AEROSPACE RECOMMENDED PRACTICE

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Superseding ARP1676

Recommended Formulae for Determining Drop Dimensions for Simple-Bend Tube Fittings with Flared and Flareless End Connections Used in Aerospace Applications

RATIONALE

This document has been determined to contain basic and stable technology which is not dynamic in nature.

STABILIZED NOTICE

This document has been declared “Stabilized” by the SAE G-3, Aerospace Couplings, Fittings, Hose, Tubing Assemblies Committee and will no longer be subjected to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. Newer technology may exist.

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1. SCOPE:

These formulae shall be used to determine drop dimensions for simple bend tube fittings utilizing flare and flareless end connection designs from 0° to 90° used in aircraft and aerospace applications. Individual design standards shall specify parameters, such as centerline bend radius (R), straight tangent length to accommodate bending equipment (X_1 and X_2), and nut to be used.

1.1 Purpose:

The purpose of this ARP is to establish formulae for the determination of drop dimensions, such that this ARP becomes a standard for design of aircraft and aerospace bent tube elbow fittings.

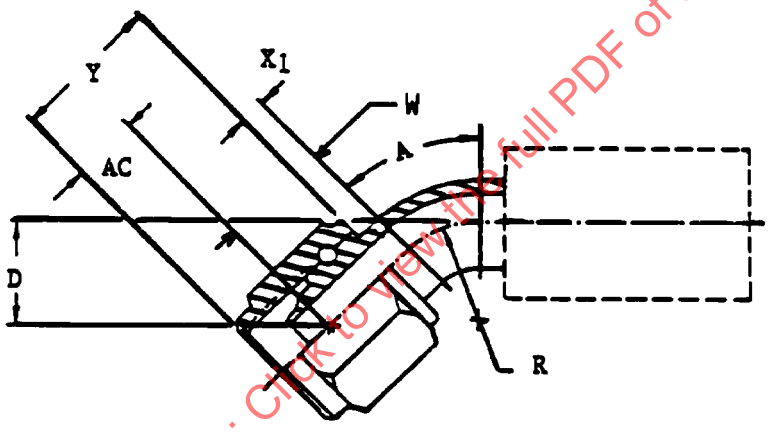

FIGURE 1. TYPICAL BENT TUBE ELBOW FITTING

2. DROP DIMENSION:

By definition, the drop dimension is the vertical distance measured from the centerline of the hose attachment portion of the fitting to the seal point of the fitting. The seal point for flared fittings is the end of the flare. The seal point for flareless fittings is the gauge diameter.

$$\text{DROP (D)} = W \sin A + R\,(1 - \cos A)$$

where,

W = Distance from fitting seal point to the start of the bend ($Y - AC + X_1$).
Y = Overall length of nut (MS27073, MS21921 or AN818, as applicable).
AC = Fitting seal point to the front face of nut.
X_1 = Straight tangent from nut to start of bend.

A = Bend angle from the horizontal (0° to 90°).
R = Centerline bend radius of tube.

2.1 The variable X_1, representing the straight (tangent) length of the tubing from the back of the nut to the start of the bend, is used to accommodate various bending techniques and fitting requirements (i.e., long drop, short drop). The value is primarily determined by the bending equipment available and whether the elbow is bent from the nut end or the hose nipple end. Welded, pre-bent elbows may not require a tangent length. Unless specifically noted in individual design standards, the value for X_1 shall be equal to:

X_1 = .125 inch + .10 (tube O.D.) inch
X_1 = 3.18 mm + .10 (tube O.D.) mm

2.2 The variable R, representing the centerline bend radius of the tube, is used to accommodate various materials, tube wall thickness and fitting requirements. Tube wall thickness “thin out” and ovality requirements of the tube are the primary considerations in the selection of a bending radius. Thin wall aluminum tubes can be bent to smaller bend radii than heavy wall stainless steel tubes used in high pressure hydraulic impulsing applications. Unless specifically noted in individual design standards, the value for centerline bend radius shall be:

SIZE	BEND RADIUS
R = 04 thru 32 (Inch)	1.0 x tube O.D.
06 thru 50 (Metric)	