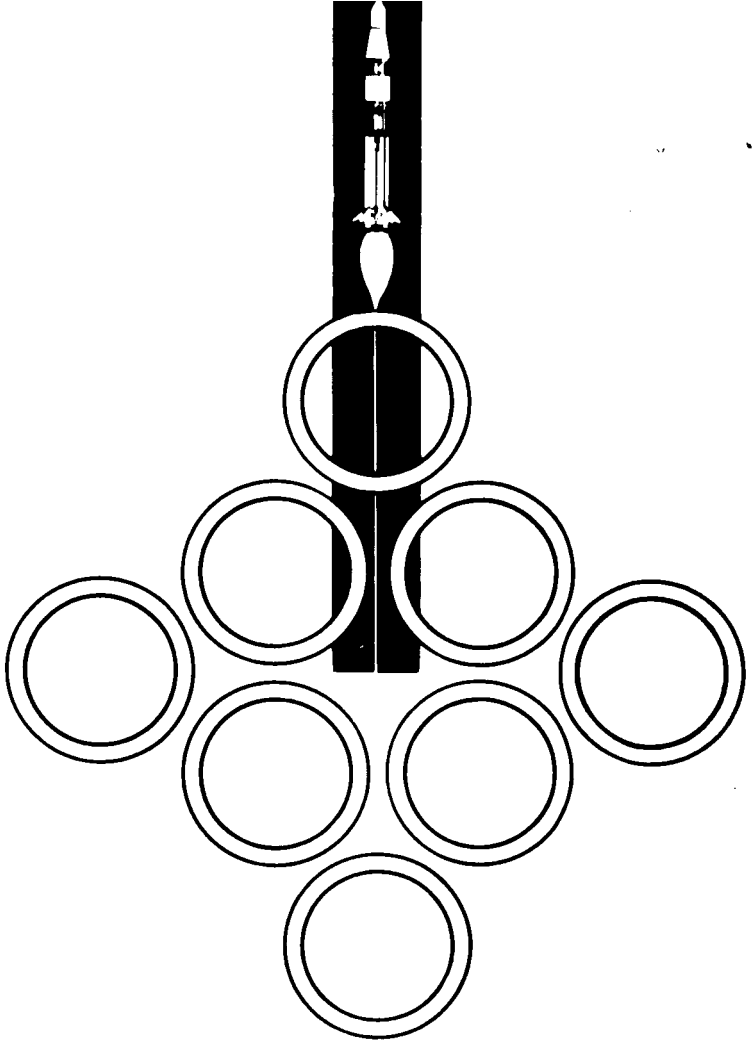

ENGINEERING DEPARTMENT

TECHNICAL REPORT

TR-RE-CCSD-FO-1073-3

March 8, 1967

SATURN IB PROGRAM

TEST REPORT
FOR

BUTTERFLY VALVE, 12-INCH, 3-PSIG

Keystone Valve Corporation Model Number Figure 100-12"

Ramcon Corporation Operator Model Number 50B

NASA Drawing Number 75M04406 PBFV-9

SPACE DIVISION CHRYSLER CORPORATION

TEST REPORT

FOR

BUTTERFLY VALVE, 12-INCH, 3-PSIG

Keystone Valve Corporation Model Number Figure 100-12"

Ramcon Corporation Operator Model Number 50B

NASA Drawing Number 75M04406 PBFV-9

ABSTRACT

This report presents the results of tests performed on one sample of Butterfly Valve 75M04406 PBFV-9. The following tests were performed:

1. Receiving Inspection
2. Proof Pressure
3. Functional
4. Low Temperature
5. High Temperature
6. Flow
7. Cycle
8. Salt Fog

The results of the tests were satisfactory. The performance of the specimen was in accordance with specification requirements.

TEST REPORT

FOR

BUTTERFLY VALVE, 12-INCH, 3-PSIG

Keystone Valve Corporation Model Number Figure 100-12"

Ramcon Corporation Operator Model Number 50B

NASA Drawing Number 75M04406 PBFV-9

March 8, 1967

CHRYSLER CORPORATION SPACE DIVISION - NEW ORLEANS, LOUISIANA

FOREWORD

The tests reported herein were conducted for the John F. Kennedy Space Center by Chrysler Corporation Space Division (CCSD), New Orleans, Louisiana. This document was prepared by CCSD under Contract NAS8-4016, Part VII, CWO 271620.

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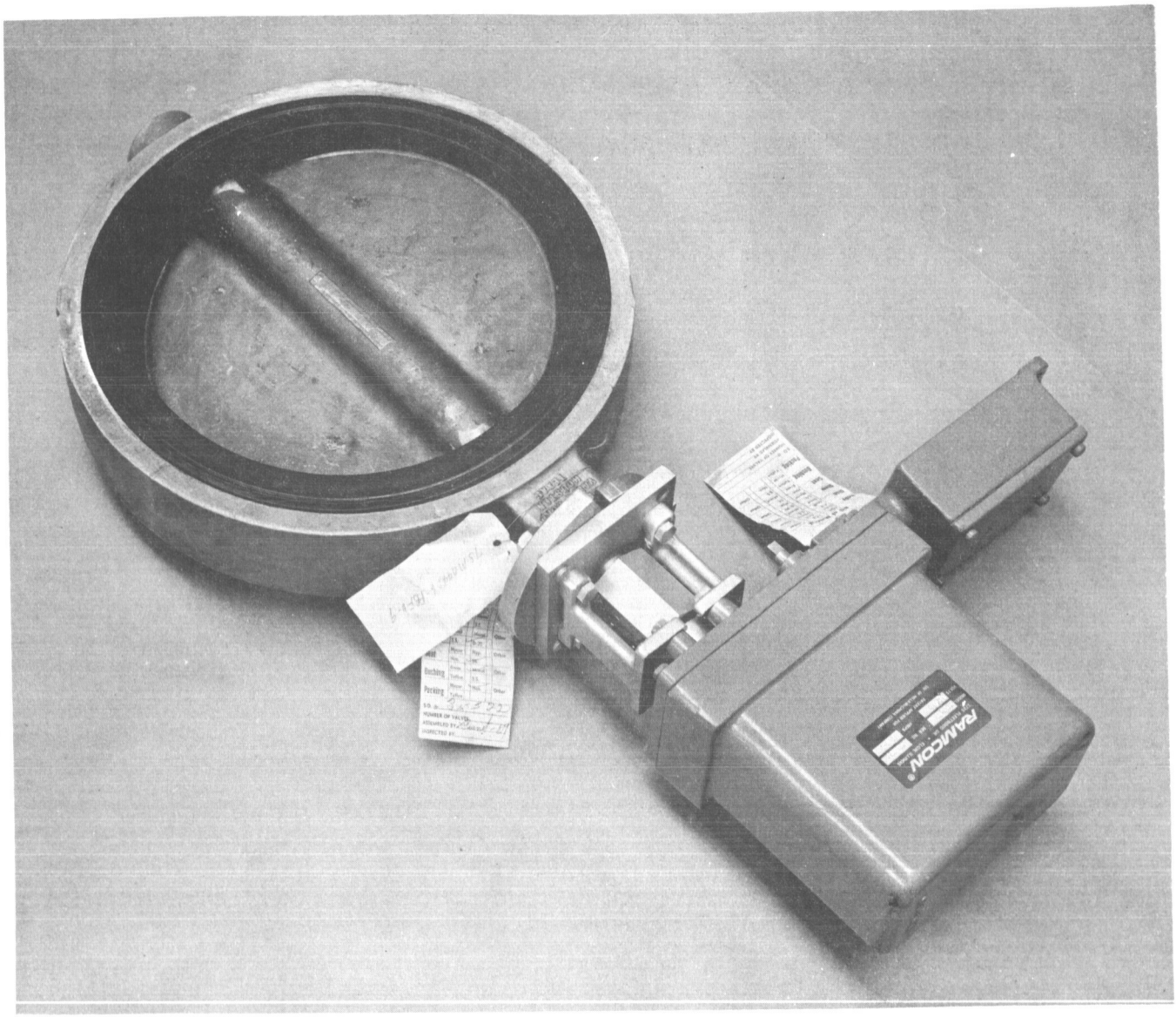


Butterfly Valve 75M04406 PBFV-9, 12-Inch, 3-PSIG

CHECK SHEET

FOR

BUTTERFLY VALVE 12-INCH, 3-PSIG

MANUFACTURER (VALVE): Keystone Valve Corporation, Houston, Texas
MANUFACTURER'S MODEL NUMBER: Figure 100-12"
MANUFACTURER(OPERATOR): Ramcon Corporation, Hampshire, Illinois
MANUFACTURER'S OPERATOR MODEL NUMBER: 50B
TESTING AGENCY: Chrysler Corporation Space Division, New Orleans, Louisiana
AUTHORIZING AGENCY: NASA KSC

I. FUNCTIONAL REQUIREMENTS

A. OPERATING MEDIUM:	Valve - Air and GN_2 Motor - 115 vac, 60 cycle
B. VALVE CAPACITY:	To be determined
C. FLOW RATE:	150 pounds air per minute
D. UPSTREAM PRESSURE:	57 inches of water, maximum 0 inches of water, minimum
E. MAXIMUM PRESSURE DROP:	1 inch of water
F. VALVE OPERATION:	12 inch, motor operated with reversible motor
G. CYCLE TIME:	15 seconds minimum, 25 seconds maximum for 90 degrees rotation

II. CONSTRUCTION

A. MATERIAL:	Body - Cast aluminum Disc- Bronze Stem - 316 stainless steel Packing - Asbestos Seat - Neoprene Motor Housing - Cast aluminum

III. ENVIRONMENTAL REQUIREMENTS

A. OPERATING TEMPERATURE:	35 to 200°F

IV. LOCATION AND USE:	Used as an air conditioning flow control valve in the environmental control system at John F. Kennedy Space Center Launch Complexes 34 and 37B.

TEST SUMMARY

FOR

BUTTERFLY VALVE, 12-INCH, 3-PSIG

75M04406 PBFV-9

Environment	Units	Operational Boundary	Test Objective	Test Results	Remarks
Proof Pressure Test	1	225 psig	Check for leakage and distortion	Satisfactory	No leakage or distortion
Functional Test	1	Insulation Resistance: 20 mego min Valve Response Speed: 15 sec min 25 sec max	Determine insulation resistance and valve response speed. Check valve overrun and valve disc position stability	Satisfactory	Insulation resistance greater than 20 mego. Valve response speed 15 sec
Low Temperature Test	1	5(+0-4)° F	Determine operating ability during and after low temperature test	Satisfactory	Test completed
High Temperature Test	1	200(+4-0) °F	Determine operating ability during and after high temperature test	Satisfactory	Test completed
Flow Test	1	NA	Determine C_v	Satisfactory	C_v: 9500 at 3000 gpm
Cycle Test	1	5000 at 3 psig	Determine operating ability after every 1000 cycles	Satisfactory	Test completed
Salt Fog Test	1	240 hours exposure to salt solution (5% salt by weight, pH 7.0(+.2,-.5) s.g. 1.030 (± .007) at 95 (+3-4)° F	Determine operating ability after exposure to salt fog	Satisfactory	Test completed

SECTION I

INTRODUCTION

1.1 SCOPE

This report presents the results of tests that were performed to determine whether butterfly valve 75M04406 PBFV-9 meets the operational and environmental requirements of the John F. Kennedy Space Center Launch Complexes 34 and 37B. A summary of the test results is presented on page viii.

1.2 ITEM DESCRIPTION

1.2.1 One specimen of Butterfly Valve 75M04406 PBFV-9 was tested.

1.2.2 The valve is a 12-inch, rotatable, disc-type valve operated by a reversible AC motor. The motor is manufactured by Ramcon Corporation, Hampshire, Illinois. The valve is manufactured by Keystone Valve Corporation, Houston, Texas, and serves as an air conditioning flow control valve in the environmental control system at Launch Complexes 34 and 37B.

1.2.3 Dimensionally, the valve is 3 inches face to face and has a motor that is 6.7 inches in overall length mounted parallel to the direction of flow. The distance from the bottom of the valve housing to the top of the motor housing is 20 inches. The valve is operated by the reversible 115-vac, 60-cycle, single-phase motor. The motor is of the capacitor-run design with a geared speed reducer. The motor has a maximum full load capacity of 80 volt-amperes and a maximum locked rotor capacity of 110 volt-amperes producing a minimum output torque at the motor reducer of 500 inch-pounds. The motor movement is controlled by two limiting switches, which are capable of field adjustment to any desired position between fully opened and fully closed, and an electromechanical brake. There is a Bakelite terminal strip on the motor to allow outside electrical connections.

1.3 APPLICABLE DOCUMENTS

The following documents contain the test requirements for Butterfly Valve 75M04406 PBFV-9:

a. KSC-STD-164(D), Standard Environmental Test Methods for Ground Support Equipment Installations at Cape Kennedy

b. NASA drawing 75M04406 PBFV-9

c. MSFC cleaning specification MSFC-SPEC-164

d. Test Plan CCSD-FO-1073-IF, Rev. "A", test requirements

e. Test Procedure TP-RE-CCSD-FO-1073-2F

SECTION II

RECEIVING INSPECTION

2.1 TEST REQUIREMENTS

The specimen shall be visually and dimensionally inspected for conformance with the applicable specifications prior to testing.

2.2 TEST PROCEDURE

A visual and dimensional inspection of the specimen was performed to determine compliance with NASA drawing 75M04406 PBFV-9 and the applicable vendor drawing to the extent possible without disassembly of the test specimen. At the same time the test specimen was also inspected for poor workmanship and manufacturing defects.

2.3 TEST RESULTS

The specimen complied with NASA drawing 75M04406 PBFV-9. No evidence of poor workmanship or manufacturing defects was observed.

2.4 TEST DATA

The data presented in tables 2-1 and 2-2 were recorded during the inspection.

Table 2-1. Specimen Nomenclature

VALVE	MOTOR
Name: Keystone Valve	Name: Ramcon Corp.
Size 12 in., 150 psig Model Figure 100-12"	Model 50 BR-WP Serial No. 5518G61

Table 2-2. Receiving Inspection Test Results

Valve Inside Diameter	12.09 in.
Valve Outside Diameter	16.0 in.
Valve Thickness	3.0 in.
Valve Top Plate Diameter	6.0 in.

SECTION III

PROOF PRESSURE TEST

3.1 TEST REQUIREMENTS

3.1.1 The inlet and outlet ports of the test specimen shall be pressurized simultaneously with H_2O at 225 psig. This pressure shall be maintained for 5 minutes.

3.1.2 Any visible leakage or distortion shall be noted.

3.2 TEST PROCEDURE

3.2.1 The proof pressure test setup was assembled as shown in figure 3-1 using the equipment listed in table 3-1.

3.2.2 It was determined that all connections were tight and gage 4 was installed and operating properly.

3.2.3 Hand valve 3 was opened and the specimen was filled with H_2O using source 7.

3.2.4 Hand valve 2 was opened and the lines and the specimen were purged of air by operating hand pump 5.

3.2.5 Hand valve 3 was closed.

3.2.6 The test specimen was pressurized to 225 psig. The pressure was monitored on gage 4.

3.2.7 Hand valve 2 was closed and the 225-psig pressure was maintained for 5 minutes. The specimen was checked for leakage. The pressure was vented and the specimen was checked for distortion.

3.3 TEST RESULTS

The test specimen did not leak, and there was no evidence of distortion.

3.4 TEST DATA

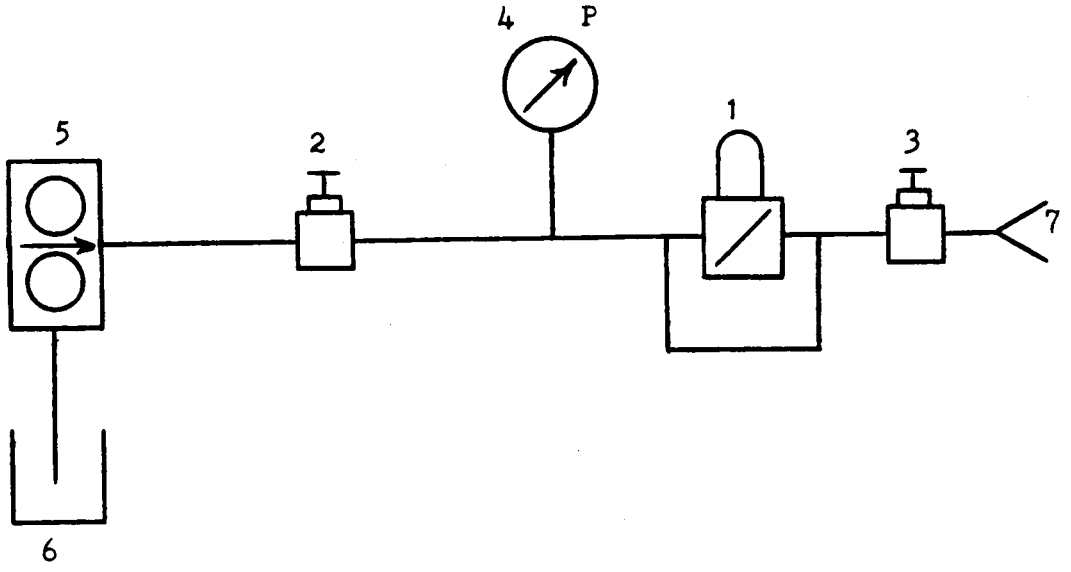
The data presented in table 3-2 were recorded during the test.

Table 3-1. Proof Pressure Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Keystone Valve Corporation	Figure 100-12"	5518G61	Butterfly Valve, 12-inch, 3-psig
2	Hand Valve	Robbins Aviation, Inc.	SSKG250 -4T	NA	¼-inch
3	Hand Valve	Robbins Aviation, Inc.	SSKG250 -4T	NA	¼-inch
4	Gage	Heise	H41043	106443	0-to 500-psig ±0.5% FS accuracy Cal date 1-21-67
5	Hand Pump	Pressure Products Industries, Inc.	NA	K750	Water
6	Reservoir	Pressure Products Industries, Inc.	NA	K750	
7	H_2O Source	CCSD	NA	NA	Chilled Water

Table 3-2. Proof Pressure Test Results

Pressure (psig)	225
Leakage	None
Distortion	None



Note: All lines ¼ inch.
Refer to table 3-1 for item identification.

Figure 3-1. Proof Pressure Test Schematic

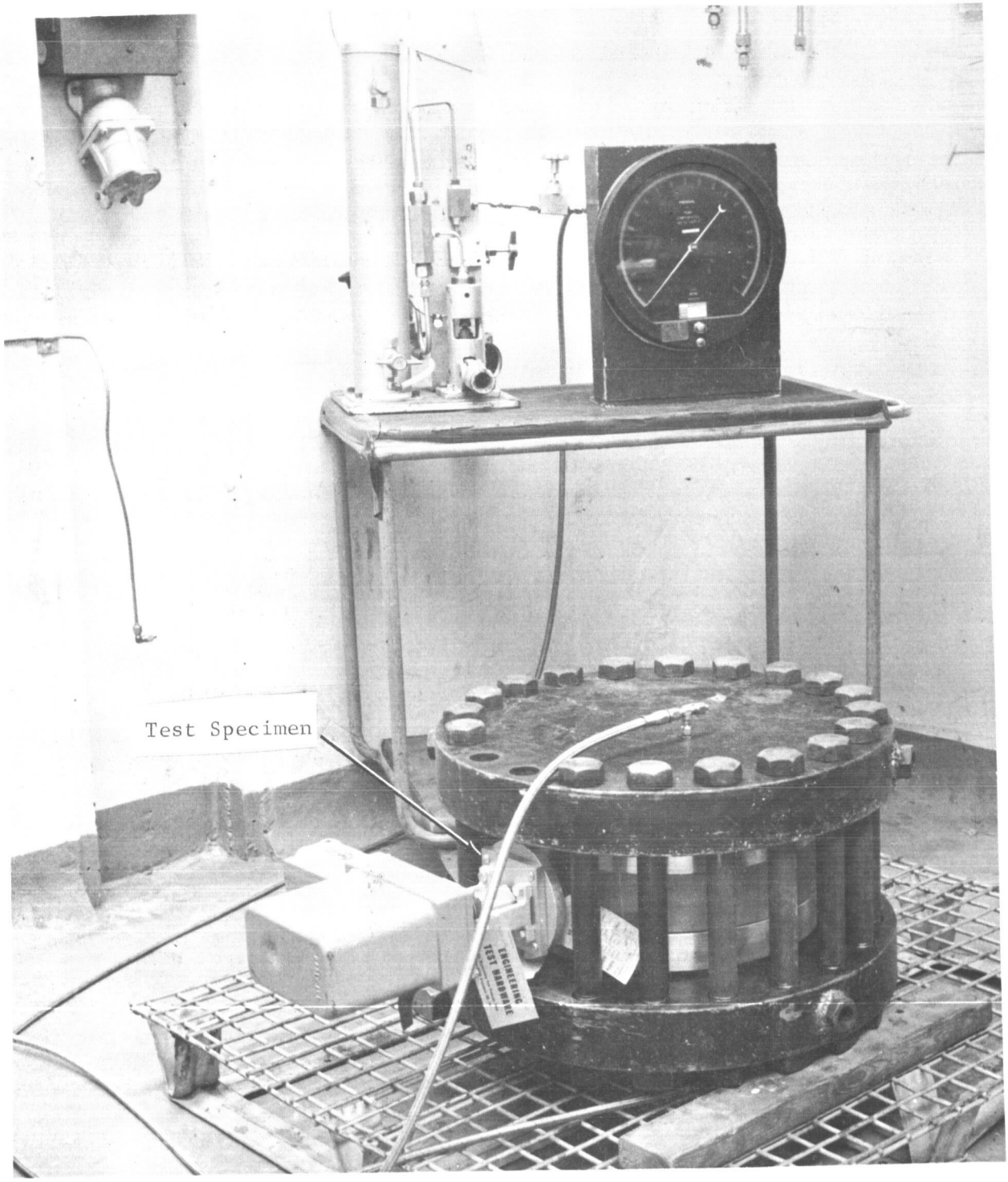


Figure 3-2. Proof Pressure Test Setup

SECTION IV

FUNCTIONAL TEST

4.1 TEST REQUIREMENTS

4.1.1 A functional test shall be performed on the test specimen to determine electrical insulation resistance, valve response speed, valve overrun, and valve disc position stability.

4.1.2 INSULATION RESISTANCE

4.1.2.1 The insulation resistance between all nonconnected terminals and between the terminals and the case shall be at least 20 megohms with 500 vdc applied for a minimum time of 60 seconds.

4.1.3 VALVE RESPONSE SPEED

4.1.3.1 The valve disc shall be electrically driven from fully opened to fully closed and from fully closed to fully opened to determine the time required for a 90-degree rotation of the disc. The minimum time for a 90-degree rotation shall be 15 seconds and the maximum time shall be 25 seconds.

4.1.4 VALVE OVERRUN

4.1.4.1 During normal flow conditions (air or GN_2 at 300 pounds per minute and 3 psig), any angular movement of the valve disc after motor shutoff shall be noted.

4.1.5 VALVE DISC POSITION STABILITY

4.1.5.1 Air or GN_2 flowing through the specimen at 300 pounds per minute and 3 psig shall not change the valve disc position.

4.2 TEST PROCEDURE

4.2.1 INSULATION RESISTANCE

Using a megohmmeter, the electrical resistance between all nonconnected terminals and between all terminals and the case was measured. Five hundred vdc were applied to the terminals for 60 seconds and the resistance values in megohms were recorded.

4.2.2 VALVE RESPONSE SPEED

4.2.2.1 The motor control limit switches were set to allow rotation of the valve disc between fully closed and fully opened.

4.2.2.2 The valve disc was driven from the fully closed position to the fully opened position by means of the electric drive motor. The time required for rotation of the valve disc was determined by means of a stopwatch and the time was recorded.

4.2.2.3 The valve disc was driven from the fully opened position to the fully closed position by means of the electric drive motor. The time required for rotation of the valve disc was determined by means of a stopwatch and the time was recorded.

4.2.3 VALVE OVERRUN

4.2.3.1 The specimen was installed as shown in figure 4-1 using the equipment listed in table 4-1.

4.2.3.2 It was determined that all connections were tight, all gages were installed and operating properly, and hand valve 5 was closed.

4.2.3.3 The specimen disc was driven to the fully opened position by means of the electric drive motor. The disc position indicator 10 was used to ensure that the valve disc was fully opened.

4.2.3.4 Hand valve 5 was opened to the fully opened position and regulator 4 was adjusted to produce a flow rate of 300 pounds per minute. The flow rate was monitored with orifice 6 and gages 7 and 11.

4.2.3.5 The electric drive motor was started and the valve disc was driven toward the closed position. The electric drive motor was immediately stopped upon reaching the 30-degree position as monitored on disc position indicator 10. Any movement of the valve disc past the 30-degree position was recorded.

4.2.3.6 The procedure in 4.2.3.5 was repeated using a valve disc position of 45 degrees.

4.2.3.7 The procedure in 4.2.3.5 was repeated using a valve disc position of 60 degrees.

4.2.3.8 Similar readings were taken at 30, 45, and 60 degrees by starting at a position greater than 60 degrees and driving the valve disc toward the open position.

4.2.4 VALVE POSITION STABILITY

4.2.4.1 Full flow conditions were established as described in 4.2.3.3 and 4.2.3.4.

4.2.4.2 It was ensured that the specimen disc was in the fully opened position by monitoring the disc position indicator. Air source 9 was closed for 30 seconds. Air source 9 was restarted and the air flow rate was verified as normal by monitoring gages 7 and 11. The disc position indicator 10 was observed throughout the test to verify that the change in flow conditions had not caused a readable change in the position of the valve disc.

4.2.4.3 Procedure 4.2.4.2 was repeated for specimen disc positions of 30, 45, and 60 degrees.

4.3 TEST RESULTS

4.3.1 The insulation resistance was 2,000,000 megohms.

4.3.2 The valve response speed was 15 seconds to open and to close.

4.3.3 The valve overrun at a position of 30 degrees was one degree. At a position of 45 degrees and 60 degrees the valve overrun was 1.5 degrees.

4.3.4 There was no change in the valve position under full flow of 300 pounds per minute of air.

4.4 TEST DATA

The data recorded during the initial functional test are presented in table 4-2.

Table 4-1. Functional Test Equipment List (Sheet 1 of 2)

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Keystone Valve Corporation	Figure 100-12"	5578G61	Butterfly valve, 12-inch, 3-psig
2	Megohmmeter	General Radio Company	1862C	NASA No. 018415	500-vdc ±3% FS accuracy Cal date 11-22-66
3	Stopwatch	NA	NA	NA	0-to 60-second
4	Regulator	Tescom Corporation	26-1002-21	3485	0-to 6000 psig inlet pressure
5	Hand Valve	Vacco Valve Co.	NV-6P-203-26	2779-39	½-inch
6	Nozzle Calibrated	Flow-Dyne Engineering, Inc.	XN320668	2326	016645-inch dia.
7	Gage	Heise	H-34948	NASA No. 014224	0-to 1000-psig ±.5% FS accuracy Cal date 10-18-66
8	Gage	Heise	H-34950	NASA No. 014226	0-to 100-psig ±0.5%FS accuracy Cal date 9-26-66
9	Air Supply	CCSD	NA	NA	3500 psig
10	Position Indicator	CCSD	NA	NA	0-to 90-degree rotation; 1-degree increments
11	Gage	Heise	H-35956	NASA No. 015532	0-to 1000-psig ±0.5%FS accuracy Cal date 10-18-66
12	Gage	Ashcroft	NA	NASA No. 109-1002-B	0-to 5000-psig ±2% FS accuracy Cal date 10-13-66

Table 4-1. Functional Test Equipment List (Sheet 2 of 2)

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
13	Ullage Chamber	CCSD	NA	NA	3-ft.^{3} 5-psig WP
14	Pressure Relief Valve	Manning, Maxwell, & Moore, Inc.	1542-H	NA	3-psig
15	Thermometer	West Instrument Corp.	IN-5	NASA No. 019461	-100 to +400°F $\pm 2^\circ$F accuracy Cal date 10-3-66

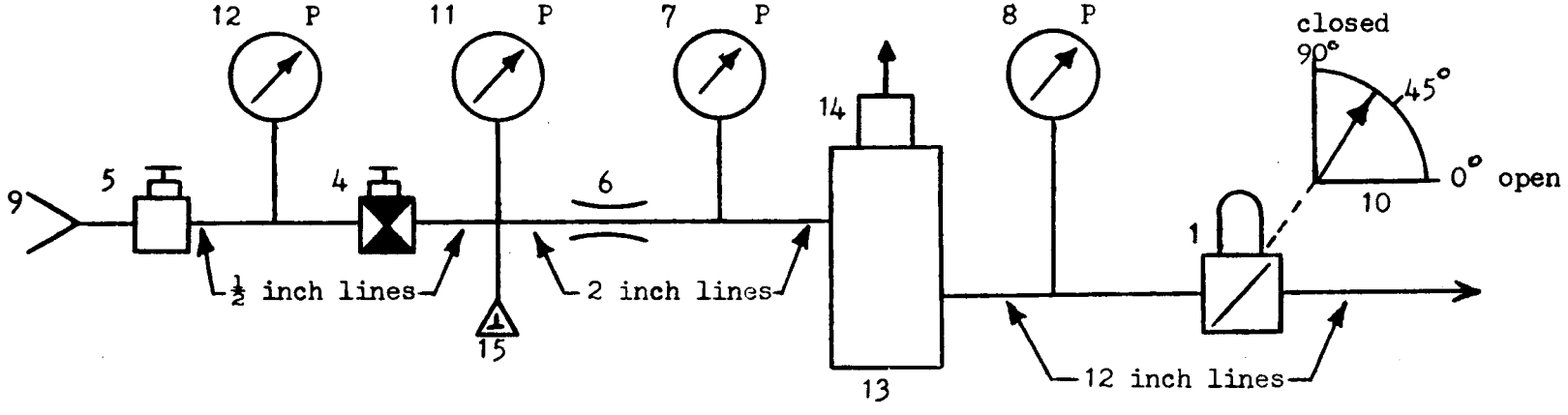
Table 4-2. Initial Functional Test Results

Insulation Resistance	
Terminal strip to housing	2,000,000 mego

Valve Response Speed	
Time required to open	15 sec
Time required to close	15 sec

Valve Overrun			
Position (degrees)	30	45	60
Overrun while opening	1.0	1.5	1.5
Overrun while closing	1.0	1.5	1.5

Valve Position Stability				
Position (degrees)	0	30	45	60
Change in position	None	None	None	None



Note: All lines ½ inch unless otherwise specified.
Refer to table 4-1 for item identification.

Figure 4-1. Functional Test Schematic (Valve Overrun and Valve Disc Position Stability)

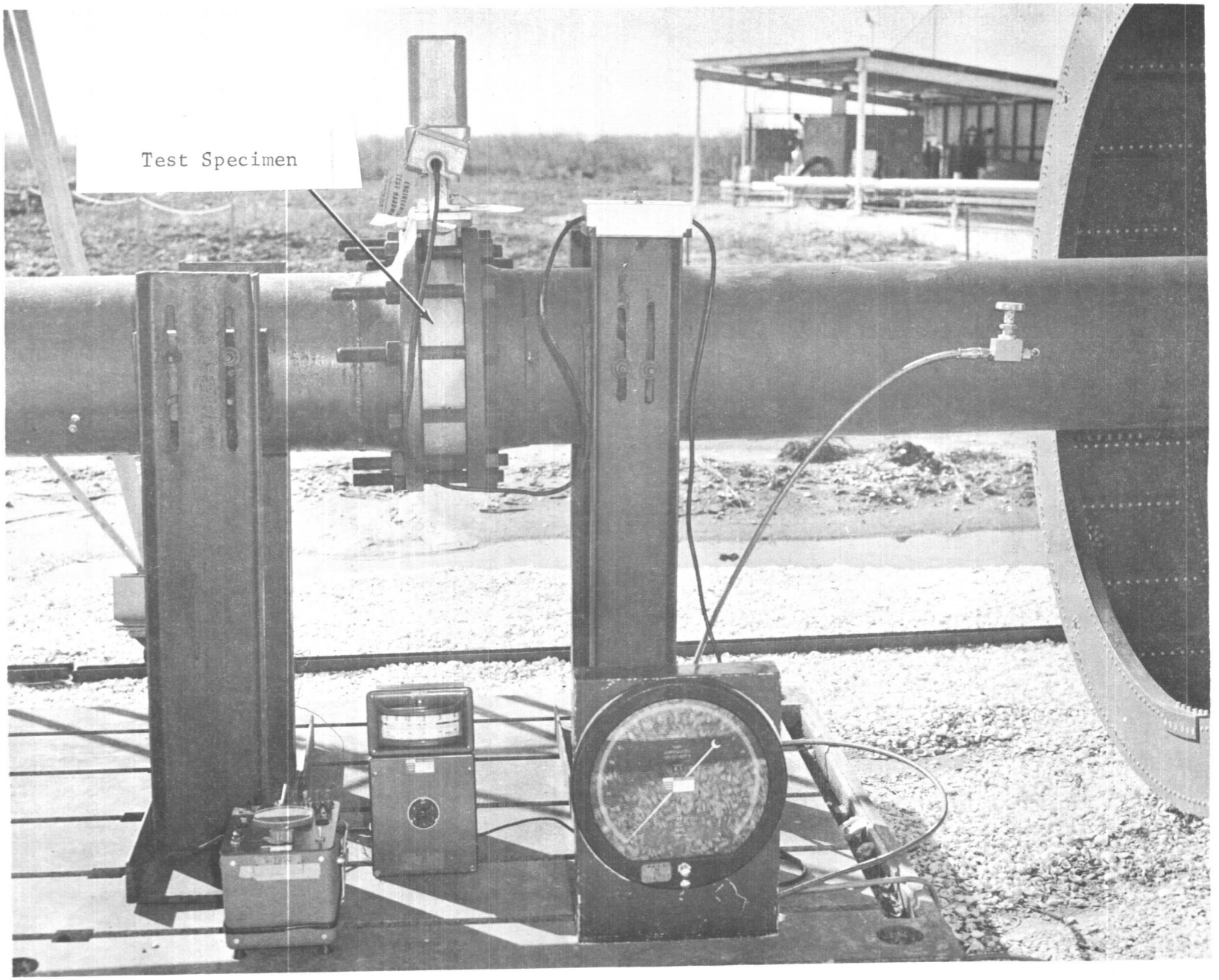


Figure 4-2. Functional Test Setup

SECTION V

LOW TEMPERATURE TEST

5.1 TEST REQUIREMENTS

5.1.1 A low temperature test will be performed to determine whether the environment causes degradation or deformation.

5.1.2 The rated low temperature is 5 (+0, -4)^{o}F.

5.1.3 A functional test shall be performed during this test.

5.2 TEST PROCEDURE

5.2.1 The specimen was placed in low temperature chamber 16 and assembled setup as shown in figure 5-1, using equipment listed in table 5-1.

5.2.2 The chamber was controlled to the specified test conditions maintaining a relative humidity between 60 and 90 per cent.

5.2.3 A functional test was performed as described in 4.2 when temperature stabilization was obtained.

5.2.4 The chamber temperature was returned to ambient conditions upon completion of the functional test.

5.2.5 Within one hour after the specimen reached ambient conditions a functional test and visual inspection were performed.

5.2.6 The test data were recorded.

5.3 TEST RESULTS

5.3.1 The functional tests performed during and after the low temperature test were satisfactory.

5.4 TEST DATA

5.4.1 The data recorded during and after the low temperature test are presented in tables 5-2 and 5-3 respectively.

Table 5-1. Low Temperature Test Equipment List (Sheet 1 of 2)

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Keystone Valve Corporation	Figure 100-12"	5578G61	Butterfly Valve 12-inch, 3-psig
2	Megohmmeter	General Radio Company	1862C	NASA No. 018415	500-vdc ±3% FS accuracy Cal date 11-22-66
3	Stopwatch	NA	NA	NA	0-to 60-second
4	Regulator	Tescom Corporation	26-1002-21	3485	0-to 6000 psig inlet pressure
5	Hand Valve	Vacco Valve Co.	NV-6P-203-26	2779-39	½-inch
6	Nozzle Calibrated	Flow-Dyne Engineering, Inc.	XN320668	2326	016645-inch dia.
7	Gage	Heise	H-34938	NASA No. 014224	0-to 1000-psig ±0.5% FS accuracy Cal date 10-18-66
8	Gage	Heise	H-34950	NASA No. 01922G	0-to 100-psig ±0.5%FS accuracy Cal date 9-26-66
9	Air Supply	CCSD	NA	NA	3500 psig
10	Position Indicator	CCSD	NA	NA	0-to 90-degree rotation; 1-degree increments
11	Gage	Heise	H-35956	NASA No. 015532	0-to 1000-psig ±0.5%FS accuracy Cal date 10-18-66
12	Gage	Ashcroft	NA	NASA No. 109-1002-B	0-to 5000-psig ±2% FS accuracy Cal date 10-13-66

Table 5-1. Low Temperature Test Equipment List (Sheet 2 of 2)

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
13	Ullage Chamber	CCSD	NA	NA	3-ft.^{3} 5-psig WP
14	Pressure Relief Valve	Manning, Maxwell, & Moore, Inc.	1542-H	NA	3-psig
15	Thermometer	West Instrument Corp.	IN-5	NASA No. 019461	-100 to +400°F +2°F accuracy Cal date 10-3-66
16	Test Chamber	CCSD	NA	NA	

Table 5-2. Low Temperature Functional Test Results

Insulation Resistance	
Terminal strip to housing	1,000 Mego

Valve Response Speed	
Time required to open	15 sec
Time required to close	15 sec

Valve Overrun			
Position (degrees)	30	45	60
Overrun while opening	0.5	0.5	0.5
Overrun while closing	0.5	0.5	1.0

Valve Position Stability				
Position (degrees)	0	30	45	60
Change in position	None	None	None	None

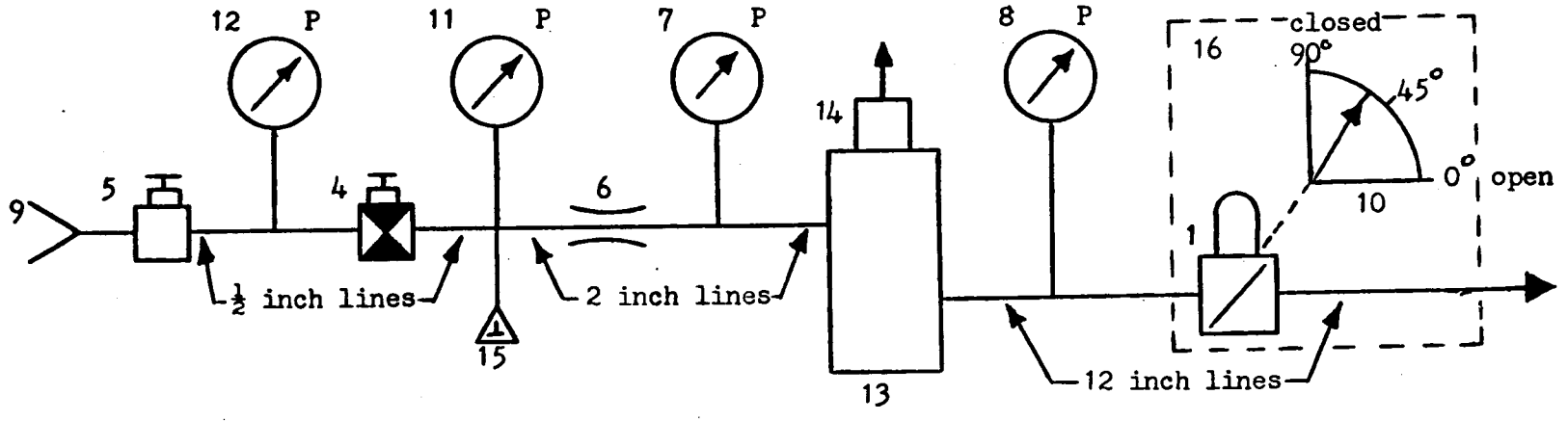
Table 5-3. Post-Low Temperature Functional Test Results

Insulation Resistance	
Terminal strip to housing	9,000 Mego

Valve Response Speed	
Time required to open	15 sec
Time required to close	15 sec

Valve Overrun			
Position (degrees)	30	45	60
Overrun while opening	1.0	2.0	1.0
Overrun while closing	1.0	2.0	1.0

Valve Position Stability				
Position (degrees)	0	30	45	60
Change in position	None	None	None	None



Note: All lines ¼ inch unless otherwise specified.
Refer to table 4-1 for item identification.

Figure 5-1. Low Temperature Test Schematic

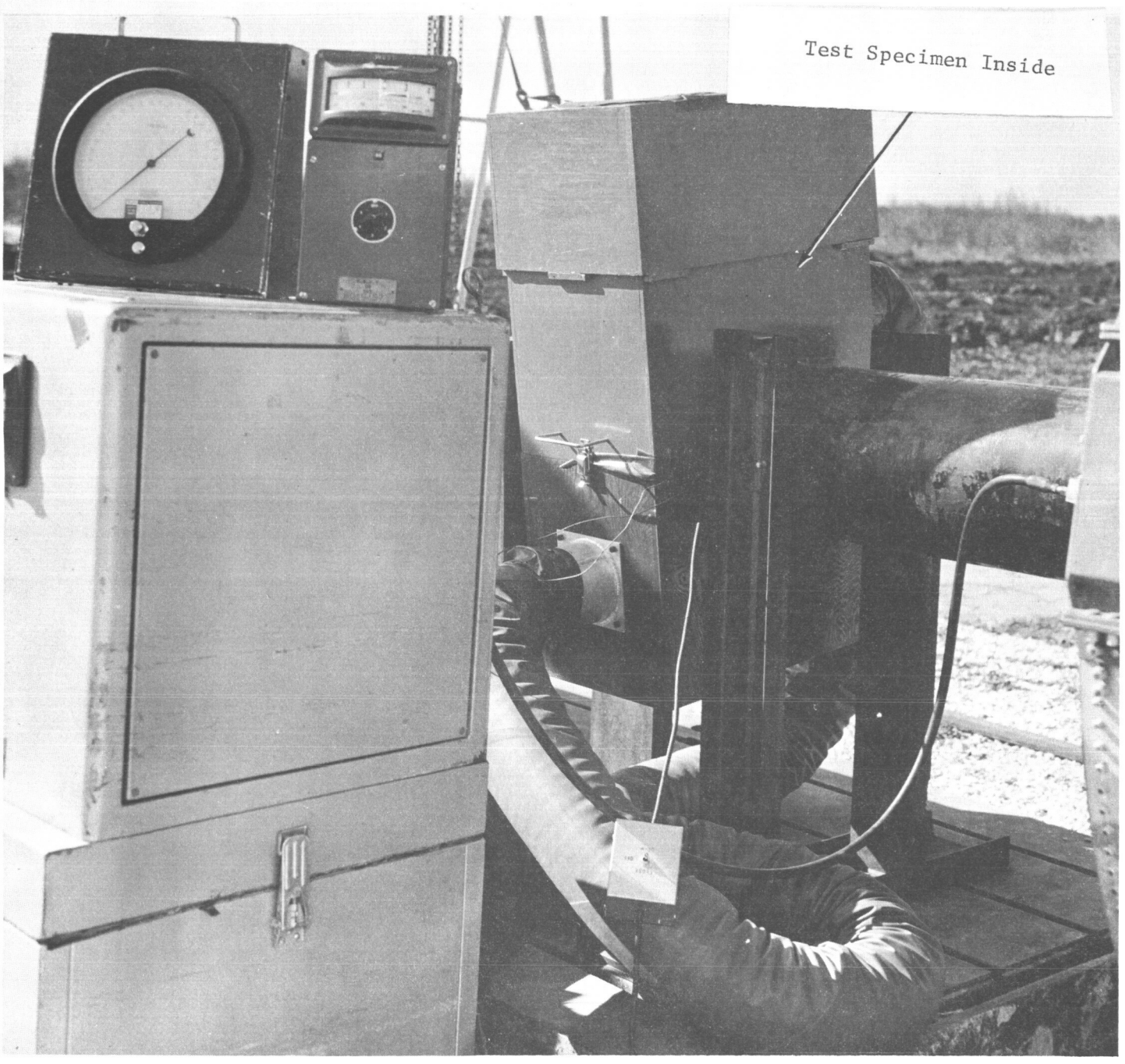


Figure 5-2. Low and High Temperature Test Setup

SECTION VI

HIGH TEMPERATURE TEST

6.1 TEST REQUIREMENTS

6.1.1 A high temperature test will be performed to determine whether the environment causes degradation or deformation.

6.1.2 The rated high temperature is 200 (+4, -0)^{o}F.

6.1.3 A functional test shall be performed during this test.

6.2 TEST PROCEDURE

6.2.1 The specimen was placed in high temperature chamber 16 and assembled setup as shown in figure 6-1, using equipment listed in table 6-1.

6.2.2 The chamber was controlled to the specified test conditions, maintaining a relative humidity of 20 ($\pm$5) per cent.

6.2.3 A functional test was performed as described in 4.2 while the chamber temperature was maintained.

6.2.4 The chamber temperature was returned to ambient conditions upon completion of the functional test.

6.2.5 Within one hour after the specimen reached ambient conditions a functional test and visual inspection were performed.

6.2.6 The test data were recorded.

6.3 TEST RESULTS

6.3.1 The functional tests performed during and after the high temperature test were satisfactory.

6.4 TEST DATA

The data recorded during and after the high temperature test are presented in tables 6-2 and 6-3 respectively.

Table 6-1. High Temperature Test Equipment List (Sheet 1 of 2)

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Keystone Valve Corporation	Figure 100-12"	5578G61	Butterfly Valve, 12-inch, 3-psig
2	Megohmmeter	General Radio Company	1862C	NASA No. 018415	500-vdc ±3% FS accuracy Cal date 11-22-66
3	Stopwatch	NA	NA	NA	0-to 60-second
4	Regulator	Tescom Corporation	26-1002-21	3485	0-to 6000 psig inlet pressure
5	Hand Valve	Vacco Valve Co.	NV-6P-203-26	2779-39	½-inch
6	Nozzle Calibrated	Flow-Dyne Engineering, Inc.		XN320668	016645-inch dia.
7	Gage	Heise	H-34948	NASA No. 014224	0-to 1000-psig ±0.5%FS accuracy Cal date 10-18-66
8	Gage	Heise	H-34950	NASA No. 019226	0-to 100-psig ±0.5%FS accuracy Cal date 9-26-66
9	Air Supply	CCSD	NA	NA	3500 psig
10	Position Indicator	CCSD	NA	NA	0-to 90-degree rotation; 1-degree increments
11	Gage	Heise	H-35956	NASA No. 015532	0-to 1000-psig ±0.5%FS accuracy Cal date 10-18-66
12	Gage	Ashcroft	NA	NASA No. 109-1002-B	0-to 5000-psig ±0.5%FS accuracy Cal date 10-13-66
13	Ullage Chamber	CCSD	NA	NA	3-ft.^{3} 5-psig WP

Table 6-1. High Temperature Test Equipment List (Sheet 2 of 2)

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
14	Pressure Relief Valve	Manning, Maxwell, & Moore, Inc.	1542-H	NA	2-psig
15	Thermometer	West Instrument Corp.	IN-5	NASA No. 019461	-100 to +400°F ±2°FS accuracy Cal date 10-3-66
16	Test Chamber	CCSD	NA	NA	

Table 6-2. -High Temperature Functional Test Results

Insulation Resistance	
Terminal strip to housing	∞

Valve Response Speed	
Time required to open	15 sec
Time required to close	15 sec

Valve Overrun			
Position (degrees)	30	45	60
Overrun while opening	3.0	3.5	3.0
Overrun while closing	3.0	2.0	3.0

Valve Position Stability				
Position (degrees)	0	30	45	60
Change in position	None	None	None	None

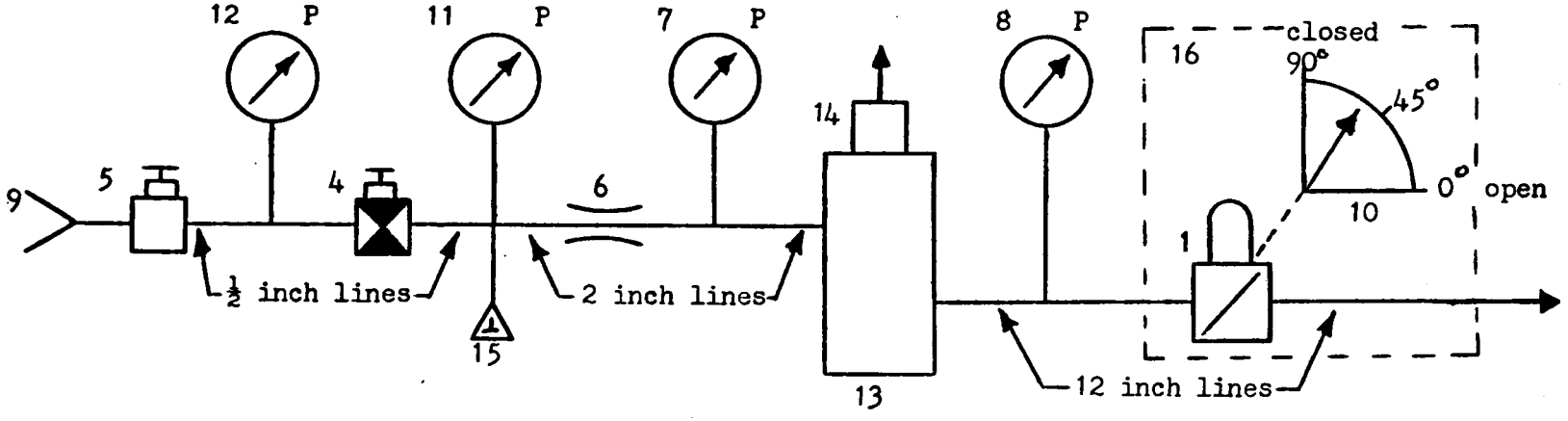
Table 6-3. Post-High Temperature Functional Test Results

Insulation Resistance	
Terminal strip to housing	∞

Valve Response Speed	
Time required to open	15 sec
Time required to close	15 sec

Valve Overrun			
Position (degrees)	30	45	60
Overrun while opening	3.0	2.0	2.0
Overrun while closing	2.0	2.0	1.0

Valve Position Stability				
Position (degrees)	0	30	45	60
Change in position	None	None	None	1.0



Note: All lines ½ inch unless otherwise specified.
Refer to table 4-1 for item identification.

Figure 6-1. High Temperature Test Schematic

SECTION VII

FLOW TEST

7.1 TEST REQUIREMENTS

The flow factor, Cv, shall be determined for the test specimen.

7.2 TEST PROCEDURE

7.2.1 The test setup was assembled as shown in figure 7-1 using the equipment listed in table 7-1. All hand valves were closed.

7.2.2 Hand valve 5 was opened and pump 3 was started. The specimen was opened to the fully opened position.

7.2.3 H_2O flow rates from 1100 to 3200 gallons per minute through the specimen were obtained by adjusting hand valve 5. The flow rate was monitored with orifice 7 and manometer 6.

7.2.4 At each of the flow rates, the pressure drop across the specimen was measured with manometer 8. The temperature of the H_2O flowing through the specimen was measured with thermocouple 9.

7.3 TEST RESULTS

7.3.1 Due to a lapse of more than 72 hours since the previous functional test, a second functional test was performed with satisfactory results prior to the flow test.

7.3.2 The flow factor (Cv) was calculated to be 9,500 at 3,000 gallons per minute.

7.3.3 The flow test results were considered to be satisfactory.

7.4 TEST DATA

Test data recorded during the test are presented in table 7-2. Pressure drop versus flow rate is represented graphically in figure 7-2. The functional test data taken prior to flow testing are presented in table 7-3. The flow factor was calculated as follows:

$$C_V = Q\sqrt{\frac{Gf}{\Delta P}}$$

Where:

C_V = Flow factor
Gf = Specific gravity of fluid
ΔP = Pressure drop across the specimen, psi
Q = Flow rate, gallons per minute

Sample calculation:

$$C_V = 3000\sqrt{\frac{1.00}{0.1}} = 9,500$$

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Keystone Valve Corporation	Figure 100-12"	5518G61	Butterfly Valve 12-inch, 3-psig
2	H_2O Reservoir	CCSD	NA	NA	
3	Pump	Fiese & Fistenberger Mfg. Co.	NA	NA	14HM0, 1760 ypm
4	Pressure Gage	Heise	H-34950	NASA No. 014226	0-to 100 psig Cal date NA
5	Hand Valve	Nord-Strom	BN390	NA	12-inch 200-psi water or gas
6	Hg Manometer	The Merriam Instrument Co.	20DA40	NASA No. 95-1455-B	0-to 60-inch $\pm$0.1%FS accuracy Cal date 10-3-66
7	Orifice	CCSD	NA	NA	7.20-inch dia.
8	Hg Manometer	King Engineering Corp.	FS8-WM-50	NASA No. 012572-B	0-to 8-inch $\pm$0.1%FS accuracy Cal date 10-4-66
9	Thermocouple	West Instrument Co.	IN-5	NASA No. 019461	-100-to +400°F $\pm$2°F accuracy Cal date 10-3-66

Table 7-2. Flow Test Data

Flow (gpm)	Measured Differential Pressure (psid)	Tare (psig)	Specimen $\triangle P$ (psig)	Media Temperature (^{o}F)
1100	0.034	0.004	0.030	55
1500	0.054	0.010	0.044	55
1800	0.079	0.025	0.054	55
2040	0.084	0.025	0.059	55
2250	0.103	0.034	0.069	55
2480	0.128	0.049	0.079	55
2670	0.162	0.074	0.088	55
2860	0.182	0.084	0.098	55
3040	0.201	0.098	0.103	55
3200	0.216	0.108	0.108	55

Table 7-3. Pre-Flow Test Functional Test Results

Insulation Resistance	
Terminal strip to housing	700 mego

Valve Response Speed	
Time required to open	15 sec
Time required to close	15 sec

Valve Overrun			
Position (degrees)	30	45	60
Overrun while opening	0.0	1.0	1.0
Overrun while closing	0.0	1.0	0.5

Valve Position Stability				
Position (degrees)	0	30	45	60
Change in position	None	None	None	None

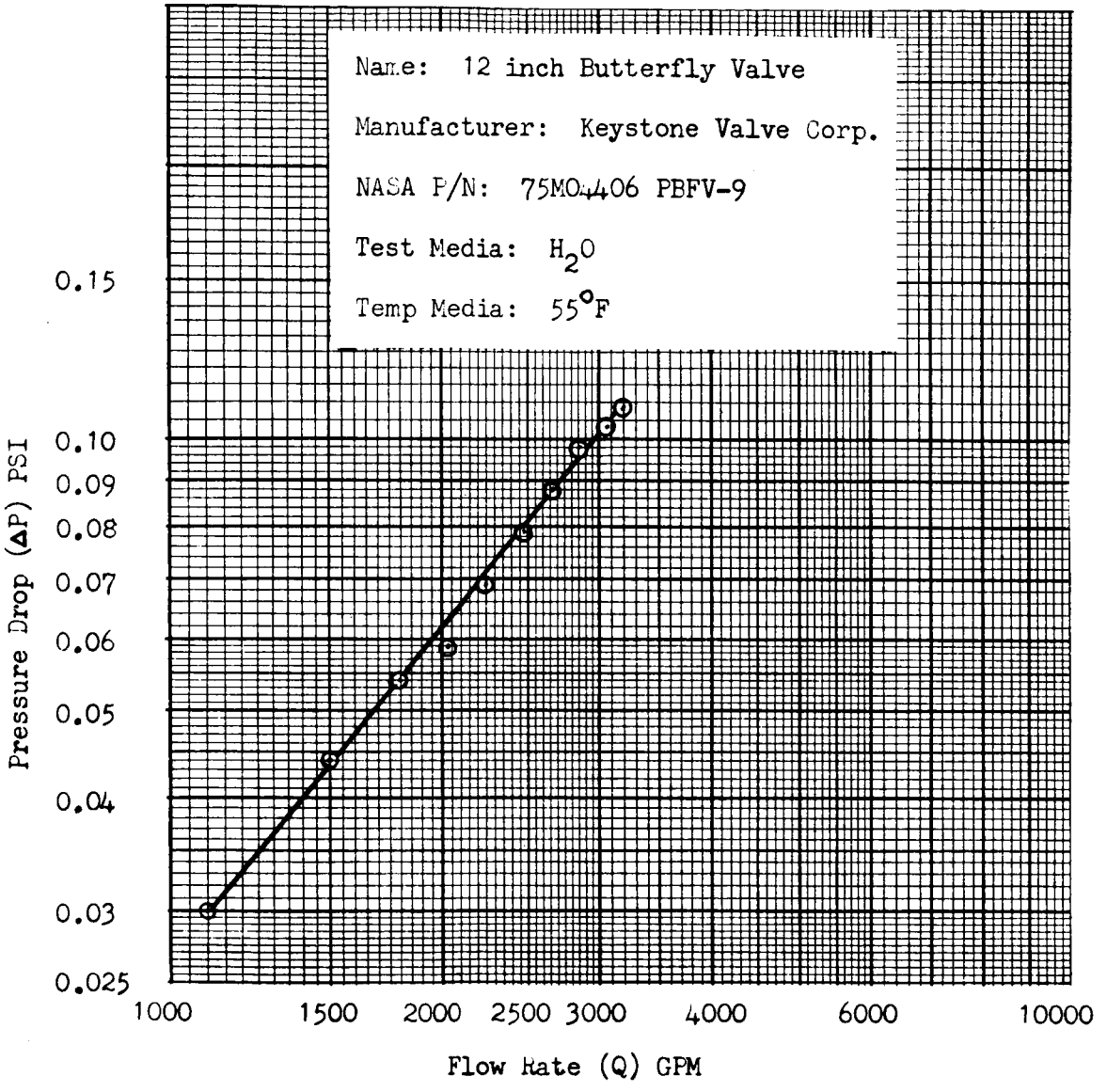
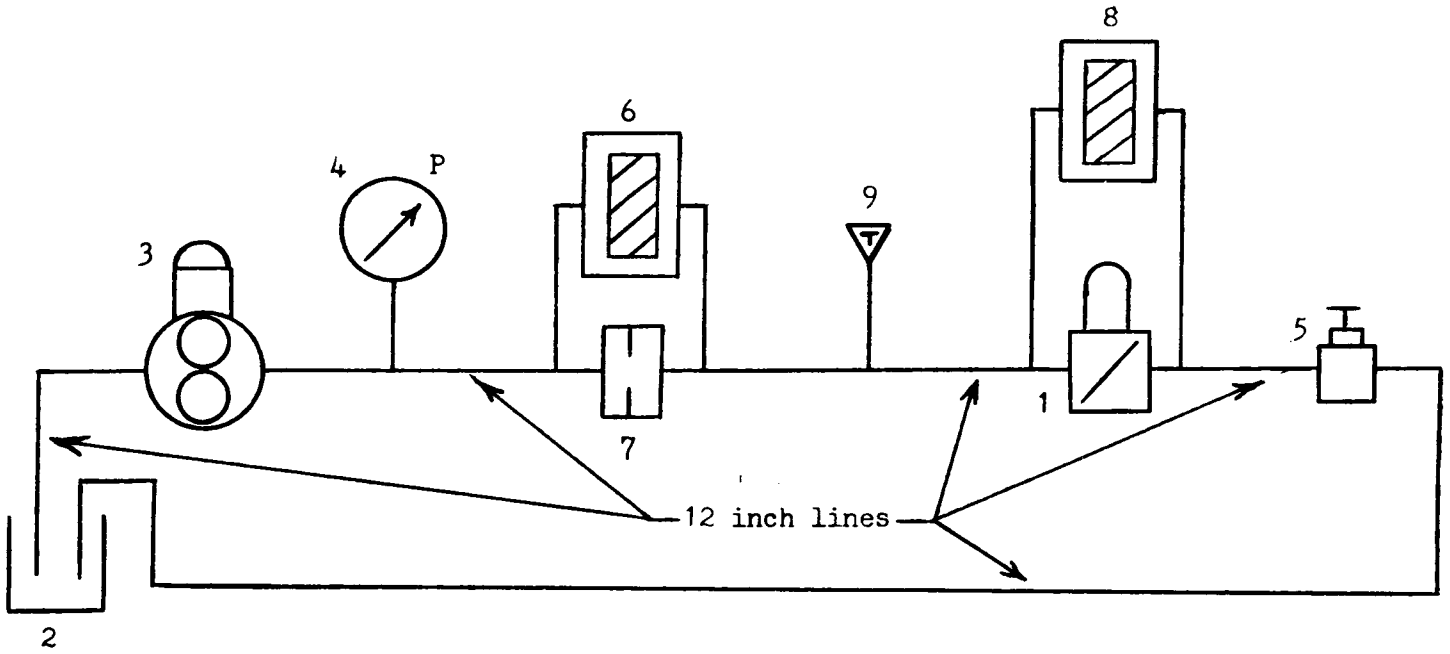


Figure 7-2. Pressure Drop versus Flow Rate



Note: All lines $\frac{1}{4}$ inch unless otherwise specified.
Refer to table 7-1 for item identification.

Figure 7-1. Flow Test Schematic

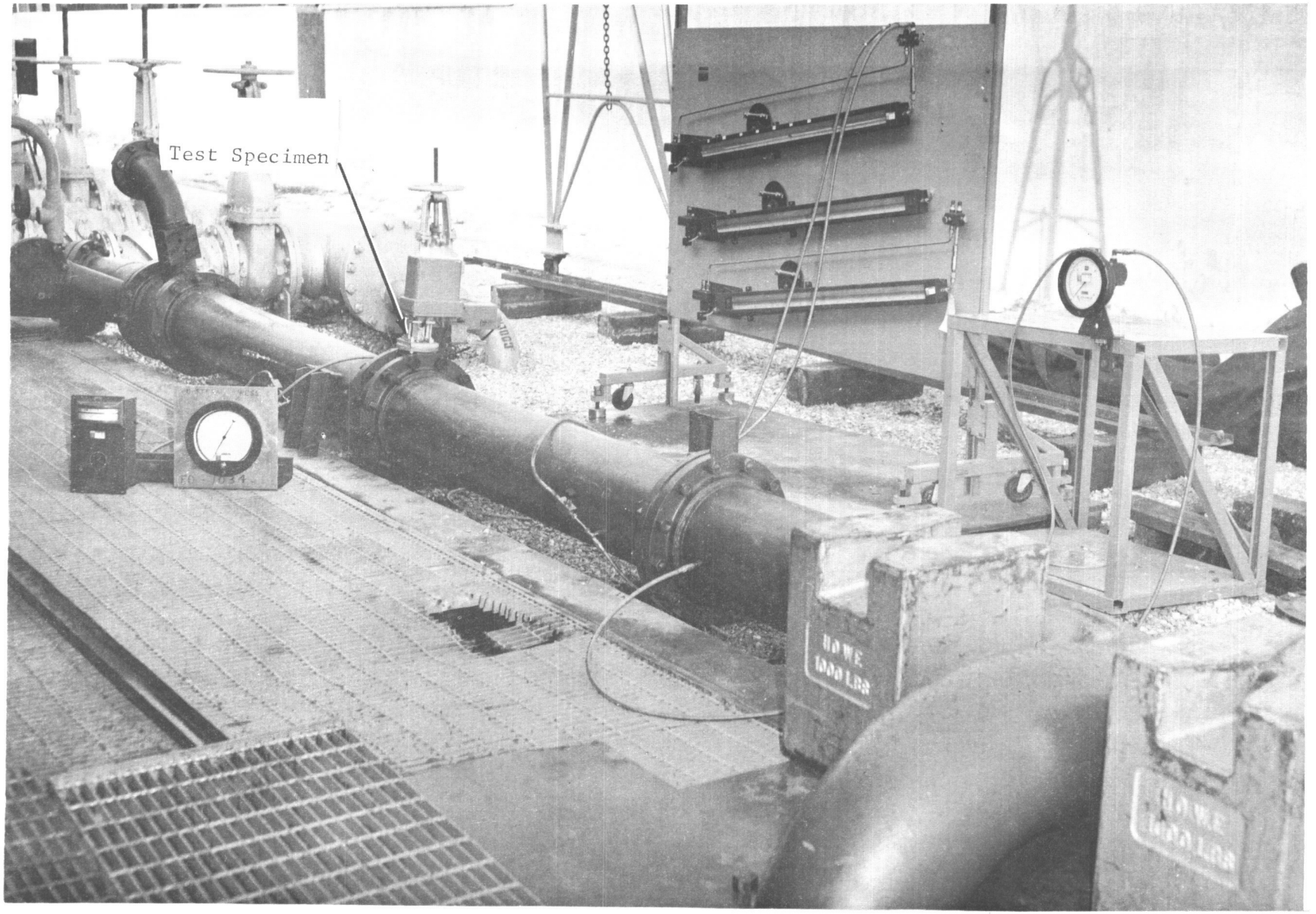


Figure 7-3. Flow Test Setup

SECTION VIII

CYCLE TEST

8.1 TEST REQUIREMENTS

8.1.1 The test specimen shall be subjected to 5000 cycles during the cycle test.

8.1.2 Each cycle shall consist of moving the specimen from fully opened to fully closed to fully open positions while the specimen is pressurized to 3 psig.

8.1.3 The specimen shall be subjected to a functional test as specified in section IV following each 1000 cycles during the cycle test.

8.2 TEST PROCEDURE

8.2.1 The test setup was assembled as shown in figure 8-1 using the equipment listed in table 8-1. Hand valve 4 and regulator 6 were closed and the outlet of the specimen was capped.

8.2.2 The inlet of hand valve 4 was pressurized to 10 psig with the GN_2 pressure source. Hand valve 4 was opened and the supply pressure was monitored on pressure gage 5.

8.2.3 The specimen was opened with the valve motor. The specimen was pressurized to 3 psig by adjusting regulator 6. The specimen pressure was monitored with pressure gage 7.

8.2.4 The specimen was moved from the fully opened to the fully closed to the fully opened positions which constituted one cycle. Five thousand cycles were performed.

8.2.5 Following every 1000 cycles, the specimen was subjected to a functional test as specified in section IV.

8.3 TEST RESULTS

8.3.1 Due to a lapse of more than 72 hours since the previous functional test, another functional test was performed with satisfactory results prior to the cycle test.

8.3.2 The specimen was subjected to 5000 cycles with a functional test performed after each 1000 cycles.

8.3.3 The test results were considered satisfactory.

8.4 TEST DATA

Functional test data recorded prior to the cycle test are presented in table 8-2. Functional test data recorded during the cycle test are presented in tables 8-3 through 8-7.

Table 8-1. Cycle Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Keystone Valve Corporation	Figure 100-12"	5518G61	Butterfly Valve 12-inch, 3-psig
2	GN_2 Pressure Source	CCSD	NA	NA	10-psig
3	Pressure Gage	Ashcroft	109-1007-B	NA	0-to 5000-psig ±0.5FS accuracy Cal date: None
4	Hand Valve	Vacco Valve Co.	NV-6P-203-26	2779-39	½-inch
5	Pressure Gage	Ashcroft	109-1015-B	NA	0-to 5000-psig 0.5% accuracy Cal date 10-24-66
6	Pressure Regulator	Tescom Corporation	26-1002-21	3485	0-to 6000-psig
7	Pressure Gage	Heise	H-34950	014226	0-to 100-psig 0.5%FS accuracy Cal date 12-26-66
8	Pressure Flange	CCSD	NA	NA	12-inch
9	Repeat Cycle Timer	G.C. Wilson & Co.	1	NA	
10	Thermocouple	West Instrument Co.	IN-5	NASA No. 019461	-100-to +400°F ±2°FS accuracy; Cal date 10-3-66

Table 8-2. Pre-Cycle Functional Test Results

Insulation Resistance	
Terminal strip to housing	2000 mego

Valve Response Speed	
Time required to open	15 sec
Time required to close	15 sec

Valve Overrun			
Position (degrees)	30	45	60
Overrun while opening	0.0	0.5	0.5
Overrun while closing	0.0	1.0	0.5

Valve Position Stability				
Position (degrees)	0	30	45	60
Change in position	None	None	None	None

Table 8-3. Cycle Functional Test Results after 1000 Cycles

Insulation Resistance	
Terminal strip to housing	1,350 mego

Valve Response Speed	
Time required to open	15 sec
Time required to close	15 sec

Valve Overrun			
Position (degrees)	30	45	60
Overrun while opening	1.0	1.0	1.0
Overrun while closing	1.0	1.0	0.5

Valve Position Stability				
Position (degrees)	0	30	45	60
Change in position	None	None	None	None

Table 8-4. Cycle Functional Test Results after 2000 Cycles

Insulation Resistance	
Terminal strip to housing	40,000 mego

Valve Response Speed	
Time required to open	15 sec
Time required to close	15 sec

Valve Overrun			
Position (degrees)	30	45	60
Overrun while opening	0.0	1.0	0.0
Overrun while closing	0.5	1.0	0.5

Valve Position Stability				
Position (degrees)	0	30	45	60
Change in position	None	1.0°	None	None

Table 8-5. Cycle Functional Test Results after 3000 Cycles

Insulation Resistance	
Terminal strip to housing	4,000 mego

Valve Response Speed	
Time required to open	15 sec
Time required to close	15 sec

Valve Overrun			
Position (degrees)	30	45	60
Overrun while opening	0.0	1.0	0.0
Overrun while closing	0.0	0.0	1.0

Valve Position Stability				
Position (degrees)	0	30	45	60
Change in position	None	None	None	None

Table 8-6. Cycle Functional Test Results after 4000 Cycles

Insulation Resistance	
Terminal strip to housing	20,000 mego

Valve Response Speed	
Time required to open	15 sec
Time required to close	15 sec

Valve Overrun			
Position (degrees)	30	45	60
Overrun while opening	1.0	1.0	2.0
Overrun while closing	1.0	2.0	1.0

Valve Position Stability				
Position (degrees)	0	30	45	60
Change in position	None	None	None	None

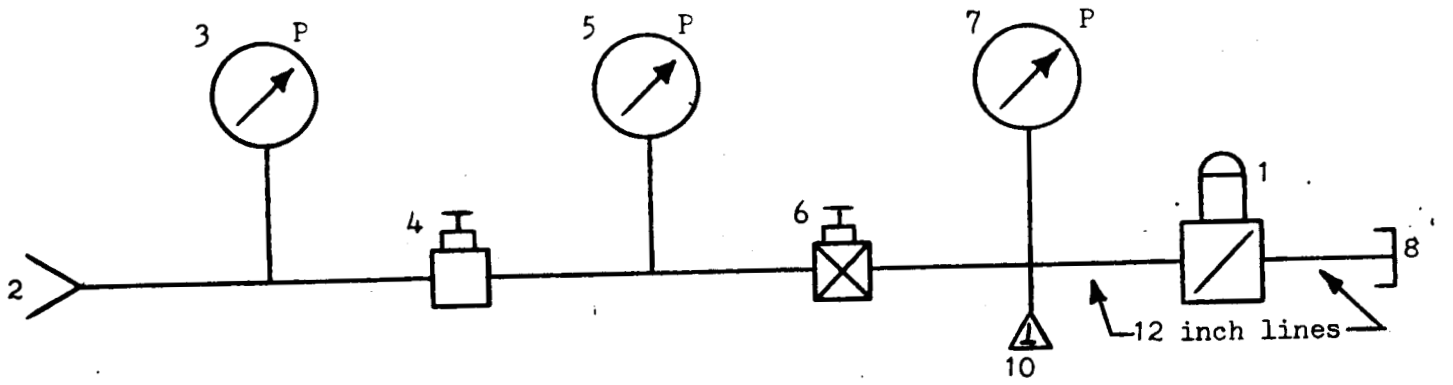
Table 8-7. Post-Cycle Functional Test Results

Insulation Resistance	
Terminal strip to housing	17,000 mego

Valve Response Speed	
Time required to open	15 sec
Time required to close	15 sec

Valve Overrun			
Position (degrees)	30	45	60
Overrun while opening	1.0	1.0	1.0
Overrun while closing	1.0	0.0	1.0

Valve Position Stability				
Position (degrees)	0	30	45	60
Change in position	None	None	None	0.5°



Note: All lines $\frac{1}{4}$ inch unless otherwise specified.
Refer to table 8-1 for item identification.

Figure 8-1. Cycle Test Schematic

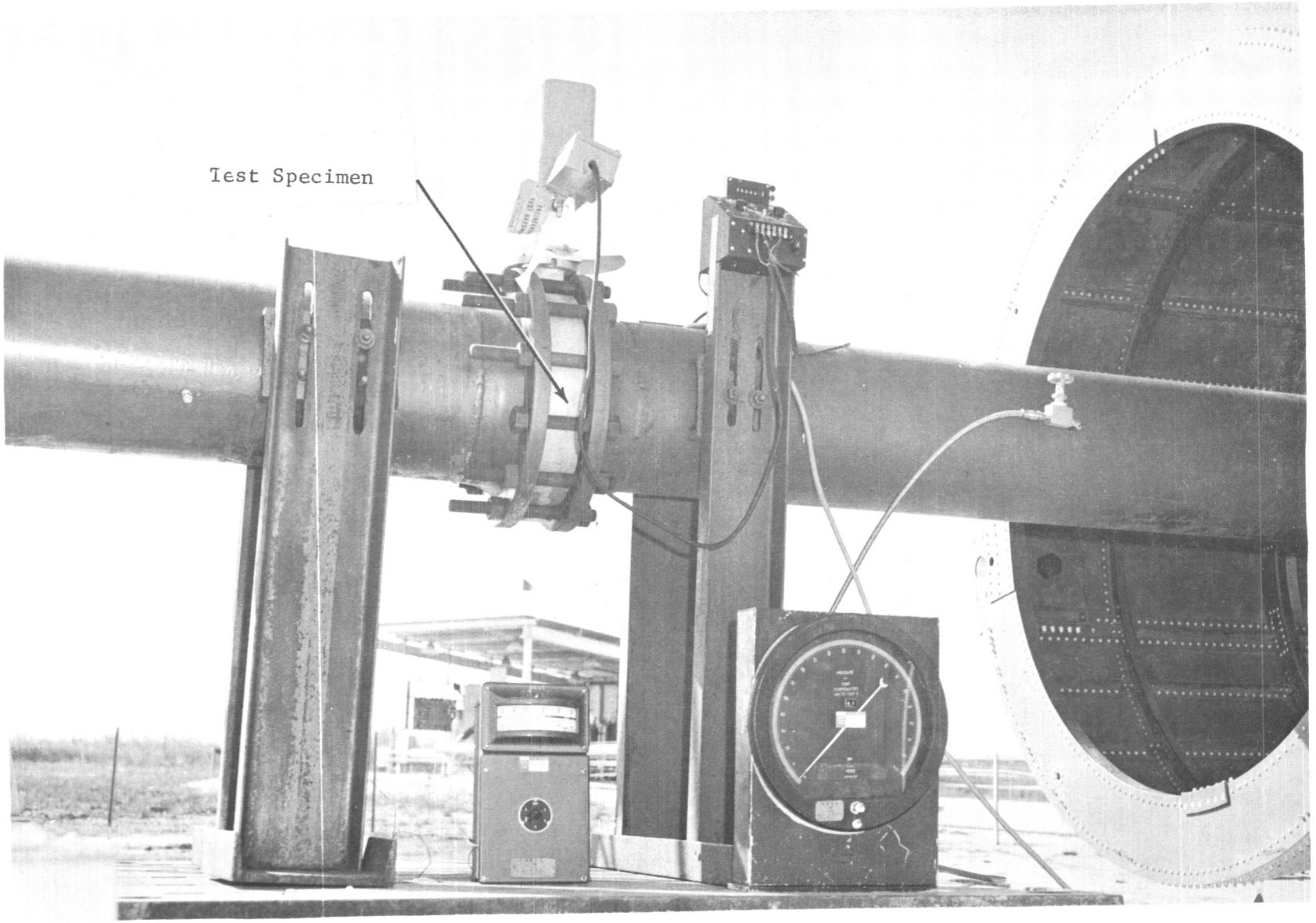


Figure 8-2. Cycle Test Setup

SECTION IX

SALT FOG TEST

9.1 TEST REQUIREMENTS

9.1.1 The test specimen shall be subjected to a salt fog test. The test specimen shall be placed in a test chamber with all the additional equipment described KSC-STD-164(D). For a period of 240 hours (±2 hours), the test specimen shall be subjected to an atomized salt solution.

9.1.2 The solution shall contain 5 parts by weight of salt and 95 parts by weight of H_2O with no more than 200 parts per million of total solids. The specific gravity of the salt solution shall be from 1.023 to 1.037 with a reference temperature of 95°F (+2,-4°F). The salt solution shall also have a pH value of 6.5 to 7.2. Diluted, chemically pure, hydrochloric acid or chemically pure sodium hydroxide may be used to adjust the pH valve.

9.1.3 Measurement of the characteristics of the salt solution shall be made according to KSC-STD-164(D).

9.1.4 Following the prolonged 240-hour exposure, the test specimen shall be subjected to a functional test within 1 hour after the specimen is returned to room ambient conditions.

9.2 TEST PROCEDURE

9.2.1 The test specimen was inspected visually for corrosion, dirt, and oily films. Unnecessary oily films and dirt particles were removed. Spots of corrosion were noted.

9.2.2 The specimen was placed in the test chamber using the equipment listed in table 9-1.

9.2.3 The chamber was adjusted so that the temperature is 95(+4,-2)°F and the clean fog-collecting receptacle in the exposure zone would collect from 0.5 to 3.0 milliliters of solution per hour for each 80 cm^2 of horizontal collecting area.

9.2.4 The test conditions were maintained for 240 hours (+2,-0 hours).

9.2.5 At the end of the 240-hour period, the specimen was removed from the chamber and was allowed to return to room ambient conditions.

9.2.6 Salt deposits were removed as necessary to make mechanical connections.

9.2.7 Within 1 hour after returning the specimen to room ambinet conditions, a functional test was performed.

9.2.8 The specimen was inspected and the salt deposits were removed.

9.2.9 The test data were recorded.

9.3 TEST RESULTS

9.3.1 Functional test data taken after the salt fog test were satisfactory.

9.3.2 Visual inspection after the salt fog test revealed some slight pitting of the valve body and valve top plate.

9.4 TEST DATA

Functional test data taken after the salt fog test are presented in table 9-2.

Table 9-1. Salt Fog Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	Keystone Valve Corporation	Figure 100-12"	5518G61	Butterfly Valve 12-inch, 3-psig
2	Salt Fog Chamber	Industrial Filter & Pump Mfg. Co.	411.1C	5-3632	As specified in KSC-STD-164(D)

Table 9-2. Post Salt Fog Test Functional Test Results

Insulation Resistance	
Terminal strip to housing	900 mego

Valve Response Speed	
Time required to open	15 sec
Time required to close	15 sec

Valve Overrun			
Position (degrees)	30	45	60
Overrun while opening	0.5	1.0	1.0
Overrun while closing	1.0	1.0	1.0

Valve Position Stability				
Position (degrees)	0	30	45	60
Change in position	None	None	None	None

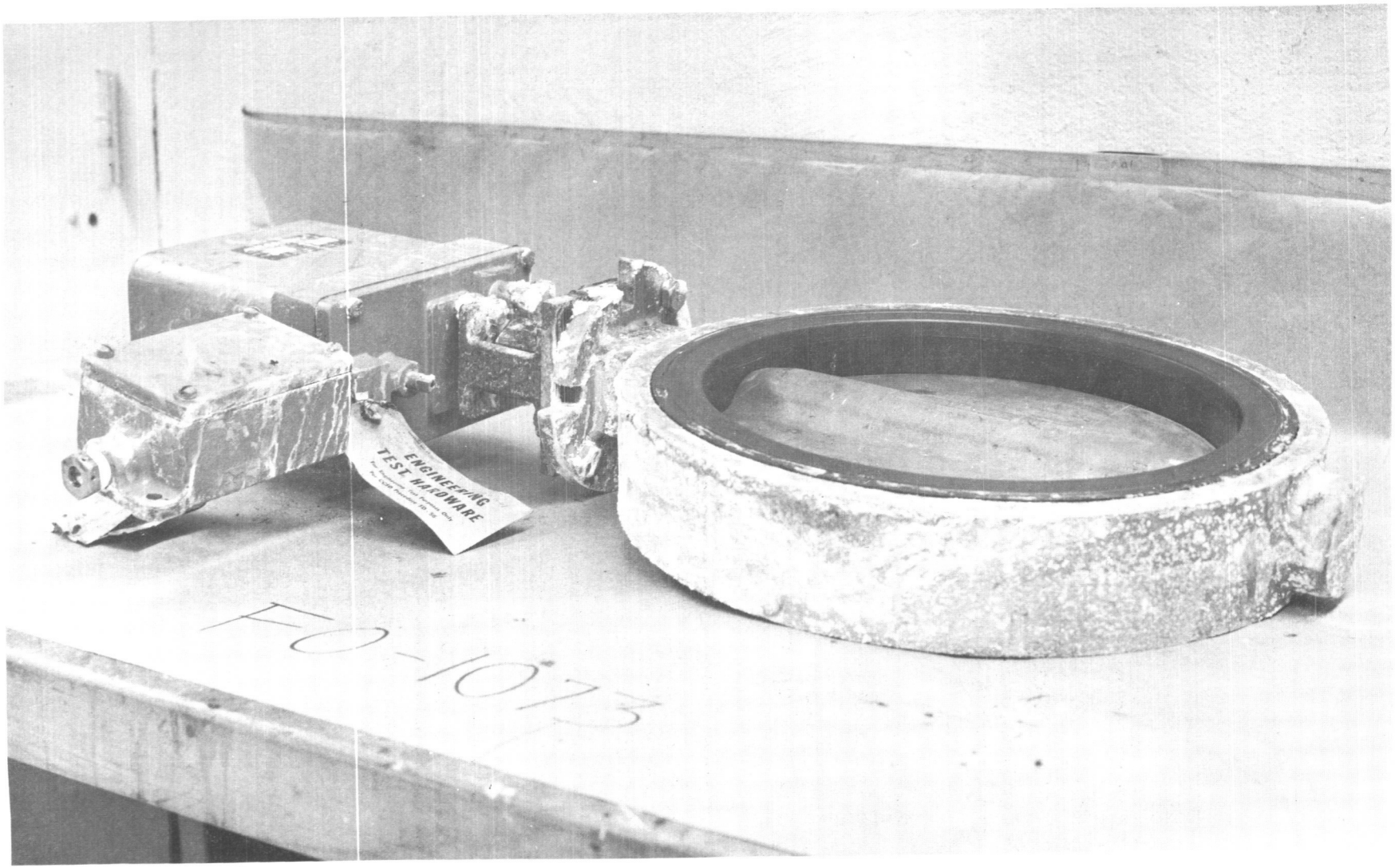


Figure 9-1. Test Specimen after Exposure to 240 hours of Salt Fog

APPROVAL

TEST REPORT

FOR

BUTTERFLY VALVE, 12-INCH, 3-PSIG

Keystone Valve Corporation Model Number Figure 100-12"

Ramcon Corporation Operator Model Number 50B

NASA Drawing Number 75M04406 PBFV-9

SUBMITTED BY:

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