



AEROSPACE STANDARD

MA2003

Issued 1981-12
Reaffirmed 2015-08

Rotary Flexure Testing of Hydraulic Tubing Joints and Fittings

RATIONALE

MA2003 has been reaffirmed to comply with the SAE five-year review policy.

INTRODUCTION

This document was prepared following an ISO/TC20/SC10 agreement to describe a flexure fatigue test procedure which allows evaluation of various tube fitting designs or material combinations. This evaluation is performed by fatigue testing the tube joints over a spectrum of bending stresses and then plotting the cycles to failure. This test procedure is intended for comparative evaluation of fatigue characteristics only, the qualification test procedure for tube fittings being specified in MA 2005. Other test methods may be used as long as they develop the same data as the rotary flexure test.

1. SCOPE:

This standard establishes flexure test procedures to determine and classify the fatigue strengths of reconnectable or permanent hydraulic tube joints.

The procedure is intended for conducting flexure tests of fittings and joints with high strength hydraulic tubes of various alloys such as corrosion resistant steel, Nimonic, titanium and aluminum alloy hydraulic tube for use on commercial and military aircraft.

A mean stress is applied by holding system pressure in the specimens and then flexing in a rotary bending test machine. This test method conforms with ARP 1185 for inch-dimensioned tubing and fittings.

2. REFERENCES:

ISO 2964 Aircraft	Tubing Outside Diameters and Thicknesses, Metric Dimensions
MA 2005	Tube Fittings, Fluid Systems Separable, General Specification for
ARP 1185	Flexure Testing of Hydraulic Tubing Joints and Fittings

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3. REQUIREMENTS:

3.1 Flexure Test Device:

The test device should be capable of testing in-line or bulkhead union test specimens and other configurations such as elbows and tees.

The rotary flexure test device should be similar to that shown in Figure 1. Each rotary flexure test device should be capable of testing one specimen, but several specimens may be tested in parallel at one time.

The device should be capable of constantly maintaining the required operating pressure during the test. The test fluid shall be water or system fluid (working fluid) unless otherwise specified by the responsible authorities. A typical pressurization and automatic shutdown system is shown in Figure 2. The shutdown should be automatic in the event of failure or pressure drop. The device should be capable of testing at controlled constant temperature, if specified by the procuring agency. The tailstock of the test device should be designed to permit alignment during initial installation and specimen mounting, and to serve as a pressure manifold. The rotating headstock should have a low-friction, self-aligning bearing and should be designed to permit total deflections of up to 25 mm, and a constant rotational frequency within the range of 1500 to 3600 rpm. The base should be of rigid construction.

3.2 Flexure Test Specimen:

The test specimen should consist of an adapter fitting (headstock end), a section of straight tubing, and a test fitting at the tailstock end. Typical test specimens are shown in Figure 3. The tubing shall be of a size and wall thickness as specified by the user or procuring agency.

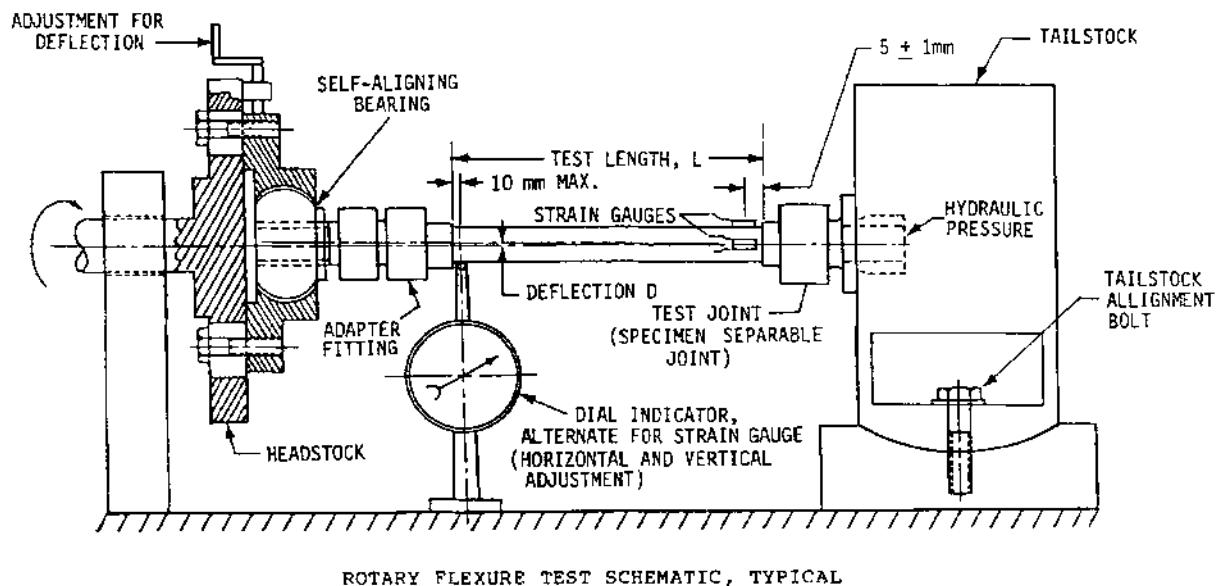


FIGURE 1

3.3 Specimen Length and Deflection Requirements:

3.3.1 Specimen Length: The length "L" of the specimens for rotary flexure testing shall be per Table I and measured as shown in Figure 1 or 3, depending on the fitting design.

TABLE I - Test Specimen Length

TUBE SIZE *)	DN05	DN06	DN08	DN10	DN12	DN14	DN16	DN20	DN25	DN32	DN40
LENGTH "L" (mm)	130	155	180	190	230	245	255	280	305	355	400

*) Selected from ISO 2964. The "DN" designates nominal tube diameters, for example, DN 05 designates a 5mm tube diameter.

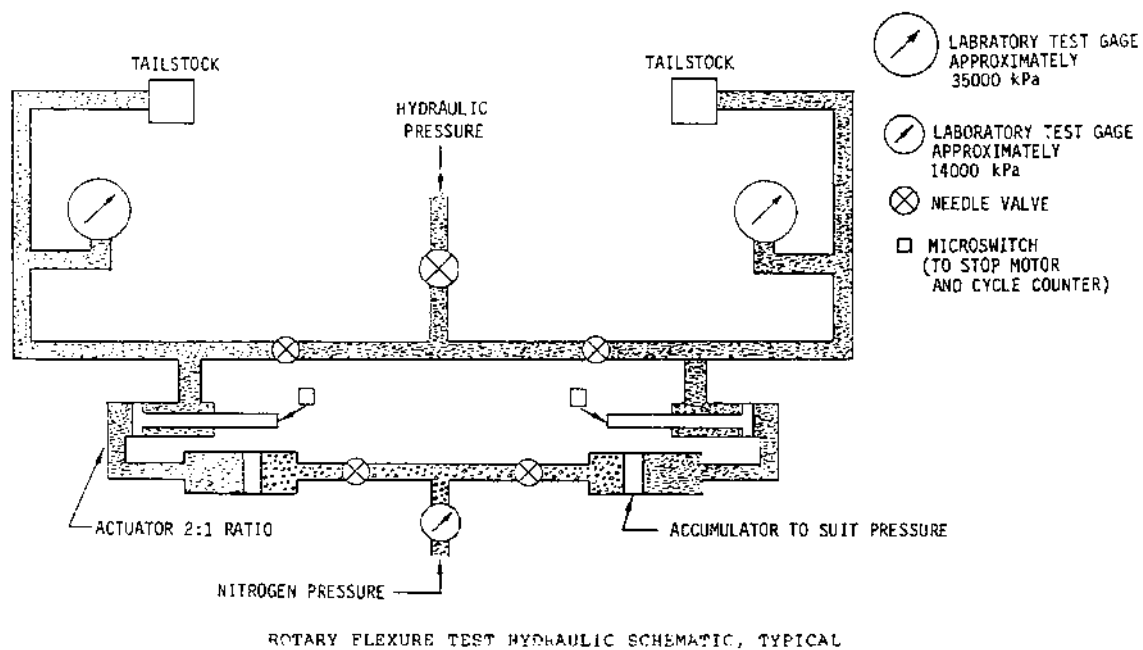


FIGURE 2

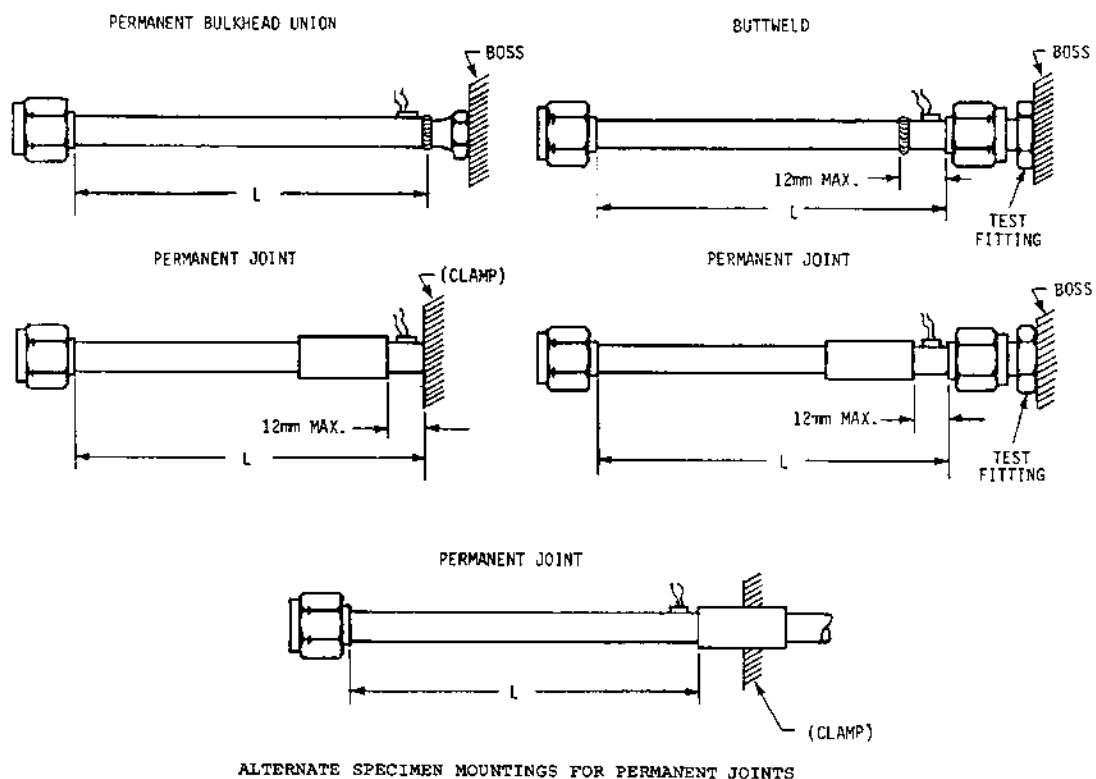


FIGURE 3