Serial No.	008	Test Eng.	RMR
Mech. Tech.	—	Q. C. ~~Eng.~~ Tech	C. Wly
Elect. Tech.	RSO		

Port "B" Open 500 Volts D. C. Pins From	To	Limit	Actual
A	B	50 meg. ohms min.	> 50 Meg
A	E	50 meg. ohms min.	
D	C	50 meg. ohms min.	
D	F	50 meg. ohms min.	

Accept ✓ Initial CBW
Reject Date 10/19/70

Comments: TOTAL CYCLES = 1867

Position Indicators After High and Low Temperature (Gaseous)

Covered by Circuit Resistance Test.

Minimum Operating Voltage, After High and Low Temperature (Gaseous)

Minimum Operating Voltage100 ms Pulse, Unpressurized	Allowable	Actual 1	2	3	O. K.	Reject	Ini
Port "A"	18 volts d.c. max.	15.5	15.5	15.0	✓		HF
Port "B"	18 volts d.c. max.	16.0	16.0	16.0	OK		WR

Date 20 OCT 70

Comments: TOTAL CYCLES = 1885

Minimum Operating Voltage 100ms Pulse 50 ± 5 psig, 100% Helium	Allowable	Actual 1	2	3	O. K.	Reject	Ini
Port "A"	18 volts d.c. max.	15.	15.5	15	✓		CB
Port "B"	18 volts d.c. max.	15.5	15.	15	✓		CB

Date 10/20/70

Comments: TOTAL CYCLES = 1907

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. — Q. C. ~~Eng.~~ TECH HPG
Elect. Tech. RED

Pulse Duration, After High and Low Temperature (Gaseous)

Minimum Pulse Duration, 28 Volts D.C. 100% Helium, 50 ± 5 psig	Allowable	Actual 1	2	3	O.K.	Reject	Initial
Port "A"	100 ms. max.	29	26	27	✓		HPG
Port "B"		27	27	26	✓		HPG

Date 10/20/70

Comments: TOTAL CYCLES = 2218

Minimum Pulse Duration, 28 Volts D.C. Zero Press	Allowable	Actual 1	2	3	O.K.	Reject	Initial
Port "A"	100 ms. max.	26	25	25	✓		HPG
Port "B"		29	28	28	✓		HPG

Date 10/20/70

Comments: TOTAL CYCLES = 2242

Power, After High and Low Temperature (Gaseous)

Power 28 Volts D.C. Steady State	Allowable	Actual A	Actual B	O.K.	Reject	Initial
Voltage	28 ± .5	28.0	28.0	✓		CBW
Current	1.14 amps	.99	.93	✓		CBW
Power	31.5 watts max.	27.72	26.04	✓		CBW

Date 10/19/70

Comments: TOTAL CYCLES = 2244

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. —— Q. C. ~~Eng.~~ Tech CBW
Elect. Tech. REO

Pulse Duration, After High and Low Temperature (Gaseous)

Minimum Pulse Duration, 28 Volts D. C. 100% Helium, 50 ± 5 psig	Allowable	Actual 1	2	3	O. K.	Reject	Initia
Port "A"	100 ms. max.	27	29	26	✓		CBW
Port "B"		26	28	26	✓		CBW

Date 10/20/70

Comments: TOTAL CYCLES = 1925

Minimum Pulse Duration, 28 Volts D. C. Zero Press	Allowable	Actual 1	2	3	O. K.	Reject	Initia
Port "A"	100 ms. max.	27.5	30	28	✓		CBW
Port "B"		29.5	29	28	✓		CBW

Date

Comments: TOTAL CYCLES = 1949

Power, After High and Low Temperature (Gaseous)

Power 28 Volts D. C. Steady State	Allowable	Actual A	B	O. K.	Reject	Initial
Voltage	28 ± .5	28.0	28.0	✓		CBW
Current	1.14 amps	1.07	1.06	✓		CBW
Power	31.5 watts max.	29.96	29.68	✓		CBW

Date 10/19/70

Comments: TOTAL CYCLES = 1951

Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 607 Test Eng. RMR
Mech. Tech. REO Q. C. Eng. H. F. Carpenito
Elect. Tech. REO

5.8.4. High Temperature, Liquid

Leakage, Valve at +100°F (Liquid)

Port A Methanol/Water	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 ccs	0.0	0.0	0.0	✓		HFC
10.0 ± 1.0 psig ΔP	0.20 ccs	0.0	0.0	0.0	✓		HFC
20.0 ± 2.0 psig ΔP	0.20 ccs	0.0	0.0	0.0	✓		HFC

Date 10/21/70

Comments: TOTAL CYCLES = 2253

Port B Methanol/Water	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 ccs	0.0	0.0	0.0	✓		HFC
10.0 ± 1.0 psig ΔP	0.20 ccs	0.0	0.0	0.016	✓		HFC
20.0 ± 2.0 psig ΔP	0.20 ccs	0.0	0.0	0.0	✓		HFC

Date 10/21/70

Comments: TOTAL CYCLES = 2265

Circuit Resistance, Valve at +100°F (Liquid)

Port "A" Open Pins From	To	Limit	Actual 1	2	3
A	E	0.5 ohms max.	0.2	0.2	0.4
D	F	0.5 ohms max.	0.3	0.3	0.4
H	Case	0.5 ohms max.	0.4	0.3	0.4
L	J	———	29.3	27.3	27.4
B	E	Open Circuit	OPEN	OPEN	OPEN
C	F	Open Circuit	OPEN	OPEN	OPEN

Accept ✓ Initial H.F.C.
Reject Date 10/21/70

Test Data Sheet

Pulse Operated Flow Diverter Valve

Specification 20M42517

Serial No. 008 Test Eng. RMR

Mech. Tech. REO Q. C. Eng. H. F. Carpenito

Elect. Tech. REO

5.8.4. High Temperature, Liquid

Leakage, Valve at +100°F (Liquid)

Port A Methanol/Water	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 ccs	0.0	0.0	0.0	✓		HFC
10.0 ± 1.0 psig ΔP	0.20 ccs	0.0	0.0	0.0	✓		HFC
20.0 ± 2.0 psig ΔP	0.20 ccs	0.0	0.0	0.0	✓		HFC

Date 10/21/70

Comments: TOTAL CYCLES = 1963

Port B Methanol/Water	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 ccs	0.0	0.0	0.0	✓		HFC
10.0 ± 1.0 psig ΔP	0.20 ccs	0.0	0.0	0.0	✓		HFC
20.0 ± 2.0 psig ΔP	0.20 ccs	0.0	0.0	0.0	✓		HFC

Date 10/21/70

Comments: TOTAL CYCLES = 1972

Circuit Resistance, Valve at +100°F (Liquid)

Port "A" Open Pins From	To	Limit	Actual 1	2	3
A	E	0.5 ohms max.	0.4	0.4	0.4
D	F	0.5 ohms max.	0.4	0.4	0.4
H	Case	0.5 ohms max.	0.2	0.3	0.4
L	J	———	26.9	26.9	26.9
B	E	Open Circuit	OPEN	OPEN	OPEN
C	F	Open Circuit	OPEN	OPEN	OPEN

Accept ✓ Initial H. F. C.

Reject Date 10/21/70

Test Data Sheet

Pulse Operated Flow Diverter Valve

Specification 20M42517

Serial No. 007 Test Eng. RMR

Mech. Tech. — Q. C. Eng. H. F. Carpenito

Elect. Tech. REO

Port "B" Open Pins From	To	Limit	Actual 1	Actual 2	Actual 3
A	E	Open Circuit	open	open	open
D	F	Open Circuit	open	open	open
H	Case	0.5 ohms max.	0.4	0.4	0.3
M	K	———	29.4	29.4	29.3
B	E	0.5 ohms max.	0.4	0.4	0.4
C	F	0.5 ohms max.	0.4	0.4	0.3

Accept ✓ Initial H. F. C.

Reject Date 10/21/70

Comments: TOTAL CYCLES = 2272

Insulation Resistance, Valve at +100°F (Liquid)

500 Volts D. C. Pins From	To	Limit	Actual
A	C	50 meg. ohms min.	>50 Meg
A	D	50 meg. ohms min.	
A	F	50 meg. ohms min.	
A	H	50 meg. ohms min.	
A	J	50 meg. ohms min.	
A	L	50 meg. ohms min.	
A	M	50 meg. ohms min.	
A	Case	50 meg. ohms min.	
B	C	50 meg. ohms min.	
B	D	50 meg. ohms min.	
B	F	50 meg. ohms min.	
B	A	50 meg. ohms min.	
B	J	50 meg. ohms min.	>50 Meg

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. — Q. C. Eng. H. F. Carpenito
Elect. Tech. PEO

Port "B" Open Pins		Limit	Actual		
			1	2	3
From	To				
A	E	Open Circuit	open	open	open
D	F	Open Circuit	open	open	open
H	Case	0.5 ohms max.	0.3	0.3	0.3
M	K	———	26.9	26.9	26.9
B	E	0.5 ohms max.	0.4	0.4	0.4
C	F	0.5 ohms max.	0.4	0.4	0.4

Accept ✓ Initial O.H.C.
Reject Date 10/21/70

Comments: TOTAL CYCLES = 1979

Insulation Resistance, Valve at +100°F (Liquid)

500 Volts D. C. Pins			
From	To	Limit	Actual
A	C	50 meg. ohms min.	> 50 meg
A	D	50 meg. ohms min.	
A	F	50 meg. ohms min.	
A	H	50 meg. ohms min.	
A	J	50 meg. ohms min.	
A	L	50 meg. ohms min.	
A	M	50 meg. ohms min.	
A	Case	50 meg. ohms min.	
B	C	50 meg. ohms min.	
B	D	50 meg. ohms min.	
B	F	50 meg. ohms min.	
B	A	50 meg. ohms min.	
B	J	50 meg. ohms min.	> 50 meg

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. —— Q. C. Eng. H. F. Carpenito
Elect. Tech. RSO

Continued

From	To	Limit	Actual
B	K	50 meg. ohms min.	> 50 MEG
B	L	50 meg. ohms min.	
B	M	50 meg. ohms min.	
B	Case	50 meg. ohms min.	
C	E	50 meg. ohms min.	
C	H	50 meg. ohms min.	
C	J	50 meg. ohms min.	
C	K	50 meg. ohms min.	
C	L	50 meg. ohms min.	
C	M	50 meg. ohms min.	
C	Case	50 meg. ohms min.	
D	E	50 meg. ohms min.	
D	H	50 meg. ohms min.	
D	J	50 meg. ohms min.	
D	K	50 meg. ohms min.	
D	L	50 meg. ohms min.	
D	M	50 meg. ohms min.	
D	Case	50 meg. ohms min.	
E	F	50 meg. ohms min.	
E	H	50 meg. ohms min.	
E	J	50 meg. ohms min.	
E	K	50 meg. ohms min.	
E	L	50 meg. ohms min.	
E	M	50 meg. ohms min.	
E	Case	50 meg. ohms min.	
F	H	50 meg. ohms min.	
F	J	50 meg. ohms min.	
F	K	50 meg. ohms min.	
F	L	50 meg. ohms min.	
F	M	50 meg. ohms min.	
F	Case	50 meg. ohms min.	
G	A	50 meg. ohms min.	
G	B	50 meg. ohms min.	
G	C	50 meg. ohms min.	
G	D	50 meg. ohms min.	
G	E	50 meg. ohms min.	> 50 MEG

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. — Q. C. Eng. H.F. Carpenter
Elect. Tech. REO

Continued

From	To	Limit	Actual
B	K	50 meg. ohms min.	>50 meg.
B	L	50 meg. ohms min.	
B	M	50 meg. ohms min.	
B	Case	50 meg. ohms min.	
C	E	50 meg. ohms min.	
C	H	50 meg. ohms min.	
C	J	50 meg. ohms min.	
C	K	50 meg. ohms min.	
C	L	50 meg. ohms min.	
C	M	50 meg. ohms min.	
C	Case	50 meg. ohms min.	
D	E	50 meg. ohms min.	
D	H	50 meg. ohms min.	
D	J	50 meg. ohms min.	
D	K	50 meg. ohms min.	
D	L	50 meg. ohms min.	
D	M	50 meg. ohms min.	
D	Case	50 meg. ohms min.	
E	F	50 meg. ohms min.	
E	H	50 meg. ohms min.	
E	J	50 meg. ohms min.	
E	K	50 meg. ohms min.	
E	L	50 meg. ohms min.	
E	M	50 meg. ohms min.	
E	Case	50 meg. ohms min.	
F	H	50 meg. ohms min.	
F	J	50 meg. ohms min.	
F	K	50 meg. ohms min.	
F	L	50 meg. ohms min.	
F	M	50 meg. ohms min.	
F	Case	50 meg. ohms min.	
G	A	50 meg. ohms min.	
G	B	50 meg. ohms min.	
G	C	50 meg. ohms min.	
G	D	50 meg. ohms min.	
G	E	50 meg. ohms min.	>50 meg.

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	007	Test Eng.	RMR
Mech. Tech.	—	Q. C. Eng.	H.F. Carpenter
Elect. Tech.	REO		

Continued

From	To	Limit	Actual
G	F	50 meg. ohms min.	>50 meg
G	H	50 meg. ohms min.	
G	J	50 meg. ohms min.	
G	K	50 meg. ohms min.	
G	L	50 meg. ohms min.	
G	M	50 meg. ohms min.	
H	J	50 meg. ohms min.	
H	K	50 meg. ohms min.	
H	L	50 meg. ohms min.	
H	M	50 meg. ohms min.	
J	K	50 meg. ohms min.	
J	M	50 meg. ohms min.	
J	Case	50 meg. ohms min.	
K	L	50 meg. ohms min.	
K	Case	50 meg. ohms min.	
L	M	50 meg. ohms min.	
L	Case	50 meg. ohms min.	
M	Case	50 meg. ohms min.	>50 meg

Accept ✓ Initial N.G.C.
Reject Date 10/21/70

Comments:

Port "A" Open 500 Volts D. C. Pins			
From	To	Limit	Actual
B	E	50 meg. ohms min.	>50 meg
B	A	50 meg. ohms min.	
C	D	50 meg. ohms min.	
C	F	50 meg. ohms min.	>50 meg

Accept ✓ Initial N.G.C.
Reject Date 10/21/70

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. Q. C. Eng. H. F. CARPENITO
Elect. Tech. REO

Continued

From	To	Limit	Actual
G	F	50 meg. ohms min.	> 50 meg
G	H	50 meg. ohms min.	
G	J	50 meg. ohms min.	
G	K	50 meg. ohms min.	
G	L	50 meg. ohms min.	
G	M	50 meg. ohms min.	
H	J	50 meg. ohms min.	
H	K	50 meg. ohms min.	
H	L	50 meg. ohms min.	
H	M	50 meg. ohms min.	> 50 meg
J	K	50 meg. ohms min.	60 meg Ω
J	M	50 meg. ohms min.	80 meg
J	Case	50 meg. ohms min.	60 meg
K	L	50 meg. ohms min.	> 50 meg
K	Case	50 meg. ohms min.	> 50 meg
L	M	50 meg. ohms min.	70 meg
L	Case	50 meg. ohms min.	> 50 meg
M	Case	50 meg. ohms min.	> 50 meg

Accept ✓ Initial H.F.C.
Reject Date 10/21/70

Comments:

Port "A" Open 500 Volts D. C. Pins			
From	To	Limit	Actual
B	E	50 meg. ohms min.	> 50 meg
B	A	50 meg. ohms min.	
C	D	50 meg. ohms min.	
C	F	50 meg. ohms min.	> 50 meg

Accept ✓ Initial H.F.C.
Reject Date 10/21/70

D-114

Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. — Q. C. Eng. H. F. Carpenter
Elect. Tech. RED

Port "B" Open 500 Volts D. C. Pins From	To	Limit	Actual
A	B	50 meg. ohms min.	> 50 MEG
A	E	50 meg. ohms min.	
D	C	50 meg. ohms min.	
D	F	50 meg. ohms min.	> 50 MEG

Accept ✓ Initial H.F.C.
Reject Date 10/21/70

Comments: TOTAL CYCLES = 2273

Position Indicators, Valve at +100°F (Liquid)

Covered by Circuit Resistance Test.

Minimum Voltage, Valve at +100°F (Liquid)

Minimum Operating Voltage100 ms Pulse, Unpressurized	Allowable	Actual 1	2	3	O. K.	Reject	Initi
Port "A"	18 volts d.c. max.	17	17	16	✓		HC
Port "B"	18 volts d.c. max.	18	17.5	18	✓		HC

Date 10/22/70

Comments: TOTAL CYCLES - 2301

Minimum Operating Voltage 100ms Pulse 50 ± 5 psig, 100% Helium	Allowable	Actual 1	2	3	O. K.	Reject	Initi
Port "A"	18 volts d.c. max.	16.5	16.5	16.5	✓		HP
Port "B"	18 volts d.c. max.	17.5	17.5	17.5	✓		HP

Date 10/22/70

Comments: TOTAL CYCLES = 2325

Serial No.	008	Test Eng.	RMR
Mech. Tech.	—	Q. C. Eng.	H.F. Carpenito
Elect. Tech.	RED		

Port "B" Open 500 Volts D. C. Pins From	To	Limit	Actual
A	B	50 meg. ohms min.	>50 meg
A	E	50 meg. ohms min.	
D	C	50 meg. ohms min.	
D	F	50 meg. ohms min.	>50 meg

Accept ✓ Initial H.F.C.
Reject Date 10/21/70

Comments: TOTAL CYCLES = 1981

Position Indicators, Valve at +100°F (Liquid)

Covered by Circuit Resistance Test.

Minimum Voltage, Valve at +100°F (Liquid)

Minimum Operating Voltage100 ms Pulse, Unpressurized	Allowable	Actual 1	2	3	O. K.	Reject	Initi
Port "A"	18 volts d.c. max.	17.5	17.5	17.0	✓		HFC
Port "B"	18 volts d.c. max.	17.5	17.5	17.9	✓		HFC

Date 10/22/70

Comments: TOTAL CYCLES = 2011

Minimum Operating Voltage 10Cms Pulse 50 ± 5 psig, 100% Helium	Allowable	Actual 1	2	3	O. K.	Reject	Initi
Port "A"	18 volts d.c. max.	17.5	17.5	17.9	✓		HFC
Port "B"	18 volts d.c. max.	17.5	17.5	17.5	✓		HFC

Date 10/22/70

Comments: TOTAL CYCLES = 2040

D116

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. —— Q. C. ~~Eng.~~ HFG / HFR
Elect. Tech. REO TECH

Pulse Duration, Valve at +100°F (Liquid)

Minimum Pulse Duration, 28 Volts D. C. 100% Helium, 50 ± 5 psig	Allowable	Actual 1	2	3	O.K.	Reject	Initial
Port "A"	100 ms. max.	29	29	29	✓		HFG
Port "B"		34	34	34	✓		HFG

Photo Taken Date 10/22/70

Comments: TOTAL CYCLES = 2345

Minimum Pulse Duration, 28 Volts D. C. Zero Press	Allowable	Actual 1	2	3	O.K.	Reject	Initial
Port "A"	100 ms. max.	27	27	26.5	✓		HFG
Port "B"		28	28	28	✓		HFG

Photo Taken Date 10/22/70

Comments: TOTAL CYCLES = 2367

Power, Valve at +100°F (Liquid)

Power 28 Volts D. C. Steady State	Allowable	Actual A	Actual B	O.K.	Reject	Initial
Voltage	28 ± .5	28.0	28.0	✓		D.S.C.
Current	1.14 amps	0.94	0.93	✓		D.S.C.
Power	31.5 watts max.	26.4	26.4	✓		D.S.C.

Date 10/21/70

Comments: TOTAL CYCLES = 2368

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. -- Q. C. ~~Eng.~~ Tech HFG/HFC
Elect. Tech. REO

Pulse Duration, Valve at +100°F (Liquid)

Minimum Pulse Duration, 28 Volts D.C. 100% Helium, 50 ± 5 psig	Allowable	Actual 1	2	3	O.K.	Reject	Initia
Port "A"	100 ms. max.	30	32	30	✓		H24
Port "B"		32	33	33	✓		H24

Photo Taken ✓
Date 10/22/70

Comments: TOTAL CYCLES = 2064

Minimum Pulse Duration, 28 Volts D.C. Zero Press	Allowable	Actual 1	2	3	O.K.	Reject	Initial
Port "A"	100 ms. max.	31	28	29	✓		H24
Port "B"		32	33	34	✓		H24

Photo Taken ✓
Date 10/22/70

Comments: TOTAL CYCLES = 2090

Power, Valve at +100°F (Liquid)

Power 28 Volts D.C. Steady State	Allowable	Actual A	B	O.K.	Reject	Initial
Voltage	28 ± .5	28.0	28.0	✓		H.F.C.
Current	1.14 amps	1.03	1.03	✓		H.F.C.
Power	31.5 watts max.	28.5	28.5	✓		H.F.C.

Date 10/21/70

Comments: TOTAL CYCLES = 2091

Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	007	Test Eng.	EMR
Mech. Tech.	RED	Q. C. ~~Eng.~~ Tech	C [illegible]
Elect. Tech.	RED		

5.8.5 Low Temperature Liquid

Leakage, Valve at -65°F (Liquid)

Port A Methanol/Water	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 ccs	0	0	0	✓		CBW
10.0 ± 1.0 psig ΔP	0.20 ccs	0	0	0	✓		CBW
20.0 ± 2.0 psig ΔP	0.20 ccs	0	0	0	✓		CBW

Date 10/26/70

Comments: TOTAL CYCLES = 2377

Port B Methanol/Water	Allowable	Actual 1	Actual 2	Actual 3	O.K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 ccs	0	0	0	✓		CBW
10.0 ± 1.0psig ΔP	0.20 ccs	0	0	0	✓		CBW
20.0 ± 2.0 psig ΔP	0.20 ccs	0	0	0	✓		CBW

Date 10/26/70

Comments: TOTAL CYCLES = 2385

Circuit Resistance, Valve at -65°F (Liquid)

Port "A" Open Pins From	To	Limit	Actual 1	Actual 2	Actual 3
A	E	0.5 ohms max.	0.0	0.0	0.0
D	F	0.5 ohms max.	0.0	0.0	0.0
H	Case	0.5 ohms max.	0.0	0.0	0.0
L	J	17.2 ohms min.	19.6	19.6	19.6
B	E	Open Circuit	INF	INF	INF
C	F	Open Circuit	INF	INF	INF

Accept ✓ Initial CBW
Reject Date 10/27/70

Serial No.	008	Test Eng.	RMR
Mech. Tech.	RDD	Q. C. Eng.	C. Way
Elect. Tech.	RSO		

5.8.5 Low Temperature Liquid

Leakage, Valve at -65°F (Liquid)

Port A Methanol/Water	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initial
							CBW
5.0 ± .5 psig ΔP	0.20 ccs	0	0	0	✓		CBW
10.0 ± 1.0 psig ΔP	0.20 ccs	0	0	0	✓		CBW
20.0 ± 2.0 psig ΔP	0.20 ccs	0	0	0	✓		CBW

Date 10/27/70

Comments: TOTAL CYCLES = 2101

Port B Methanol/Water	Allowable	Actual 1	Actual 2	Actual 3	O.K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 ccs	0	0	0	✓		CBW
10.0 ± 1.0psig ΔP	0.20 ccs	0	0	0	✓		CBW
20.0 ± 2.0psig ΔP	0.20 ccs	0	0	0	✓		CBW

Date 10/27/70

Comments: TOTAL CYCLES = 2111

Circuit Resistance, Valve at -65°F (Liquid)

Port "A" Open Pins From	To	Limit	Actual 1	Actual 2	Actual 3
A	E	0.5 ohms max.	0	.1	.1
D	F	0.5 ohms max.	0	.1	.1
H	Case	0.5 ohms max.	0	0	0
L	J	17.2 ohms min.	18.2	18.3	18.4
B	E	Open Circuit	INF	INF	INF
C	F	Open Circuit	INF	INF	INF

Accept ✓ Initial CBW

Reject Date 10/26/70

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. — Q. C. ~~Eng.~~ TECH CBW
Elect. Tech. REO

Port "B" Open Pins		Limit	Actual		
			1	2	3
From	To				
A	E	Open Circuit	INF	INF	INF
D	F	Open Circuit	INF	INF	INF
H	Case	0.5 ohms max.	0.0	0	0
M	K	17.2 ohms min.	19.6	19.6	19.6
B	E	0.5 ohms max.	0.0	0	0
C	F	0.5 ohms max.	0.0	0	0

Accept ✓ Initial ~~to~~ CBW
Reject Date 10/27/70

Comments: TOTAL CYCLES = 2387

Insulation Resistance, Valve at -65°F (Liquid)

500 Volts D. C. Pins From	To	Limit	Actual
A	C	50 meg. ohms min.	>50 MEG
A	D	50 meg. ohms min.	
A	F	50 meg. ohms min.	
A	H	50 meg. ohms min.	
A	J	50 meg. ohms min.	
A	L	50 meg. ohms min.	
A	M	50 meg. ohms min.	
A	Case	50 meg. ohms min.	
B	C	50 meg. ohms min.	
B	D	50 meg. ohms min.	
B	F	50 meg. ohms min.	
B	A	50 meg. ohms min.	
B	J	50 meg. ohms min.	

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. Q. C. ~~Eng.~~ CEW
Elect. Tech. REO TECH

Port "B" Open Pins		Limit	Actual		
			1	2	3
From	To				
A	E	Open Circuit	INF	INF	INF
D	F	Open Circuit	INF	INF	INF
H	Case	0.5 ohms max.	.1	.4	.3
M	K	17.2 ohms min.	18.7	18.5	19.1
B	E	0.5 ohms max.	.1	.3	.4
C	F	0.5 ohms max.	.2	.2	.4

Accept ✓ Initial CEW
Reject Date 10/26/

Comments: TOTAL CYCLES = 2114

Insulation Resistance, Valve at -65°F (Liquid)

500 Volts D. C. Pins			
From	To	Limit	Actual
A	C	50 meg. ohms min.	> 50 MEG
A	D	50 meg. ohms min.	
A	F	50 meg. ohms min.	
A	H	50 meg. ohms min.	
A	J	50 meg. ohms min.	
A	L	50 meg. ohms min.	
A	M	50 meg. ohms min.	
A	Case	50 meg. ohms min.	
B	C	50 meg. ohms min.	
B	D	50 meg. ohms min.	
B	F	50 meg. ohms min.	
B	A	50 meg. ohms min.	
B	J	50 meg. ohms min.	

Test Data Sheet

Pulse Operated Flow Diverter Valve

Specification 20M42517

Serial No. 007 Test Eng. RMR

Mech. Tech. ______ Q. C. ~~Eng.~~ Tech C. [illegible]

Elect. Tech. REO

Continued

From	To	Limit	Actual
B	K	50 meg. ohms min.	>50 MEG
B	L	50 meg. ohms min.	
B	M	50 meg. ohms min.	
B	Case	50 meg. ohms min.	
C	E	50 meg. ohms min.	
C	H	50 meg. ohms min.	
C	J	50 meg. ohms min.	
C	K	50 meg. ohms min.	
C	L	50 meg. ohms min.	
C	M	50 meg. ohms min.	
C	Case	50 meg. ohms min.	
D	E	50 meg. ohms min.	
D	H	50 meg. ohms min.	
D	J	50 meg. ohms min.	
D	K	50 meg. ohms min.	
D	L	50 meg. ohms min.	
D	M	50 meg. ohms min.	
D	Case	50 meg. ohms min.	
E	F	50 meg. ohms min.	
E	H	50 meg. ohms min.	
E	J	50 meg. ohms min.	
E	K	50 meg. ohms min.	
E	L	50 meg. ohms min.	
E	M	50 meg. ohms min.	
E	Case	50 meg. ohms min.	
F	H	50 meg. ohms min.	
F	J	50 meg. ohms min.	
F	K	50 meg. ohms min.	
F	L	50 meg. ohms min.	
F	M	50 meg. ohms min.	
F	Case	50 meg. ohms min.	
G	A	50 meg. ohms min.	
G	B	50 meg. ohms min.	
G	C	50 meg. ohms min.	
G	D	50 meg. ohms min.	
G	E	50 meg. ohms min.	

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. — Q. C. ~~Eng.~~ TECH CBW
Elect. Tech. REO

Continued

From	To	Limit	Actual
B	K	50 meg. ohms min.	>50 MEG
B	L	50 meg. ohms min.	
B	M	50 meg. ohms min.	
B	Case	50 meg. ohms min.	
C	E	50 meg. ohms min.	
C	H	50 meg. ohms min.	
C	J	50 meg. ohms min.	
C	K	50 meg. ohms min.	
C	L	50 meg. ohms min.	
C	M	50 meg. ohms min.	
C	Case	50 meg. ohms min.	
D	E	50 meg. ohms min.	
D	H	50 meg. ohms min.	
D	J	50 meg. ohms min.	
D	K	50 meg. ohms min.	
D	L	50 meg. ohms min.	
D	M	50 meg. ohms min.	
D	Case	50 meg. ohms min.	
E	F	50 meg. ohms min.	
E	H	50 meg. ohms min.	
E	J	50 meg. ohms min.	
E	K	50 meg. ohms min.	
E	L	50 meg. ohms min.	
E	M	50 meg. ohms min.	
E	Case	50 meg. ohms min.	
F	H	50 meg. ohms min.	
F	J	50 meg. ohms min.	
F	K	50 meg. ohms min.	
F	L	50 meg. ohms min.	
F	M	50 meg. ohms min.	
F	Case	50 meg. ohms min.	
G	A	50 meg. ohms min.	
G	B	50 meg. ohms min.	
G	C	50 meg. ohms min.	
G	D	50 meg. ohms min.	
G	E	50 meg. ohms min.	

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. ✓ Q. C. Eng. CB
Elect. Tech. REO

Continued

From	To	Limit	Actual
G	F	50 meg. ohms min.	>750 Meg
G	H	50 meg. ohms min.	
G	J	50 meg. ohms min.	
G	K	50 meg. ohms min.	
G	L	50 meg. ohms min.	
G	M	50 meg. ohms min.	
H	J	50 meg. ohms min.	
H	K	50 meg. ohms min.	
H	L	50 meg. ohms min.	
H	M	50 meg. ohms min.	
J	K	50 meg. ohms min.	
J	M	50 meg. ohms min.	
J	Case	50 meg. ohms min.	
K	L	50 meg. ohms min.	
K	Case	50 meg. ohms min.	
L	M	50 meg. ohms min.	
L	Case	50 meg. ohms min.	
M	Case	50 meg. ohms min.	

Accept ✓ Initial CBW
Reject Date 10/27/70

Comments:

Port "A" Open 500 Volts D. C. Pins From	To	Limit	Actual
B	E	50 meg. ohms min.	>750 MEG
B	A	50 meg. ohms min.	
C	D	50 meg. ohms min.	
C	F	50 meg. ohms min.	

Accept ✓ Initial CBW
Reject Date 10/27/70

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. — Q. C. ~~Eng.~~ CBW
Elect. Tech. REO Tech

Continued

From	To	Limit	Actual
G	F	50 meg. ohms min.	>50 MEG
G	H	50 meg. ohms min.	
G	J	50 meg. ohms min.	
G	K	50 meg. ohms min.	
G	L	50 meg. ohms min.	
G	M	50 meg. ohms min.	
H	J	50 meg. ohms min.	
H	K	50 meg. ohms min.	
H	L	50 meg. ohms min.	
H	M	50 meg. ohms min.	
J	K	50 meg. ohms min.	
J	M	50 meg. ohms min.	
J	Case	50 meg. ohms min.	
K	L	50 meg. ohms min.	
K	Case	50 meg. ohms min.	
L	M	50 meg. ohms min.	
L	Case	50 meg. ohms min.	
M	Case	50 meg. ohms min.	

Accept ✓ Initial CBW
Reject Date 10/26/70

Comments:

Port "A" Open 500 Volts D. C. Pins From	To	Limit	Actual
B	E	50 meg. ohms min.	>50 MEG
B	A	50 meg. ohms min.	
C	D	50 meg. ohms min.	
C	F	50 meg. ohms min.	

Accept ✓ Initial CBW
Reject Date 10/26/70

D-126

Serial No. 007 Test Eng. RMR
Mech. Tech. — Q. C. ~~Eng.~~ Tech Cilley
Elect. Tech. REO

Port "B" Open 500 Volts D. C. Pins From	To	Limit	Actual
A	B	50 meg. ohms min.	>50 MEG
A	E	50 meg. ohms min.	
D	C	50 meg. ohms min.	
D	F	50 meg. ohms min.	

Accept ✓ Initial CBW
Reject Date 10/27/70

Comments: TOTAL CYCLES = 2388

Position Indicators, Valve at -65°F (Liquid)

Covered by Circuit Resistance Test.

Minimum Voltage, Valve at -65°F (Liquid)

Minimum Operating Voltage100 ms Pulse, Unpressurized	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Init
Port "A"	18 volts d.c. max.	15	12	13	✓		CBW
Port "B"	18 volts d.c. max.	14	13	13	✓		CBW

A.F. TPC 10/23

Date 10/23/70

Comments: TOTAL CYCLES = 2412

Minimum Operating Voltage100 ms Pulse 50 ± 5 psig, 100% Helium	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Init
Port "A"	18 volts d.c. max.	13	12	12	✓		CBW
Port "B"	18 volts d.c. max.	13.5	14	14	✓		CBW

A.F. TPC 10/23

Date 10/23/70

Comments: TOTAL CYCLES = 2437

Serial No.	008	Test Eng.	RMR
Mech. Tech.		Q. C. ~~Eng.~~ Tech	C. Wy
Elect. Tech.	REO		

Port "B" Open 500 Volts D. C. Pins From	To	Limit	Actual
A	B	50 meg. ohms min.	750 MEG
A	E	50 meg. ohms min.	
D	C	50 meg. ohms min.	
D	F	50 meg. ohms min.	

Accept ✓ Initial CBW

Reject Date 10/26/70

Comments: TOTAL CYCLES = 2115

Position Indicators, Valve at -65°F (Liquid)

Covered by Circuit Resistance Test.

Minimum Voltage, Valve at -65°F (Liquid)

Minimum Operating Voltage100 ms Pulse, Unpressurized	Allowable	Actual 1	2	3	O. K.	Reject	Init
Port "A"	18 volts d.c. max.	12	11	11	✓		CBW
Port "B"	18 volts d.c. max.	11	12	11	✓		CBW

Date 10/23/70

Comments: TOTAL CYCLES = 2141

Minimum Operating Voltage100 ms Pulse 50 ± 5 psig, 100% Helium	Allowable	Actual 1	2	3	O. K.	Reject	Initi
Port "A"	18 volts d.c. max.	12.5	12	12.5	✓		CBW
Port "B"	18 volts d.c. max.	12	13	12	✓		CBW

Date 10/23/70

Comments: TOTAL CYCLES = 2161

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. — Q. C. ~~Eng.~~ Tech CBW
Elect. Tech. REO

Pulse Duration, Valve at -65°F (Liquid)

Minimum Pulse Duration, 28 Volts D.C. 100% Helium, 50 ± 5 psig	Allowable	Actual 1	2	3	O.K.	Reject	Initial
Port "A"	100 ms. max.	32	31	31	✓		CBW
Port "B"		37	37	37	✓		CBW

A.F. TPC 10/27

Date 10/23/70

Comments: TOTAL CYCLES = 2460

Minimum Pulse Duration, 28 Volts D.C. Zero Press	Allowable	Actual 1	2	3	O.K.	Reject	Initial
Port "A"	100 ms. max.	30	29	27	✓		CBW
Port "B"		27	27	27	✓		CBW

A.F. TPC 10/27

Date 10/23/70

Comments: TOTAL CYCLES = 2480

Power, Valve at -65°F (Liquid)

Power 28 Volts D.C. Steady State	Allowable	Actual A	Actual B	O.K.	Reject	Initial
Voltage	28 ± .5	27.8	27.8	✓		CBW
Current	1.61 amps max.	1.35	1.33	✓		CBW
Power	45.0 watts max.	37.5	36.9	✓		CBW

Date 10/27/70

Comments: TOTAL CYCLES = 2481

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. — Q. C. ~~Eng.~~ Tech C. Wy
Elect. Tech. REO

Pulse Duration, Valve at -65°F (Liquid)

Minimum Pulse Duration, 28 Volts D. C. 100% Helium, 50 ± 5 psig	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initial
Port "A"	100 ms. max.	32	31	30	✓		CBW
Port "B"		31	33	31	✓		CBW

Date 10/23/70

Comments: TOTAL CYCLES = 2187

Minimum Pulse Duration, 28 Volts D. C. Zero Press	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initial
Port "A"	100 ms. max.	27	28	26	✓		CBW.
Port "B"		26	28	28	✓		CBW

Date 10/23/70

Comments: TOTAL CYCLES = 2227

Power, Valve at -65°F (Liquid)

Power 28 Volts D. C. Steady State	Allowable	Actual A	Actual B	O. K.	Reject	Initial
Voltage	28 ± .5	28.0	28.0	✓		CBW
Current	1.61 amps max.	1.45	1.43	✓		CBW
Power	45.0watts max.	40.6	40.3	✓		CBW

Date 10/26/70

Comments:

TOTAL CYCLES = 2228

Serial No. 007 Test Eng. RMR
Mech. Tech. REO Q. C. ~~Eng.~~ TECH HPG
Elect. Tech. REO

5.8.6 After High and Low Temperature, Liquid

Leakage, After High and Low Temperature, Liquid

100% helium @ 50 ± 5 pgg	Allowable	Actual	O. K.	Reject	Initi
Internal Press	1.6×10^{-6} sccs	1.69×10^{-7}	✓		HPG

Date

Comments: STD LEAK RATE = 1.3×10^{-8}
STD LEAK READING = 2.6 VALVE LEAK READING = 34.0
TOTAL CYCLES = 2485

Port A Methanol/Water	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 sccs	.001	.005	.003	✓		HPG
10.0 ± 1.0 psig ΔP	0.20 sccs	.001	.01	.003	✓		HPG
20.0 ± 2.0 psig ΔP	0.20 sccs	.001	.02	.006	✓		HPG

Date 10-29-70

Port B Methanol/Water	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 sccs	0	0	0	✓		HPG
10.0 ± 1.0 psig ΔP	0.20 sccs	0	0	0	✓		HPG
20.0 ± 2.0 psig ΔP	0.20 sccs	0	0	0	✓		HPG

Date 10-29-70

Comments: TOTAL CYCLES = 2507

Serial No.	008	Test Eng.	RMR
Mech. Tech.	REO	Q. C. ~~Eng.~~ Tech	APG
Elect. Tech.	REO		

5.8.6 After High and Low Temperature, Liquid

Leakage, After High and Low Temperature, Liquid

100% helium @ 50 ± 5 pgg Internal Press	Allowable	Actual	O. K.	Reject	Initia
	1.6x10^{-6} sccs	5.5x10^{-9}	✓		HPG

Date ______

Comments: STANDARD LEAK RATE = 1.3X10^{-8}
STANDARD LEAK READING = 2.6 VALVE LEAK READING =
TOTAL CYCLES = 2231

Port A Methanol/Water	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 sccs	0	0	0	✓		HPG
10.0 ± 1.0 psig ΔP	0.20 sccs	0	0	0	✓		HPG
20.0 ± 2.0 psig ΔP	0.20 sccs	0	0	0	✓		HPG

Date 10-29-70

Port B Methanol/Water	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 sccs	0	0	0	✓		HPG
10.0 ± 1.0 psig ΔP	0.20 sccs	0	0	0	✓		HPG
20.0 ± 2.0 psig ΔP	0.20 sccs	0	0	0	✓		HPG

Date 10-29-70

Comments: TOTAL CYCLES = 2250

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. — Q. C. ~~Eng.~~ HG
Elect. Tech. RSO TECH

Circuit Resistance After High and Low Temperature, Liquid

Port "A" Open Pins From	To	Limit	Actual 1	2	3
A	E	0.5 ohms max.	0.1	0.1	0.1
D	F	0.5 ohms max.	0.1	0.1	0.1
H	Case	0.5 ohms max.	0.1	0	0
L	J	25-29 ohms	27.9	27.9	27.8
B	E	Open Circuit	OPEN	OPEN	OPEN
C	F	Open Circuit	OPEN	OPEN	OPEN

Accept ✓ Initial HG
Reject Date 10-29-70

Port "B" Open Pins From	To	Limit	Actual 1	2	3
A	E	Open Circuit	OPEN	OPEN	OPEN
D	F	Open Circuit	OPEN	OPEN	OPEN
H	Case	0.5 ohms max.	0	0	0
M	K	25-29 ohms	27.9	27.2	27.2
B	E	0.5 ohms max.	0.1	0.1	0.1
C	F	0.5 ohms max.	0.1	0.1	0.1

Accept ✓ Initial HG
Reject Date 10-29-70

Comments: TOTAL CYCLES = 2515

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. — Q. C. ~~Eng.~~ TECH HPG
Elect. Tech. REO

Circuit Resistance After High and Low Temperature, Liquid

Port "A" Open Pins From	To	Limit	Actual 1	2	3
A	E	0.5 ohms max.	0.1	0.1	0.0
D	F	0.5 ohms max.	0.0	0.1	0.0
H	Case	0.5 ohms max.	0.0	0.0	0.0
L	J	25-29 ohms	25.3	25.4	25.1
B	E	Open Circuit	OPEN	OPEN	OPEN
C	F	Open Circuit	OPEN	OPEN	OPEN

Accept ✓ Initial HPG
Reject Date 10-29-70

Port "B" Open Pins From	To	Limit	Actual 1	2	3
A	E	Open Circuit	OPEN	OPEN	OPEN
D	F	Open Circuit	OPEN	OPEN	OPEN
H	Case	0.5 ohms max.	0	0	0
M	K	25-29 ohms	25.4	25.4	25.4
B	E	0.5 ohms max.	0	0	0.1
C	F	0.5 ohms max.	0.1	0.0	0.1

Accept ✓ Initial HPG
Reject Date 10-29-70

Comments: TOTAL CYCLES = 2258

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. — Q. C. ~~Eng.~~ TECH HPG
Elect. Tech. REO

500 Volts D. C. Pins From	To	Limit	Actual
A	C	50 meg. ohms min.	> 50 Mn
A	D	50 meg. ohms min.	
A	F	50 meg. ohms min.	
A	H	50 meg. ohms min.	
A	J	50 meg. ohms min.	
A	L	50 meg. ohms min.	
A	M	50 meg. ohms min.	
A	Case	50 meg. ohms min.	
B	C	50 meg. ohms min.	
B	D	50 meg. ohms min.	
B	F	50 meg. ohms min.	
B	A	50 meg. ohms min.	
B	J	50 meg. ohms min.	

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. — Q. C. ~~Eng.~~ HPG
Elect. Tech. RSO ~~Tech~~

500 Volts D. C. Pins From	To	Limit	Actual
A	C	50 meg. ohms min.	750 MΩ
A	D	50 meg. ohms min.	
A	F	50 meg. ohms min.	
A	H	50 meg. ohms min.	
A	J	50 meg. ohms min.	
A	L	50 meg. ohms min.	
A	M	50 meg. ohms min.	
A	Case	50 meg. ohms min.	
B	C	50 meg. ohms min.	
B	D	50 meg. ohms min.	
B	F	50 meg. ohms min.	
B	A	50 meg. ohms min.	
B	J	50 meg. ohms min.	

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMC
Mech. Tech. — Q. C. ~~Eng.~~ Tech HPG
Elect. Tech. REO

Continued

From	To	Limit	Actual
B	K	50 meg. ohms min.	>50 MΩ
B	L	50 meg. ohms min.	
B	M	50 meg. ohms min.	
B	Case	50 meg. ohms min.	
C	E	50 meg. ohms min.	
C	H	50 meg. ohms min.	
C	J	50 meg. ohms min.	
C	K	50 meg. ohms min.	
C	L	50 meg. ohms min.	
C	M	50 meg. ohms min.	
C	Case	50 meg. ohms min.	
D	E	50 meg. ohms min.	
D	H	50 meg. ohms min.	
D	J	50 meg. ohms min.	
D	K	50 meg. ohms min.	
D	L	50 meg. ohms min.	
D	M	50 meg. ohms min.	
D	Case	50 meg. ohms min.	
E	F	50 meg. ohms min.	
E	H	50 meg. ohms min.	
E	J	50 meg. ohms min.	
E	K	50 meg. ohms min.	
E	L	50 meg. ohms min.	
E	M	50 meg. ohms min.	
E	Case	50 meg. ohms min.	
F	H	50 meg. ohms min.	
F	J	50 meg. ohms min.	
F	K	50 meg. ohms min.	
F	L	50 meg. ohms min.	
F	M	50 meg. ohms min.	
F	Case	50 meg. ohms min.	
G	A	50 meg. ohms min.	
G	B	50 meg. ohms min.	
G	C	50 meg. ohms min.	
G	D	50 meg. ohms min.	
G	E	50 meg. ohms min.	

<u>Test Data Sheet</u>
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 — Test Eng. RMR
Mech. Tech. — Q. C. ~~Eng.~~ TECH HPG
Elect. Tech. RSO

Continued

From	To	Limit	Actual
B	K	50 meg. ohms min.	>50 MΩ
B	L	50 meg. ohms min.	
B	M	50 meg. ohms min.	
B	Case	50 meg. ohms min.	
C	E	50 meg. ohms min.	
C	H	50 meg. ohms min.	
C	J	50 meg. ohms min.	
C	K	50 meg. ohms min.	
C	L	50 meg. ohms min.	
C	M	50 meg. ohms min.	
C	Case	50 meg. ohms min.	
D	E	50 meg. ohms min.	
D	H	50 meg. ohms min.	
D	J	50 meg. ohms min.	
D	K	50 meg. ohms min.	
D	L	50 meg. ohms min.	
D	M	50 meg. ohms min.	
D	Case	50 meg. ohms min.	
E	F	50 meg. ohms min.	
E	H	50 meg. ohms min.	
E	J	50 meg. ohms min.	
E	K	50 meg. ohms min.	
E	L	50 meg. ohms min.	
E	M	50 meg. ohms min.	
E	Case	50 meg. ohms min.	
F	H	50 meg. ohms min.	
F	J	50 meg. ohms min.	
F	K	50 meg. ohms min.	
F	L	50 meg. ohms min.	
F	M	50 meg. ohms min.	
F	Case	50 meg. ohms min.	
G	A	50 meg. ohms min.	
G	B	50 meg. ohms min.	
G	C	50 meg. ohms min.	
G	D	50 meg. ohms min.	
G	E	50 meg. ohms min.	

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007
Mech. Tech. —
Elect. Tech. REO
Test Eng. RMR
Q. C. ~~Eng.~~ TECH HPG

Continued

From	To	Limit	Actual
G	F	50 meg. ohms min.	> 50 MΩ
G	H	50 meg. ohms min.	
G	J	50 meg. ohms min.	
G	K	50 meg. ohms min.	
G	L	50 meg. ohms min.	
G	M	50 meg. ohms min.	
H	J	50 meg. ohms min.	
H	K	50 meg. ohms min.	
H	L	50 meg. ohms min.	
H	M	50 meg. ohms min.	
J	K	50 meg. ohms min.	
J	M	50 meg. ohms min.	
J	Case	50 meg. ohms min.	
K	L	50 meg. ohms min.	
K	Case	50 meg. ohms min.	
L	M	50 meg. ohms min.	
L	Case	50 meg. ohms min.	
M	Case	50 meg. ohms min.	

Accept ✓ Initial HPG
Reject Date 10-29-70

Comments:

Port "A" Open 500 Volts D. C. Pins From	To	Limit	Actual
B	E	50 meg. ohms min.	> 50 MΩ
B	A	50 meg. ohms min.	
C	D	50 meg. ohms min.	
C	F	50 meg. ohms min.	

Accept ✓ Initial HPG
Reject Date 10-29-70

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	008	Test Eng.	RMR
Mech. Tech.	—	Q. C. ~~Eng.~~ Tech	HPG
Elect. Tech.	REO		

Continued

From	To	Limit	Actual
G	F	50 meg. ohms min.	>50 MΩ
G	H	50 meg. ohms min.	↓
G	J	50 meg. ohms min.	
G	K	50 meg. ohms min.	
G	L	50 meg. ohms min.	
G	M	50 meg. ohms min.	
H	J	50 meg. ohms min.	
H	K	50 meg. ohms min.	
H	L	50 meg. ohms min.	
H	M	50 meg. ohms min.	
J	K	50 meg. ohms min.	
J	M	50 meg. ohms min.	
J	Case	50 meg. ohms min.	
K	L	50 meg. ohms min.	
K	Case	50 meg. ohms min.	
L	M	50 meg. ohms min.	
L	Case	50 meg. ohms min.	
M	Case	50 meg. ohms min.	

Accept ✓ Initial HPG
Reject Date 10-29-70

Comments:

Port "A" Open 500 Volts D. C. Pins From	To	Limit	Actual
B	E	50 meg. ohms min.	>50 MΩ
B	A	50 meg. ohms min.	↓
C	D	50 meg. ohms min.	
C	F	50 meg. ohms min.	

Accept ✓ Initial HPG
Reject Date 10-29-70

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	007	Test Eng.	RMTR
Mech. Tech.	—	Q. C. ~~Eng.~~ TECH	HPG
Elect. Tech.	RCO		

Port "B" Open 500 Volts D. C. Pins From	To	Limit	Actual
A	B	50 meg. ohms min.	750 MΩ
A	E	50 meg. ohms min.	↓
D	C	50 meg. ohms min.	
D	F	50 meg. ohms min.	

Accept ✓ Initial HPG
Reject Date 10-27-70

Comments: TOTAL CYCLES = 2517

Position Indicators After High and Low Temperature Liquid

Covered by Circuit Resistance Test.

Minimum Voltage, After High and Low Temperature, Liquid

Minimum Operating Voltage 100 ms Pulse, Unpressurized	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initi
Port "A"	18 volts d.c. max.	17.0	16.0	16.0	✓		HPG
Port "B"	18 volts d.c. max.	16.0	16.0	17.0	✓		HPG

Date 11/2/70

Comments: TOTAL CYCLES = 2529

Minimum Operating Voltage 100 ms Pulse 50 ± 5 psig, 100% Helium	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initi
Port "A"	18 volts d.c. max.	16.0	16.0	16.0	✓		HPG
Port "B"	18 volts d.c. max.	17.0	17.0	16.0	✓		HPG

Date 11/2/70

Comments: TOTAL CYCLES = 2538

Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. — Q. C. ~~Eng.~~ TECH HPG
Elect. Tech. RED

Port "B" Open 500 Volts D. C. Pins From	To	Limit	Actual
A	B	50 meg. ohms min.	750 Meg
A	E	50 meg. ohms min.	↓
D	C	50 meg. ohms min.	↓
D	F	50 meg. ohms min.	↓

Accept ✓ Initial HPG
Reject Date 10-29-70

Comments:

Position Indicators After High and Low Temperature Liquid

Covered by Circuit Resistance Test.

Minimum Voltage, After High and Low Temperature, Liquid

Minimum Operating Voltage 100ms Pulse, Unpressurized	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Ini
Port "A"	18 volts d.c. max.	17.0	16.0	16.0	✓		HP
Port "B"	18 volts d.c. max.	16.0	16.5	17.0	✓		HP

Date 11/2/70

Comments: TOTAL CYCLES = 2268

Minimum Operating Voltage 100ms Pulse 50 ± 5 psig, 100% Helium	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Ini
Port "A"	18 volts d.c. max.	16.0	16.0	16.0	✓		HP
Port "B"	18 volts d.c. max.	16.5	16.0	16.0	✓		[illegible]

Date 11/2/70

Comments: TOTAL CYCLES = 2278

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. DMR
Mech. Tech. — Q. C. ~~Eng.~~ TECH HRG
Elect. Tech. RSO

Pulse Duration, After High and Low Temperature, Liquid

Minimum Pulse Duration, 28 Volts D. C. 100% Helium, 50 ± 5 psig	Allowable	Actual 1	2	3	O.K.	Reject	Initial
Port "A"	100 ms. max.	32.0	32.0	31.0	✓		HRG
Port "B"		34.0	34.0	34.0	✓		HRG

Photo Taken ✓
Date 11/2/70

Comments: TOTAL CYCLES = 2547

Minimum Pulse Duration, 28 Volts D. C. Zero Press	Allowable	Actual 1	2	3	O.K.	Reject	Initial
Port "A"	100 ms. max.	31.0	31.0	31.0	✓		HRG
Port "B"		33.0	35.0	34.0	✓		HRG

Photo Taken ✓
Date 11/2/70

Comments: TOTAL CYCLES = 2557

Power, After High and Low Temperature, Liquid

Power 28 Volts D. C. Steady State	Allowable	Actual A	B	O.K.	Reject	Initial
Voltage	28 ± .5	28.0	28.0	✓		HRG
Current	1.14 amps	0.98	0.97	✓		HRG
Power	31.5 watts max.	27.4	27.1	✓		HRG

Date 10-29-70

Comments: TOTAL CYCLES = 2558

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. — Q. C. ~~Eng.~~ Tech HRG
Elect. Tech. REO

Pulse Duration, After High and Low Temperature, Liquid

Minimum Pulse Duration, 28 Volts D.C. 100% Helium, 50 ± 5 psig	Allowable	Actual 1	2	3	O.K.	Reject	Initial
Port "A"	100 ms. max.	35.0	32.0	32.0	✓		HRG
Port "B"		34.0	35.0	34.0	✓		HRG

Photo Taken Date 11/2/70

Comments: TOTAL CYCLES = 2278

Minimum Pulse Duration, 28 Volts D.C. Zero Press	Allowable	Actual 1	2	3	O.K.	Reject	Initial
Port "A"	100 ms. max.	33.0	34.0	33.0	✓		HRG
Port "B"		34.0	34.0	34.0	✓		HRG

Photo Taken Date 11/2/70

Comments: TOTAL CYCLES = 2288

Power, After High and Low Temperature, Liquid

Power 28 Volts D.C. Steady State	Allowable	Actual A	Actual B	O.K.	Reject	Initial
Voltage	28 ± .5	28.0	28.0	✓		HRG
Current	1.14 amps	1.07	1.07	✓		HRG
Power	31.5 watts max.	29.9	29.9	✓		HRG

Date 10-29-70

Comments: TOTAL CYCLES = 2289

Test Data Sheet

Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	007	Test Eng.	RMR
Mech. Tech.		Q. C. ~~Eng.~~ TECH	ALRT/CBW
Elect. Tech.	REO		

5.9 Full Flow

P @ 900 lb/hr Room Temp.	Allowable	Actual 1	2	3	O. K.	Reject	Initial
Port A - C	0.5 psid max.	0.23	.31	.36	✓		ALRT
Port B - C	0.5 psid max.	0.22	.32	.32	✓		ALRT
Port C - A	0.5 psid max.	0.32	.38	.38	✓		ALRT
Port C - B	0.5 psid max.	0.42	.45	.40	✓		ALRT

Photo Taken ✓
Date 5 November '70

Comments: FLOW METER S-3586 DUE NOVEMBER '71
TOTAL CYCLES = 2564

Circuit Resistance During Full Flow

Port "A" Open Pins From	To	Limit	Actual 1	2	3
A	E	0.5 ohms max.	0.4	0.5	0.5
D	F	0.5 ohms max.	0.4	0.5	0.4
H	Case	0.5 ohms max.	0.5	0.5	0.4
L	J	25-29 ohms	27.6	27.9	28.2
B	E	Open Circuit	INF.	INF.	INF.
C	F	Open Circuit	INF.	INF.	INF.

Accept ✓ Initial CBW
Reject Date 11/9/70

Port "B" Open Pins From	To	Limit	Actual 1	2	3
A	E	Open Circuit	INF	INF	INF
D	F	Open Circuit	INF	INF	INF
H	Case	0.5 ohms max.	0.1	0.1	0.2
M	K	25-29 ohms	28.6	28.1	28.9
B	E	0.5 ohms max.	0.3	0.2	0.3
C	F	0.5 ohms max.	0.3	0.2	0.3

Accept ✓ Initial CBW
Reject Date 11/9/70

Comments:

Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. REO Q. C. ~~Eng.~~ TECH CBW
Elect. Tech. REO

5.9 Full Flow

P @ 900 lb/hr Room Temp.	Allowable	Actual 1	2	3	O. K.	Reject	Initial
Port A - C	0.5 psid max.	.49	.38	.4	✓		CBW
Port B - C	0.5 psid max.	.25	.27	.34	✓		CBW
Port C - A	0.5 psid max.	.38	.38	.38	✓		CBW
Port C - B	0.5 psid max.	.22	.33	.35	✓		CBW

Photo Taken ✓
Date 11/5/70

Comments: TOTAL CYCLES = 2305

Circuit Resistance During Full Flow

Port "A" Open Pins From	To	Limit	Actual 1	2	3
A	E	0.5 ohms max.	0.5	0.3	0.3
D	F	0.5 ohms max.	0.5	0.3	0.3
H	Case	0.5 ohms max.	0.1	0.3	0.4
L	J	25-29 ohms	27.1	27.5	26.9
B	E	Open Circuit	INF	INF	INF
C	F	Open Circuit	INF	INF	INF

Accept ✓ Initial CBW
Reject Date 11/9/70

Port "B" Open Pins From	To	Limit	Actual 1	2	3
A	E	Open Circuit	INF	INF	INF
D	F	Open Circuit	INF	INF	INF
H	Case	0.5 ohms max.	0.1	0.3	0.3
M	K	25-29 ohms	27.3	27.2	27.4
B	E	0.5 ohms max.	0.3	0.4	0.4
C	F	0.5 ohms max.	0.3	0.3	0.3

Accept ✓ Initial CBW
Reject Date 11/9/70

Comments: TOTAL CYCLES = 2312

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. — Q. C. ~~Eng.~~ TECH CBW
Elect. Tech. REO

Minimum Voltage During Full Flow

Minimum Operating Voltage 100 ms Pulse, Unpressurized	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Init
Port "A"	18 volts d.c. max.	15.	15.	15	✓		CBW
Port "B"	18 volts d.c. max.	16.	16.	16	✓		CBW

35

Date 11/9/70

Comments: TOTAL CYCLES = 2596

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. Q. C. Eng.
Elect. Tech. RED

Minimum Voltage During Full Flow

Minimum Operating Voltage 100 ms Pulse, Unpressurized	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	In
Port "A"	18 volts d.c. max.	16	15	15	✓		CB
Port "B"	18 volts d.c. max.	16	16	15	✓		CB

Date 11/9/70

Comments: TOTAL CYCLES = 2334

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. — Q. C. ~~Eng.~~ TECH CBW
Elect. Tech. RED

Minimum Pulse Duration, 28 Volts D. C. Zero Press	Allowable	Actual 1	2	3	O.K.	Reject	Initial
Port "A"	100 ms. max.	32	30	32	✓		CBW
Port "B"		35	36	35	✓		CBW

35

Date 11/9/70

Comments: TOTAL CYCLES = 2616

Power During Full Flow

Power 28 Volts D. C. Steady State	Allowable	A Actual	B	O. K.	Reject	Initial
Voltage	28 ± .5	28.0	28.0	✓		CBW
Current	1.14 amps	.97	.94	✓		CBW
Power	31.5 watts max.	27.2	26.3	✓		

35

Date 11/9/70

Comments:

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. — Q. C. ~~Eng.~~ TECH CBW
Elect. Tech. REO

Minimum Pulse Duration, 28 Volts D. C. Zero Press	Allowable	Actual 1	2	3	O. K.	Reject	Initial
Port "A"	100 ms. max.	33	35	30	✓		CBW
Port "B"		32	34	33	✓		CBW

Date 11/9/70

Comments: TOTAL CYCLES = 2352

Power During Full Flow

Power 28 Volts D. C. Steady State	Allowable	A Actual	B	O. K.	Reject	Initial
Voltage	28 ± .5	27.8	27.8	✓		CBW
Current	1.14 amps	1.04	1.00	✓		CBW
Power	31.5 watts max.	28.9	27.8	✓		CBW

Date 11/9/70

Comments: TOTAL CYCLES = 2354

5.10 Humidity

Per 5.10 240 Hrs.	Allowable	O. K.	Reject	Initial
Examination	No failure or damage	✓		WRE

Photo Taken OK
Date 23 Nov 70

Comments: WITNESSED SET UP 11-13-70 W J Boran AFQAR
9:30 AM
11-23-70 12:45 PM J J Boran
AFQAR

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. — Q. C. Eng. [illegible] 11-23-70
Elect. Tech. REO

Leakage After Humidity

	Allowable	Actual	O. K.	Reject
100% helium @ 50 ± 5 pgg Internal Press	1.6 x 10-6 sccs	$.47 \times 10^{-6}$	✓	

Date 11-23-70

Comments: TOTAL CYCLES = 2360

Port A Methanol/Water	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		[illegible]
10.0 ± 1.0psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		[illegible]
20.0 ± 2.0psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		[illegible]

Date 11-23-70

Port B Methanol/Water	Allowable	Actual 1	2	3	O. K.	Reject	Initi
5.0 ± .5psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		[illegible]
10.0 ± 1.0psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		[illegible]
20.0 ± 2.0psig ΔP	0.20 sccs	0.0	0.0	0.0	✓		[illegible]

AD 76

Date 11-23-70

Comments: TOTAL CYCLES = 2366

Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	008	Test Eng.	RMR
Mech. Tech.	—	Q. C. ~~Eng.~~ TECH.	ALT
Elect. Tech.	REO		

Circuit Resistance After Humidity

Port "A" Open Pins From	To	Limit	Actual 1	2	3
A	E	0.5 ohms max.	0.2	0.5	0.4
D	F	0.5 ohms max.	0.3	0.4	0.4
H	Case	0.5 ohms max.	0.3	0.3	0.3
L	J	25-29 ohms	25.6	25.7	25.7
B	E	Open Circuit	OPEN	OPEN	OPEN
C	F	Open Circuit	OPEN	OPEN	OPEN

Accept ✓ Initial ALT
Reject ____ Date 11-23-70

Port "B" Open Pins From	To	Limit	Actual 1	2	3
A	E	Open Circuit	OPEN	OPEN	OPEN
D	F	Open Circuit	OPEN	OPEN	OPEN
H	Case	0.5 ohms max.	0.5	0.0	0.0
M	K	25-29 ohms	25.7	25.5	25.4
B	E	0.5 ohms max.	0.4	0.1	0.1
C	F	0.5 ohms max.	0.3	0.1	0.1

Accept ✓ Initial ALT
Reject ____ Date 11-23-70

Comments: TOTAL CYCLES = 2372

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

HPC-A
U-2340

Serial No. 008
Mech. Tech. ——
Elect. Tech. REO
Test Eng. RMR
Q. C. Eng. ACH 11-23-70

Insulation Resistance After Humidity

500 Volts D. C. Pins From	To	Limit	Actual
A	C	50 meg. ohms min.	> 50 meg Ω
A	D	50 meg. ohms min.	
A	F	50 meg. ohms min.	
A	H	50 meg. ohms min.	
A	J	50 meg. ohms min.	
A	L	50 meg. ohms min.	
A	M	50 meg. ohms min.	
A	Case	50 meg. ohms min.	
B	C	50 meg. ohms min.	
B	D	50 meg. ohms min.	
B	F	50 meg. ohms min.	
B	A	50 meg. ohms min.	
B	J	50 meg. ohms min.	> 5 meg Ω

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

HRE
11-23-70

Serial No.	008	Test Eng.	RMR
Mech. Tech.	—	Q. C. Eng.	Alt 11-23-70
Elect. Tech.	REO		

Continued

From	To	Limit	Actual
B	K	50 meg. ohms min.	> 50 meg Ω
B	L	50 meg. ohms min.	
B	M	50 meg. ohms min.	
B	Case	50 meg. ohms min.	
C	E	50 meg. ohms min.	
C	H	50 meg. ohms min.	
C	J	50 meg. ohms min.	
C	K	50 meg. ohms min.	
C	L	50 meg. ohms min.	
C	M	50 meg. ohms min.	
C	Case	50 meg. ohms min.	
D	E	50 meg. ohms min.	
D	H	50 meg. ohms min.	
D	J	50 meg. ohms min.	
D	K	50 meg. ohms min.	
D	L	50 meg. ohms min.	
D	M	50 meg. ohms min.	
D	Case	50 meg. ohms min.	
E	F	50 meg. ohms min.	
E	H	50 meg. ohms min.	
E	J	50 meg. ohms min.	
E	K	50 meg. ohms min.	
E	L	50 meg. ohms min.	
E	M	50 meg. ohms min.	
E	Case	50 meg. ohms min.	
F	H	50 meg. ohms min.	
F	J	50 meg. ohms min.	
F	K	50 meg. ohms min.	
F	L	50 meg. ohms min.	
F	M	50 meg. ohms min.	
F	Case	50 meg. ohms min.	
G	A	50 meg. ohms min.	
G	B	50 meg. ohms min.	
G	C	50 meg. ohms min.	
G	D	50 meg. ohms min.	
G	E	50 meg. ohms min.	> 50 meg Ω

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. EMR
Mech. Tech. — Q. C. ~~Eng.~~ TEW AJ
Elect. Tech. REO

Continued

From	To	Limit	Actual
G	F	50 meg. ohms min.	> 50 meg Ω
G	H	50 meg. ohms min.	
G	J	50 meg. ohms min.	
G	K	50 meg. ohms min.	
G	L	50 meg. ohms min.	
G	M	50 meg. ohms min.	
H	J	50 meg. ohms min.	
H	K	50 meg. ohms min.	
H	L	50 meg. ohms min.	
H	M	50 meg. ohms min.	
J	K	50 meg. ohms min.	
J	M	50 meg. ohms min.	
J	Case	50 meg. ohms min.	
K	L	50 meg. ohms min.	
K	Case	50 meg. ohms min.	
L	M	50 meg. ohms min.	
L	Case	50 meg. ohms min.	
M	Case	50 meg. ohms min.	> 50 meg Ω

HPC-A 11-23-70

Accept ✓ Initial Alb
Reject Date 11-23-70

Comments:

Port "A" Open 500 Volts D. C. Pins From	To	Limit	Actual
B	E	50 meg. ohms min.	> 50 meg Ω
B	A	50 meg. ohms min.	
C	D	50 meg. ohms min.	
C	F	50 meg. ohms min.	> 50 meg Ω

HPC 11-23-

Accept ✓ Initial Alb
Reject Date 11-23-70

D-155

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. — Q. C. ~~Eng.~~ TECH AH
Elect. Tech. REO

Port "B" Open 500 Volts D. C. Pins From	To	Limit	Actual
A	B	50 meg. ohms min.	>50 meg
A	E	50 meg. ohms min.	
D	C	50 meg. ohms min.	
D	F	50 meg. ohms min.	>50 meg

HPC 11-23

Accept ✓ Initial AH
Reject Date 11-23-70

Comments:

Position Indicators After Humidity

Covered by Circuit Resistance Test.

Minimum Voltage After Humidity

Minimum Operating Voltage100 ms Pulse, Unpressurized	Allowable	Actual 1	2	3	O. K.	Reject	Init
Port "A"	18 volts d.c. max.	15.5	15.5	15.0	✓		HPC
Port "B"	18 volts d.c. max.	16.0	15.5	16.0	✓		HPC

11-24 HPC

Date 11/24/70

Comments: TOTAL CYCLES = 2397

Minimum Operating Voltage 100 ms Pulse 50 ± 5 psig, 100% Helium	Allowable	Actual 1	2	3	O. K.	Reject	Init
Port "A"	18 volts d.c. max.	14.0	15.0	15.0	✓		HPC 11-24
Port "B"	18 volts d.c. max.	15.0	14.0	16.0	✓		HPC

11-24 HPC

Date 11/24/70

Comments: TOTAL CYCLES = 2407

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 008 Test Eng. RMR
Mech. Tech. Q. C. ~~Eng.~~ TECH HPG
Elect. Tech. REO

Pulse Duration After Humidity

Minimum Pulse Duration, 28 Volts D. C. 100% Helium, 50 ± 5 psig	Allowable	Actual 1	2	3	O. K.	Reject	Initial
Port "A"	100 ms. max.	30	29	27	✓		HPG
Port "B"		30	32	31	✓		HPG

Date 11/24/70

Comments: TOTAL CYCLES = 2422

Minimum Pulse Duration, 28 Volts D. C. Zero Press	Allowable	Actual 1	2	3	O. K.	Reject	Initial
Port "A"	100 ms. max.	29	28	32	✓		HPG
Port "B"		29	31	28	✓		HPG

Date 11/24/70

Comments: TOTAL CYCLES = 2434

Power After Humidity

Power 28 Volts D. C. Steady State	Allowable	COIL A Actual	COIL B	O. K.	Reject	Initial
Voltage	28 ± .5	28.0	28.0	✓		HPG
Current	1.14 amps	1.07	1.05	✓		HPG
Power	31.5 watts max.	29.9	29.4	✓		HPG

Date 11/24/70

Comments: TOTAL CYCLES = 2435

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	008	Test Eng.	RMR
Mech. Tech.	—	Q. C. ~~Eng.~~ TECH	WRC/AFC
Elect. Tech.	REO		

5.11 Salt Fog

This test has been deleted by Modification 5 to the contract.

5.12 Sand and Dust

This test has been deleted by Modification 5 to the contract.

5.13 Fungus

This test has been deleted by Modification 5 to the contract.

5.14 Collapse Pressure

Ext. Pressure = 19 psig min. Int. Pressure = 0 psig for 3 Minutes Minimum	Allowable	Actual Int. Press.	Actual Ext. Press.	Time	o.k.	Reject	Initia
Examine	No rupture	0 PSIG	190 PSIG	3	✓		WRC

Photo Taken YES
Date 12-4-70

Comments: VALVE CYCLED AFTER TEST. NO PROBLEM WITH OPERATION.
TOTAL CYCLES = 2440

5.15 Burst Pressure

1. Hydrostatic Pressure 125 psig min, for 3 min. 2. Increase Pressure to Burst	Allowable	Actual Pressure	Actual Time	O.K.	Reject	Initial
1. Examination	No rupture	130 PSIG	3 MIN	✓		
2. Measure Rupture Pressure	Greater than 125 psig	450 PSIG *	—	✓		WRC

Photo Taken
Date 12/4/70

Comments: * DIAPHRAGM BURST
COVER BURST = 2000 PSIG. VALVE SUCCESSFULLY OPERATED
AFTER 125 PSIG BURST TEST. TOTAL CYCLES = 2447

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMC
Mech. Tech. — Q. C. ~~Eng.~~ TECH HRG
Elect. Tech. RED

5.16 Temperature Cycling

	Allowable	Actual Time	Actual Cycle	O. K.	Reject	In.
200 Thermal cycles, from $0^{o}F$ to $120^{o}F$. Each cycle within 90 minutes.	No permanent damage or loss of function	~55 MINUTES	203	✓		HRG

Comments: COMPLETED 12-1-70

11/12/70 ofl
10:00 AM

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. —— Q. C. ~~Eng.~~ TECH WRC
Elect. Tech. REO

Leakage After Thermal Cycling

100% helium @ 50 ± 5 pgg Internal Press	Allowable	Actual	O. K.	Reject	Initial
	1.6x10^{-6} sccs	.72x10^{-4}	✓		WRC

Date

Comments: TOTAL CYCLES = 2616

Port A Methanol/Water	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 sccs	0	0	0	✓		WRC
10.0±1.0 psig ΔP	0.20 sccs	0	0	0	✓		WRC
20.0±2.0 psig ΔP	0.20 sccs	0	0	0	✓		WRC

Date 2-DEC 70

Port B Methanol/Water	Allowable	Actual 1	2	3	O. K.	Reject	Initial
5.0 ± .5 psig ΔP	0.20 sccs	0	0	0	✓		WRC
10.0± 1.0 psig ΔP	0.20 sccs	0	0	0	✓		WRC
20.0±2.0 psig ΔP	0.20 sccs	0	0	0	✓		WRC

Date 2-DEC 70

Comments: TOTAL CYCLES = 2626

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	007	Test Eng.	RMR
Mech. Tech.	—	Q. C. ~~Eng.~~ TECH	WRC
Elect. Tech.	REO		

Circuit Resistance After Thermal Cycling

Port "A" Open Pins From	To	Limit	Actual 1	2	3
A	E	0.5 ohms max.	.1	.2	.1
D	F	0.5 ohms max.	.1	.2	.2
H	Case	0.5 ohms max.	0	0	.1
L	J	25-29 ohms	27.9	27.9	27.9
B	E	Open Circuit	∞	∞	∞
C	F	Open Circuit	∞	∞	∞

Accept ______ Initial WRC
Reject ______ Date 2 DEC 70

Port "B" Open Pins From	To	Limit	Actual 1	2	3
A	E	Open Circuit	∞	∞	∞
D	F	Open Circuit	∞	∞	∞
H	Case	0.5 ohms max.	.2	.3	.4
M	K	25-29 ohms	28	28.1	28.2
B	E	0.5 ohms max.	.3	.3	.3
C	F	0.5 ohms max.	.4	.3	.5

Accept ______ Initial WRC
Reject ______ Date 2 DEC 70

Comments: TOTAL CYCLES = 2632

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	007	Test Eng.	RMR
Mech. Tech.	~	Q. C. ~~Eng.~~ TECH	WRC
Elect. Tech.	REO		

Insulation Resistance After Thermal Cycling

500 Volts D. C. Pins From	To	Limit	Actual
A	C	50 meg. ohms min.	> 50 MEG Ω
A	D	50 meg. ohms min.	
A	F	50 meg. ohms min.	
A	H	50 meg. ohms min.	
A	J	50 meg. ohms min.	
A	L	50 meg. ohms min.	
A	M	50 meg. ohms min.	
A	Case	50 meg. ohms min.	
B	C	50 meg. ohms min.	
B	D	50 meg. ohms min.	
B	F	50 meg. ohms min.	
B	A	50 meg. ohms min.	
B	J	50 meg. ohms min.	> 50 MEG Ω

WRC
2 DEC 70

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	007	Test Eng.	RMR
Mech. Tech.	—	Q. C. ~~Eng.~~ TECH	WRC
Elect. Tech.	RED		

Continued

From	To	Limit	Actual
B	K	50 meg. ohms min.	> 50 MEG Ω
B	L	50 meg. ohms min.	
B	M	50 meg. ohms min.	
B	Case	50 meg. ohms min.	
C	E	50 meg. ohms min.	
C	H	50 meg. ohms min.	
C	J	50 meg. ohms min.	
C	K	50 meg. ohms min.	
C	L	50 meg. ohms min.	
C	M	50 meg. ohms min.	
C	Case	50 meg. ohms min.	
D	E	50 meg. ohms min.	
D	H	50 meg. ohms min.	
D	J	50 meg. ohms min.	
D	K	50 meg. ohms min.	
D	L	50 meg. ohms min.	
D	M	50 meg. ohms min.	
D	Case	50 meg. ohms min.	
E	F	50 meg. ohms min.	
E	H	50 meg. ohms min.	
E	J	50 meg. ohms min.	
E	K	50 meg. ohms min.	
E	L	50 meg. ohms min.	
E	M	50 meg. ohms min.	
E	Case	50 meg. ohms min.	
F	H	50 meg. ohms min.	
F	J	50 meg. ohms min.	
F	K	50 meg. ohms min.	
F	L	50 meg. ohms min.	
F	M	50 meg. ohms min.	
F	Case	50 meg. ohms min.	
G	A	50 meg. ohms min.	
G	B	50 meg. ohms min.	
G	C	50 meg. ohms min.	
G	D	50 meg. ohms min.	
G	E	50 meg. ohms min.	> 50 MEG Ω

2 DEC 70

Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No.	007	Test Eng.	RMR
Mech. Tech.	—	Q. C. ~~Eng.~~ TECH	WRC
Elect. Tech.	REO		

Continued

From	To	Limit	Actual
G	F	50 meg. ohms min.	> 50 MEG Ω
G	H	50 meg. ohms min.	
G	J	50 meg. ohms min.	
G	K	50 meg. ohms min.	
G	L	50 meg. ohms min.	
G	M	50 meg. ohms min.	
H	J	50 meg. ohms min.	
H	K	50 meg. ohms min.	
H	L	50 meg. ohms min.	
H	M	50 meg. ohms min.	
J	K	50 meg. ohms min.	
J	M	50 meg. ohms min.	
J	Case	50 meg. ohms min.	
K	L	50 meg. ohms min.	
K	Case	50 meg. ohms min.	
L	M	50 meg. ohms min.	
L	Case	50 meg. ohms min.	
M	Case	50 meg. ohms min.	> 50 MEG Ω

Accept ✓ Initial WRC
Reject Date 2 DEC 70

Comments:

Port "A" Open 500 Volts D. C. Pins From	To	Limit	Actual
B	E	50 meg. ohms min.	> 50 MEG Ω
B	A	50 meg. ohms min.	
C	D	50 meg. ohms min.	
C	F	50 meg. ohms min.	> 50 MEG Ω

Accept ✓ Initial WRC
Reject Date 2 DEC 70

Test Data Sheet
Pulse Operated Flow Diverter Valve
Specification 20M42517

Serial No. 007 Test Eng. RMR
Mech. Tech. — Q. C. ~~Eng.~~ TECH WRC
Elect. Tech. RED

Port "B" Open 500 Volts D. C. Pins From	To	Limit	Actual
A	B	50 meg. ohms min.	>50 MEG Ω
A	E	50 meg. ohms min.	
D	C	50 meg. ohms min.	
D	F	50 meg. ohms min.	>50 MEG Ω

Accept ✓ Initial WRC
Reject Date 2 DEC 70

Comments:

Position Indicators After Thermal Cycling

Covered by Circuit Resistance Test.

Minimum Voltage After Thermal Cycling

Minimum Operating Voltage100 ms Pulse, Unpressurized	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Init
Port "A"	18 volts d.c. max.	17	17	17	✓		WRC
Port "B"	18 volts d.c. max.	17	16	16	✓		WRC

Date 3 DEC 70

Comments: TOTAL CYCLES = 2642

Minimum Operating Voltage 100 ms Pulse 50 ± 5 psig, 100% Helium	Allowable	Actual 1	Actual 2	Actual 3	O. K.	Reject	Initi
Port "A"	18 volts d.c. max.	17	16	16	✓		WRC
Port "B"	18 volts d.c. max.	15	16	15	✓		WRC

Date 3 DEC 70

Comments: TOTAL CYCLES = 2654

Serial No.	007	Test Eng.	RMR
Mech. Tech.	—	Q. C. ~~Eng.~~ TECH	WRC
Elect. Tech.	RED		

Pulse Duration After Thermal Cycling

Minimum Pulse Duration, 28 Volts D. C. 100% Helium, 50 ± 5 psig	Allowable	Actual 1	2	3	O. K.	Reject	Init
Port "A"	100 ms. max.	33	32	32	✓		WRC
Port "B"		30	30	30	✓		WRC

Date 3 DEC 70

Comments: TOTAL CYCLES = 2665

Minimum Pulse Duration, 28 Volts D. C. Zero Press	Allowable	Actual 1	2	3	O. K.	Reject	Init
Port "A"	100 ms. max.	32	31	32	✓		WRC
Port "B"		30	30	30	✓		WRC

Date 3 DEC 70

Comments: TOTAL CYCLES = 2675

Power After Thermal Cycling

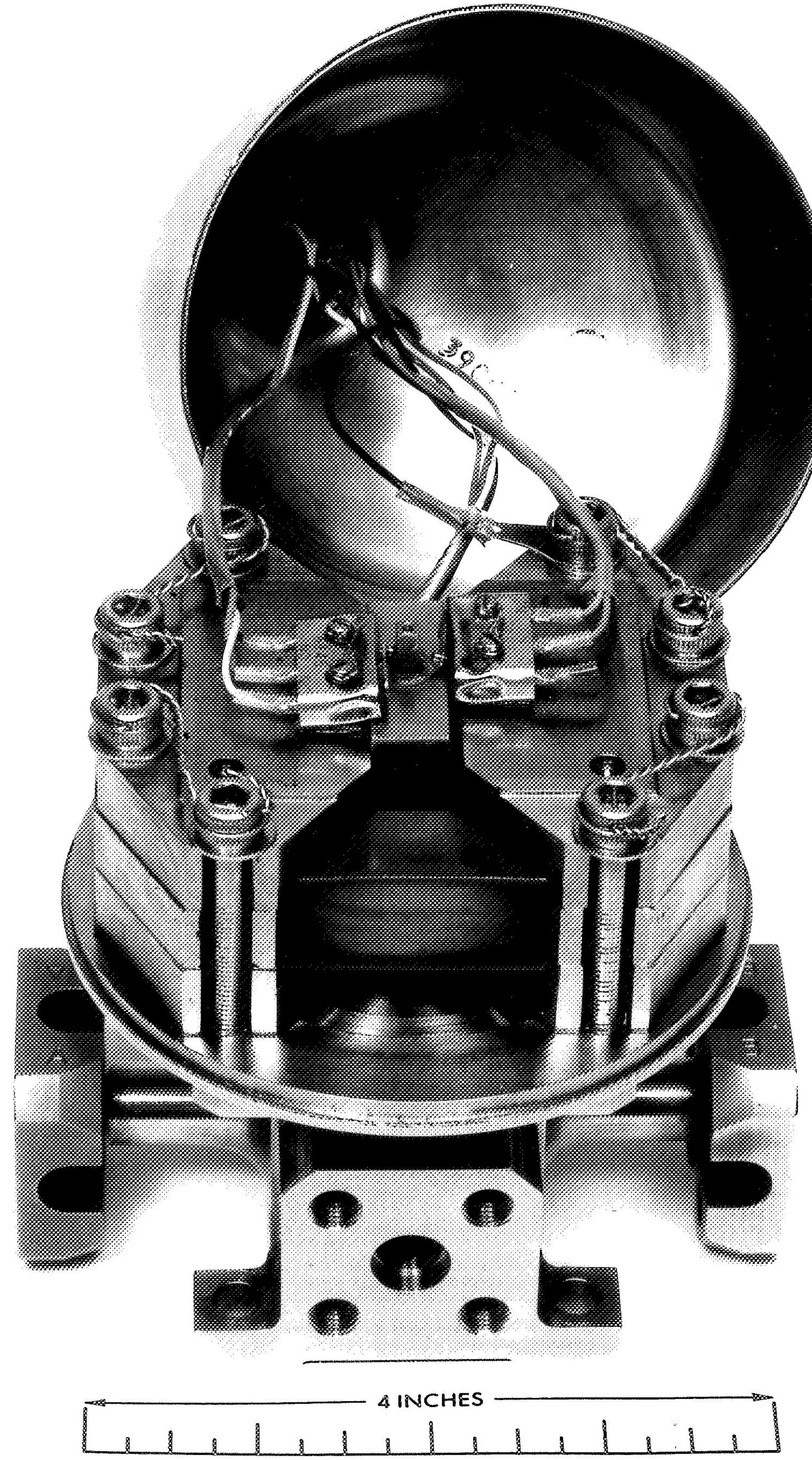
Power 28 Volts D. C. Steady State	Allowable	Actual A	Actual B	O. K.	Reject	Initial
Voltage	28 ± .5	28	28	✓		WRC
Current	1.14 amps	.98	.97	✓		WRC
Power	31.5 watts max.	27.4	27.1	✓		WRC

Date 2 DEC 70

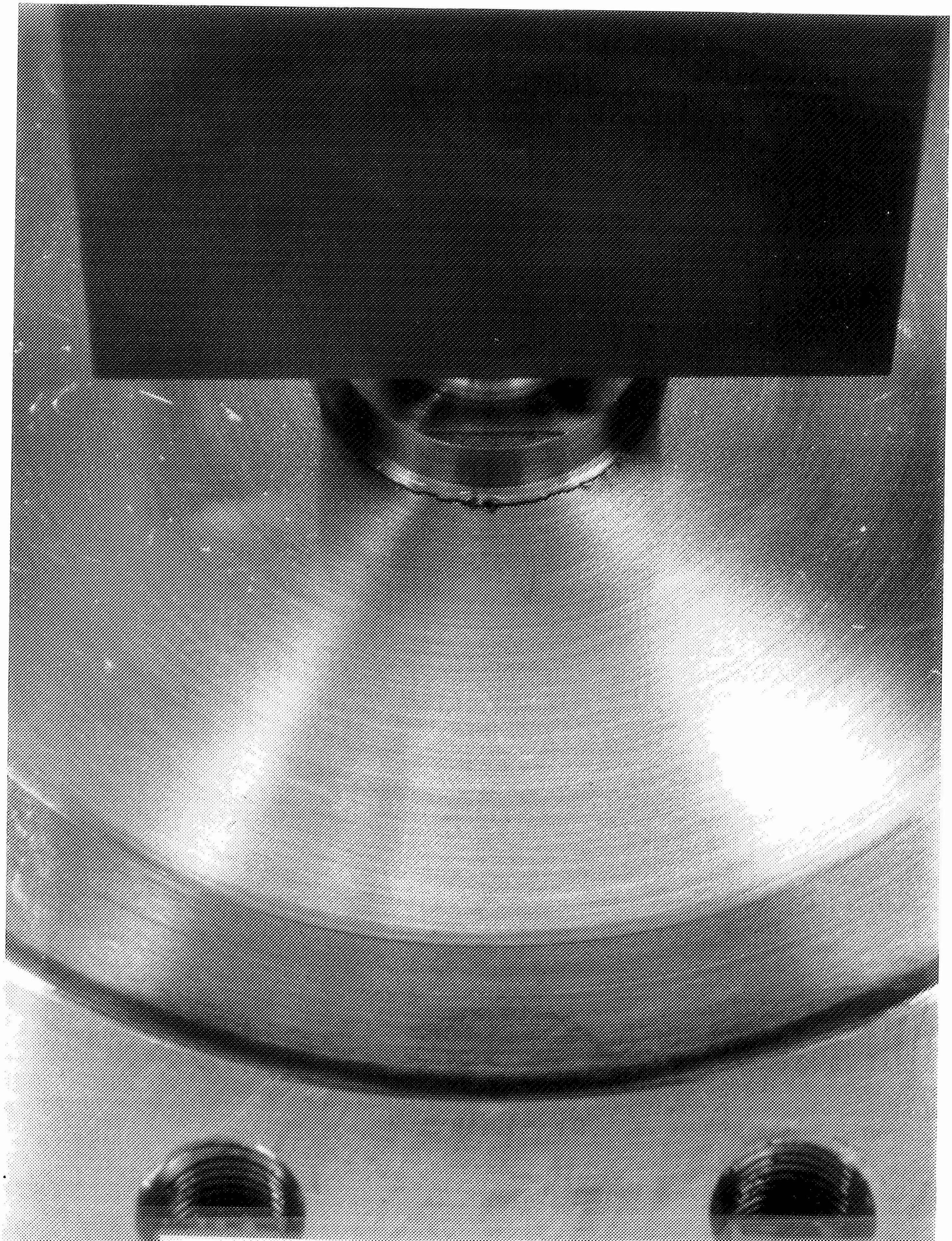
Comments: TOTAL CYCLES = 2676

5.17 Compatibility

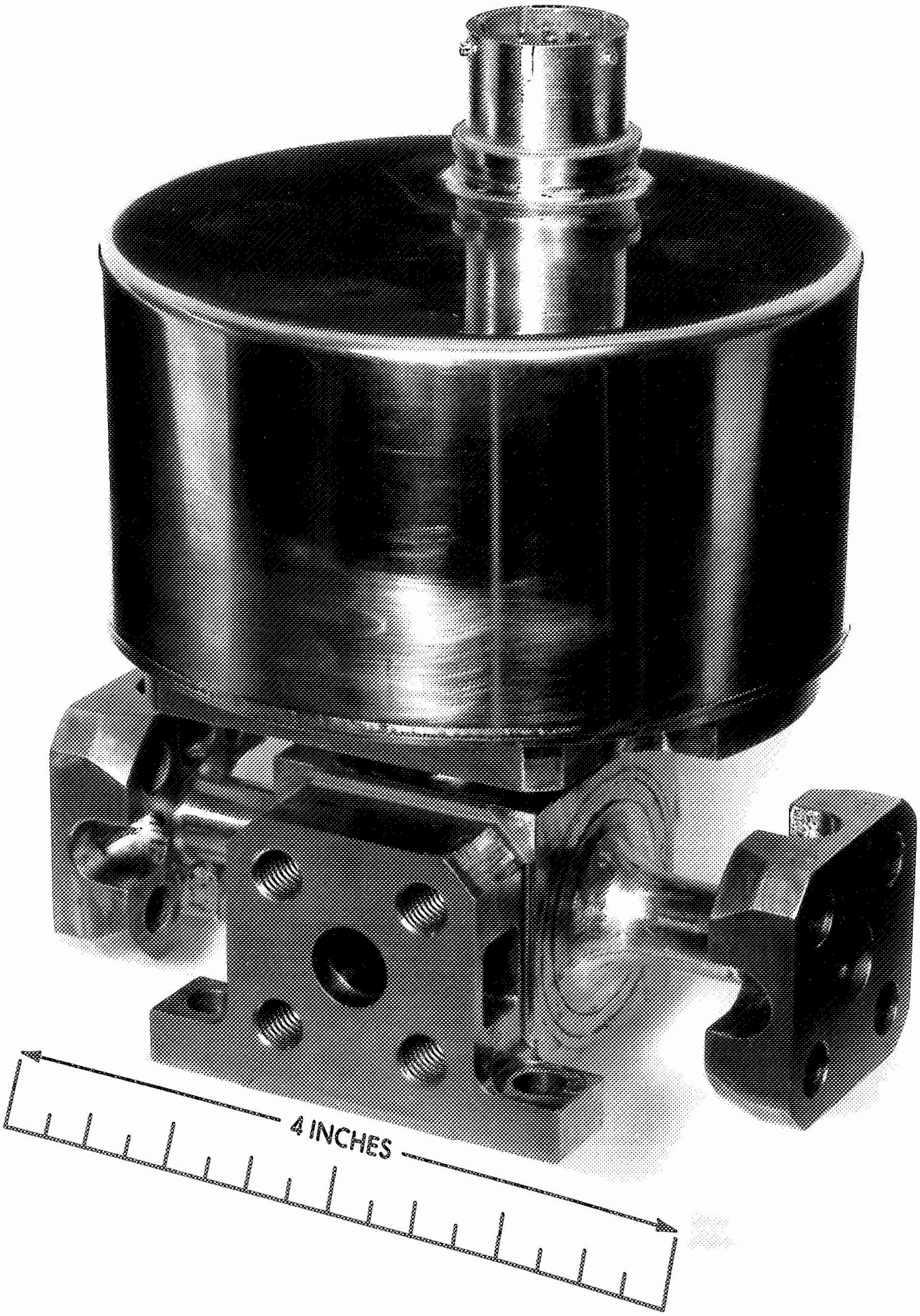
This test has been deleted by Modification 5 to the contract.



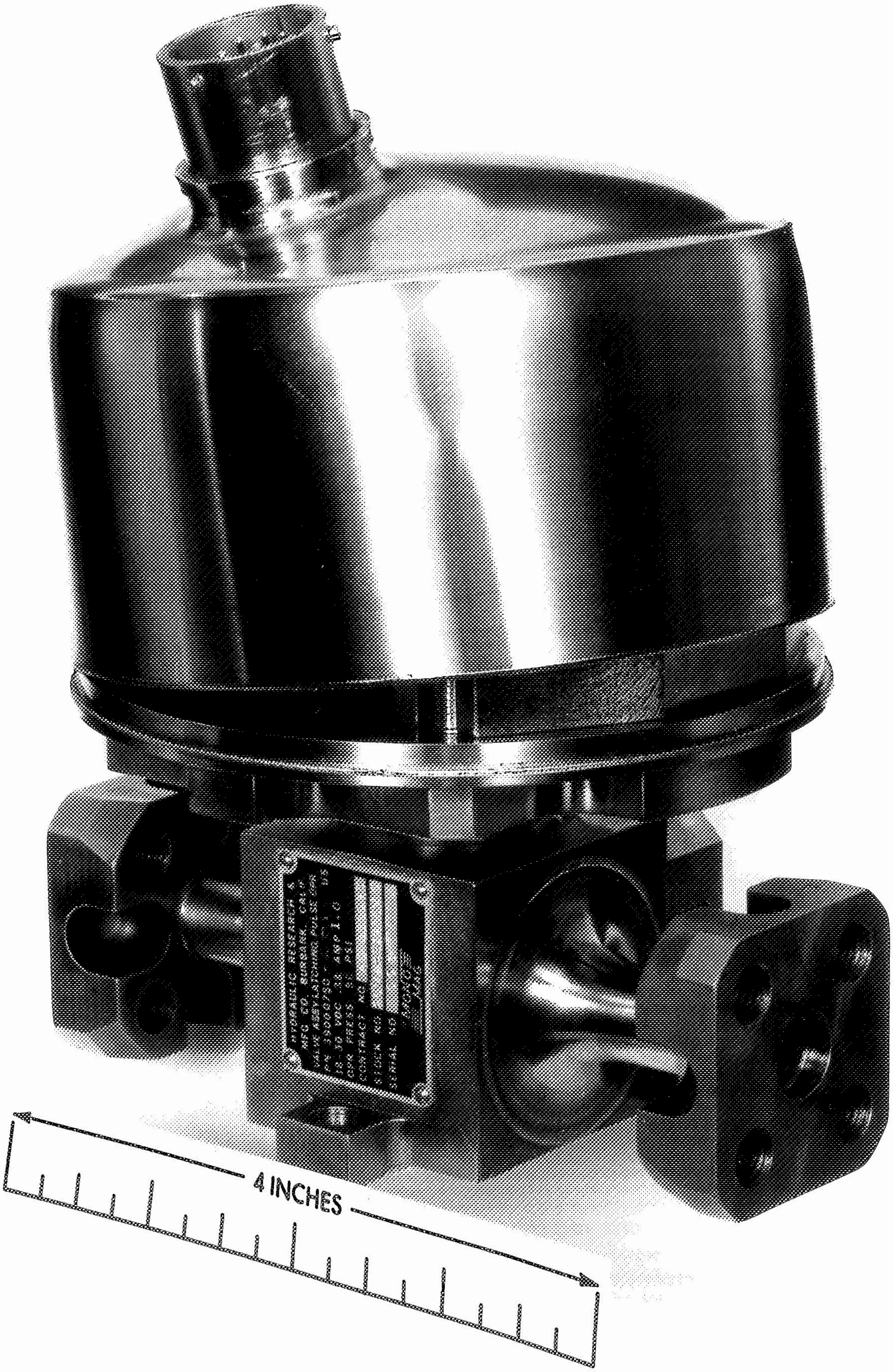
Exposed Torque Motor Assem[illegible] After Destructive Burst Te[illegible]



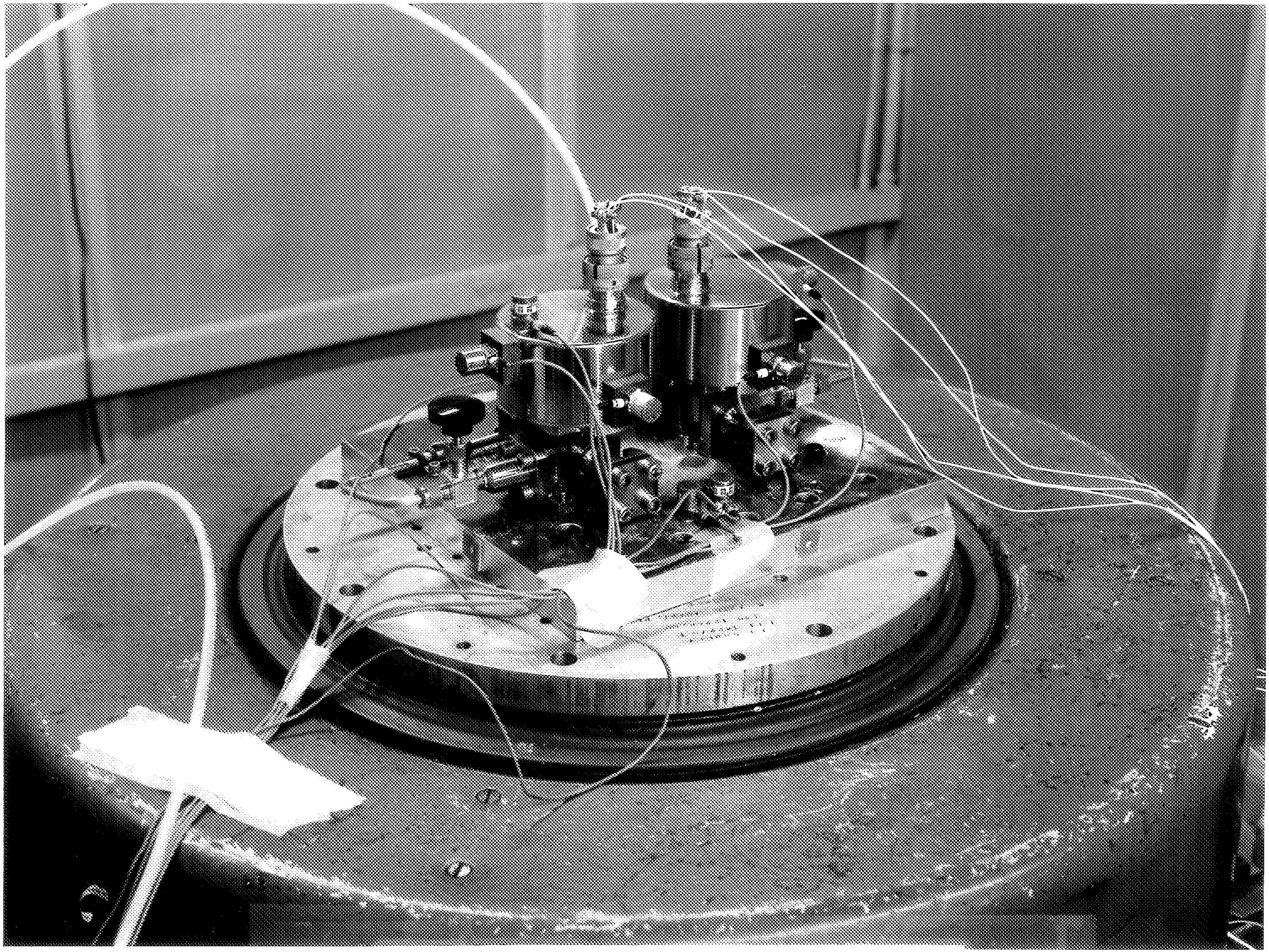
Diaphragm Failure Point As A Result of Destructive Burst Test



Flow Diverter Valve/Hydraulic Research P/N 39000750

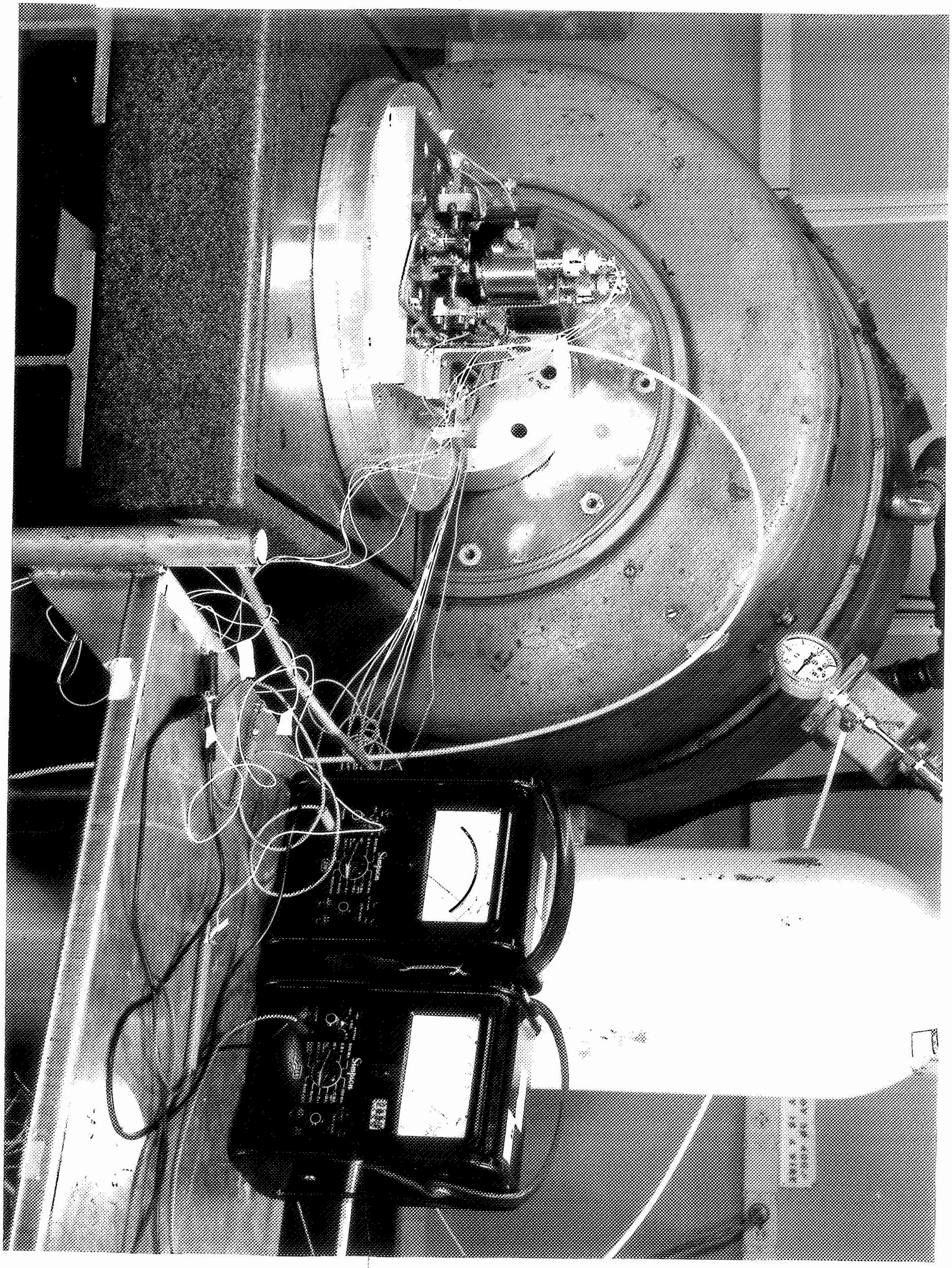


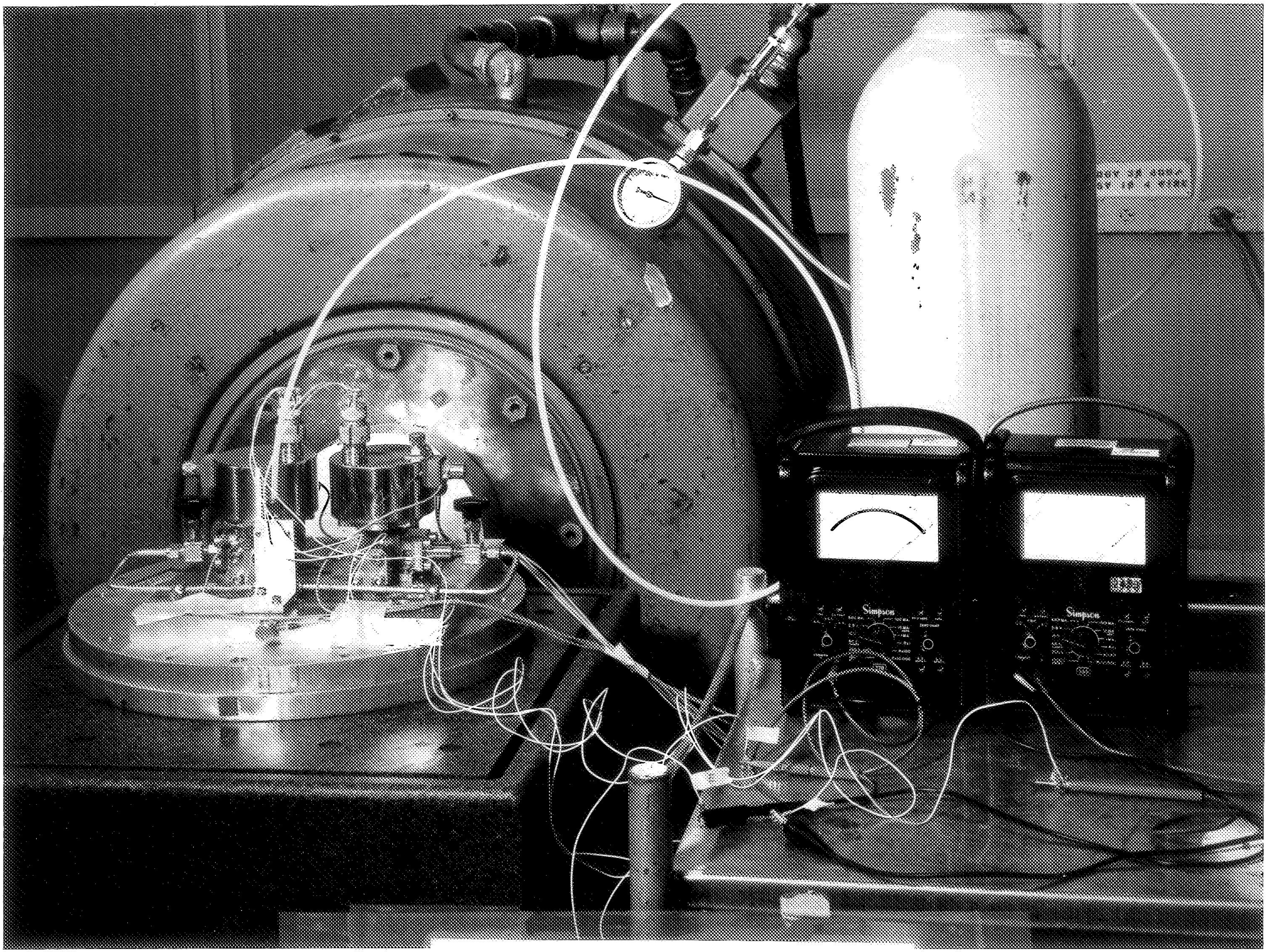
Flow Diverter Valve After Destructive Burst Test



Sinusoidal Vibration Along Major (Z) Axis of Valve

Sinusoidal Vibration Along Port C Axis





Sinusoidal Vibration Along Port A–B Axis

DEVIATION APPROVAL REQUEST

SHEET 1 OF ___

1. FOR: ☐ BEFORE-THE-FACT ☒ AFTER-THE-FACT ☐ SUMMARY OF MINOR NONCONFORMANCES

2. FROM CONTRACTOR:	3. CONTRACT NUMBER:	4. REQUEST NUMBER:
HYDRAULIC RESEARCH AND MFG. CO.	NAS 830075	001

5. NOMENCLATURE:	6. NUMBER:	7. REVISION:	8. DATE:
VALVE	39000750-001	P	2-17-70

9. NONCONFORMANCE:	10. MRB ACTION NO.:	11. SERIAL NUMBER(S):	12. LOT NUMBER:	13. QUANTITY:
☒ MINOR ☐ MAJOR	NONE	NONE	NONE	1

14. SUPPLIER OR SUBCONTRACTOR (GIVE NAME AND ADDRESS):
HYDRAULIC RESEARCH AND MANUFACTURING CO. 25200 W. RYE CYN. RD. VALENCIA, CAL.

15. SPECIFIED REQUIREMENTS:
REF. B/P 3900104 ZN. C-6 SEC. C-C.
.398/.400 X.135 DP.

NOTE: THIS PART IS P/N 3900104 HOUSING AND IS A COMPONENT OF END ITEM P/N 39000750-001.

16. DESCRIPTION OF DEPARTURE FROM REQUIREMENTS:
OVERSIZED TO .438 TO A DEPTH OF .035

17. REASON FOR REQUEST AND/OR CORRECTIVE ACTION TAKEN: THIS CONDITION WILL NOT AFFECT VALVE PERFORMANCE IN FACT THIS CONDITION WILL NEVER BE NOTICED AS THE 3900163 PURGING SCREW IS HELIARC WELDED FLUSH WITH THIS DIA. C/A: MACHINE VENDOR NO LONGER IN BUSINESS.

18. REMARKS: HYD. RES. & MFG. CO. P.O. FROM AVCO IS 754495.
Avco has reviewed the above discrepancy and concurs with the reason for request.
Des. Eng. R. Rouleau 2/24/70
C.C. R. McStephen 2/24/70

19. CONTRACTOR CERTIFICATION: THE CONTRACTOR HEREBY CERTIFIES THAT THE ABOVE DESCRIBED DEVIATION IS A DEPARTURE FROM THE CONTRACTUAL REQUIREMENTS IN THE QUANTITIES AND/OR CONDITIONS AS STATED ABOVE.

☐ ________ COST ADJUSTMENT (EXPLAIN)
☒ NO COST ADJUSTMENT

Q.A. Administrator	Robert C. Noel	2-17-70
TITLE	SIGNATURE OF AUTHORIZED REPRESENTATIVE	DATE

20. GOVERNMENT QUALITY ASSURANCE REPRESENTATIVE COMMENTS:
Reviewed and forwarded to MSFC for action

AFQAR	Richard R. L'Italien	24 Feb 1970
TITLE	SIGNATURE	DATE

21. MSFC REVIEW:

ORGANIZATION SYMBOL	REPRESENTATIVE	CONCURRENCE	NON-CONCURRENCE	DATE
S&E-ASTN-EMC	COR - Design	Kenneth G. Anthony		March 2, 70
S&E-QUAL-ATA	NASA - MSFC	Fred J. Dolan		3-2-70

Pending successful acceptance functional test and qualification tests.

22. CONTRACTING OFFICER'S REPRESENTATIVE OR OTHER DULY DELEGATED AUTHORITY:
☐ DISAPPROVAL (RECOMMENDED)
☒ APPROVAL (RECOMMENDED) ~~(WITH)~~ (WITHOUT) PRICE ADJUSTMENT. $ ______

Kenneth G. Anthony	Mar 2, 70
SIGNATURE	DATE

23. CONTRACTING OFFICER:
☒ APPROVED
☐ DISAPPROVED
☐ SUBJECT TO CONDITIONS STATED ON MSFC FORM ____-1.

Phillip H. Taylor 3-2-70
Phillip H. Taylor, Contracting Officer

DEVIATION APPROVAL REQUEST

SHEET 1 OF ___

1. FOR: ☐ BEFORE-THE-FACT ☒ AFTER-THE-FACT MAR 2 1 REC'D ☐ SUMMARY OF MINOR NONCONFORMANCES

2. FROM CONTRACTOR:	3. CONTRACT NUMBER:	4. REQUEST NUMBER:
HYDRAULIC RESEARCH AND MFG. CO.	NAS 830075	002

5. NOMENCLATURE:	6. NUMBER:	7. REVISION:	8. DATE:
VALVE	39000750-001	P	2-17-70

9. NONCONFORMANCE:	10. MRB ACTION NO.:	11. SERIAL NUMBER(S):	12. LOT NUMBER:	13. QUANTITY:
☒ MINOR ☐ MAJOR	NONE	NONE	~~[illegible]~~ 80862	2

14. SUPPLIER OR SUBCONTRACTOR (GIVE NAME AND ADDRESS):
HYDRAULIC RESEARCH AND MFG. CO. 25200 W. RYE CYN. RD. VALENCIA, CAL.

15. SPECIFIED REQUIREMENTS:
REF. B/P 39001112 ZN C-5 & C-7
1.) .625/.630 DIA. (ZN C-5)
2.) 1.242/1.244 DIA. (ZN C-7)

NOTE: THIS PART IS P/N 39001112 POPPET AND IS A COMPONENT OF END ITEM P/N 39000750-001

16. DESCRIPTION OF DEPARTURE FROM REQUIREMENTS:
1.) (2) PIECES ARE UNDERSIZED TO .623 DIA.
2.) (1) PIECE IS UNDERSIZED TO 1.241/1.243 ALSO OUT OF ROUND.

17. REASON FOR REQUEST AND/OR CORRECTIVE ACTION TAKEN: THESE CONDITIONS WILL NOT AFFECT VALVE PERFORMANCE. C/A: MACHINE VENDOR CONTACTED AND CORRECTIVE ACTION RECEIVED THAT CONDITION IS A RESULT OF OPERATOR ERROR AND THAT FUTURE PARTS SHALL MEET DWG. REQUIREMENTS.

18. REMARKS: HYD. RES. AND MFG. CO. P.O. FROM AVCO IS 754495.
Avco Remarks:
Avco has reviewed the above discrepancy and concurs with the reason for request. Sealing surface of poppet not affected. Des. Eng. R. Rouleau 2/24/70
Q.C. R. Damphousse 2/24/70

19. CONTRACTOR CERTIFICATION: THE CONTRACTOR HEREBY CERTIFIES THAT THE ABOVE DESCRIBED DEVIATION IS A DEPARTURE FROM THE CONTRACTUAL REQUIREMENTS IN THE QUANTITIES AND/OR CONDITIONS AS STATED ABOVE.

☐ ______ COST ADJUSTMENT (EXPLAIN)
☒ NO COST ADJUSTMENT

Q.A. Administrator — [signature] — 2-17-70
TITLE — SIGNATURE OF AUTHORIZED REPRESENTATIVE — DATE

20. GOVERNMENT QUALITY ASSURANCE REPRESENTATIVE COMMENTS:
CC: R. Damphousse 3/11/70
R. Rouleau Reviewed and forwarded to MSFC for action

AFCAR — Richard R. [signature] — 24 Feb 1970
TITLE — SIGNATURE — DATE

21. MSFC REVIEW:

ORGANIZATION SYMBOL	REPRESENTATIVE	CONCURRENCE	NON-CONCURRENCE	DATE
S&E-ASTN-EMC	COR - Design	Kenneth [signature]		March 2, 70
S&E-QUAL-ATA	NASA - MSFC	Fred [signature]		3-2-70

E. dins successful acceptance functional test and qualification tests.

22. CONTRACTING OFFICER'S REPRESENTATIVE OR OTHER DULY DELEGATED AUTHORITY:
☐ DISAPPROVAL (RECOMMENDED)
☑ APPROVAL (RECOMMENDED) ~~(WITH)~~ (WITHOUT) PRICE ADJUSTMENT. $ ______
Kenneth C. Anthony — Mar 2, 70

23. CONTRACTING OFFICER:
☒ APPROVED
☐ DISAPPROVED
☐ SUBJECT TO CONDITIONS STATED ON MSFC FORM ______-1.
Philip H. Taylor — 3-2-70

DEVIATION APPROVAL REQUEST

R. Roulleau

SHEET 1 OF ___

1. FOR: ☐ BEFORE-THE-FACT ☒ AFTER-THE-FACT ☐ SUMMARY OF MINOR NONCONFORMANCES

2. FROM CONTRACTOR:	3. CONTRACT NUMBER:	4. REQUEST NUMBER:
HYDRAULIC RESEARCH AND MFG. CO.	NAS 830075	003

5. NOMENCLATURE:	6. NUMBER:	7. REVISION:	8. DATE:
VALVE	39000750-001	P	2-17-70

9. NONCONFORMANCE:	10. MRB ACTION NO.:	11. SERIAL NUMBER(S):	12. LOT NUMBER:	13. QUANTITY:
☒ MINOR ☐ MAJOR	NONE	NONE	NONE	1

14. SUPPLIER OR SUBCONTRACTOR (GIVE NAME AND ADDRESS):
HYDRAULIC RESEARCH AND MFG. CO. 25200 W. RYE CYN. RD. VALENCIA, CAL.

15. SPECIFIED REQUIREMENTS:	16. DESCRIPTION OF DEPARTURE FROM REQUIREMENTS:
REF. B/P 39001114 ZN A-5 1.443/1.447 DIM. NOTE: THIS PART IS P/N 39001114 SUSPENSION AND IS A COMPONENT OF END ITEM P/N 39000750-001.	UNDERSIZED TO 1.4418.

17. REASON FOR REQUEST AND/OR CORRECTIVE ACTION TAKEN: THIS CONDITION WILL NOT AFFECT VALVE PERFORMANCE. C/A: MACHINE VENDOR NO LONGER IN BUSINESS.

18. REMARKS: HYD. RES. & MFG. CO. P.O. FROM AVCO IS 754495.
Avco has reviewed the above discrepancy and concurs with the reason for request. Poppet stroke not affected, since valve parts are shimmed at assy. Poppet stroke measured in op'n # 40 of the HRC Assy Test & Insp Procedure. Design R. Roulleau 2/24/70 E.C. [illegible] 2/24/70

19. CONTRACTOR CERTIFICATION: THE CONTRACTOR HEREBY CERTIFIES THAT THE ABOVE DESCRIBED DEVIATION IS A DEPARTURE FROM THE CONTRACTUAL REQUIREMENTS IN THE QUANTITIES AND/OR CONDITIONS AS STATED ABOVE.

☐ ________ COST ADJUSTMENT (EXPLAIN)
☒ NO COST ADJUSTMENT

Q.A. Administrator	[signature]	2-17-70
TITLE	SIGNATURE OF AUTHORIZED REPRESENTATIVE	DATE

20. GOVERNMENT QUALITY ASSURANCE REPRESENTATIVE COMMENTS:

Reviewed and forwarded to MSFC for action

AFQAR	Richard R. L'Heureux	24 Feb 1970
TITLE	SIGNATURE	DATE

21. MSFC REVIEW:

ORGANIZATION SYMBOL	REPRESENTATIVE	CONCURRENCE	NON-CONCURRENCE	DATE
S&E-ASTN-EMC	COR - Design	Kenneth B. Anthony		March 2, 70
S&E-QUAL-ATA	NASA / MSFC	Fred J. Dolan		3-2-70

Pending successful acceptance functional test and qualification tests

22. CONTRACTING OFFICER'S REPRESENTATIVE OR OTHER DULY DELEGATED AUTHORITY:

☐ DISAPPROVAL (RECOMMENDED)
☑ APPROVAL (RECOMMENDED) ~~(WITH)~~ (WITHOUT) PRICE ADJUSTMENT. $ ______

Kenneth B. Anthony — Mar 2, 70
SIGNATURE — DATE

23. CONTRACTING OFFICER:

☒ APPROVED
☐ DISAPPROVED
☐ SUBJECT TO CONDITIONS STATED ON MSFC FORM ______-1.

Phillip H. Taylor — 3-2-70
Phillip H. Taylor Contracting Officer — SIGNATURE — DATE

DEVIATION APPROVAL REQUES[T] JUN 30 1970 SHEET 1 OF 1

[ ] BEFORE-THE-FACT [X] AFTER-THE-FACT [ ] SUMMARY OF MINOR NONCONFORMANCES

[PRIME] CONTRACTOR:	3. CONTRACT NUMBER:	4. REQUEST NUMBER:
[A]vco Systems Division	NAS 830075	Avco-205

[NO]MENCLATURE:	6. NUMBER:	7. REVISION:	8. DATE:
[Valv]e Assy, Latching, Pulse Operated	39000750-001	R	5/27/70

[NONCON]FORMANCE:	10. MRB ACTION NO.:	11. SERIAL NUMBER(S):	12. LOT NUMBER:	13. QUANTITY:
MINOR [ ] MAJOR	IR #05258	HRC ~~008~~ 009 / Avco E050093 E050094	N/A	2

SUPPLIER OR SUBCONTRACTOR (GIVE NAME AND ADDRESS):

Hydraulic Research & Mfg. Co., 25200 W. Rye Cyn Rd., Valencia, California

SPECIFIED REQUIREMENTS:	16. DESCRIPTION OF DEPARTURE FROM REQUIREMENTS:
5/16 - 24 UNF 3B Th'ds at Port A - 4 Holes on S/N 008, E050093	4 Holes accepts No Go TPG 2 to 5 1/2 turns
5/16 - 25 UNF 3B Th'd at Port B on hole on S/N 009, E050094	1 Hole accepts No Go TPG loosely through red dot on 188 x 45°.

[17]. REASON FOR REQUEST AND/OR CORRECTIVE ACTION TAKEN:

(1) Avco to repair thread on S/N 009, E050094 using helicoil insert (Flight Unit).
(2) S/N 008, E050093, submitted as is. Condition is considered acceptable to Avco for test (Qual. Unit).

18. REMARKS:

HRC to be advised of problem and corrective action requested. Done per Telecon with R. Wood, Quality Rep. @ HRC on 5/27/70.

19. CONTRACTOR CERTIFICATION: THE CONTRACTOR HEREBY CERTIFIES THAT THE ABOVE DESCRIBED DEVIATION IS A DEPARTURE FROM THE CONTRACTUAL REQUIREMENTS IN THE QUANTITIES AND/OR CONDITIONS AS STATED ABOVE.

[ ] ______ COST ADJUSTMENT (EXPLAIN)

[X] NO COST ADJUSTMENT

Quality Task Mgr. — R. M. Dumphouse — 5/27/70

TITLE — SIGNATURE OF AUTHORIZED REPRESENTATIVE — DATE

20. GOVERNMENT QUALITY ASSURANCE REPRESENTATIVE COMMENTS:

* S/N 008 - RECOMMEND THAT THIS UNIT BE ACCEPTED PROVIDING A POSITIVE IDENTIFICATION IS APPLIED TO UNIT STIPULATING "QUAL TEST UNIT ONLY"

* S/N 009 - RECOMMEND TENTATIVE ACCEPTANCE PENDING SUBMITTAL OF A REWORK PROCEDURE FOR HELICOIL INSTALLATION - James A. Smith

AFQAR — Gerard J. Villano — 27 May 70

TITLE — SIGNATURE — DATE

21. MSFC REVIEW:

ORGANIZATION SYMBOL	REPRESENTATIVE	CONCURRENCE	NON-CONCURRENCE	DATE
S&E-ASTN-EPC	COR- K. Chaffin	✓		MAY 28 70
S&E-QUAL-AFC	James A. Smith	✓*		June 1, 1970
MSE-ATM	R. S. Hockey	✓		6-8-70

22. CONTRACTING OFFICER'S REPRESENTATIVE OR OTHER DULY DELEGATED AUTHORITY:

[ ] DISAPPROVAL (RECOMMENDED)

[X] APPROVAL (RECOMMENDED) ~~(WITH)~~ (WITHOUT) PRICE ADJUSTMENT. $ ______

June 15, 70

23. CONTRACTING OFFICER:

[✓] APPROVED

[ ] DISAPPROVED

[ ] SUBJECT TO CONDITIONS STATED ON MSFC FORM ______

Matthew A. Linnair — 6/23/70

SIGNATURE — DATE

TM

DEVIATION APPROVAL REQUEST

SHEET 1 OF 1

1\. FOR: ☐ BEFORE-THE-FACT ☒ AFTER-THE-FACT ☐ SUMMARY OF MINOR NONCONFORMANCES

FROM CONTRACTOR:	3. CONTRACT NUMBER:	4. REQUEST NUMBER:
Avco Systems Division	NAS 830075	Avco-006

5. NOMENCLATURE:	6. NUMBER:	7. REVISION:	8. DATE:
Valve Assy, Latching, Pulse Operated	39000750-001	R	5/27/70

9. NONCONFORMANCE:	10. MRB ACTION NO.:	11. SERIAL NUMBER(S):	12. LOT NUMBER:	13. QUANTITY:
☒ MINOR ☐ MAJOR	IR #05155	HRC S/N 010 Avco S/N E050105		1

14\. SUPPLIER OR SUBCONTRACTOR (GIVE NAME AND ADDRESS):

15. SPECIFIED REQUIREMENTS:	16. DESCRIPTION OF DEPARTURE FROM REQUIREMENTS:
(1) Valve Assy QATP SD-200	Actual Measurements
para 9.5.2 pins L to J = 24.5 to 27.5 ohms	28.6 ohms
para 9.5.3 pins M to K = 24.5 to 27.5 ohms	28.5 ohms
para 9.11.3 power drain A = 30 ± 1.5 watts	26.88 watts
para 9.11.5 power drain B = 30 ± 1.5 watts	26.60 watts
(2) 5/16-24 UNF-3B Thread, 4 holes port A.	(2) Two holes accept No-Go gauge through and 2 holes accept No-Go gauge 75% through.

17\. REASON FOR REQUEST AND/OR CORRECTIVE ACTION TAKEN:

(1) Values within HRC dwg requirements, QATP SD-200 to be revised.
(2) Threads to be repaired using helicoil inserts (4 holes)

18\. REMARKS: This "DAR" Does Not relieve the contractor from the obligation of meeting the functional requirements of the comtract on ~~this~~ these valve. ~~XXXXXX~~ FAD

19\. CONTRACTOR CERTIFICATION: THE CONTRACTOR HEREBY CERTIFIES THAT THE ABOVE DESCRIBED DEVIATION IS A DEPARTURE FROM THE CONTRACTUAL REQUIREMENTS IN THE QUANTITIES AND/OR CONDITIONS AS STATED ABOVE.

☐ ______ COST ADJUSTMENT (EXPLAIN)
☒ NO COST ADJUSTMENT

Quality Task Manager (TITLE) — R. M. Damphousse (SIGNATURE OF AUTHORIZED REPRESENTATIVE) — 5/27/70 (DATE)

20\. GOVERNMENT QUALITY ASSURANCE REPRESENTATIVE COMMENTS:

* (REF - Item No. 2 - Block 15) RECOMMEND TENTATIVE APPROVAL WITH PROVISIONAL ACCEPTANCE PENDING SUBMITTAL OF A REWORK PROCEDURE FOR HELICOIL INSTALLATION — James A Snively (MECH)

See remarks column above FAD

AFQAR (TITLE) — Gerard J. Villano (SIGNATURE) — 27 May 70 (DATE)

21\. MSFC REVIEW:

ORGANIZATION SYMBOL	REPRESENTATIVE	CONCURRENCE	NON-CONCURRENCE	DATE
S&E-ASTN-EMC	COR K. Arthur	✓		5/28/70
S&E-QUAL-PFC	James A Snively	* ✓		6-1-70
S&E-QUAL-ATA	Fred J. Dolan	✓		
PM-SE-ATM	[illegible]	✓		6-8-70

22\. CONTRACTING OFFICER'S REPRESENTATIVE OR OTHER DULY DELEGATED AUTHORITY:

☐ DISAPPROVAL (RECOMMENDED)
☒ APPROVAL (RECOMMENDED) ~~(WITH)~~ (WITHOUT) PRICE ADJUSTMENT. $ ______

Kenneth G. Arthur (SIGNATURE) — June 15, 70 (DATE)

23\. CONTRACTING OFFICER:

☒ APPROVED
☐ DISAPPROVED
☐ SUBJECT TO CONDITIONS STATED ON MSFC FORM ______-1.

Wesley A. Lenoir (SIGNATURE) — 6/23/70 (DATE)

MSFC- Form 847 (Rev August 1964)

ORIGINAL

DEVIATION APPROVAL REQUEST

1. FOR: ☐ BEFORE-THE-FACT ☒ AFTER-THE-FACT ☐ SUMMARY OF MINOR NONCONFORMANCES

2. FROM CONTRACTOR:	3. CONTRACT NUMBER:	4. REQUEST NUMBER:
HYDRAULIC RESEARCH & MFG. COMPANY 25200 West Rye Cyn Rd., Valencia, Calif. 91355	NAS 830075	008

5. NOMENCLATURE:	6. NUMBER:	7. REVISION:	8. DATE:
Valve Assy., Latching	39000750-001	R	7-23-70

9. NONCONFORMANCE:	10. MRB ACTION NO.:	11. SERIAL NUMBER(S):	12. LOT NUMBER:	13. QUANTITY:
☒ MINOR ☐ MAJOR	AVCO Insp. Rept. #05402	011 & 012	--	2

14. SUPPLIER OR SUBCONTRACTOR (GIVE NAME AND ADDRESS):

HYDRAULIC RESEARCH & MANUFACTURING COMPANY
25200 West Rye Canyon Road, Valencia, California 91355

15. SPECIFIED REQUIREMENTS:	16. DESCRIPTION OF DEPARTURE FROM REQUIREMENTS:
Ref. Dwg. 39001118 (Ports A & B) The 5/16-24 UNF-3B threaded holes must conform to thread specification. Note: 39001118 is P/N of Ports components in which discrepancies exist.	S/N 011 & S/N 012 (Ports A & B) MS 21209-F5-15 Helicoils have been installed in ports "A" and "B"

17. REASON FOR REQUEST AND/OR CORRECTIVE ACTION TAKEN:

Reason for Request: Instructions from AVCO for installation of Helicoils.

18. REMARKS:

Reason for Helicoil installation: Threads were oversized on the pitch and/or minor diameters.

Acceptable to S&E-QUAL pending form, fit, and functions checks at MSFC JAH. 9-18

19. CONTRACTOR CERTIFICATION: THE CONTRACTOR HEREBY CERTIFIES THAT THE ABOVE DESCRIBED DEVIATION IS A DEPARTURE FROM THE CONTRACTUAL REQUIREMENTS IN THE QUANTITIES AND/OR CONDITIONS AS STATED ABOVE.

☐ ______ COST ADJUSTMENT (EXPLAIN)
☒ NO COST ADJUSTMENT

TITLE	SIGNATURE OF AUTHORIZED REPRESENTATIVE	DATE
Quality Assurance Administrator	*Bobby L. [signature]*	7-23-70

20. GOVERNMENT QUALITY ASSURANCE REPRESENTATIVE COMMENTS:

Recommend approval - forwarded for your action.

cc R Roskow 7/29

TITLE	SIGNATURE	DATE
AFQAR	*R. R. L. [signature]*	*8/20/70*

21. MSFC REVIEW:

ORGANIZATION SYMBOL	REPRESENTATIVE	CONCURRENCE	NON-CONCURRENCE	DATE
S&E-QUAL-ATA	*James A. Hays*	*Provisional ✓*		*9-18-70*
PM/SE-ATM	*David E. Snodley*	*✓*		*9-23-70*

22. CONTRACTING OFFICER'S REPRESENTATIVE OR OTHER DULY DELEGATED AUTHORITY:

☐ DISAPPROVAL (RECOMMENDED)
☒ APPROVAL (RECOMMENDED) (~~WITH~~)
(WITHOUT) PRICE ADJUSTMENT. $ ______

SIGNATURE	DATE
Kenneth G. Anthony	*Sept 23, 70*

23. CONTRACTING OFFICER:

☒ APPROVED
☐ DISAPPROVED
☐ SUBJECT TO CONDITIONS STATED ON MSFC FORM ______

SIGNATURE	DATE
Charles C. Linn CHARLES C. LINN	*9-23-70*

CONTRACTING OFFICER

DEVIATION APPROVAL REQUEST

SHEET 1 OF ___

1. FOR: ☐ BEFORE-THE-FACT ☐ AFTER-THE-FACT ☒ SUMMARY OF MINOR NONCONFORMANCES

2. FROM CONTRACTOR:	3. CONTRACT NUMBER:	4. REQUEST NUMBER:
vco Systems Division, Lowell Industrial Park, Lowell, Massachusetts 01851	NAS 8-30075	Avco-010

5. NOMENCLATURE:	6. NUMBER:	7. REVISION:	8. DATE:
Flow Diverter Valve	39000750-001 MSFC 20M42517	S C	2 Sept. 1970

9. NONCONFORMANCE:	10. MRB ACTION NO.:	11. SERIAL NUMBER(S):	12. LOT NUMBER:	13. QUANTITY:
☒ MINOR ☐ MAJOR		007, 008, 009, 010, 011, 012, 013, 014		eight (8)

14. SUPPLIER OR SUBCONTRACTOR (GIVE NAME AND ADDRESS):

Hydraulic Research and Manufacturing Co., 25200 West Rye Canyon Road, Valencia, California 91355

15. SPECIFIED REQUIREMENTS:

1. Coil transient voltage - specification 20M42517, Rev. C., para. 4.3.4.15. Peak transient voltage not to exceed 150% of rated voltage.
2. Qualification Test Procedure-STP-SSD-1024, para. 5.6.5. Transient voltage of 72vdc applied for 5 microseconds.

16. DESCRIPTION OF DEPARTURE FROM REQUIREMENTS:

1. S/N 007, 008, 009, 010, 011, 012, 013, 014-*See Remarks. Peak transient voltage on S/N 007 and 008 with 28VDC rated voltage is 50-52 volts. Should be 42 volts.
2. Transient voltage of 72 VDC applied for approximately 2 microseconds and remaining 3 microseconds at approximately 20 VDC.

17. REASON FOR REQUEST AND/OR CORRECTIVE ACTION TAKEN:

1. Request to use as is. All valves are assembled and covers welded in place. Requires major rework to correct discrepancy. 2. Reduced pulse width is result of coupling effect between valve coil (inductive load) and pulse generator which limits pulse width at full amplitude.

REMARKS:

*Peak transient voltage of 50-52 VDC has been measured on S/N 007 and 008 (qualification units) only. Due to design and construction, the same results are anticipated on all other units. This test is not part of acceptance testing.

19. CONTRACTOR CERTIFICATION: THE CONTRACTOR HEREBY CERTIFIES THAT THE ABOVE DESCRIBED DEVIATION IS A DEPARTURE FROM THE CONTRACTUAL REQUIREMENTS IN THE QUANTITIES AND/OR CONDITIONS AS STATED ABOVE.

☐ ____________ COST ADJUSTMENT (EXPLAIN)

☒ NO COST ADJUSTMENT

Project Engr. — [signature] — 9/3/70

Q.C. Pr. Engr. — J. H. Mopola — 9/3/70

TITLE — SIGNATURE OF AUTHORIZED REPRESENTATIVE — DATE

20. GOVERNMENT QUALITY ASSURANCE REPRESENTATIVE COMMENTS:

Forwarded for your review and action

AFQAR — Richard R. L'Italien — 9/3/70

TITLE — SIGNATURE — DATE

21. MSFC REVIEW:

ORGANIZATION SYMBOL	REPRESENTATIVE	CONCURRENCE	NON-CONCURRENCE	DATE
S&E-QUAL-E	R. W. Linchfield		✓	10/6/70
S&E-ASTR-SE	[signature]	✓ (See Attachment)		11/30/70
S/SE-ATM	[signature]			[illegible]

22. CONTRACTING OFFICER'S REPRESENTATIVE OR OTHER DULY DELEGATED AUTHORITY:

☐ DISAPPROVAL (RECOMMENDED)

☒ APPROVAL (RECOMMENDED)(WITH) (WITHOUT) PRICE ADJUSTMENT. $ —0—

[signature] — Dec 4, 70

SIGNATURE — DATE

23. CONTRACTING OFFICER:

☒ APPROVED

☐ DISAPPROVED

☐ SUBJECT TO CONDITIONS STATED ON MSFC FORM ______-1.

[signature] — 12-4-70

SIGNATURE — DATE

MSFC- Form 847 (Rev August 1964) COPY #2 CONTRACTING OFFICER'S REPRESENTATIVE

Mr. Morgan DEVIATION APPROVAL REQUEST SHEET 1 OF 1

1. FOR: ☐ BEFORE-THE-FACT ☒ AFTER-THE-FACT ☐ SUMMARY OF MINOR NONCONFORMANCES JUN 10 Rec'd

2. FROM CONTRACTOR:	3. CONTRACT NUMBER:	4. REQUEST NUMBER:
(HY)DRAULIC RESEARCH AND MFG. CO.	NAS 830075	004

5. NOMENCLATURE:	6. NUMBER:	7. REVISION:	8. DATE:
VALVE	39000750-001		

9. NONCONFORMANCE:	10. MRB ACTION NO.:	11. SERIAL NUMBER(S):	12. LOT NUMBER:	13. QUANTITY:
☒ MINOR ☐ MAJOR	NONE	NONE	80862	2

14. SUPPLIER OR SUBCONTRACTOR (GIVE NAME AND ADDRESS):
(HY)DRAULIC RESEAR(CH) AND MFG. CO. 25200 W. RYE CYN. RD. VALENCIA, CAL.

15. SPECIFIED REQUIREMENTS:
REF. B/P 39001112 ZN C-3 SEC. A-A.

1.) | ⌖ | A Ⓢ | .003 TOTAL Ⓢ |
— B DIA —

NOTE: THIS PART IS P/N 39001112 POPPET AND IS A COMPONENT OF END ITEM P/N 39000750-001 VALVE.

16. DESCRIPTION OF DEPARTURE FROM REQUIREMENTS:
1.) THE 'B' DIA. IS OFF LOCATION TO 'A' FROM .005 TO .008

17. REASON FOR REQUEST AND/OR CORRECTIVE ACTION TAKEN: THIS DISCREPANCY WILL NOT AFFECT VALVE PERFORMANCE. C/A: MACHINE VENDOR, PRECISION MACHINE CO., WILL ON FUTURE PARTS, MANUFACTURE AND INSPECT THIS DIMENSION USING A FIXTURE.

18. REMARKS: HYD. RES. AND MFG. CO. P.O. FROM AVCO IS 754495.
AVCO COMMENT:
Housing, suspension, & poppet have been fit checked and there is no interference.
Avco Q.C R.M. Danphouse 5/27/70
Avco Eng'g. R. Paulsen 5/27/70

19. CONTRACTOR CERTIFICATION: THE CONTRACTOR HEREBY CERTIFIES THAT THE ABOVE DESCRIBED DEVIATION IS A DEPARTURE FROM THE CONTRACTUAL REQUIREMENTS IN THE QUANTITIES AND/OR CONDITIONS AS STATED ABOVE.

☐ ________ COST ADJUSTMENT (EXPLAIN)
☒ NO COST ADJUSTMENT

Q.A. ADMINISTRATOR — TITLE | Bobby R. Hood — SIGNATURE OF AUTHORIZED REPRESENTATIVE | 5-21-70 — DATE

20. GOVERNMENT QUALITY ASSURANCE REPRESENTATIVE COMMENTS:

AFQAR — TITLE | Gerard J. Villano — SIGNATURE | 27-May 70 — DATE

21. MSFC REVIEW:

ORGANIZATION SYMBOL	REPRESENTATIVE	CONCURRENCE	NON-CONCURRENCE	DATE
S&E-ASTN-ENC	COR Design Kenneth Anthony		✓	June 4/70

22. CONTRACTING OFFICER'S REPRESENTATIVE OR OTHER DULY DELEGATED AUTHORITY:
☑ DISAPPROVAL (RECOMMENDED)
☐ APPROVAL (RECOMMENDED)(WITH) (WITHOUT) PRICE ADJUSTMENT. $
Kenneth G. Anthony — SIGNATURE | June 4/70 — DATE

23. CONTRACTING OFFICER:
☐ APPROVED
☒ DISAPPROVED
☐ SUBJECT TO CONDITIONS STATED ON MSFC FORM ______-1.
Charles C. Linn
Charles C. Linn, Contracting Officer — SIGNATURE | 6-5-70 — DATE

MSFC Form 847 (Rev August 1964) COPY #1 CONTRACTING OFFICER

DEVIATION APPROVAL REQUEST SHEET 1 OF ____

1. FOR: [ ] BEFORE-THE-FACT [X] AFTER-THE-FACT [ ] SUMMARY OF MINOR NONCONFORMANCES

2. FROM CONTRACTOR:	3. CONTRACT NUMBER:	4. REQUEST NUMBER:
Avco Systems Division	NAS 8-30075	Avco-009

5. NOMENCLATURE:	6. NUMBER:	7. REVISION:	8. DATE:
Valve Assy, Latching, Pulse Operated	39000750-001	R	9-2-70

9. NONCONFORMANCE:	10. MRB ACTION NO.:	11. SERIAL NUMBER(S):	12. LOT NUMBER:	13. QUANTITY:
[X] MINOR [ ] MAJOR	IR #05481	HRC / Avco 014 G050126 013 G050125	N/A	2

14. SUPPLIER OR SUBCONTRACTOR (GIVE NAME AND ADDRESS):

Hydraulic Research & Mfg. Co., 25200 W. Rye Cyn Rd., Valencia, California

15. SPECIFIED REQUIREMENTS:

S/N 014-Port 'B'

Hole 1	Hole 2	Hole 3	Hole 4
X Dim .438	X Dim .438	X Dim .876	X Dim .876
Y Dim .876	Y Dim .438	Y Dim .438	Y Dim .876

S/N 014-Port 'A'

Hole 1	Hole 2	Hole 3	Hole 4
X Dim .876	X Dim .876	X Dim .438	X Dim .438
Y Dim .438	Y Dim .876	Y Dim .876	Y Dim .438

S/N 013 No marks on face of Port 'A'

16. DESCRIPTION OF DEPARTURE FROM REQUIREMENTS:

S/N 014-Port 'B'

Hole 1	Hole 2	Hole 3	Hole 4
X Dim-.0027	X Dim+.0018	X Dim-.0042	X Dim-.0067
Y Dim-.0065	Y Dim -.0047	Y Dim-.001	Y Dim-.0063

S/N 014-Port 'A'

Hole 1	Hole 2	Hole 3	Hole 4
X Dim+.0053	X Dim+.0001	X Dim-.0033	X Dim+.0007
Y Dim-.0019	Y Dim-.0047	Y Dim-.0015	Y Dim+.0038

S/N 013 Nick on face near edge at 'A' Port .040 Dia x .030 Deep

17. REASON FOR REQUEST AND/OR CORRECTIVE ACTION TAKEN:

S/N 014 - Hole location conforms to Nasa/MSFC 20M 42522, which allows greater tolerance than HRC Dwg. 39001118

S/N 013 - Nick on edge of Port beyond sealing area, and will not prevent sealing at flange.

18. REMARKS:

None

Acceptable TO S&E-QUAL pending Form Fit & Function TEST AT MSFC.
JAH 9-18-70

19. CONTRACTOR CERTIFICATION: THE CONTRACTOR HEREBY CERTIFIES THAT THE ABOVE DESCRIBED DEVIATION IS A DEPARTURE FROM THE CONTRACTUAL REQUIREMENTS IN THE QUANTITIES AND/OR CONDITIONS AS STATED ABOVE.

[ ] ____ COST ADJUSTMENT (EXPLAIN)

[ ] NO COST ADJUSTMENT

Q. C. Project Engineer — J. H. Mazzola — 9/3/70

TITLE — SIGNATURE OF AUTHORIZED REPRESENTATIVE — DATE

20. GOVERNMENT QUALITY ASSURANCE REPRESENTATIVE COMMENTS:

Forwarded for your review and action

cc: R Rouleau 9/29

AFQAR — Richard R. L'Stahi — 9/3/70

TITLE — SIGNATURE — DATE

21. MSFC REVIEW:

ORGANIZATION SYMBOL	REPRESENTATIVE	CONCURRENCE	NON-CONCURRENCE	DATE
S&E-QUAL-ATA	James A. Harp	Provisional ✓		9-18-70
PM/SE-ATM	David E. Snoddy	✓		9-23-70

22. CONTRACTING OFFICER'S REPRESENTATIVE OR OTHER DULY DELEGATED AUTHORITY:

[ ] DISAPPROVAL (RECOMMENDED)

[X] APPROVAL (RECOMMENDED) ~~(WITH)~~

(WITHOUT) PRICE ADJUSTMENT. $ ____

Kenneth G. Anthony — Sept 23, 70

SIGNATURE — DATE

23. CONTRACTING OFFICER:

[X] APPROVED

[ ] DISAPPROVED

[ ] SUBJECT TO CONDITIONS STATED ON MSFC FORM ____-1.

Charles C. Linn — CHARLES C. LINN — 9-23-70

SIGNATURE — DATE

MSFC Form 847 (Rev August 1964)

1. FOR: ☐ BEFORE-THE-FACT ☒ AFTER-THE-FACT ☐ SUMMARY OF MINOR NONCONFORMANCES

2. FROM CONTRACTOR:	3. CONTRACT NUMBER:	4. REQUEST NUMBER:
Avco Systems Division	NAS 830075	Avco 007

5. NOMENCLATURE:	6. NUMBER:	7. REVISION:	8. DATE:
Valve Assy, Latching, Pulse Operated	39000750-001	R	6/5/70

9. NONCONFORMANCE:	10. MRB ACTION NO.:	11. SERIAL NUMBER(S):	12. LOT NUMBER:	13. QUANTITY:
☒ MINOR ☐ MAJOR	IR #05267	HRC S/N 007 Avco E050106		1

14. SUPPLIER OR SUBCONTRACTOR (GIVE NAME AND ADDRESS):

15. SPECIFIED REQUIREMENTS:	16. DESCRIPTION OF DEPARTURE FROM REQUIREMENTS:
(1) 5/16-24 UNF-3B Thread, 4 Holes Pad A.	(1) 5/16-24 UNF 3B Thread (4 Holes) accepts No-Go gauge from 4 to 8 1/2 turns.
(2) Surface finish on Pad B should be 32	(2) Surface finish on Pad B is 55

17. REASON FOR REQUEST AND/OR CORRECTIVE ACTION TAKEN:

(1) Threads to be used as is. (This is a non-flight unit to be used for qualification tests.)
(2) Pad B is to be reworked to correct surface finish.

18. REMARKS:

None

19. CONTRACTOR CERTIFICATION: THE CONTRACTOR HEREBY CERTIFIES THAT THE ABOVE DESCRIBED DEVIATION IS A DEPARTURE FROM THE CONTRACTUAL REQUIREMENTS IN THE QUANTITIES AND/OR CONDITIONS AS STATED ABOVE.

☐ ________ COST ADJUSTMENT (EXPLAIN)
☒ NO COST ADJUSTMENT

Quality Task Manager — TITLE
Joseph H. Mogol — SIGNATURE OF AUTHORIZED REPRESENTATIVE
6/15/70 — DATE

20. GOVERNMENT QUALITY ASSURANCE REPRESENTATIVE COMMENTS:

cc R. Royleau 2/2/71

AFQAR — TITLE
Richard R. L'Esther — SIGNATURE
6/15/70 — DATE

21. MSFC REVIEW:

ORGANIZATION SYMBOL	REPRESENTATIVE	CONCURRENCE	NON-CONCURRENCE	DATE

22. CONTRACTING OFFICER'S REPRESENTATIVE OR OTHER DULY DELEGATED AUTHORITY:

☐ DISAPPROVAL (RECOMMENDED)
☒ APPROVAL (RECOMMENDED) (~~WITH~~)
(WITHOUT) PRICE ADJUSTMENT. $ ________

Kenneth G. Anthony — SIGNATURE
Jan 29-71 — DATE

23. CONTRACTING OFFICER:

☒ APPROVED
☐ DISAPPROVED
☐ SUBJECT TO CONDITIONS STATED ON MSFC FORM ____-1.

Charles C. Linn — SIGNATURE
CHARLES C. LINN
1-29-71 — DATE

MSFC- Form 847 (Rev August 1964)

~~COPY - CONTRACTOR~~ Original

Attachment to Waiver No.
39000750001 MSFC 20M42517

TRANSIENT GENERATION
(50M02477, Paragraph 4)

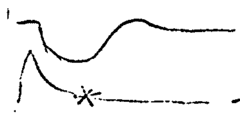
P/DS No. 1

Equipment Nomenclature: FLOW PATH SELECTOR VALVE
Manufacturer: HYDRAULIC RESEARCH
Model Number: 20M42517
Serial Number: 013
Procedure: Apply 28 volt power to test specimen through the same type power switching device used in the system. Record transients developed across the Power Distribution Simulator network during "ON" and "OFF" switching. Turn specimen "ON and record operational transients across PDS network. Record both steady-state and mode change transients.

Power Switching Devices: ECA - ATM THERMAL CONTROL

Turn On transient: 1.4V @ 20ms

Turn Off transient: * 2V @ 10ms



Operational: N/A

If too complex to define, attach photograph.

Remarks: * AC SCOPE COUPLING
2Ω LOAD IN XIEWG NETWORK (1.7 VOLT DROP)

Test conducted by E. ENGLAND

Responsible Engineer KEN. ANTHONY

Test Date 11-25-70

Qualified YES LW³ 11-25-70

Waiver Status N/A

The Flow Diverter Valve passed 50M02477 transient specification.