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AEROSPACE RECOMMENDED PRACTICE

ARP 603E

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IMPULSE TESTING OF HYDRAULIC HOSE ASSEMBLIES, TUBING, AND FITTINGS

1. SCOPE

This Aerospace Recommended Practice (ARP) establishes the requirements and the procedures for impulse testing of hose assemblies, tubing, and fittings for use in aerospace hydraulic systems of 4000 psi nominal operating pressure or less. It also refers to standard impulse test equipment to be used in conducting these impulse tests.

2. APPLICABLE DOCUMENTS

AIR 1228 - Standard Impulse Machine Equipment and Operation
MIL-L-7808 - Lubrication Oil, Aircraft Turbine Engine, Synthetic Base

3. REQUIREMENTS

3.1 Shape of Trace: The traces shown are the approximate pressure-time cycles when observed on an oscilloscope and instrumented per AIR 1228. It is mandatory that the pressure-time curve be confined to the shaded area indicated. The dynamic impulse trace produced by the test machine shall be in conformance with Fig 1.

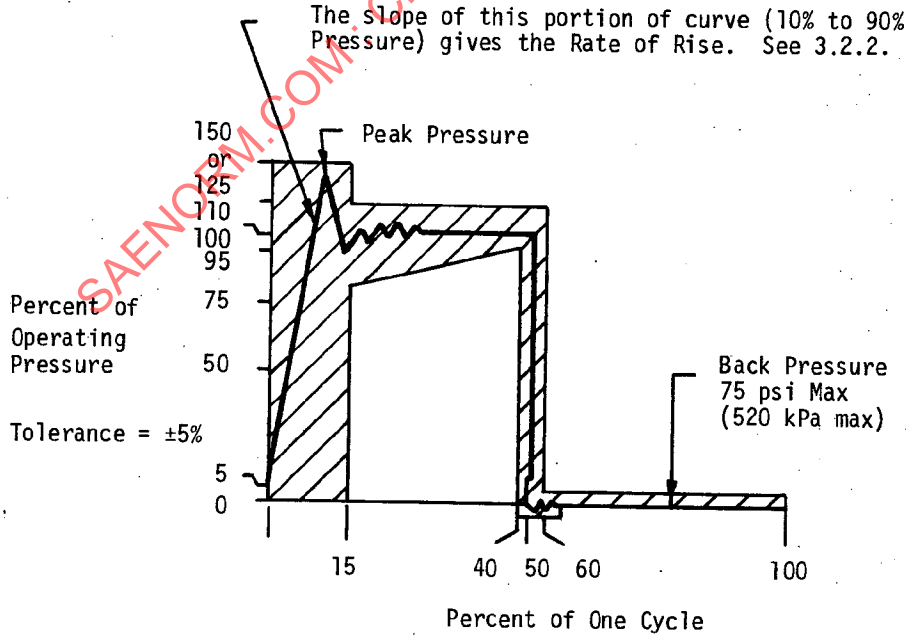

FIGURE 1

3.2 Rate of Rise:

3.2.1 Definition: The rate of rise is defined as the slope of the pressure-time curve in the straight portion of the pressure increase portion. For purposes of definition, the rate of rise shall be determined between 10% of the total rise above back pressure and 10% of the total rise below peak pressure.

3.2.2 Calculation: The rate of rise will be calculated as follows:

T = Time in secs.

$$\text{Rate of Rise} = \frac{0.9 \text{ Peak Pressure} - 0.1 \text{ Peak Pressure}}{\text{T at } 0.9 \text{ Peak Pressure} - \text{T at } 0.1 \text{ Peak Pressure}}$$

Sweep rate on the oscilloscope shall be adjusted so that the slope of the pressure rise shall take advantage of the full size of the screen. The trace and photos of the impulse cycle should be an accurate record of the impulse cycle and show a grid or other means to permit accurate checking.

3.3 Preparation of Specimens:

ø 3.3.1 Aging of Specimens: Aging of the test specimens shall be as defined in the detail specification.

3.3.2 Corrosion Pre-treatment: Corrosion pre-treatment is generally specified only on hose assemblies for qualification testing. For routine quality control testing, periodic testing, periodic control and sampling tests, corrosion pre-treatment is not required, unless so specified in the detail specification.

ø When corrosion pre-treatment is specified in the detail specification, the following corrosion pre-treatment shall be performed:

The test specimens shall be pressurized to the operating pressure. While maintaining this pressure at room temperature, the hose assemblies shall be immersed in a 3.5% NA Cl solution for 8-10 min., then allowed to air dry for the remainder of 1 hour. This immersion and air drying process shall be repeated 50 times.

3.4 Equipment: The testing shall be conducted on equipment in accordance with AIR 1228, or equivalent equipment.

3.5 Test Fluid: Unless the component materials or other considerations prevent it, MIL-L-7808 oil shall be used as the test fluid.

3.6 Test Duration and Temperature Cycling: Test shall be continuous with as few shutdowns for repair and/or replacement as necessary. Attempts should be made to schedule testing to minimize down-
ø time, such as over weekends, whether temperature is maintained or not, to provide more nearly uniform conditions of temperature cycling and aging.

A record of the total duration of the test (from mounting to completion) will be kept and this time reported in the test report.

4. TEST PROCEDURE

This method of testing is intended to determine the ability of flexible hose assemblies, tubing, and fittings to withstand hydraulic impulse for qualification testing under simulated conditions.

4.1 Hose Assemblies: For testing of hose assemblies, the cycle rate shall be 70 ± 5 cpm, and the rate of pressure rise shall be per Table I, unless otherwise specified. Test specimens shall be installed in an impulse machine to the minimum bend radius specified, unless otherwise detailed in the design specification.

TABLE I

Type	Size	Maximum No. of Samples (Hose)	Rate of Pressure Increase Minimum psi/sec	Minimum kPa/sec	Maximum psi/sec	Maximum kPa/sec
Extra High Pressure Hose Asemblies Tubing and Fittings 4000 psi (30,000 kPa) Operating and 150% peak	-4 thru -8	6	60,000	420,000	300,000	2,100,000
	-10 thru -12	4	60,000	420,000	300,000	2,100,000
	-16	2	60,000	420,000	300,000	2,100,000
High Pressure Hose Assemblies and Tubing and Fittings 3000 psi (20,000 kPa) Operating and 150% peak	-4 thru -8	6	45,000	315,000	300,000	2,100,000
	-10 thru -12	4	45,000	315,000	300,000	2,100,000
	-16	2	45,000	315,000	300,000	2,100,000
Medium Pressure Hose Assemblies 1500 psi (10,000 kPa) Operating & 125% peak	-4 thru -8	6	18,000	126,000	100,000	700,000
	-10 thru -16	6	18,000	126,000	75,000	520,000
	-20	4	18,000	126,000	50,000	340,000
	-24	2	18,000	126,000	40,000	280,000

4.2 Tubing and Fittings: For testing of tubing and fittings, including boss or port fittings, the cycle rate shall be 70 ± 5 cpm, the rate of pressure rise shall be per Table I. The assembly shall be tested in the sequence shown in the following table, unless otherwise specified:

Number of Cycles (Minimum)	Temp. (Ambient and Fluid)
100,000	Maximum Operating
48,000	Room
2,000	Minimum Operating
10,000	Maximum Operating

The total number of cycles shall be 200,000. The balance of the cycles not shown in Table (40,000) may be added to any sequence or divided among the sequences.

After each temperature is stabilized, a minimum soak of 1 hr is required before beginning that portion of test sequence. The temperature shall be measured within 0.500 in. (13 mm) of the test manifold and shall be maintained within the tolerance limitations defined during the testing.