



AEROSPACE INFORMATION REPORT

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PRESTRESSING (AUTOFRETTAGING) OF HYDRAULIC TUBING LINES

1. SCOPE

This AIR is intended to describe and document a process presently in use for proof testing, which at the same time improves the fatigue life of 304 1/8 hard CRES and 3A1-2.5V CWSR titanium hydraulic tubing lines.

2. INTRODUCTION AND BACKGROUND

Prestressing (Autofrettaging) is a process whereby tubing lines are prestressed by the use of momentary internal pressure at or near the yield point of the tubing. Testing has shown that prestressing of tubing lines decreases ovality in the bend areas which may have resulted from the bending operation. Prestressing also has been shown to favorably alter the residual stresses on the inside surface of the tubing. The net result is that tubing fatigue life is improved. Prestressing of stainless steel tubing lines has been performed for years by some aerospace companies and presently is being used for cold worked titanium tubing as well. Since the introduction of cold worked titanium tubing, tests have verified the benefits of prestressing to be equal to or greater than for stainless steel tubing.

3. APPLICATION

Prestressing is performed on tubing lines on the bench prior to installation in the vehicle. All tubing lines that are to be used in hydraulic systems with operating pressures of 3,000 psi (20 MPa) are designed to withstand and be proof pressure tested at the prestress pressure shown in Table I. Some titanium tubing lines listed in Table I are used in return systems but are subjected to the same prestress pressure as the pressure lines.

4. PROCEDURE

Prestressing is performed by attaching the tube end to a pressure source. The opposite end is capped. No restraint fixtures are required. Pressure is applied at an approximate rate of 20,000 psi (138 MPa) per minute until the prestressing pressure is reached. This pressure is held for a minimum of 20 seconds, then released and the prestressing is complete. Tubing lines utilizing "AN" or Resistoflex Dynatube ® * connectors are subjected to prestressing with the connectors attached. The connectors are not replaced after prestressing. Tubing lines utilizing Deutsch "Permaswage" connectors are prestressed prior to "on-assembly" installation of connectors.

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