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LOCKHEED MODIFIED AN FITTINGS

FOR

3,000 PSIG HYDRAULIC SERVICE

26 AUGUST 1964

NASA-K-DE3

TASK ORDER H-110

CONTRACT NO. NAS8-2483

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HAYES PROJECT NO. 530P4

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CONTRACT NO. NAS8-2483

HAYES PERSONNEL

PREPARED BY: T. F. Gilmore DATE 26 August '64
T. F. Gilmore

CHECKED BY: W. G. Smith DATE 28 August '64
W. G. Smith

APPROVED BY: E. P. Thompson DATE 11 Sept '64
E. P. Thompson

APPROVED BY: A. E. Hand DATE 11 Sept '64
A. E. Hand

NASA PERSONNEL

CHECKED BY: H. B. Ford DATE 10-14-64

APPROVED BY: J. A. Kunkle DATE 10-17-64

APPROVED BY: R. H. Wickall DATE 10-19-64

PREFACE

This report is a presentation of results from; (1) a Preliminary Leakage Test, (2) a Temperature Susceptibility Leakage Test, (3) and a Deflection-Leakage Test. The tests were performed on Lockheed Modified AN Fittings.

This report is presented in two sections, an "A" section which contains the test results and a "B" section which contains the Test Procedure.

All tests were conducted in the high pressure test facility at Hayes International Corporation, Birmingham, Alabama, under Contract No. NAS8-2483, Task Order H-110 for NASA-K-DE3.

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PURPOSE

The purpose of these tests was to determine the hydraulic leakage characteristics of the Lockheed Modified AN Fittings.

SUMMARY

The 1 1/4 inch, 3/4 x 1/2 inch Lockheed Modified Fittings were subjected to (1) a Preliminary Leakage Test, (2) Temperature Susceptibility Leakage Test, and a Deflection - Leakage Test. The fittings were tested for service using MIL-H-5606 Hydraulic Fluid as the service media. Following are tabulated results from the aforementioned tests.

PRELIMINARY-LEAKAGE TEST

FITTING SIZE	TORQUE (IN-LB)	PRESS. (PSIG)	RESULTS
1 1/4 inch	1500	3,000	No leakage
3/4 x 1/2 inch	900 x 400	3,000	No leakage
1/2 inch	400	3,000	No leakage

TEMPERATURE SUSCEPTIBILITY TEST

FITTING	TORQUE	PRESS.	SPECIMEN	RESULTS
1 1/4 inch	1500	3,000	-65°F	No leakage
			+165°F	No leakage
3/4 x 1/2 inch	900 x 400	3,000	-65°F	No leakage
			+165°F	No leakage
1/2 inch	400	3,000	-65°F	No leakage
			+165°F	No leakage

DEFLECTION-LEAKAGE

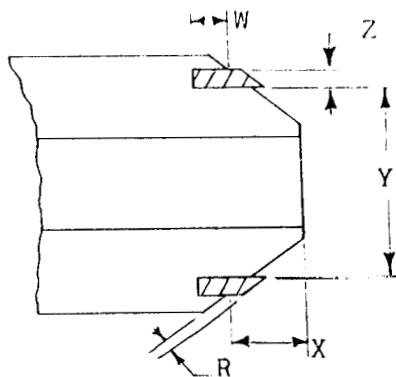
The 1 1/4 inch, 3/4 x 1/2 inch and 1/2 inch tube assemblies were pressurized to 3,000 PSIG. Load was applied at the end of the tubing until a permanent tubing deformation resulted. No leakage occurred over a five minute monitoring period.

TEST SUMMARY SHEET
LOCKHEED MODIFIED AN FITTINGS
TEST REPORT NO. 10908

TEST	UNIT OR UNITS	OPERATIONAL BOUNDARY	TEST OBJECTIVE	TEST RESULTS	REMARKS
PRELIMINARY LEAKAGE	1 1/4", 3/4 x 1/2", 1/2"	Torque fittings to minimum tightness and pressurize to 3000 PSIG. Leak check and increase torque until leak tight.	To determine if the specimens leak at their allowable torque range while under operating pressure.	satisfactory	Specimens leak tight at minimum torque values. 1500 in-lb for 1 1/4" fittings, 900 in-lb for 3/4" fittings and 400 in-lb for 1/2" fittings.
TEMPERATURE SUSCEPTIBILITY LEAKAGE	1 1/4", 3/4 x 1/2", 1/2"	Torque fittings to leak tight torque. Pressurize to 3,000 PSIG. Subject to temperature of +165°F and -65°F. Leak check and increase torque until leak tight.	To determine the effects of temperature extremes on the sealing characteristics of the test specimens.	satisfactory	Specimens leak tight for three runs at torque values given in Preliminary Leakage Test.
DEFLECTION LEAKAGE	1 1/4", 3/4 x 1/2", 1/2"	Torque fitting to leak tight torque values found in the Temperature Susceptibility Test. Pressurize to 3,000 PSIG. Subject to bending stresses and leak check.	To determine the effect of bending stresses on the sealing characteristics of the test specimens.	satisfactory	Fittings were leak tight when tubes buckled. Torque values were same as given in Preliminary Leakage Test.

SPECIMEN DESCRIPTION

The test specimens consisted of one (1) $1\frac{1}{4}$ inch, two (2) $3/4$ inch x $1/2$ inch, and one (1) $1/2$ inch Lockheed Modified AN Unions. The modification consisted of a machined annular groove around the nose of the fitting, at the point of contact with the tube flare. A Teflon seal was placed in the annular groove. Below is a sketch and dimensions illustrating the Lockheed Modification.



Fitting Size	Tube Size	X $\pm .0025$	Y $\pm .002$	Z $\begin{matrix} +.000 \\ -.001 \end{matrix}$	R	W $\pm .002$
-8	$1/2$ "	.056	.450	.032	.005	.040
-12	$3/4$ "	.060	.685	.032	.005	.040
-20	$1-1/4$ "	.100	1.200	.040	.005	.040

CONCLUSIONS

The results of the hydraulic leakage tests performed on the Lockheed Modified AN Fittings lead to the following conclusions.

- (1) With a Teflon ring inserted between the tube flare and fitting, the tube would not turn on the fitting when torqueing the "B" nut.
- (2) The 1 1/4 inch, 3/4 x 1/2 inch and 1/2 inch unions were leak tight when torqued to 1500 IN-LB, 900 x 400 IN-LB and 400 IN-LB respectively, and pressurized to 3,000 PSIG.
- (3) At stabilized temperature extremes, sealing characteristics are not affected.
- (4) Deflection has no effect on the sealing characteristics of the test specimens.

DISCUSSION OF RESULTS

The 1 1/4 inch, 3/4 x 1/2 inch, and 1/2 inch Lockheed Modified AN Fittings and tubes were assembled using torque values of 1500 in-lb, 900 in-lb x 400 in-lb, and 400 in-lb, respectively. In each case, the tube did not turn on the fitting. This was caused by the co-efficient of friction between the Teflon seal and the tube flare. The tubes had to be fixed rigidly before the required torque values could be reached.

PRELIMINARY LEAKAGE TEST

The 1 1/4 inch, 3/4 x 1/2 inch and 1/2 inch tube assemblies were hydraulically pressurized to 3,000 PSIG and leak checked both visually and by observing a pressure gage. No leaks were detected.

TEMPERATURE SUSCEPTIBILITY TEST

The tube assemblies were placed in the thermal chamber and were pressurized to 3,000 PSIG. The specimen temperature was lowered to -65°F using GN₂. After the specimen temperature stabilized at -65°F, a visual inspection was performed. No leakage was evident. The specimens were then subjected to a temperature of +165°F. Care was taken not to approach the flash point of the hydraulic fluid. After the specimen temperature stabilized at +165°F, a visual inspection was performed. No leakage was evident.

DEFLECTION-LEAKAGE TEST

The Deflection-Leakage Test was set up in accordance with Figure No. 3, Page No. B13. The tube assemblies were torqued to values given in the Preliminary Leakage Test and were pressurized to 3,000 PSIG.

The tube assembly was deflected by applying a load with lead weights. The loading was continued until a permanent deformation occurred. After five minutes, no leakage was evident.

TEST PROCEDURE, LOCKHEED MODIFIED AN FITTINGS

ITEM II.10

3,000 PSIG HYDRAULIC SERVICE

HAYES PERSONNEL

PREPARED BY T. F. Gilmore DATE 18 May '64
T. F. Gilmore

CHECKED BY W. G. Smith DATE 20 May '64
W. G. Smith

APPROVED BY E. P. Thompson DATE 2 June '64
E. P. Thompson

APPROVED BY A. E. Hand DATE 2 June '64
A. E. Hand

NASA PERSONNEL

CHECKED BY H. B. Ford DATE 10-19-64

APPROVED BY J. S. Kunkle DATE 10-17-64

APPROVED BY R. H. Mackall DATE 10-19-64

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PURPOSE: The purpose of these tests is to determine if the test specimen will leak while under simulated operating conditions.

I. GENERAL INSTRUCTIONS

1.1 SAFETY

1.1.1 The technician performing the test shall inspect all test setups, and shall be responsible for safety of personnel and equipment while tests are being conducted.

1.2 EQUIPMENT

1.2.1 A list of all equipment used during the test, including date of last calibration and accuracy of each, shall be attached to this Test Procedure.

1.2.2 Precaution shall be exercised to keep the test system clean at all times. Protect disconnected lines, open ports, etc., from contamination by covering with aluminum foil. Prior to installing the test specimen in the test fixture, purge all parts of the system that have been disconnected.

1.3 OPERATIONS

1.3.1 Each operation in this Test Procedure shall be completed and signed by the technician performing the operation.

1.3.2 Pressure readings shall be made with calibrated gages. Gage accuracy to be 1/4 of 1% of full scale.

1.3.3 External leakage shall be determined with a leak detector solution unless otherwise specified.

1.3.4 Temperature measurements shall be made with thermocouples.

1.4 RECORDS

1.4.1 Complete records of all test operations shall be maintained.

1.4.2 All pertinent information obtained during testing shall be

entered on the Data Sheets provided in this Test Procedure, or written on a separate sheet and attached to this Test Procedure.

1.5 FAILURES

1.5.1 Failures shall be reported to the Test Engineer immediately.

1.6 RETESTING

1.6.1 Retesting shall be done at the discretion of the Test Engineer to prove the reliability of data obtained.

1.6.2 Reliability of data shall be the responsibility of the contractor.

1.6.3 Retesting at the request of the customer can be negotiated.

1.7 DEVIATIONS

1.7.1 Deviations from the requirements shall be accomplished only after approval from the NASA Monitoring Agency.

1.8 REPORTS

1.8.1 An Engineering Test Report shall be prepared and submitted to the customer upon completion of testing.

1.9 DISPOSITION

1.9.1 The specimen, with all spare parts, shall be reassembled and packaged for shipment to NASA. Shipping instructions will be furnished by the NASA Monitoring Agency.

II. TEST PROCEDURE

2.1 PRELIMINARY LEAKAGE TEST

The purpose of the Preliminary Leakage Test is to determine if the test specimens leak at their minimum and/or maximum torque while under operating pressure.

2.1.1 Assemble the test specimens according to Figure No. 1, Page No. B10 and according to the following instructions.

2.1.1.1 Cut two sections of tubing 1 1/4" x .049" wall, two sections of tubing 3/4" x .095" wall, and three sections of tubing 1/2" x .065" wall, each 10 inches long.

2.1.1.2 Clean all of the Modified AN Fittings and tubes with trichloroethylene and water.

2.1.1.3 Place the appropriate sized sleeve and "B" nut on each end of each tube.

2.1.1.4 Flare each end tube per Design Standard MC146.

2.1.1.5 Connect each section of tubing per Figure No. 1, Page No. B10.

2.1.1.6 Torque the 1 1/4 inch fittings to 1500 in-lb, the 3/4 inch fittings to 900 in-lb, and the 1/2 inch fittings to 400 in-lb, per MSFC-SPEC-10509303.

2.1.1.7 Complete the test setup by connecting the 1 1/4 inch tube assembly to the hydraulic pressure system, per Figure No. 1, Page No. B10.

2.1.2 Using Pump No. 1, pressurize the test specimen to 3,000 PSIG as indicated on gage No. 2.

2.1.3 Check each fitting for leakage visually and by monitoring gage No. 2 for 5 minutes. Record findings on Data Sheet No. 1, Page No. B15.

2.1.4 If any leakage can be detected, depressurize the system by loosening plug at the end of tubing.

- 2.1.5 Increase the torque on the leaking fittings in increments of 50 in-lb, until leaking stops. Repeat operations 2.1.2 through 2.1.4 for each increment of torque. Record the torque value at which the fittings are leak tight, on Data Sheet No. 1, Page No. B15.
- 2.1.6 Depressurize the system by loosening plug at the end of tubing.
- 2.1.7 Repeat 2.1.1.7 thru 2.1.6 for the 3/4 x 1/2 inch fitting and 1/2 inch tube fitting.

2.2 TEMPERATURE SUSCEPTIBILITY-LEAKAGE TEST

The purpose of the Temperature Susceptibility-Leakage Test is to determine the effects of environmental temperature extremes on the sealing characteristics of the test specimens.

2.2.1 Arrange the test setup according to Figure No. 2, Page No. B12.

Ascertain that all valves are closed. Torque the fittings to the leak tight torque values obtained in Section 2.1 of this Test Procedure.

2.2.2 Pressurize the system to 3,000 PSIG, as indicated by gage No. 2, by increasing air pressure at the hydraulic pressure panel No. 1.

2.2.3 Slowly open valve No. 5 until a steady flow of GN_2 enters the thermal chamber. Allow the test specimens' body temperature to stabilize at -65°F .

2.2.4 Visually check for external leakage of hydraulic fluid. Record findings on Data Sheet No. 2, Page B16.

2.2.5 Close valve No. 5. Energize heater No. 4 by closing switch No. 10.

2.2.6 Allow the test specimens' body temperature to stabilize at $+165^\circ\text{F}$. Care should be taken so heater element does not physically contact test setup and that hydraulic pressure increase due to temperature change is readjusted by manipulation of hand valve No. 3.

2.2.7 Repeat 2.2.4

2.2.8 Open switch No. 10 and depressurize system by opening valve No. 3.

2.3 DEFLECTION-LEAKAGE TEST

The purpose of the Deflection-Leakage Test is to determine the leakage characteristics of the test specimens while under pressure and while being subjected to bending stresses.

- 2.3.1 Arrange the Deflection-Leakage Test setup according to Figure No. 3 Page No. B13. Torque all fittings to leak tight torque values found in 2.2 of this Test Procedure.
- 2.3.2 With test setup "A" energizing Switch No. 3 on pump No. 2 and pressurize the system to 3,000 PSIG as indicated by gage No. 1.
- 2.3.3 Begin adding weights until a permanent deformation exists in the tubing.
- 2.3.4 Monitor gage No. 1 for five minutes. Record findings on Data Sheet No. 3 Page B17.
- 2.3.5 Remove weights and depressurize the system by loosening cap at end of tube.
- 2.3.6 Repeat 2.3.2 thru 2.3.5 for setup "B".

APPENDIX NO. 1

FIGURE NO.	PAGE
1. PRELIMINARY LEAKAGE TEST SETUP	B10
2. TEMPERATURE SUSCEPTIBILITY-LEAKAGE TEST SETUP	B12
3. DEFLECTION-LEAKAGE TEST SETUP	B13

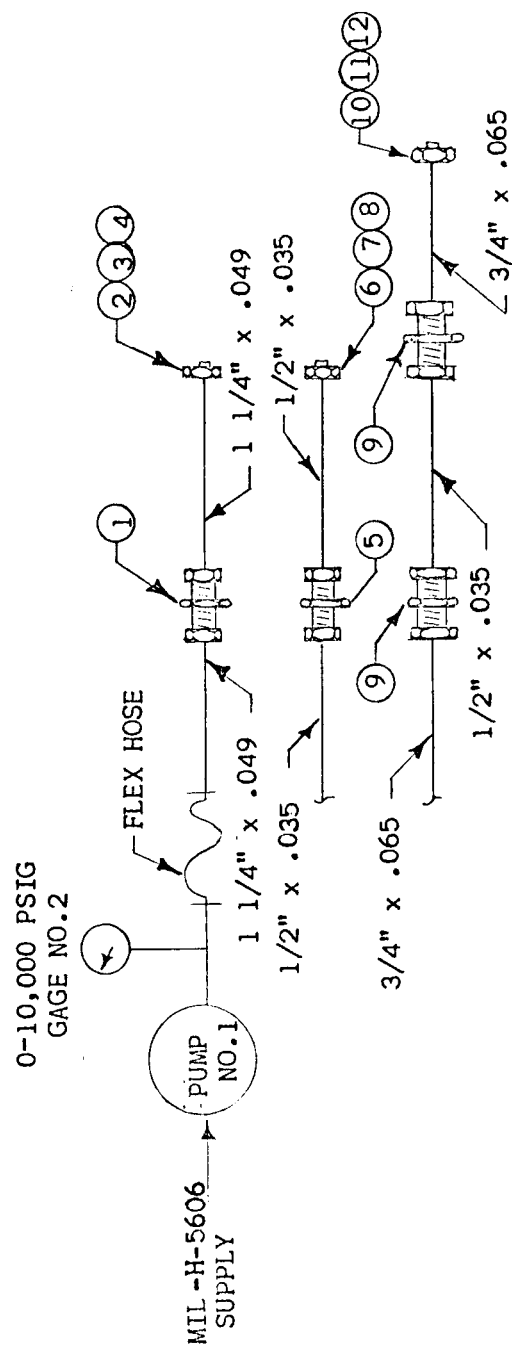


FIGURE NO. 1 PRELIMINARY LEAKAGE TEST SETUP

FIND NO.	QUAN.	DESCRIPTION	SIZE	VENDOR
1	1	UNION	1 $\frac{1}{4}$ "	LOCKHEED
2	1	B NUT	1 $\frac{1}{4}$ "	
3	1	SLEEVE	1 $\frac{1}{4}$ "	
4	1	PLUG	1 $\frac{1}{4}$ "	
5	1	UNION	$\frac{1}{2}$ "	LOCKHEED
6	1	B NUT	$\frac{1}{2}$ "	
7	1	SLEEVE	$\frac{1}{2}$ "	
8	1	PLUG	$\frac{1}{2}$ "	
9	2	UNION	3/4"x1/2"	LOCKHEED
10	1	B NUT	3/4"	
11	1	SLEEVE	3/4"	
12	1	PLUG	3/4"	

NOMENCLATURE SHEET - PRELIMINARY LEAKAGE TEST SETUP

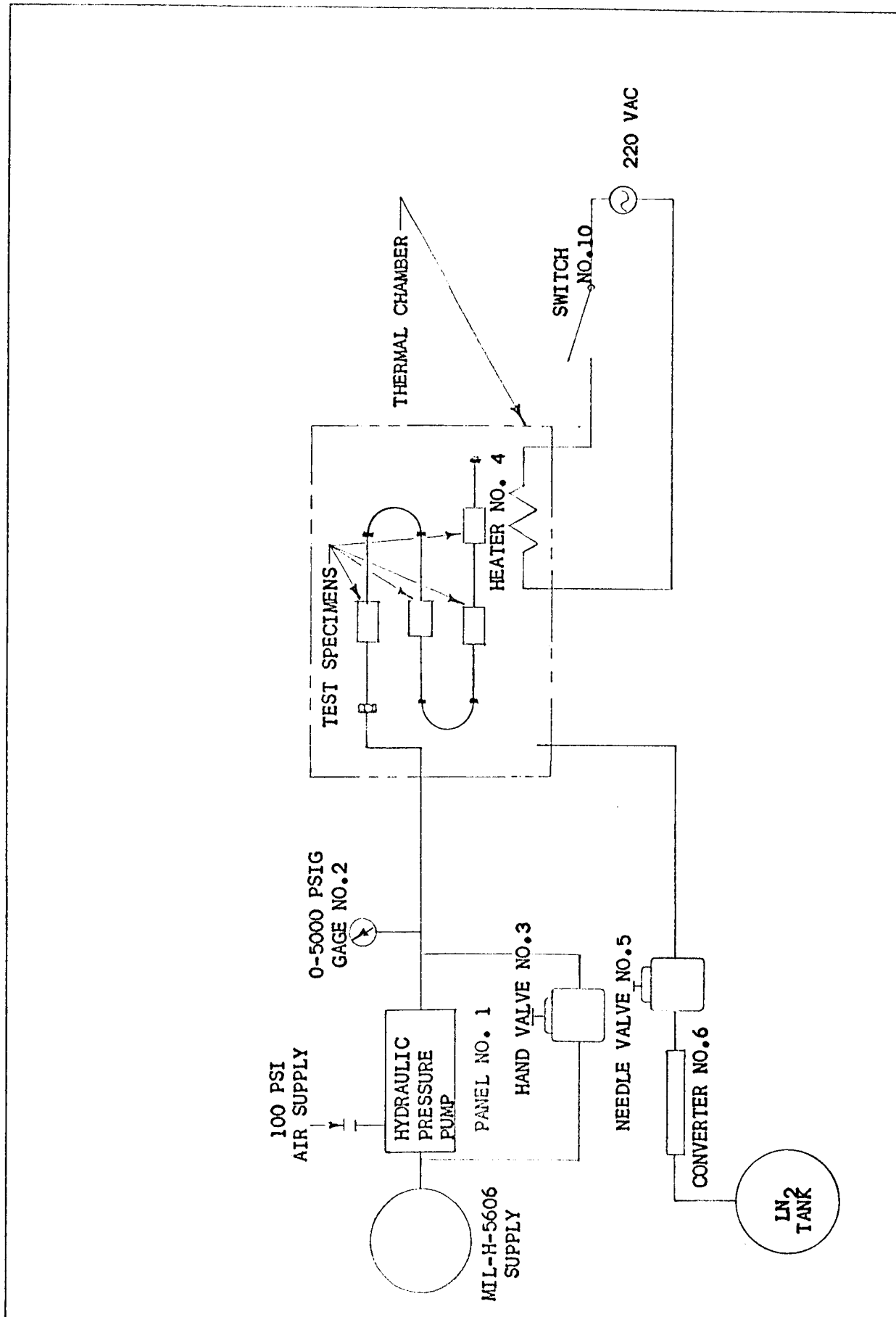


FIGURE NO. 2 TEMPERATURE SUSCEPTIBILITY - LEAKAGE TEST SETUP

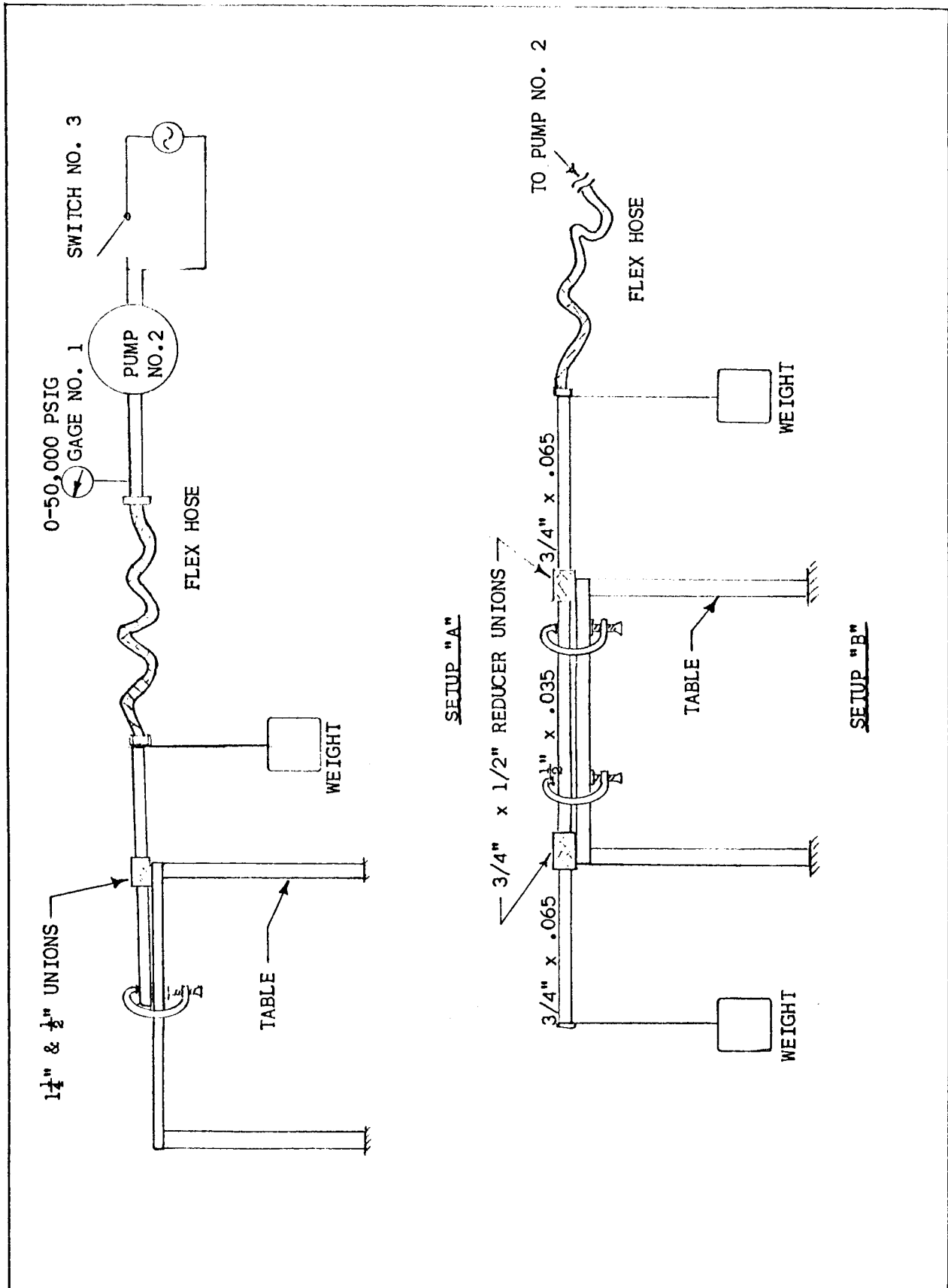


FIGURE NO. 3 DEFLECTION - LEAKAGE TEST SETUP

APPENDIX NO. 2

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3. DEFLECTION-LEAKAGE TEST	B17

TEST DATA SHEET NO. 1

MODIFIED AN FITTINGS

2.1 PRELIMINARY LEAKAGE TEST

1 1/4 INCH FITTING			
CONNECTION 1		CONNECTION 2	
TORQUE	LEAKAGE	TORQUE	LEAKAGE
1500 in. lb.	None	1500 in. lb.	None
*			
*			

REDUCER FITTING			
3/4" CONNECTION		1/2" CONNECTION	
TORQUE	LEAKAGE	TORQUE	LEAKAGE
900 in. lb.	None	400 in. lb.	None
*			
*			

1/2 INCH FITTING			
CONNECTION 1		CONNECTION 2	
TORQUE	LEAKAGE	TORQUE	LEAKAGE
400 in. lb.	None	400 in. lb.	None
*			
*			

REDUCER FITTING			
3/4" CONNECTION		1/2" CONNECTION	
TORQUE	LEAKAGE	TORQUE	LEAKAGE
900 in. lb.	None	400 in. lb.	None
*			
*			

* No retorquing necessary for leak tight connection.

DATE 27 May 1964

BY T. F. Gilmore
T. F. Gilmore

TEST DATA SHEET NO. 2

MODIFIED AN FITTINGS

2.2 TEMPERATURE SUSCEPTIBILITY - LEAKAGE TEST

1 1/4 INCH FITTING			
-65°F		+165°F	
TORQUE	LEAKAGE	TORQUE	LEAKAGE
1500 in.lb.	None	1500 in.lb.	None
*		*	
*		*	

REDUCER FITTING			
-65°F		+165°F	
TORQUE	LEAKAGE	TORQUE	LEAKAGE
900 x 400 in.lb.	None	900 x 400 in. lb.	None
*		*	
*		*	

1/2 INCH FITTING			
-65°F		+165°F	
TORQUE	LEAKAGE	TORQUE	LEAKAGE
400 in.lb.	None	400 in.lb.	None
*		*	
*		*	

REDUCER FITTING			
-65°F		+165°F	
TORQUE	LEAKAGE	TORQUE	LEAKAGE
900 x 400 in. lb.	None	900 x 400 in. lb.	None
*		*	
*		*	

* No retorquing necessary for leak tight connection.

DATE 28 May 1964

BY



I. F. Gilmore

TEST DATA SHEET NO. 3

2.3 DEFLECTION-LEAKAGE TEST

MODIFIED AN FITTINGS

1 1/4 INCH FITTING			
CONNECTION 1		CONNECTION 2	
TORQUE	LEAKAGE	TORQUE	LEAKAGE
1500 in.lb.	None	1500 in.lb.	None
REMARKS: Deflected until permanent deformation existed in tubing.			

REDUCER FITTING			
3/4" CONNECTION		1/2" CONNECTION	
TORQUE	LEAKAGE	TORQUE	LEAKAGE
900 in.lb.	None	400 in.lb.	None
REMARKS: Deflected until permanent deformation existed in tubing.			

1/2 INCH FITTING			
CONNECTION 1		CONNECTION 2	
TORQUE	LEAKAGE	TORQUE	LEAKAGE
400 in.lb.	None	400 in.lb.	None
REMARKS: Deflected until permanent deformation existed in tubing.			

REDUCER FITTING			
3/4" CONNECTION		1/2" CONNECTION	
TORQUE	LEAKAGE	TORQUE	LEAKAGE
900 in.lb.	None	400 in.lb.	None
REMARKS: Deflected until permanent deformation existed in tubing.			

DATE 28 May 1964

BY

T. F. Gilmore

T. F. Gilmore

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