



AEROSPACE STANDARD	AS4467™	REV. A
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Standardization, Hydraulic Tube Walls		

RATIONALE

This Technical Report is being stabilized because it covers technology, products, or processes which are mature and not likely to change in the foreseeable future.

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Documents

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1. SCOPE:

This SAE Aerospace Standard (AS) defines a series of standardized tube walls to be used for high pressure hydraulic tubing. These tube walls are applicable to all homogenous tube materials (i.e., aluminum, steel, titanium) throughout a rated pressure range of 1000 to 8000 psi and a maximum rated operating temperature range of 160 to 450 °F. All future aerospace applications for which a required tube outside diameter/tube wall combination is not presently available shall be selected from the table contained herein (see Figure 1).

2. APPLICABLE DOCUMENTS:

The following publications form a part of this document to the extent specified herein. The latest issue of SAE publications shall apply. The applicable issue of other publications shall be the issue in effect on the date of the purchase order. In the event of conflict between the text of this document and references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

2.1 SAE Publications:

Available from SAE, 400 Commonwealth Drive, Warrendale, PA 15096-0001.

AMS 4945 Titanium Alloy Tubing, Seamless, Hydraulic, 3Al-2.5V, Texture Controlled,
105 000 psi (724 MPa) Yield Strength

3. BACKGROUND:

For many years the industry has been aware that the proliferation of hydraulic system tube wall thicknesses, used in aerospace, has been an item of major expense to all concerned (i.e., tube suppliers, fitting suppliers, aircraft builders, and aircraft users). Throughout this time most tube and fitting suppliers accepted as sacred, the tube material and wall thicknesses selected by the aircraft builder. The aircraft builder's selection was accepted without question, even though the fact of the given selection might force slightly varied "nonstandard" fitting designs and/or minor tooling revisions on top of an ever increasing proliferation of tube walls. All of this has almost inevitably led to additional qualification tests and considerable additional cost.

4. TUBE WALL STANDARDIZATION TABLE:

Figure 1 lists the standardized minimum tube walls which shall be used for hydraulic system tubing. The standardized tube walls shall apply to all hydraulic tubing whose material, conditions of use, or other requirements cannot be met by tubing currently available. Should the tubing planned for procurement fall outside the range of the tube sizes listed in the table, the D/t ratios shown at the bottom of the table shall be used to compute the minimum tube wall thicknesses for the nontabulated sizes. The formula for the computation shall be as shown in Equation 1:

$$\text{Nominal tube OD/D/t ratio} = \text{Computed minimum wall thickness} \quad (\text{Eq. 1})$$

4.1 Table Preparation Parameters:

The table is prepared to cover the range of temperatures, pressures, and materials listed in Section 1 in such a manner that the differential wall thickness between any adjacent wall thickness column is never greater than 1.5% of the listed tube OD. In this way, any theoretically ideal, wall thickness will not be far away from an available "standardized" wall thickness. The table was prepared using the following general parameters:

- a. A linearly decreasing safety factor with increasing pressure (see 4.1.1).
- b. Wall thickness determined using a slightly modified version of the burst pressure formula in AMS 4945 for those sizes whose walls are determined by burst pressure (see 4.1.2).
- c. A selected material (3Al-2.5V Ti), and a selected operating temperature (275 °F) (see 4.1.3).
- d. A selected series of rated operating pressures (1000, 1500, 2000, 2500, 3000, 4000, 5000, 6000, 7000, 8000, and 10,000 psi) which were later submerged and redesignated as "selection series" numbers 1, 1.5, 2, 2.5, 3, 4, 5, 6, 7, 8, and 10 respectively (see 4.1.4).