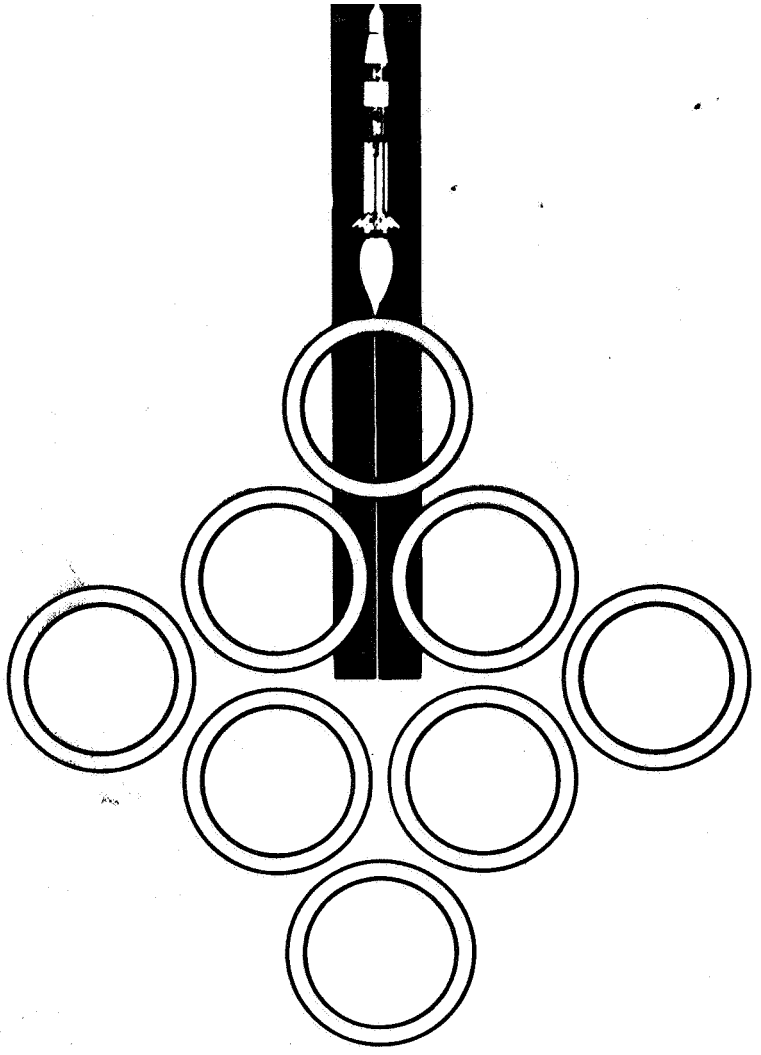

ENGINEERING DEPARTMENT

TECHNICAL REPORT

TR-RE-CCSD-FO-1080-3

August 22, 1967

SATURN IB PROGRAM

TEST REPORT
FOR

CHECK VALVE

1/2-INCH, SPRING-POPPET

James, Pond, and Clark Part Number 220T6-8TT-3

NAS Part Number 75M12944 FCV-9

SPACE DIVISION CHRYSLER CORPORATION

TEST REPORT

FOR

CHECK VALVE

1/2-INCH, SPRING-POPPET

James, Pond, and Clark Part Number 220T6-8TT-3

NASA Part Number 75M12944 FCV-9

ABSTRACT

This report presents the results of tests performed on one specimen of Check Valve 75M12944 FCV-9. The following tests were performed:

1. Receiving Inspection
2. Proof Pressure
3. Functional
4. Flow
5. Surge
6. Low Temperature
7. High Temperature
8. Cycle
9. Burst

The specimen performance was in conformance with the specification requirements of NASA drawing 75M12944 FCV-9 except for the initial functional test.

Test requirements specify 3 psig cracking pressure during the functional test. The test specimen cracked at zero psig and also reseated at zero psig. The valve was returned to the vendor for reworking. The average cracking pressure after the vendor reworked the valve was 1.85 psig. This was accepted and testing was continued.

TEST REPORT

FOR

CHECK VALVE

1/2-INCH, SPRING-POPPET

James, Pond, and Clark Part Number 220T6-8TT-3

NASA Part Number 75M12944 FCV-9

August 22, 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 NAS 8-4016, Part VII, CWO 271620.

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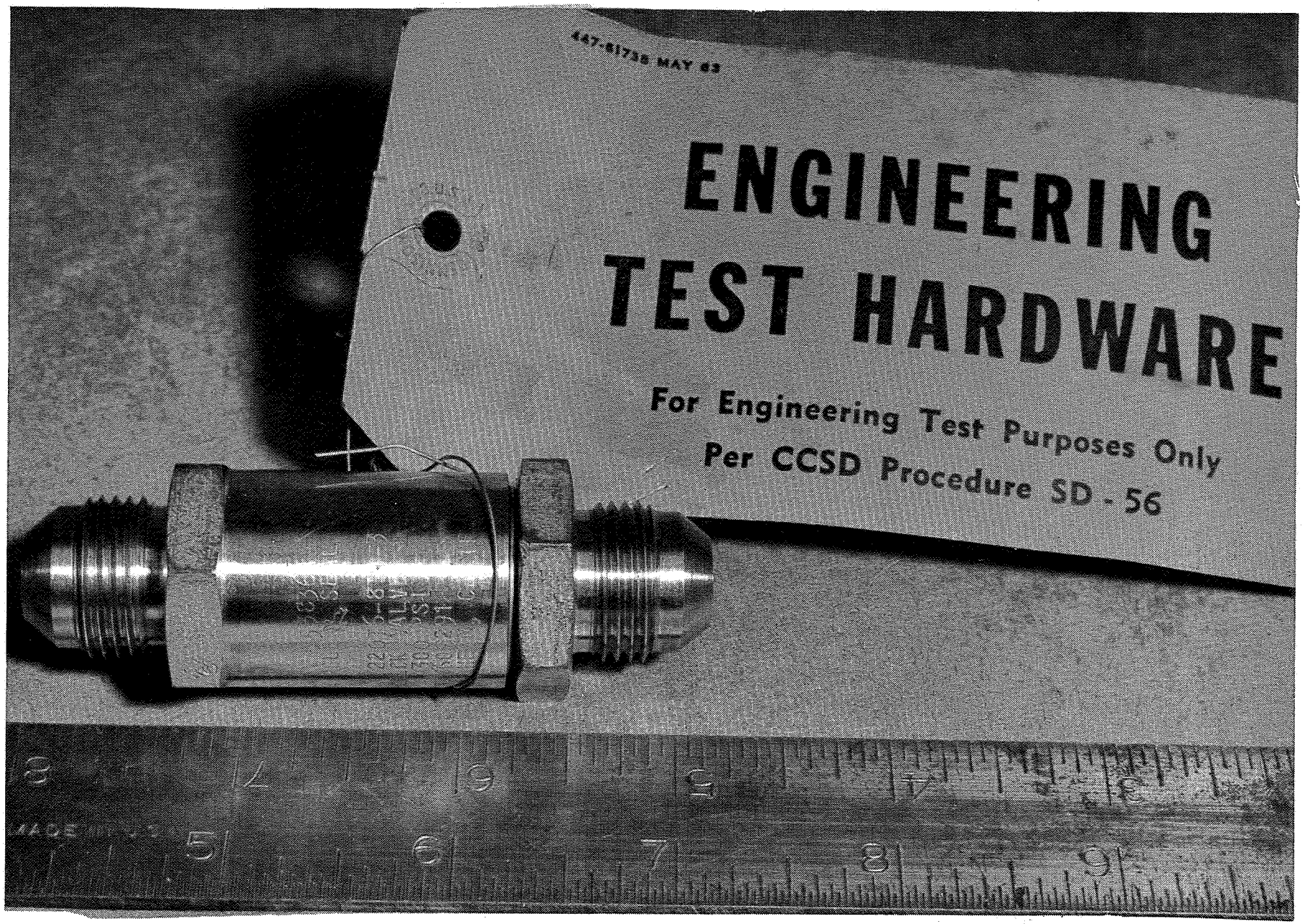

447-81736 MAY 63
ENGINEERING
TEST HARDWARE
For Engineering Test Purposes Only
Per CCSD Procedure SD - 56

CHECK SHEET

FOR

CHECK VALVE

1/2-INCH, SPRING-POPPET

MANUFACTURER: James, Pond, and Clark, Incorporated
MANUFACTURER'S PART NUMBER: 220T6-8TT-3
NASA DRAWING NUMBER: 75M12944 FCV-9
TESTING AGENCY: Chrysler Corporation Space Division, New Orleans, Louisiana
AUTHORIZING AGENCY: NASA KSC

I. FUNCTIONAL REQUIREMENTS

A.	OPERATING MEDIA:	N_2O_4, GN_2
B.	OPERATING PRESSURE:	0 to 300 psig
C.	CRACKING PRESSURE:	3 psig
D.	PROOF PRESSURE:	450 psig
E.	BURST PRESSURE:	1200 psig

II. CONSTRUCTION

A.	BODY MATERIAL:	304 stainless steel
B.	SEAL, GASKET, AND O-RING MATERIAL:	Teflon
C.	DIAMETER:	1/2 inch nominal
D.	END FITTING:	MS33656-8

III. ENVIRONMENTAL CHARACTERISTICS

TEMPERATURE RANGE:	12 to 125°F

IV. SPECIAL REQUIREMENTS

CLEANING SPECIFICATION:	A1OM01671, Level IV

V. LOCATION AND USE:

Supplies blanket GN2 purge to N_2O_4 piping in Spacecraft Support System; checks flow of N_2O_4 into the purge line.

TEST SUMMARY

CHECK VALVE, 1/2-INCH, SPRING-POPPET

75M12944 FCV-9

Environment	Units	Operational Boundary	Test Objective	Test Results	Remarks
Receiving Inspection	1	Specifications and drawings	Conformance to drawings and specifications	Satisfactory	Test completed
Proof Pressure Test	1	450 psig.	Check for leakage and distortion	Satisfactory	No leakage or distortion
Functional Test	1	Operating pressure 0 to 300 psig; cracking pressure 3 psig	Determine cracking and reseating pressure; check seat leakage	Unsatisfactory (acceptable after rework)	Specimen cracked and reseated at zero' pressure
Flow Test	1	To be determined	Determine flow coefficient, C_v	Satisfactory	Test completed
Surge Test	1	0 to 25 psig at inlet within 100 milliseconds	Determine if specimen operation is impaired by surge pressure	Satisfactory	Test completed
Low Temperature Test	1	12 (+0, -4)°F	Determine if specimen operation is impaired by low temperature	Satisfactory	Test completed
HKgh Temperature Test	1	125 (+4, -0)°F	Determine if specimen operation is impaired by high temperature	Satisfactory	Test completed
Cycle Test	1	Zero to 25 psig and back to zero	Determine if specimen operation is impaired by repeating cycling	Satisfactory	Test completed
Burst Test	1	1200 psig to inlet and outlet for 5 minutes	Check for structural damage and leakage at minimum burst pressure	Satisfactory	No leakage or damage
		Increase pressure till rupture	Determine actual burst pressure	Satisfactory	Burst at 23,500 psig

SECTION I

INTRODUCTION

1.1 SCOPE

1.1.1 This report presents the results of tests that were performed to determine if 1/2-inch, spring-poppet Check Valve 75M12944 FCV-9 meets the operational and environmental requirements for the John F. Kennedy Space Center. A summary of the test results is presented on page ix.

1.1.2 One valve speeimen was tested. The tests were performed using the test media listed in table 1-1.

1.2 ITEM DESCRIPTION

The valve specimen has an operating pressure range from zero to 300 psig and a cracking pressure of 3 psig. The valve body and all major components are constructed to type 304 stainless steel. The valve inlet and outlet ports are in accordance with standard MSFC MS33656-8.

The valve is used to supply blanket GN2 purge to N_2O_4 piping in the Spacecraft Support System and to check the flow of N_2O_4 into the purge lines.

1.3 APPLICABLE DOCUMENTS

The following documents contain test requirements for Check Valve 75M12944 FCV-9:

a. 75M12944 FCV-9, Component Specification

b. KSC-STD-164(D), Environment Test Methods

c. Test Plan CCSD-FO-1080-1F

d. A1OM01671, Cleanliness Requirement

e. Technical Procedure TP-RE-CCSD-FO-1080-2F

1.4 TEST SEQUENCE

1.4.1 The test specimen was tested in the sequence shown in table 1-1 and in accordance with KSC-STD-164(D) unless otherwise specified.

1.4.2 A functional test was performed before (if 72 hours or more had elapsed since the previous functional test), during (when specified), and within 1 hour following each test.

1.4.3 Test media was as specified in table 1-1.

Table 1-1. Test Sequence and Media

Tests	Medium
Receiving Inspection	
Proof Pressure	H_2O
Functional	N_2O_4, GN_2
Flow	H_2O
Surge	GN_2
Low Temperature	GN_2
High Temperature	GN_2
Cycle	GN_2
Burst	H_2O

SECTION II

RECEIVING INSPECTION

2.1 REQUIREMENTS

The check valve specimen shall be checked for conformance with NASA specification 75M12944 FCV-9 and applicable vendor drawings to the extent possible without disassembly of the specimen. The specimen shall also be inspected for poor workmanship and manufacturing defects.

2.2 PROCEDURE

The specimen was inspected for conformance with NASA specification 75M12944 FCV-9 and applicable vendor drawings without disassembly of the specimen. At the same time the specimen was inspected for poor workmanship and manufacturing defects. The specimen was also measured using the equipment listed in table 2-1.

2.3 TEST RESULTS

The specimen complied with NASA drawing 75M12944 FCV-9. No evidence of poor workmanship or manufacturing defects was observed.

2.4 TEST DATA

Dimensional test data are presented in table 2-2.

Table 2-1. Receiving Inspection Test Equipment List

Item No.	Item	Manufacturer	Model Part No.	Serial No.	Calibration Date
1	Scale	Brown and Sharp	300	NASA 101-1013	7-23-64

Table 2-2. Specimen Dimensions

Length (inches)	Hex Dimension (inches)
3.75	1.0

SECTION III

PROOF PRESSURE TEST

3.1 TEST REQUIREMENTS

3.1.1 A proof pressure of 450 psig shall be simultaneously applied to the inlet and outlet ports of the test specimen for 5 minutes.

3.1.2 Any leakage or distortion shall be monitored.

3.1.3 The inlet and outlet ports shall be simultaneously vented.

3.2 TEST PROCEDURE

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

3.2.2 All hand valves were closed and regulator 5 was adjusted for zero outlet pressure.

3.2.3 Hand valve 2 was opened and pressure was applied using pressure source 7.

3.2.4 Pressure gage 4 indicated 3300 psig.

3.2.5 Regulator 5 was adjusted until 450 psig was established on pressure gage 6.

3.2.6 The 450-psig pressure was maintained for 5 minutes. The test specimen was monitored for ***any*** leakage or distortion occurring during this time.

3.2.7 Hand valve 2 was closed and the inlet and outlet ports of the specimen were simultaneously vented by opening valve 8.

3.2.8 All test data were recorded.

3.3 TEST RESULTS

The test specimen displayed no leakage or distortion when the inlet and outlet ports were pressurized and maintained for 5 minutes at 450 psig.

3.4 TEST DATA

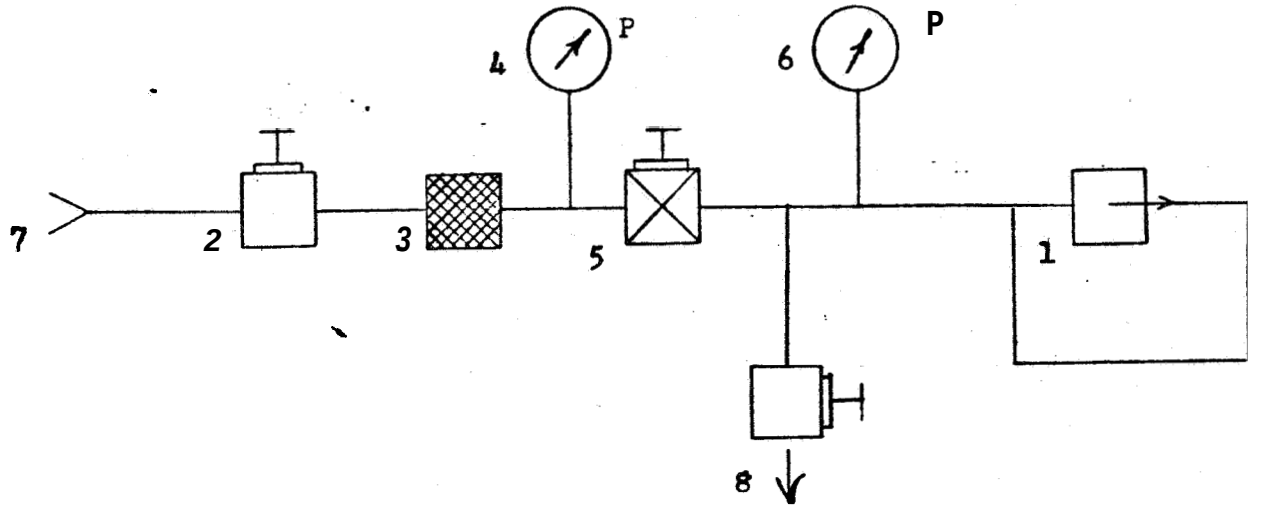
Proof pressure data are presented in table 3-2.

Table 3-1. Proof Pressure Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	James, Pond, and Clark, Inc.	220T6-8TT-3	609291	1/2-inch check valve
2	Hand Valve	Combination Pump and Valve Co.	NA	NA	3/4-in.
3	Filter	Bendix	1731260	NA	2-micron
4	Pressure Gage	Ashcroft	1850	200616-L	0-to 500-psig ±2% FS Cal date 10-25-67
5	Pressure Regulator	Tescom Corp.	26-1003	1008	3000-psig inlet 0-to 500-psig outlet
6	Pressure Gage	Ashcroft	1850	200616-K	0-to 1000-psig ±0.25% FS Cal date 10-25-67
7	GN_2 Pressure Source	CCSD	NA	NA	3000-psig
8	Hand Valve	Robbins	SSKG-250-4R	NA	1/4-in.

Table 3-2. Proof Pressure Test Data

Specimen	Inlet and Outlet Ports Simultaneously Pressurized	Leakage or Distortion
1	450 psig	None



Note: All lines $\frac{1}{4}$ inch.

Refer to table 3–1 for item identification.

Figure 3-1. Proof **Pressure Test** Schematic

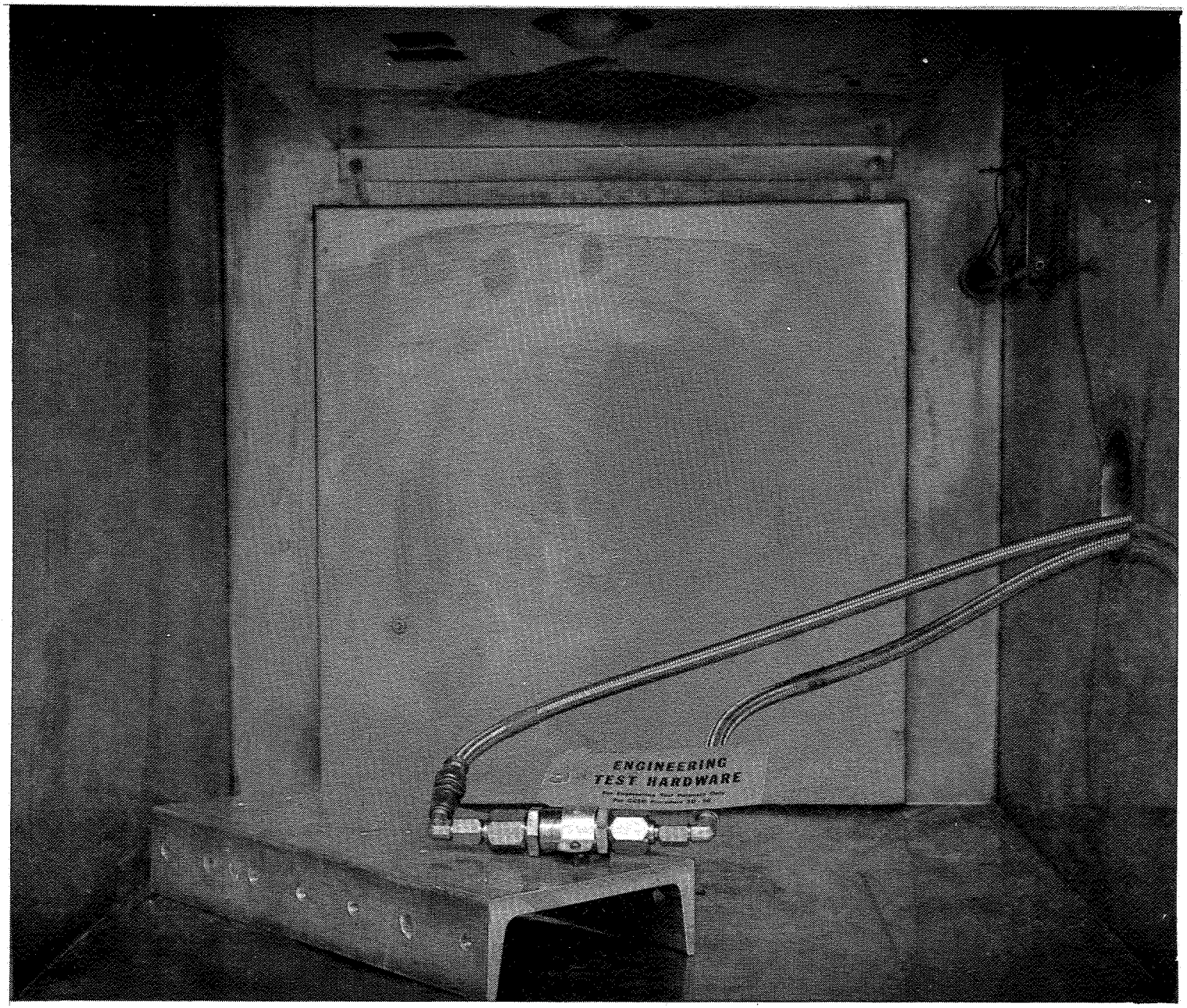


Figure 3-2. Proof Pressure Test Setup

SECTION. I V

FUNCTIONAL TEST

4.1 TEST REQUIREMENTS

4.1.1 A functional test shall be performed on the specimen using GN_2 as the test medium.

4.1.2 The inlet port shall be slowly pressurized from zero to 20 psig and back to zero. The cracking pressure and the reseating pressure shall be recorded. Fifteen such cycles shall be performed initially. Subsequent functional tests shall consist of five cycles.

4.1.3 Zero internal and external leakage shall be verified by pressurizing the outlet port of the valve to 450 psig.

4.1.4 During the initial functional test only, the valve shall be filled with nitrogen tetroxide (N_2O_4) for 24 hours to determine corrosion effects and seal deterioration. Procedures described in 4.1.2 (five cycles) and 4.1.3 shall be repeated following this test.

4.2 TEST PROCEDURE

4.2.1 The functional test setup was assembled as shown in figures 4-1 and 4-2 utilizing the equipment listed in table 4-1.

4.2.2 All hand valves were closed and regulator 5 was adjusted for zero outlet pressure.

4.2.3 Hand valve 2 was opened and pressure was applied using pressure source 17.

4.2.4 The reading on pressure gage 4 was 500 psig.

4.2.5 Hand valves 7, 11, and 15 were opened.

4.2.6 Regulator 5 was slowly adjusted to increase specimen inlet pressure until bubbles appeared in water tank 14. The pressure was recorded when bubbles appeared in water tank 14. This was the cracking pressure of the specimen.

4.2.7 Hand valve 11 was closed and hand valve 13 was opened.

4.2.8 Regulator 5 was adjusted so that the pressure on gage 9 read 20 psig.

4.2.9 Regulator 5 was adjusted to decrease the pressure to approximately 3.5 psig.

4.2.10 Hand valve 13 was closed and hand valve 11 was opened.

4.2.11 The pressure was slowly decreased and the pressure at which the bubbles ceased in water tank 14 was recorded. This was the reseating pressure of the specimen.

4.2.12 Procedures in 4.2.6 through 4.2.11 were performed fifteen times during the initial functional test and five times during subsequent functional tests.

4.2.13 Hand valves 7, 11, and 15 were closed.

4.2.14 Hand valves 8 and 10 were opened.

4.2.15 Regulator 5 was adjusted to establish 450 psig on pressure gage 12.

4.2.16 Internal and external leakage was recorded.

4.2.17 The valve specimen was taken out of the test setup and shipped to Ogden Technology Laboratories, Incorporated. The test setup was assembled as shown in figure 4-3. The specimen was filled with N_2O_4 and the inlet and outlet ports were capped.

4.2.18 The N_2O_4 was maintained in the specimen for 24 hours.

4.2.19 After the 24-hour period the caps were removed and the specimen was flushed with water.

4.2.20 Corrosion effects and deterioration were observed. The specimen was returned to CCSD.

4.2.21 The specimen was placed in the setup shown in figure 4-1.

4.2.22 Procedures described in 4.2.6 through 4.2.11 were performed five times. The procedures described in 4.2.13 through 4.2.16 were repeated.

4.2.23 Procedures described in 4.2.17 through 4.2.22 were performed only during the initial functional test.

4.2.24 All test data were recorded.

4.3 TEST RESULTS

During the initial functional test the specimen failed to meet the cracking pressure requirement of 3 psig. The cracking and seating pressure was zero. The valve was returned to the vendor, James, Pond, and Clark, Incorporated, who reworked the valve and then returned it to CCSD for further testing.

During the second functional test the specimen's cracking pressure averaged 1.84 psig. This pressure also failed to meet the 3 psig requirement; however, the working pressure was approved and the testing was satisfactorily completed.

The test specimen was sent to Ogden Technology Laboratories, Incorporated, for testing with nitrogen tetroxide. No corrosive effects or seal deterioration were noted after 24 hours of internal saturation.

4.4 TEST DATA

Test data are presented in tables 4–2 through 4–5.

Table 4–1. Functional Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	James, Pond, and Clark, Inc.	220T6-8TT-3	609291	1/2-inch check valve
2	Hand Valve	Combination Pump and Valve Co.	NA	NA	3/4-in.
3	Filter	Bendix	1731260	NA	2-micron
4	Pressure Gage	Ashcroft	1850	200616-L	0-to 5000-psig ±2% FS Cal date 1-25-67
5	Pressure Regulator	Tescom Corp.	26-1003	1008	500-psig inlet 3-to 450-psig outlet
6	Pressure Gage	Ashcroft	1850	200616-K	0-to 5000-psig ±0.25% FS Cal date 1-25-67
7	Hand Valve	Robbins	SSKG-250-4T	NA	1/4-in.
8	Hand Valve	Robbins	SSKG-250-4T	NA	1/4-in.
9	Pressure Gage	Wallace & Tiernan	FA-145	NA	0-to 120-inch Hg ±0.25% FS Cal date 12-22-66
10	Hand Valve	Robbins	SSKG-250-4T	NA	1/4-in.
11	Hand Valve	Robbins	SSKG-250-4T	NA	1/4-in.
12	Pressure Gage	Heise	H39702	95-1376-B	0-to 500-psig ±0.25% FS Cal date 2-1-67
13	Hand Valve	Robbins	SSKG-250-4T	NA	1/4-in.

Table 4–1. Functional. Test Equipment List (Continued)

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
14	Water Tank	NASA	NA	NA	Bubble detection
15	Hand Valve	Robbins	SSKG-250-4T	NA	1/4-in.
16	Temperature Chamber	Conrad	NA	200494-1	0 to 150°F Cal date 10-20-66 (required during temperature tests only)
17	GN_2 Pressure Source	CCSD	NA	NA	500–psig

Table 4-2. Initial Functional Test Data (GN_2)

Cycle	Cracking Pressure psig	Reseating Pressure psig
1	0.25	0.0
2	0.25	0.0
3	0.0	0.0
4	0.0	0.0
5	0.0	0.0
6	0.0	0.0
7	0.0	0.0
8	0.0	0.0
9	0.0	0.0
10	0.0	0.0

Note: Specimen failed.
Cracking specification is 3 psig,

Table 4-3. Leakage Test Data (GN_2)

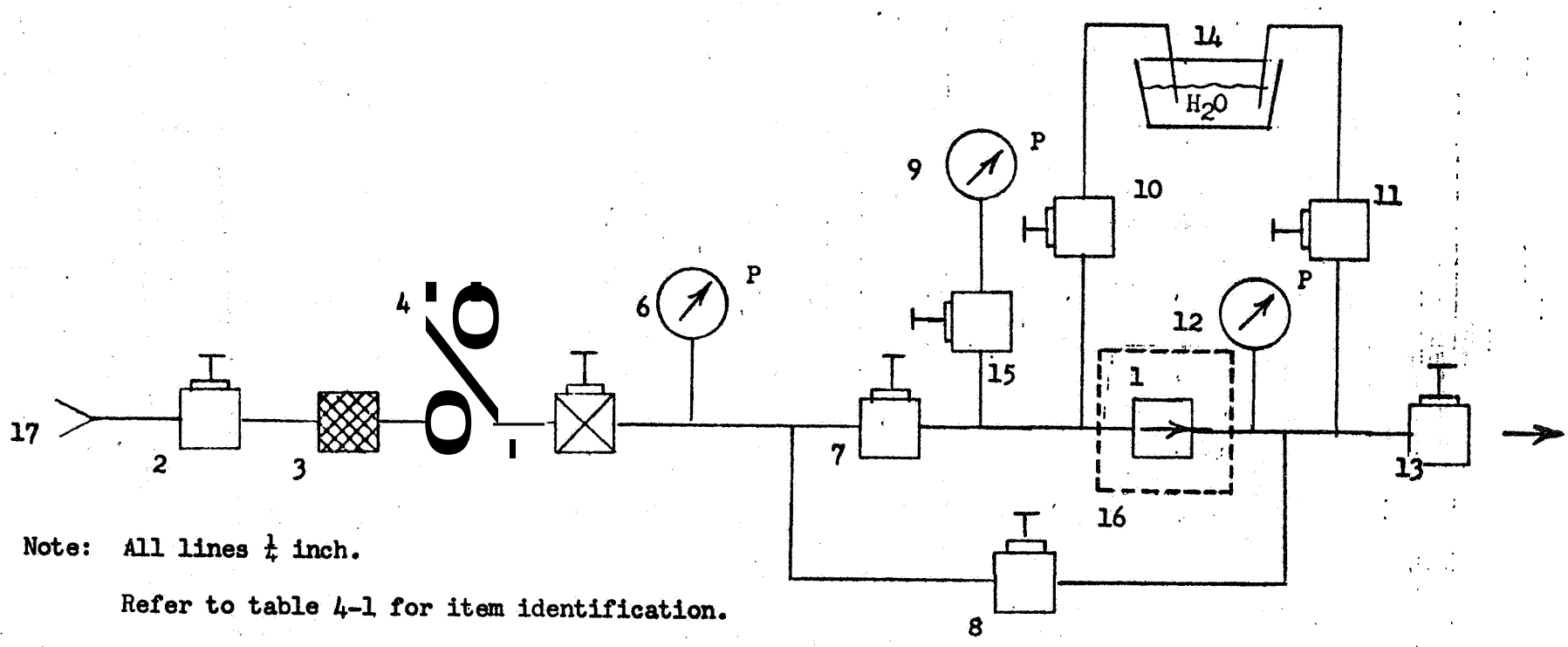
Pressurized Outlet Port	Leakage
450 psig	None

Table 4-4. Functional Test Data After Reworking (GN_2)

Cycle	Cracking Pressure psig	Reseating Pressure psig
1	2.406	1.718
2	2.455	0.736
3	1.375	1.080
4	1.669	1.080
5	2.209	1.718
6	2.455	1.227
7	2.209	1.326
8	2.357	0.736
9	1.473	1.375
10	2.113	0.884
11	1.817	0.491
12	0.982	0.786
13	1.375	0.835
14	1.129	0.491
15	1.718	0.736

Table 4-5. Leakage Test Data After Reworking (GN_2)

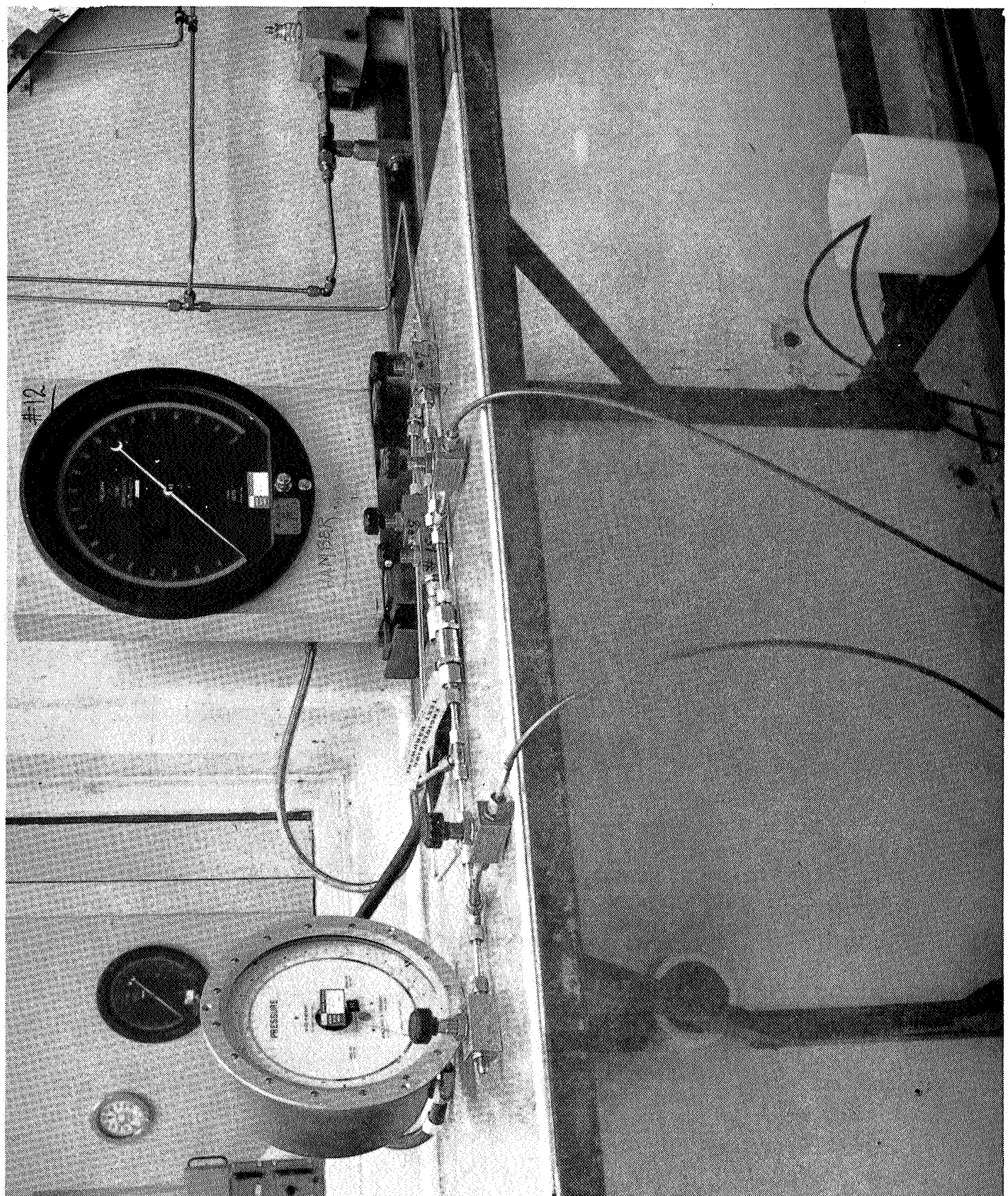
Pressurized Outlet Port	Leakage
450 psig	None



Note: All lines ¼ inch.

Refer to table 4-1 for item identification.

Figure 4-1. Functional Test Schematic



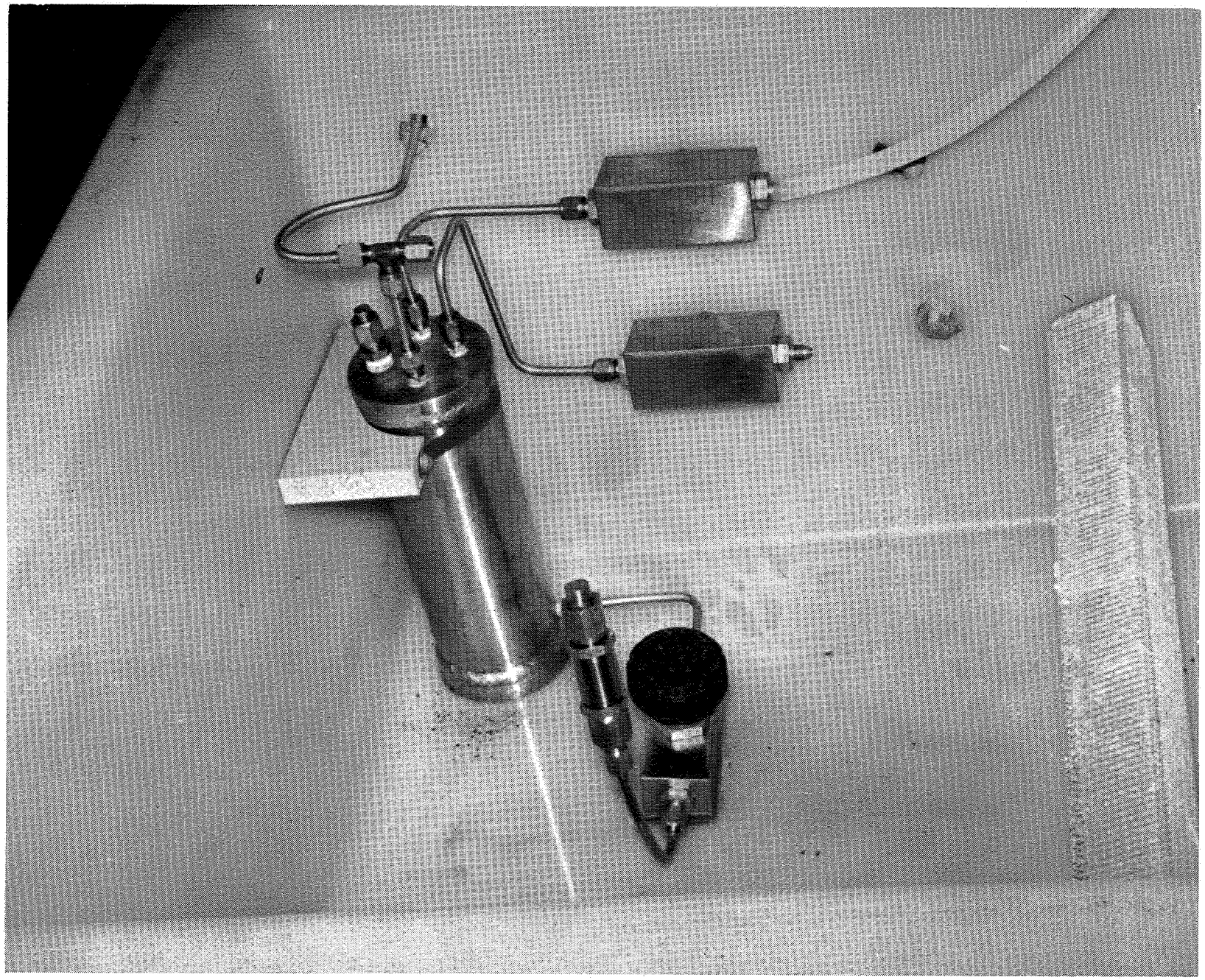


Figure 4-3. Nitrogen (N_2O_4) Test Setup

SECTION V

FLOW TEST

5.1 TEST REQUIREMENTS

5.1.1 A flow test shall be performed on the specimen.

5.1.2 The flow coefficient, C_V, for the specimen shall be determined.

5.1.3 The test medium shall be H_2O.

5.2 TEST PROCEDURE

5.2.1 The test setup was assembled as shown in figures 5-2, 5-3, and 5-4 utilizing the equipment listed in table 5-1. All hand valves were closed.

5.2.2 Hand valve 3 was closed and reservoir vent valve 11 was opened. Hand valve 14 was opened and reservoir 10 was filled to approximately 75 percent of its capacity.

5.2.3 Hand valves 11 and 14 were closed.

5.2.4 Hand valve 3 was opened and regulator 6 was adjusted so that a 500 psig pressure was placed in the reservoir. The pressure was monitored on gage 16.

5.2.5 Hand valve 26 was opened.

5.2.6 Regulators 17 and 18 were adjusted so that flowrates of 5 through 13 gallons per minute were attained as indicated on flowmeter 19 (or EPUT-meter 20). The pressure drop across the valve and the pipe loss were read on gages 21, 22, and 23 and recorded. The water temperature as indicated by temperature recorder 25 was recorded.

5.2.7 The flow coefficient (C_V) was determined at each flowrate by using the follow equation:

$$C_V = Q \sqrt{\frac{\rho_T}{\rho \Delta P}}$$

Where: Q = flow in gpm
ρ_T = density of water at the temperature indicated on the temperature probe
ρ = density of water at 60°F
ΔP = pressure drop across specimen

5.2.8 All test data were recorded.

5.3 TEST RESULTS

The average flow coefficient (C_V) was determined to be 2.54, recorded from nine different points of flow.

5.4 TEST DATA

5.4.1 Flow test data are presented in table 5-2. Flowrate in gallons per minute versus pressure drop is presented in figure 5-1.

5.4.2 Functional test data following the flow test and functional test data after a 72 hour delay period following the flow test are presented in tables 5-3 through 5-6.

Table 5-1. Flow Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	James, Pond, and Clark, Inc.	220T6-8TT-3	609291	1/2-inch check valve
2	Air Supply		NA	NA	3000 psig
3	Hand Valve	Combination Pump and Valve Corp.	PL-63	NA	1/2-in.
4	Filter	Bendix	1731261	NA	10-micron
5	Pressure Gage	Ashcroft	1057 S	95-1210-B	0-to 5000-psig ±1/2% FS Cal date 11-15-66.
6	Regulator	Tescom Corp.	261201-14	NA	0- to 4000-psig
7	Pressure Gage	Ashcroft	1850	95-1227-B	0-to 500-psig ±1/2% FS Cal date 10-6-66
8	Relief Valve	Anderson Greenwood	3TS44-2	16057	1500-psig
9	Check Valve	Crissair	2C5758	NA	3/4-in.
10	Water Tank	CCSD	NA	105471	666-gal.
11	Hand Valve	Marsh Instrument	1924	NA	3/4-in.
12	Check Valve	Crissair	2C5758	NA	3/4-in.
13	Relief Valve	Anderson Greenwood	3TS44-2	15734	100-psig
14	Hand Valve	Jenkins Bros.	46U	NA	1/2-in.
15	Water Supply	NA	NA	NA	
16	Pressure Gage	Ashcroft	1850	95-1209B	0-to 3000-psig ±0.5% FS Cal date 12-10-66
17	Hand Regulator	Vacco	MV6P4G32G	5116-18	1/2-in.

Table 5-1. Flow Test Equipment List (Continued)

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
18	Hand Regulator	Vacco	NVA6P404S	19-90794	1-in.
19	Flowmeter	cox	AN-12	019167	0-to 50-gpm Cal date 10-15-66
20	EPUT-meter	Beckman	5311	016579	Recorder Cal date 1-8-67
21	Pressure Gage	Heise	NA	93-1092C	0-to 1000-psig ±0.1% FS Cal date 12-20-66
22	Pressure Gage	Heise	NA	95-1637B	0-to 100-psig ±0.1% FS Cal date 12-20-66
23	Pressure Gage	Heise	NA	95-1083C	0-to 100-psig ±0.1% FS Cal date 12-20-66
24	Temperature Probe	Honeywell	2T2M13P	NA	Copper/Consonant
25	Temperature Recorder	Westronics	NA	019461	-100 to +400°F Cal date 10-3-66
26	Hand Valve	Vacco	1600137-1	5116-6	1/2-in.

Table 5-2. Flow Test Data

Flow (gpm)	Specimen Pressure		Tare (psi)	ΔP (psi)	Media Temperature (°F)	Flaw Coefficient (C_V)
	Upstream (psig)	Downstream (psig)				
5	32.0	26.0	0	6.0	65	2.02
6	43.5	36.0	0	7.5	65	2.19
7	58.0	50.b	0	8.0	65	2.48
8	75.0	66.0	0	9.0	65	2.67
9	95.0	84.0	0	11.0	65	2.72
10	117.0	104.0	0	13.0	65	2.78
11	142.0	126.0	0	15.5	45	2.79
12	170.0	150.0	0	20.0	65	2.69
13	200.0	176.0	0	24.0	65	2.55

Table 5–3. Functional Test Data Following Flow Test (GN_2)*

Cycle	Cracking Pressure psig	Reseating Pressure psig
1	1.6	1.0
2	1.5	1.0
3	1.6	1.0
4	1.7	1.0
5	1.6	1.0

Table 5–4. Leakage Test Following Flow Test (GN_2)

Pressurized Outlet Port	Leakage
450 psig	None

Table 5-5. Functional Test Data After 72 Hour Delay Following the Flow Test (GN_2)

Cycle	Cracking Pressure psig	Reseating Pressure psig
1	1.82	0.88
2	1.47	0.88
3	0.98	0.88
4	0.98	0.88
5	0.88	0.88

Table 5-6. Leakage Test Data After 72 Hour Delay

Pressurized Outlet Port	Leakage
k50 psig	None

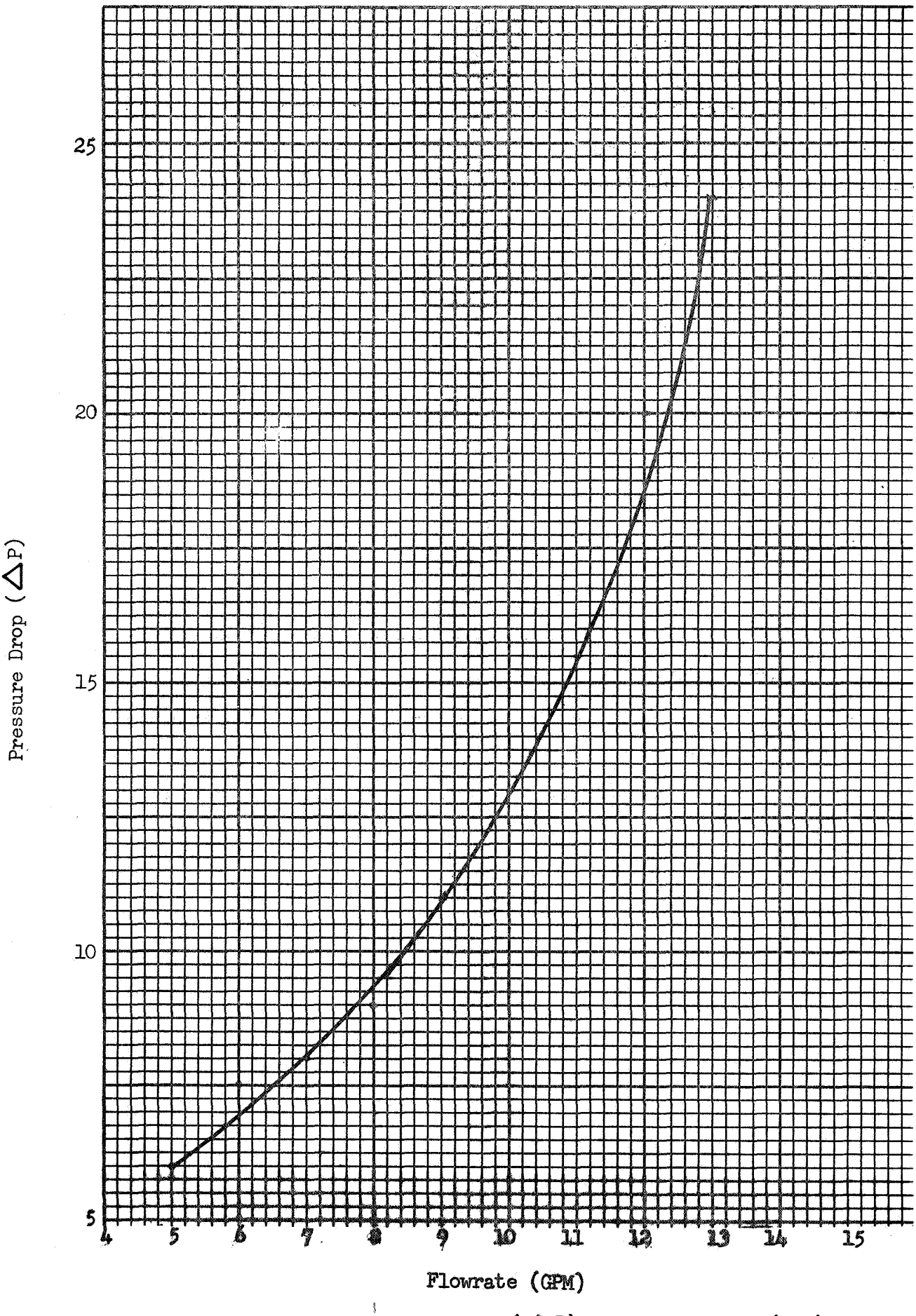
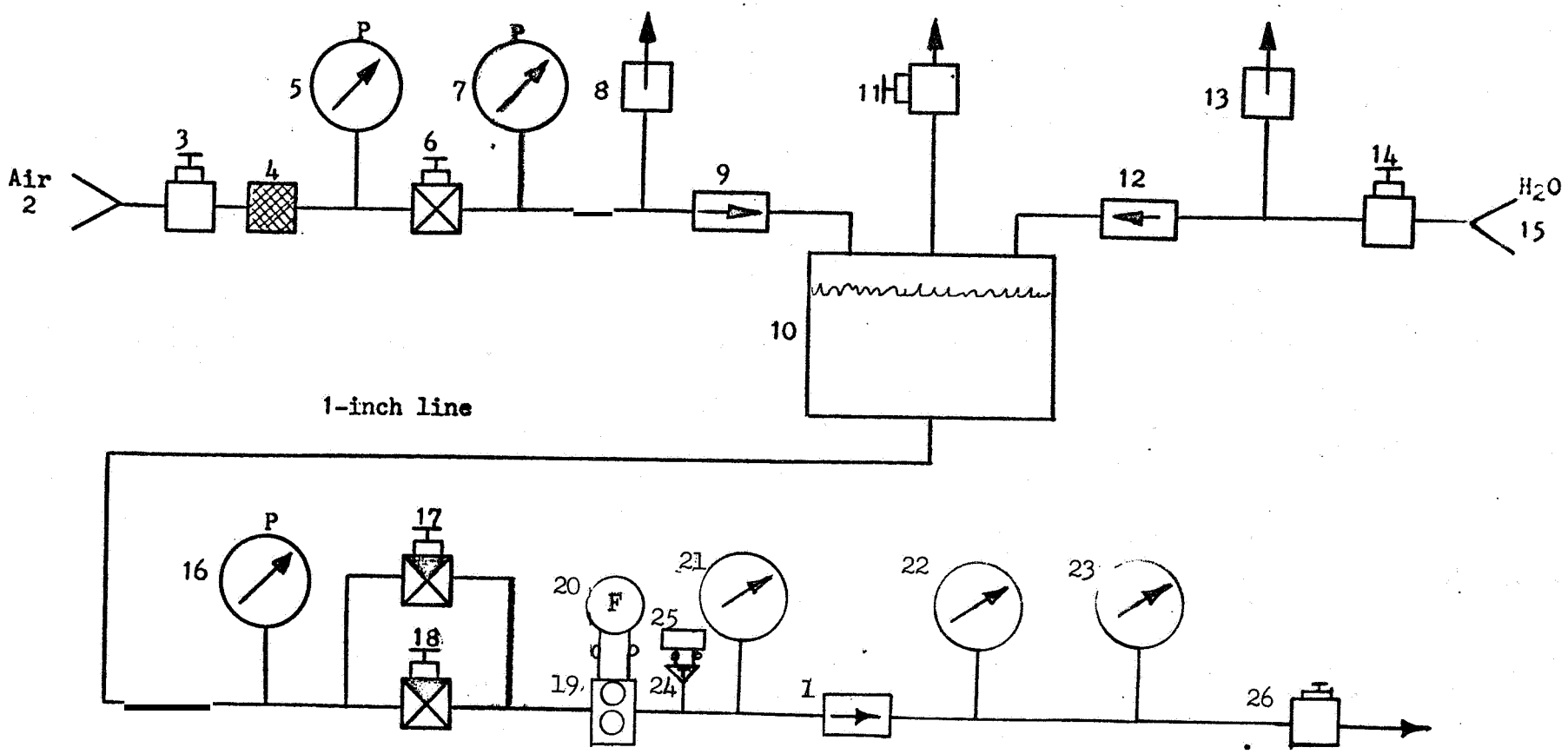


Figure 5-1. Pressure Drop (△P) Versus Flowrate (GPM)



Note: All lines $\frac{1}{4}$ inch unless otherwise indicated.
Refer to table 5-1 for item identification.

Figure 5-2. Flow Test Schematic

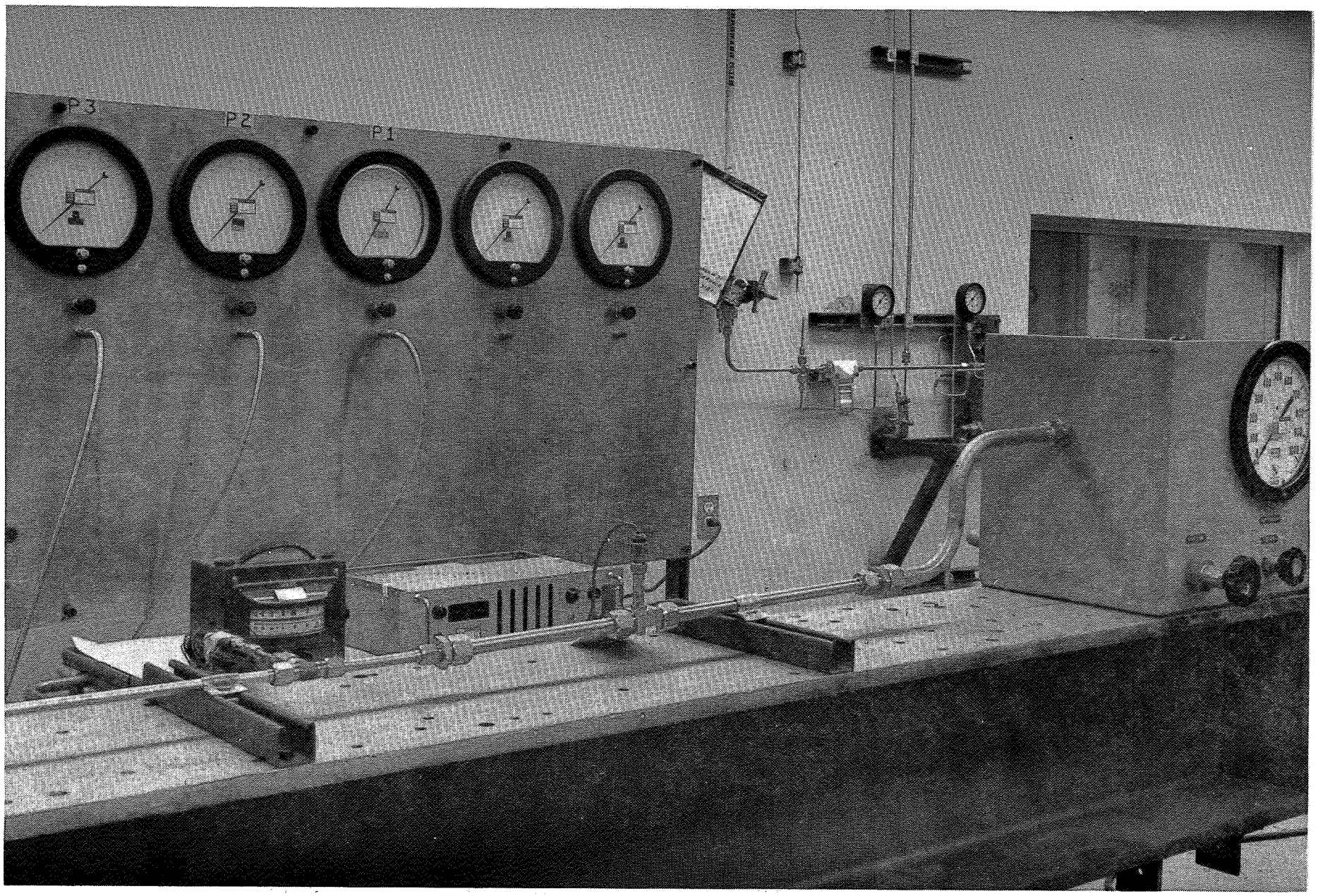


Figure 5-3. Flow Test Setup

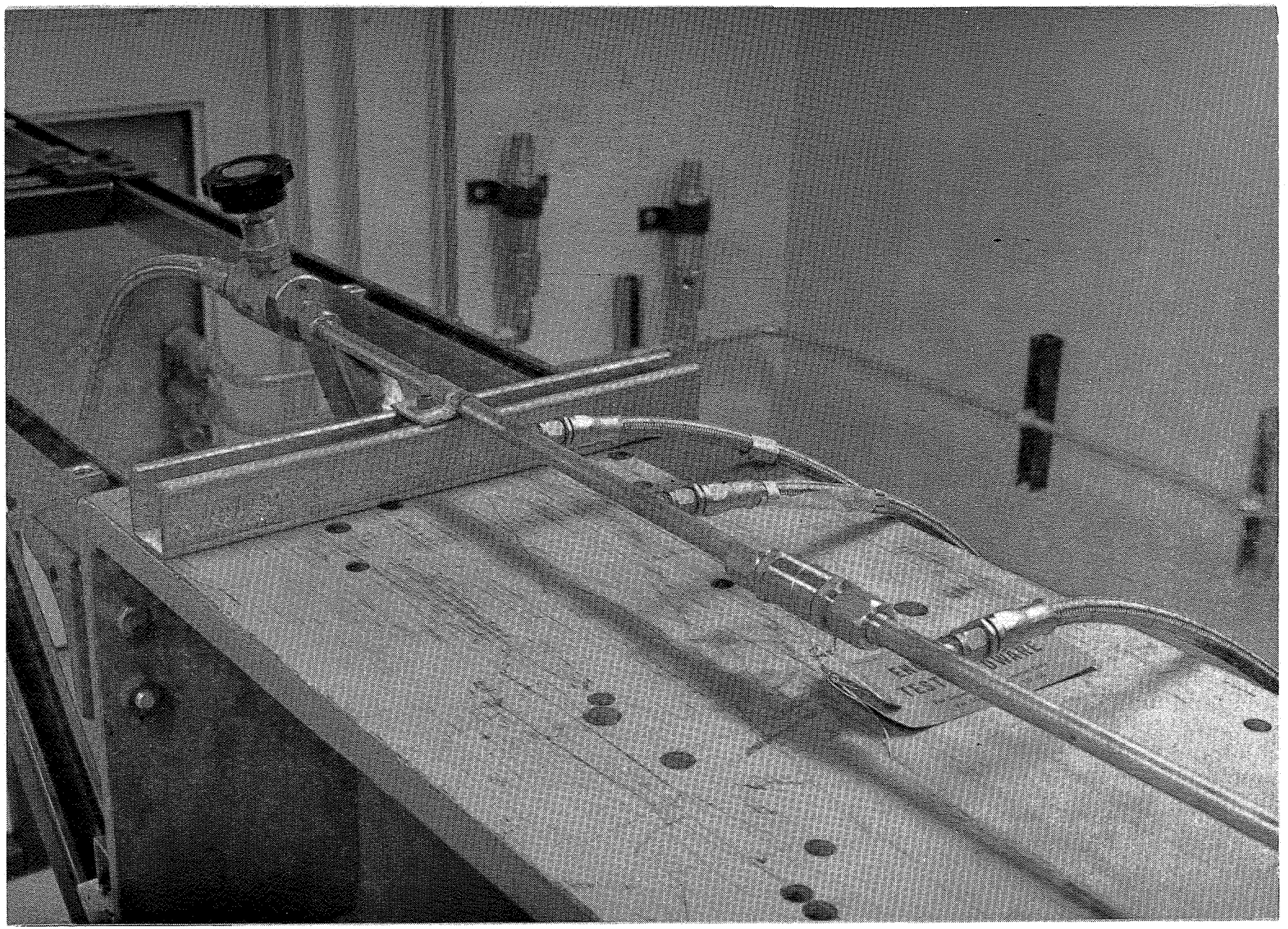


Figure 5-4. Flow Test Setup (Continued)

SECTION VI

SURGE TEST

6.1 TEST REQUIREMENTS

6.1.1 A surge test shall be performed on the test specimen to determine whether the environment causes degradation or deformation.

6.1.2 The test specimen shall be surged from zero to 25 psig within 100 milliseconds for a total of 100 cycles.

6.2 TEST PROCEDURE

6.2.1 The surge test setup was assembled as shown in figure 6-1 utilizing the equipment listed in table 6-1.

6.2.2 All hand valves were closed.

6.2.3 Hand valve 5 was adjusted for zero outlet pressure.

6.2.4 Hand valve 2 was opened and pressure was applied using pressure source 11.

6.2.5 The reading on gage 4 was 500 psig.

6.2.6 Hand valve 5 was adjusted to establish 25 psig on pressure gage 6. Hand valve 14 was opened.

6.2.7 Timer 8 was adjusted to energize and de-energize solenoid valve 7.

6.2.8 Hand valve 5 was adjusted so that the specimen was pressurized from zero to 25 psig within 100 milliseconds.

6.2.9 A total of 100 cycles was performed as indicated by counter 12.

6.2.10 Oscillograph 10 was used to record the output from pressure transducer 9 during cycling.

6.2.11 All test data were recorded.

6.3 TEST RESULTS

The specimen withstood 100 surge cycles from 0 to 25 psig at the inlet port. Functional test results following the surge test were satisfactory.

6.4 TEST DATA

6.4.1 A typical surge waveform as recorded during the test is presented in figure 6-1.

6.4.2 Functional test data following the surge test are presented in tables 6-2 and 6-3.

Table 6-1. Surge Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	James, Pond, and Clark, Inc.	220T6-8TT-3	609291	1/2-inch check valve
2	Hand Valve	Combination Pump and Valve Co.	NA	NA	3/4-inch
3	Filter	Bendix	111-41072	106446	2-micron
4	Pressure Gage	Heise	H34947	014223	0-to 1000-psig ±0.25% FS Cal date 1-18-67
5	Hand Valve	Robbins	SSKG-250-4T	NA	1/4-inch
6	Pressure Gage	Duragauge	95-FA-003	95-1613-B	0-to 600-psig ±0.25% FS Cal date 1-12-67
7	Solenoid Valve	Marotta Valve Co.	MV-583	2845	3-way, 1/2-inch
8	Timer	G. C. Wilson and co.	1	NA	Repeat cycle 28-vdc
9	Pressure Transducer	C. E. C.	4-350-0001	2420	0-to 100-psig ±0.25% FS Cal date 1-17-67
10	Oscillograph	C. E. C.	5-124	312588	Recorder Cal date 1-3-67
11	GN_2 Pressure Source	CCSD	NA	NA	500-psig
12	Counter	Durant Co.	NA	NA	3-digit
13	Power Supply	CCSD	NA	NA	28-vdc
14	Hand Valve	Kacco Valve Co.	VV-6P-403-2G	5116-1	1/2-inch
15	Hand Valve	Robbins	SSKG-250-4T	NA	1/4-inch

Table 6-1. Surge Test Equipment List (Continued)

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
16	Pressure Gage	Heise	NA	95-1376-B	0-to 60-psig ±0.25% FS Cal date 1-18-67

Table 6-2. Functional Test Data Following Surge Test (GN_2)

Cycle	Cracking Pressure psig	Reseating Pressure psig
1	2.30	1.08
2	1.47	0.884
3	0.98	0.786
4	1.96	1.080
5	2.06	0.786

Table 6-3. Leakage Test Data Following Surge Test

Pressurized Outlet Port (GN_2)	Leakage
450 psig	None

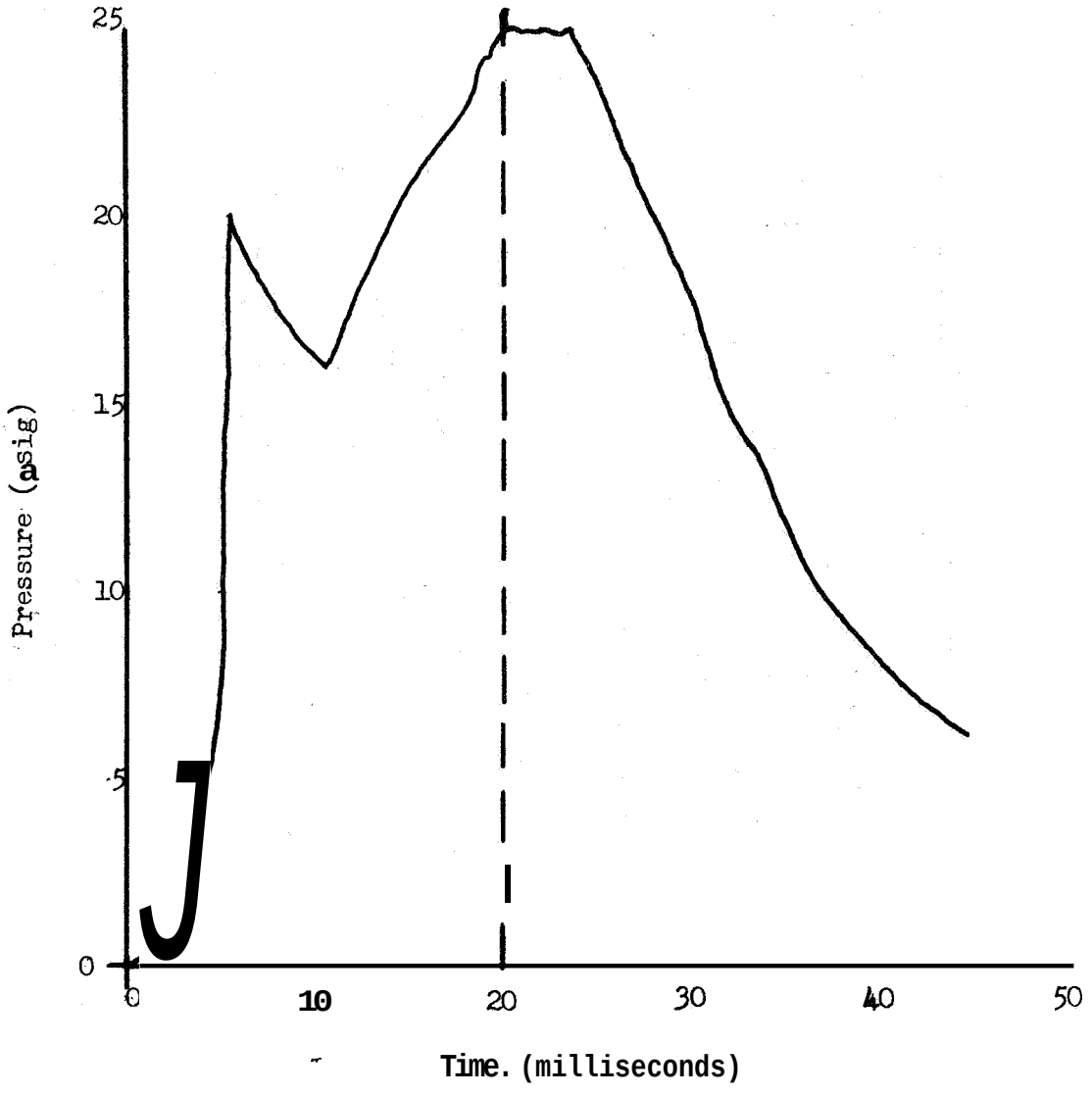
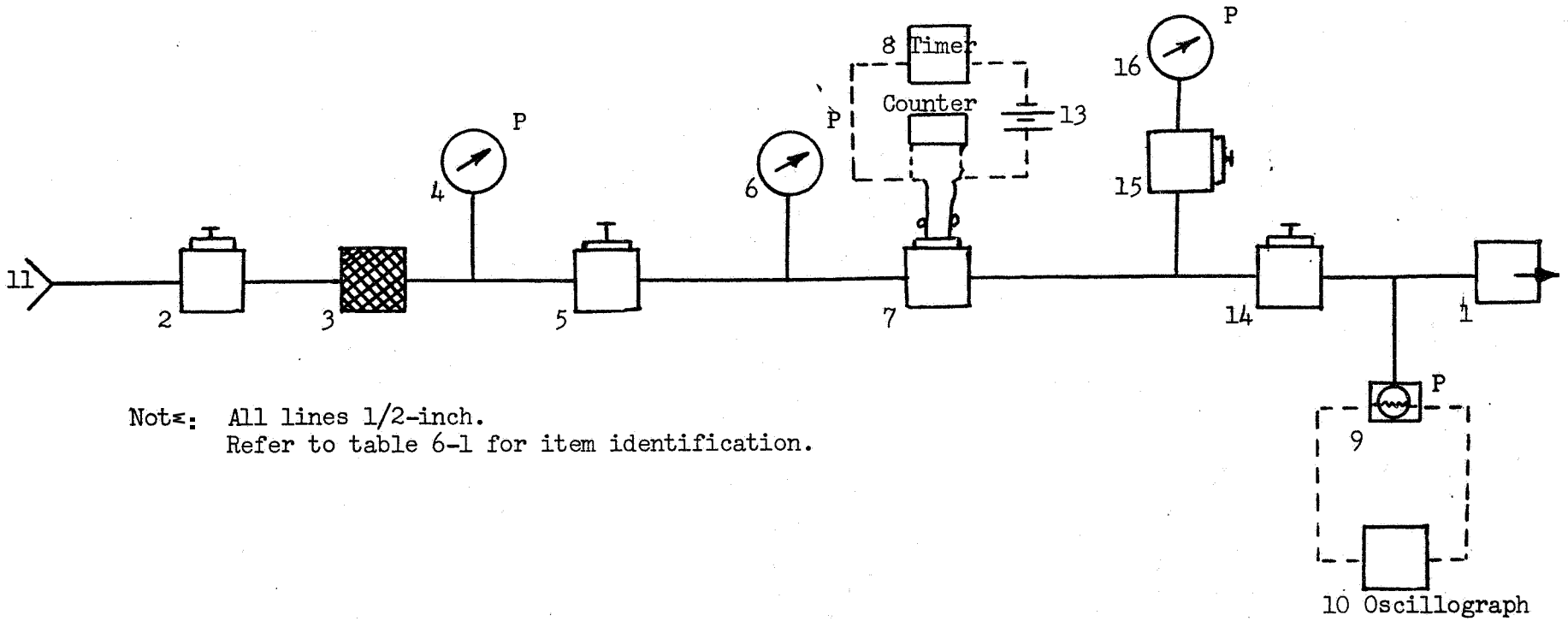


Figure 6-1. Typical Surge Waveform



Note: All lines 1/2-inch.
Refer to table 6-1 for item identification.

Figure 6-2. Surge and Cycle Test

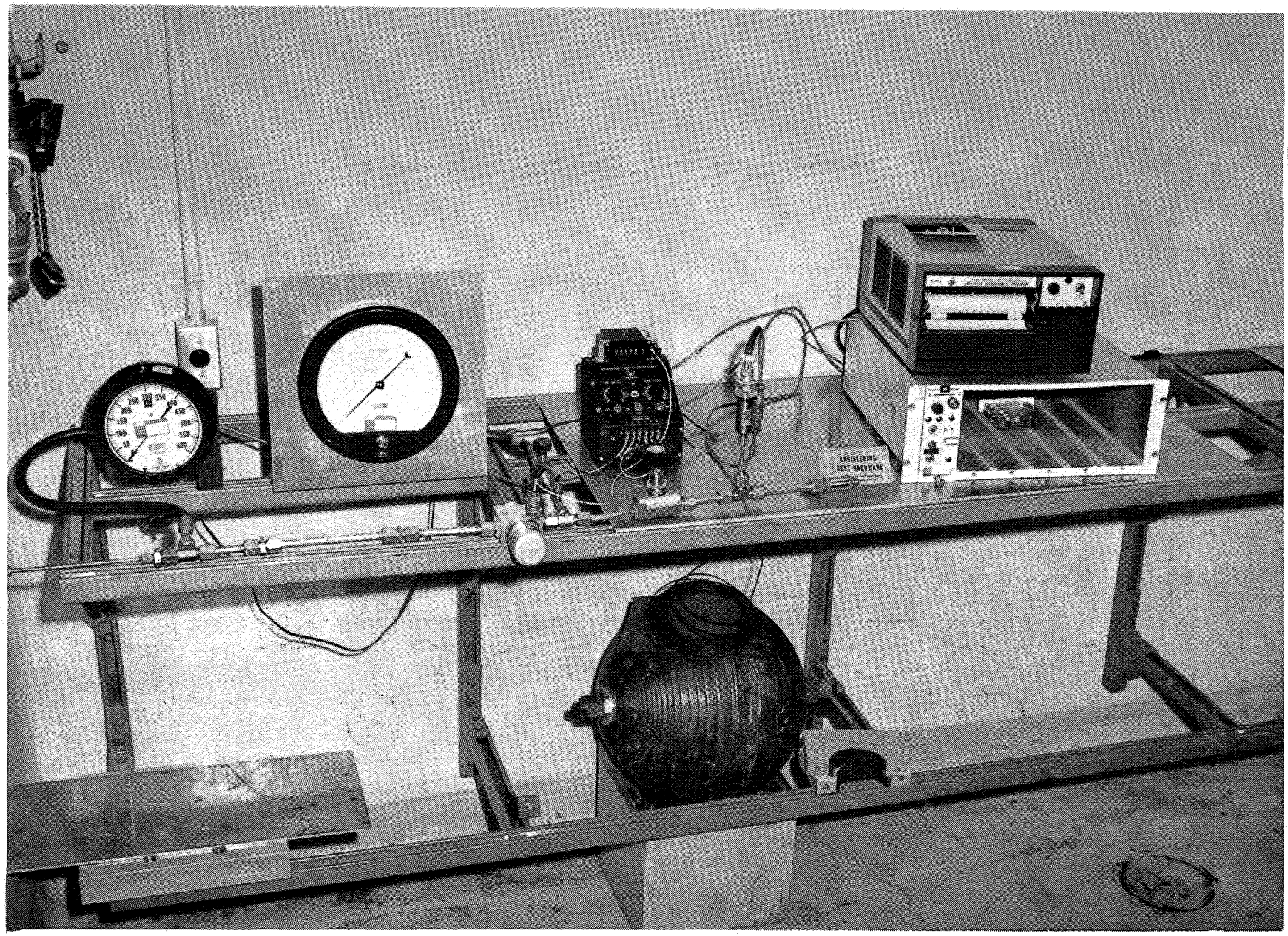


Figure 6-3. Surge and Cycle Test Setup

SECTION VII

LOW TEMPERATURE TEST

7.1 TEST REQUIREMENTS

7.1.1 A low temperature test will be performed on the test specimen to determine whether the, environment causes degradation or deformation.

7.1.2 The rated low temperature is 12 (+0, -4)°F. Maximum temperature change rate shall be 1°F per minute.

7.1.3 A functional test is to be performed during this test.

7.2 TEST PROCEDURE

7.2.1 The test specimen was placed in a temperature chamber as shown in figures 4-1 and 7-1 utilizing the equipment listed in table 4-1.

7.2.2 The chamber was controlled to the specified 12°F temperature while maintaining a relative humidity between 60 and 90 percent. A temperature change rate of 1°F per minute was maintained.

7.2.3 A functional test was performed when the temperature was stabilized at 12°F. Temperature stabilization is defined as a maximum temperature change rate of 4°F per hour as determined from the instrumentation monitoring the test specimen.

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

7.2.5 The test specimen was visually inspected and functionally tested within 1 hour following the return to ambient conditions.

7.2.6 All test data were recorded.

7.3 TEST RESULTS

The specimen functioned satisfactorily during and following the low temperature test.

7.4 TEST DATA

7.4.1 The functional test data presented in tables 7-1 through 7-4 were recorded during the low temperature test and immediately after the specimen had returned to room ambient temperature.

7.4.2 No leakage existed at the inlet port while the outlet port was pressurized to 450 psig during or after the low temperature test.

Table 7-1. Functional Test Data During the Low Temperature Test (GN_2)

Cycle	Cracking Pressure psig	Reseating Pressure psig
1	1.77	0.49
2	1.47	2.45
3	0.98	0.37
4	1.18	0.37
5	1.08	2.45

Table 7-2. Leakage Test Data During the Low Temperature Test (GN_2)

Pressurized Outlet Port	Leakage
450 psig	None

Table 7-3. Functional Test Data at Ambient Conditions (GN_2)

Cycle	Cracking Pressure psig	Reseating Pressure psig
1	1.47	0.24
2	0.78	0.74
3	0.78	0.49
4	0.68	0.49
5	0.68	0.37

Table 7-4. Leakage Test Data at Ambient Conditions (GN_2)

Pressurized Outlet Port	Leakage
450 psig	None

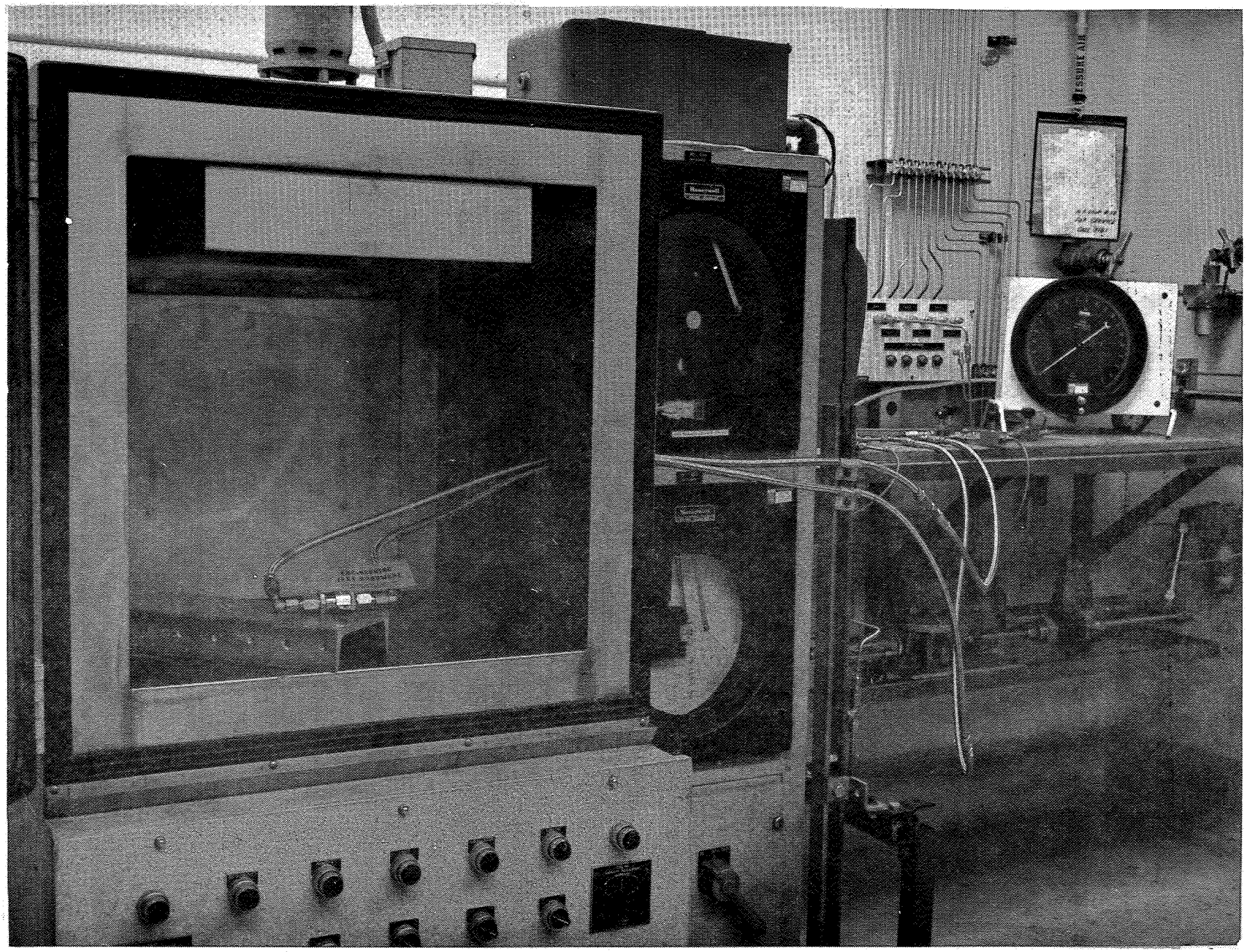


Figure 7-1. Low and High Temperature Test Setup

SECTION VIII

HIGH TEMPERATURE TEST

8.1 TEST REQUIREMENTS

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

8.1.2 The rated high temperature is 125 (+4, -0)°F.

8.1.3 A functional test shall be performed during this test;

8.2 TEST PROCEDURE

8.2.1 The test specimen was placed in a high temperature chamber as shown in figures 4-1 and 7-1 utilizing the equipment listed in table 4-1.

8.2.2 The chamber temperature was increased to the specified 125°F and a relative humidity of 20 (±5) percent was maintained. A maximum temperature change rate of 1°F per minute was not exceeded.

8.2.3 This temperature was maintained for a period of 72 hours.

8.2.4 A functional test was conducted while the chamber temperature was maintained.

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

8.2.6 The specimen was visually inspected and functionally tested within 1 hour following the establishment of ambient conditions.

8.2.7 All test data were recorded.

8.3 TEST RESULTS

The specimen functioned satisfactorily during and following the high temperature test.

8.4 TEST DATA

8.4.1 Functional test data presented in tables 8-1 through 8-4 were recorded during the high temperature test and immediately after the specimen was returned to ambient conditions.

8.4.2 No leakage existed at the inlet port when the outlet port was pressurized to 450 psig.

Table 8–1. Functional Test Data During the High Temperature Test (GN_2)

Cycle	Cracking Pressure psig	Reseating Pressure psig
1	2.16	0.25
2	0.98	0.25
3	0.49	0.49
4	0.84	0.25
5	0.74	0.49

Table 8–2. Leakage Test Data During the High Temperature Test (GN_2)

Pressurized Outlet Port	Leakage
450 psig	None

Table 8-3. Functional Test Data at Ambient Conditions (GN_2)

Cycle	Cracking Pressure psig	Reseating Pressure psig
1	2.45	0.84
2	0.89	0.49
3	0.49	0.39
4	0.79	0.49
5	1.28	0.39

Table 8-4. Leakage Test Data at Ambient Conditions (GN_2)

Pressurized Outlet Port	Leakage
450 psig	None

SECTION IX

CYCLE TEST

9.1 TEST REQUIREMENTS

9.1.1 A cycle test shall be performed on the test specimen to determine whether the environment causes degradation or deformation.

9.1.2 The specimen shall be pressurized from zero to 25 psig and back to zero for a total of 1000 cycles.

9.1.3 A functional test shall be conducted after 50, 100, 500, and 1000 cycles.

9.2 TEST PROCEDURE

9.2.1 The cycle test setup was assembled as shown in figures 6-2 and 6-3 utilizing the equipment listed in table 6-1.

9.2.2 Regulator 5 was adjusted for zero outlet pressure.

9.2.3 Hand valve 2 was opened and pressure was applied using pressure source 11.

9.2.4 The pressure reading on gage 4 was 500 psig.

9.2.5 Regulator 5 was adjusted to establish 25 psig on pressure gage 6. Hand valve 14 was cracked.

9.2.6 Timer 8 was adjusted to energize and de-energize solenoid valve 7 at approximately 15 cycles per minute. Hand valve 14 was adjusted so that the specimen was slowly pressurized from zero to 25 psig and back to zero during each cycle.

9.2.7 A total of 1000 cycles was conducted as indicated by counter 12.

9.2.8 A functional test was performed after 50, 100, 500, and 1000 cycles.

9.2.9 All test data were recorded.

9.3 TEST RESULTS

The test specimen successfully withstood 1000 operational cycles from 0 to 25 psig. The results during and following the cycle test were satisfactory.

9.4 TEST DATA

9.4.1 No leakage existed at the inlet port while the outlet port was pressurized to 450 psig after the cycle test.

9.4.2 Functional test data are shown in tables 9–1 through 9–8 after 50, 100, 500 and 1000 cycles.

Table 9-1. Functional Test Data After 50 Cycles (GN_2)

Cycle	Cracking Pressure psig	Reseating Pressure psig
1	1.72	0.25
2	0.29	0.25
3	0.34	0.25
4	0.24	0.29
5	0.39	0.19

Table 9-2. Leakage Test After 50 Cycles (GN_2)

Pressurized Outlet Port	Leakage
450 psig	None

Table 9-3. Functional Test Data After 100 Cycles (GN_2)

Cycle	Cracking Pressure psig	Reseating Pressure psig
1	1.82	0.25
2	0.98	0.25
3	0*49	0.25
4	0.39	0.25
5	0.39	0.19

Table 9-4. Leakage Test After 100 Cycles (GN_2)

Pressurized Outlet Port	Leakage
450 psig	None

Table, 9-5. - Functional Test Data After 500 Cycles (GN_2)

Cycle	Cracking Pressure psig	Reseating Pressure psig
1	1.72	0.49
2	0.59	0.19
3	0.25	0.19
4	1.96	0.29
5	1.47	0.25

Table 9-6. Leakage Test Data After 500 Cycles (GN_2)

Pressurized Outlet Port	Leakage
450 psig	None

Table 9-7. Functional Test Data After 1000 Cycles (GN_2)

Cycle	Cracking Pressure psig	Reseating Pressure psig
1	1.47	0.49
2	0.59	0.25
3	0.25	0.19
4	0.19	0.15
5	0.49	0.34

Table 9-8. Leakage Test Data After 1000 Cycles (GN_2)

Pressurized Outlet Port	Leakage
450 psig	None

SECTION X

BURST TEST

10.1 TEST REQUIREMENTS

10.1.1 A burst pressure test will be performed on the test specimen to determine whether the specimen will satisfy minimum burst pressure requirements. Pressure shall be simultaneously applied to the specimen inlet and outlet.

10.1.2 The minimum burst pressure shall be maintained for 5 minutes.

10.1.3 A visual inspection for specimen structural damage and leakage shall be made.

10.1.4 Pressurization of the specimen shall be continued until rupture occurs.

10.1.5 The rupture pressure shall be recorded.

10.2 TEST PROCEDURE

10.2.1 The specimen was placed in a burst test setup as shown in figures 10-1 and 10-2 utilizing the equipment listed in table 10-1.

10.2.2 All hand valves were closed and regulator 21 was adjusted for zero outlet pressure.

10.2.3 Hand valves 6, 7, 9, 10, and 11 were opened to fill the specimen and system with water. Fittings at the specimen and gage 3 were loosened to bleed all air from the system.

10.2.4 Hand valves 6, 9, and 11 were closed.

10.2.5 Hand valve 5 was opened. Gage 14 indicated 3000 psig.

10.2.6 Switch 17 was closed to open solenoid valve 18.

10.2.7 Regulator 21 was adjusted to provide a pressure of 50 to 100 psig as indicated on gage 15. Pump 19 began operating.

10.2.8 Pumping was continued until specimen pressure, as indicated on gage 3, was 1200 psig. Solenoid valve 18 was closed by opening switch 17 to stop pump.

10.2.9 The 1200-psig pressure was maintained for 5 minutes. The specimen was examined for structural damage and leakage.

10.2.10 Pumping was resumed by closing switch 17 which opened solenoid valve 18.

10.2.11 Pumping was continued until the specimen ruptured.

10.2.12 The rupture pressure was recorded as indicated on gage 3.

10.3 TEST RESULTS

10.3.1 The specimen successfully withstood the 1200 psig minimum burst pressure. It did not leak or show any evidence of structural damage.

10.3.2 The pressure on the inlet and outlet ports was slowly increased until the specimen ruptured at 23,500 psig.

10.4 TEST DATA

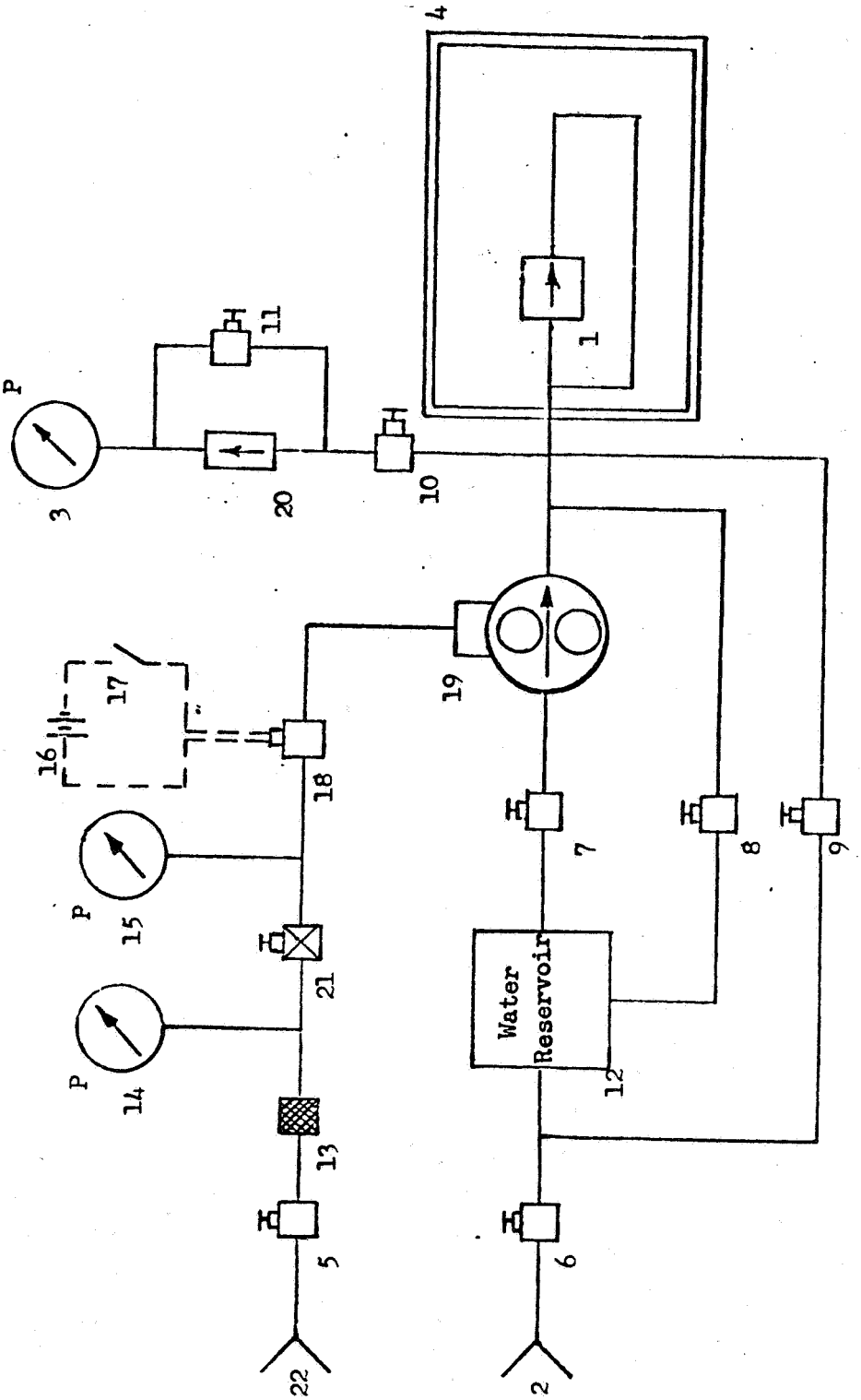
Figure 10-3 shows failure of ruptured seal, failing at 23,500 psig.

Table 10-1. Burst Test Equipment List

Item No.	Item	Manufacturer	Model/ Part No.	Serial No.	Remarks
1	Test Specimen	James, Pond, and Clark, Inc.	220T6-8TT-3	609291	1/2-inch check valve
1A	Specimen Actuator	NA	6325	NA	Cylinder
2	Water Supply	CCSD	NA	NA	Tap water
3	Hydrostatic Pressure Gage	Astra	NA	011893-A	0-to 100,000-psig ±0.5% FS Cal date 11-2-66
4	Burst Chamber	CCSD	NA	201344	3 ft x 3 ft x 3 ft
5	Hand Valve	Aminco	50011A	NA	1/4-inch
6	Hand Valve	Aminco	50011A	NA	1/4-inch
7	Hand Valve	Aminco	50011A	NA	1/4-inch
8	Hand Valve	Aminco	50011A	NA	1/4-inch
9	Hand Valve	Aminco	50011A	NA	1/4-inch
10	Hand Valve	Aminco	50011A	NA	1/4-inch
11	Hand Valve	Aminco	50011A	NA	1/4-inch
12	Water Reservoir	CCSD	NA	NA	2-gallon
13	Pneumatic Filter	Bendix Corp.	1731260	NA	2-micron
14	Pneumatic Gage	Ashcroft	10575	NA	0-to 5000-psig ±2.0% FS N.C.
15	Pneumatic Gage	U. S. G.	8990	NA	0-to 300-psig ±2.0% FS N.C.
16	Power Supply	Perkin	MRST-28-300A-009941	NA	28-vdc
17	Switch	Cutler-Hammer	NA	NA	SPST

Table 10-1. **Burst** Test Equipnent List (Continued)

Item No.	Itan	Manufacturer	Model/ Part No.	Serial No.	Remarks
18	Solenoid Valve, 2-Way	Marotta Valve **Corp.**	207803	**NA**	Normally closed
19	Hydrostatic Pump	Sprague Engineer-ing Corp.	NA	300-16-64	Air operated, maximum pressure 50,000 psig
20	Check Valve	Aminco	44-6305	NA	1/4-inch
21	Regulator	Marotta Valve Corp.	NA	NA	3000-psig inlet 0-to 200-psig outlet
22	Pneumatic Pressure Source	Air Products	NA	NA	3000-psig



Note: All lines ¼ inch.

Refer to table 10-1 for item identification.

Figure 10-1. Burst Test Schematic

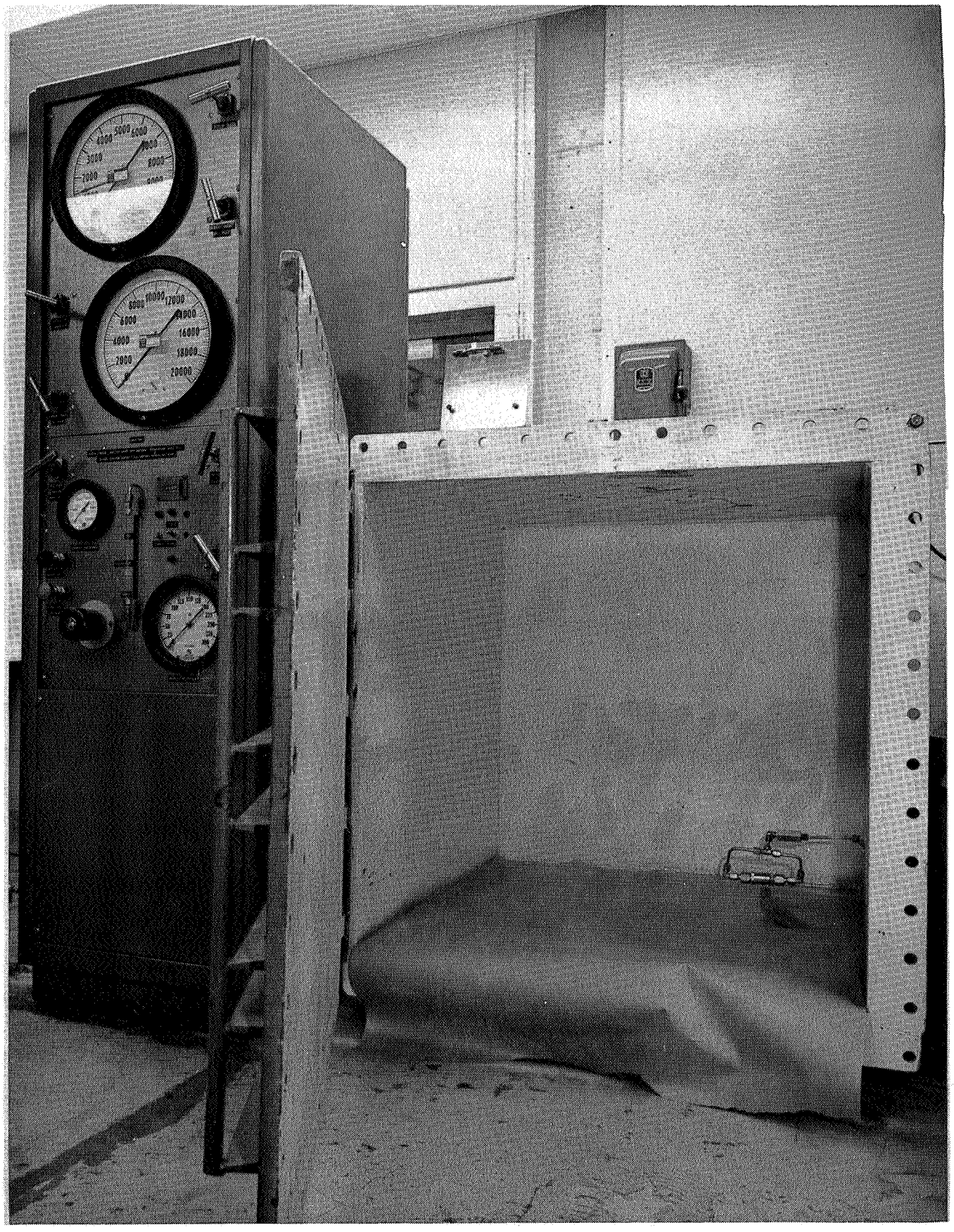


Figure 10-2. Burst Test Setup

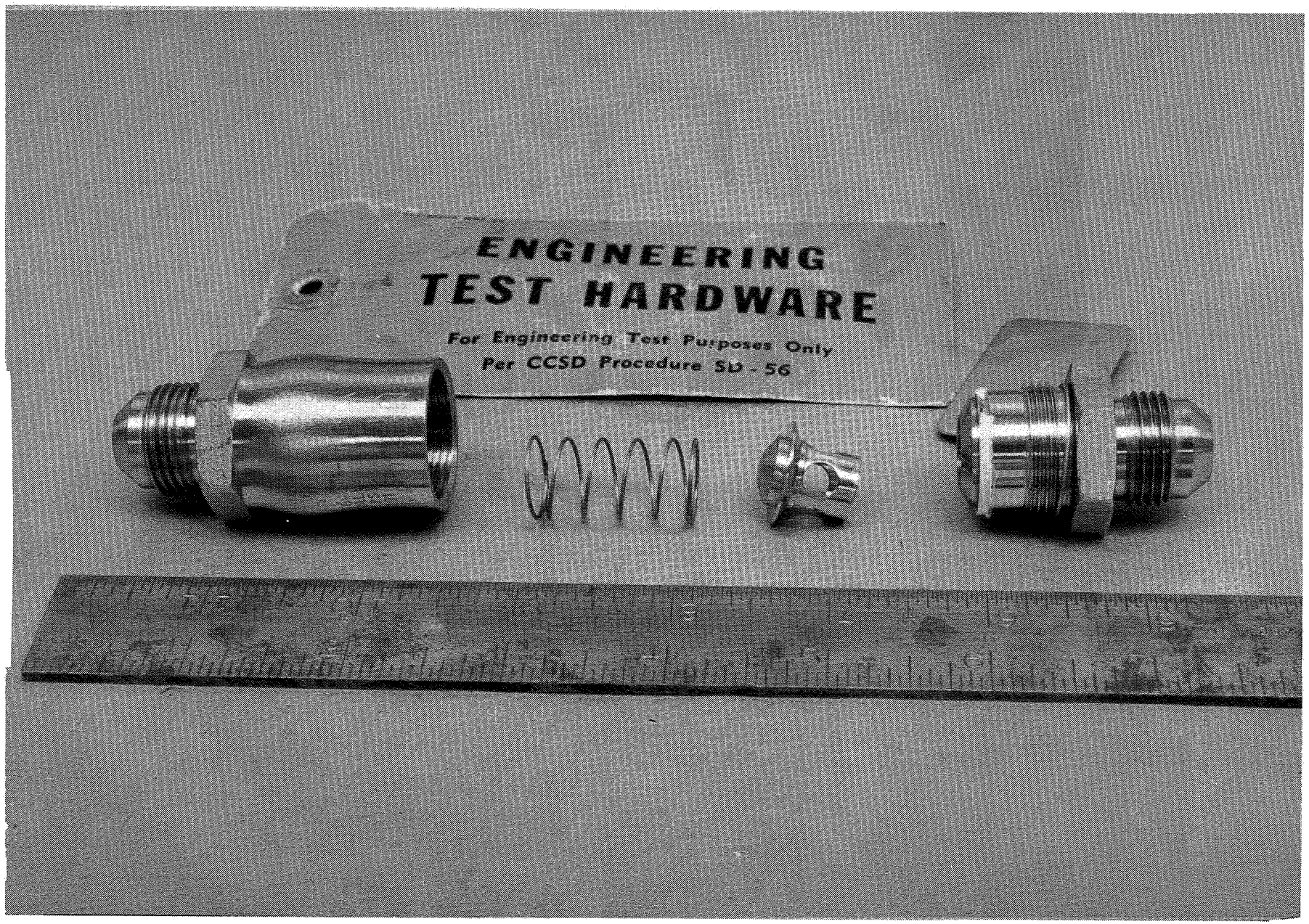


Figure 10-3. Seal Failure During Burst Test

APPROVAL

TEST REPORT

FOR

CHECK VALVE

1/2-INCH, SPRING-POPPET

James, Pond, and Clark Part Number 220T6-8TT-3

NASA Part Number 75M12944 FCV-9

SUBMITTED BY:

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