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AEROSPACE RECOMMENDED PRACTICE

ARP 1383

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Revised

IMPULSE TESTING OF HYDRAULIC ACTUATORS, VALVES, PRESSURE CONTAINERS AND SIMILAR FLUID SYSTEM COMPONENTS

1. SCOPE

This Aerospace Recommended Practice (ARP) establishes the requirements and the procedures for impulse testing of actuators, valves and pressure containers for use in aerospace hydraulic systems. It also refers to standard impulse test equipment which may be used in conducting these impulse tests.

2. APPLICABLE DOCUMENTS

ARP 603D Impulse Testing of Hydraulic Hose Assemblies, Tubing, and Fittings

AIR 1228 Standard Impulse Machine Equipment and Operation

3. REQUIREMENTS

Pressure impulse requirements for hydraulic system components are occasionally specified as necessary to satisfy vehicle or system specifications. The following recommendations are applicable when such testing is necessary.

3.1 Shape of Trace: The limits shown in Fig. 1 define the pressure-time cycle for both pressure and return cavities when observed on an oscilloscope and instrumented per AIR 1228. It is mandatory that the actual pressure-time curve be confined to the area shown. The dynamic impulse trace produced by the test machine shall be in conformance with Fig. 1.

3.2 Rate of Rise: The rate of rise is defined as the slope of the pressure-time curve in the straight portion of the initial 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.

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.

The rate of pressure rise shall be less than 200,000 psi/sec (1,400,000 kPa/sec) unless otherwise specified in the detail specification.

3.3 Cycling Rate: The cycling rate shall be between 1 cycle/sec (large components) and 5 cycles/sec (small components), with the actual cyclic rate to be defined in the component detail specification.

3.4 Temperature: The fluid temperature during testing shall be maintained at the nominal component operating temperature ±10% and shall be specified in the detail specification.

3.5 Number of Cycles: Unless otherwise specified in the detail specification, the following number of pressure impulse cycles shall be applied separately to both the pressure and returns (when applicable) cavities of the component. Avoid backflowing electro-hydraulic servo valves if present in the assembly under test.

Flight control actuators/valves	200,000 cycles
Utility actuators/valves	100,000 cycles
Other pressure containers	40,000 cycles

3.6 Preparation of Specimens: The preparation of test specimens shall be defined in the component detail specification.

3.7 Test Equipment: Use a test circuit that will produce repeatable pressure pulses within the limits defined in 3.1.

3.8 Test Fluid: The fluid used for the test shall be the service fluid of the component undergoing test.

3.9 Performance After Test: The component shall conform to the performance requirements specified in the detail specification after completion of the impulse testing.

4. TEST PROCEDURE

This method of testing is intended to determine the ability of hydraulic actuators, valves and pressure containers to withstand hydraulic impulse for qualification testing under simulated conditions.

4.1 Accuracy: Set up and maintain equipment accuracy so that all data is accurate within 2% of actual.

4.2 Component Setup: Bleed entrapped air from test pressure containing envelope and circuit. Allow all drains and low pressure ports that are not part of the pressure containing envelopes to drain freely and keep them at atmospheric pressure. Metal shot or loosely fitting metal pieces may be placed in the unit under test if desired to minimize fluid volume.

4.3 Impulse Test: Conduct the impulse test as required under paragraph 3 and the detail specification. Half of the test cycles shall be applied with the component at one end of its range of motion (if applicable) and half at the other end.

4.4 Component Verification: After completion of the impulse testing, the unit shall be tested to the performance limits specified in 3.9. The unit shall then be disassembled and inspected for cracks or structural failure.

5. INTENDED USE

5.1 Design Standard: This recommended practice is intended for use as a design standard to promote standardization of impulse test requirements, procedures and equipment for the standard qualification and evaluation impulse testing of the hydraulic system hardware indicated. Impulse testing of hydraulic hose assemblies, tubing, coils and fittings should be tested per ARP 603D.

5.2 Reference: When this ARP is referenced in a design specification as part of the requirements, the following additional requirements must be specified.

1. Operating pressure
2. Operating temperature
3. Fluid

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