1.0 GENERAL

1.1 The fits and tolerances specified herein serve as a general manufacturing and inspection standard and are applicable to all undimensioned drawings (manual or computer generated Lofts) and all dimensioned drawings where a specific tolerance is not called up on the drawing.

1.2 Where there is apparent conflict between the tolerances specified herein and those on the drawing, the order of precedence is as follows:

1. In the Field of Drawing for the subject part.
2. In applicable Production Process Standards (PPS).
3. In the Requirement Block of the subject drawing.
4. In DS 50.

1.3 Unless otherwise specified on the drawing, all dimensions and limits apply after plating and application of "baked on" dry film lubricants. Refer to Engineering Manual or PPS 23.02 for coating thickness.

1.4 Standard Requirement Block tolerances do not apply to X, Y, Z coordinates, and to points, lines, planes, holes, etc. which are designated as tooling datums. Intersecting coordinates and tooling datums are considered as basic.

1.5 For drilling and reaming tolerances, see PPS 1.09.

1.5.1. For Dash 7 and subsequent aircraft of DHI design, tolerances on reamed holes must be specified on the Engineering Drawing.

2.0 MACHINED PARTS

2.1 Flatness

2.1.1. Flatness is the condition of a surface having all elements in one plane.

2.1.2. The surface must be within the specified tolerance of size and must lie between two parallel planes, 0.030 inches apart. Ref. Figure 1.

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CHECKED	B. EDWARDS
STRESSED	E. CROMIE
APPROVED	B. EDWARDS

FITS AND TOLERANCES

DS 50

SHEET: **1**

E

2.1.3. Tolerance is cumulative at a rate of 0.001 in./in. to a maximum of 0.060 inches over the entire surface, with a maximum allowable collective deviation of 0.015 inches in any 10 inches

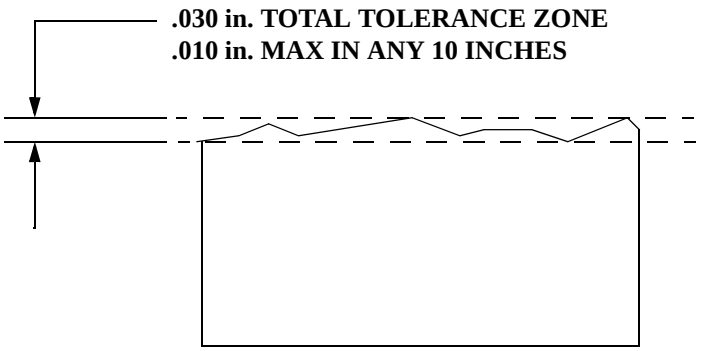

FIGURE 1: FLATNESS TOLERANCE

2.2 Straightness

2.2.1. Straightness is a condition where an element of a surface or an axis is a straight line.

2.2.2. The feature must be within the specified tolerance of size and any longitudinal element of its surface must lie between two parallel lines 0.030 inches apart. Ref. Figure 2

E

2.2.3. Tolerance is cumulative at a rate of 0.001 in./in. to a maximum of 0.060 inches over the entire surface, with a maximum allowable collective deviation of 0.015 inches in any 10 inches

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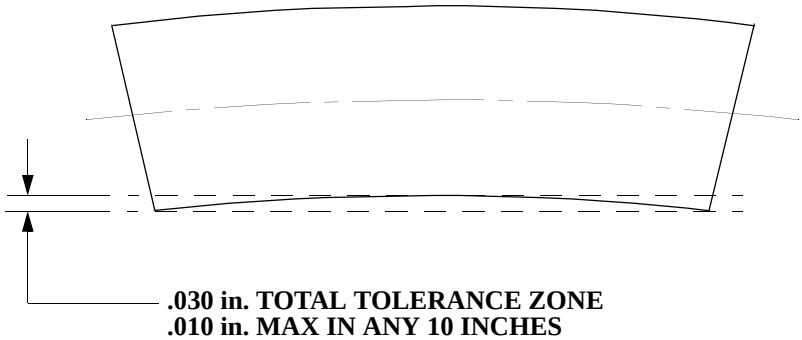

FIGURE 2: STRAIGHTNESS TOLERANCE

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REV:E - 10 JAN 2016
REV: D - 27 OCT 00
REV: C - 8 APR 96
REV: B - 24 JUL 91
REV: A - 28 APR 77
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E PARA 3.1.3; and 3.2.3
" ...0.060 INCHES" was " ...0.030 INCHES"
" ...0.015 INCHES" was " ...0.010 INCHES"

2.3 Parallelism

2.3.1. Parallelism is the condition of a surface or centre plane, being equidistant at all points from a datum plane; or an axis being equidistant along its length from one or more datum planes or a datum axis.

2.3.2. The feature must be within the specified tolerance of size and any element of its surface must lie between two parallel lines (0.030 inches apart) which are parallel to the datum plane axis. Ref. Figure 3.

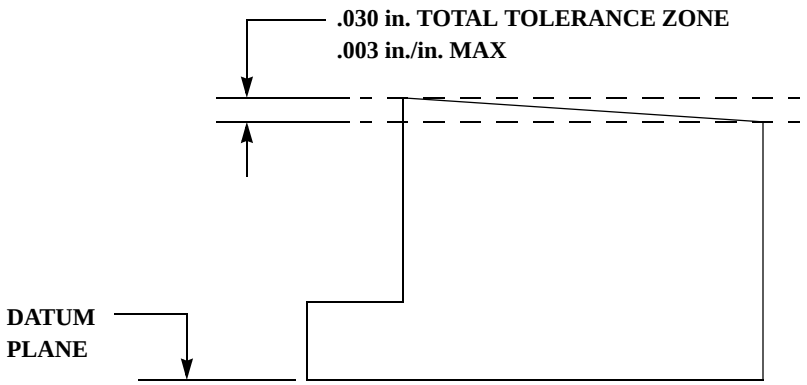

FIGURE 3: PARALLELISM TOLERANCE

2.4 Perpendicularity

2.4.1. Perpendicularity is the condition of a surface, centre plane or axis being at right angles to a datum plane or axis.

2.4.2. Surfaces or centrelines shown as perpendicular must be within +/- 0^{o} 30' of the datum plane or axis.

2.5 Circular Runout

2.5.1. Runout is a composite tolerance used to control the functional relationship of one or more features of a part to a common datum axis.

2.5.2. Machined diameters must be within the specified tolerance of size and any element of their surface must lie within two parallel lines (0.010 inches apart and parallel to the datum axis) while the part is rotated through 360^{o} on the datum axis, i.e maximum Full Indicator Movement (FIM) = 0.010 inches. Ref. Figure 4.

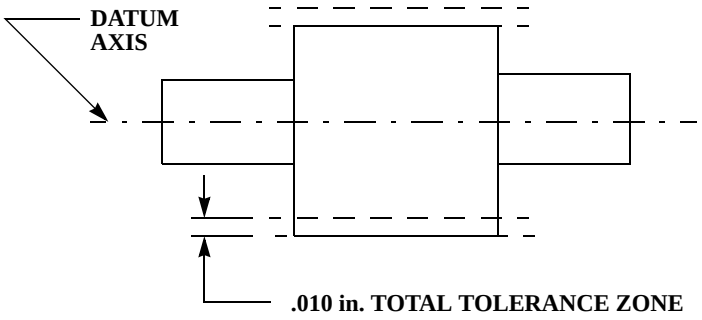

FIGURE 4: CIRCULAR RUNOUT

2.6 Mismatch

2.6.1. The maximum allowable cutter path mismatch between nominally blended, non-attaching surfaces, is 0.010 inches with a minimum corner fillet radius of 0.060 inches and all surfaces must be within the specified tolerance of size. Ref. Figure 5.

2.6.2. No mismatch is permissible on attaching surfaces.

2.6.3. Where holes are specified to be in line or coaxial (e.g. fork end fittings), the mating part, or a bar equivalent in diameter, must be capable of insertion into the two holes simultaneously without binding.

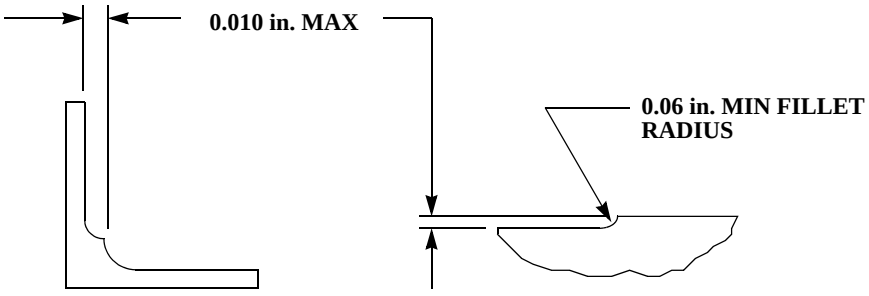

FIGURE 5: CUTTER MISMATCH TOLERANCE

(H) REDRAWN ON NEW DS TEMPLATE
NO TECHNICAL CHANGE

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2.7 Other Machined Part Tolerances

2.7.1. All other tolerances of form and position for machined parts must be specified on the Engineering Drawing.

3.0 UNDIMENSIONED LOFT DRAWINGS (Machined and Sheet Metal Parts)

3.1 General

3.1.1. The tolerances specified herein, when applied to a manually or digitally lofted part, indicate the permissible variation of any feature from the actual loft line.

3.1.2. For checking and photo reproduction purposes, most hand drawn lofts include a 5.000 inch square grid, accurate within 0.003 inch of true dimension, as well as trammel point targets indicating specific horizontal and vertical dimensions between targets, accurate within +/- 0.010 inches. Ref. Figure 6.

3.1.3. Where dimensional targets are provided on computer generated (digital) lofts, such targets are accurate within 0.005 inches of true dimension.

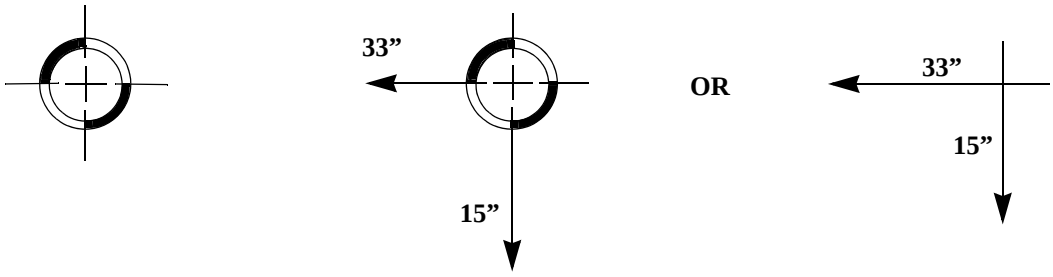

FIGURE 6: LOFTED TRAMMEL POINTS

3.2 Hole Locations

3.2.1. Except as noted in 3.2.2., hole locations must be within a 0.010” dia. of indicated position.

3.2.2. Rivet holes produced by means other than N/C, may vary within a 0.020” dia. of indicated position.

3.3 Edge Profile - Including Lightening Holes

3.3.1. Refer to Table 1 for the maximum allowable profile deviation from the actual loft line for sheet metal parts in the flat development. All profile edges must fair or blend smoothly

3.3.2. Profile tolerances for machined parts as per Table 1, are only applicable to parts which are fabricated to the "Loft Lines" using a router template to guide the router cutter. Refer to DS121 for tolerances applicable to N/C machined parts..

Table 1: PROFILE TOLERANCES - LOFTED PARTS

PART CLASSIFICATION	AIRCRAFT PROGRAM	MAXIMUM DEVIATION FROM LOFT
SHEET METAL	ALL EXCEPT DASH 8 - S400	+/- 0.030 in.
	DASH 8 - S400	+/- 0.010 in
MACHINED PART	ALL	+/- 0.015 in

3.4 Flange Angles

3.4.1. Refer to Table 2 for the maximum allowable deviation on formed flange angles. Refer to Figure 7 for general description of a typical formed flange.

Table 2: FLANGE ANGLE TOLERANCES

DESIGN APPLICATION	AIRCRAFT PROGRAM	FLANGE HEIGHT	FLANGE ANGLE	
			PLUS	MINUS
ATTACHMENT FLANGES	DHC-2 THRU DHC-6	ALL	2^o	2^o
	DHC-7 AND SUB		1^o	1^o
STIFFENING FLANGES (Non-Attaching) 80^o to 90^o FLANGE ANGLE	ALL	FLANGE HT. UP TO 0.35"	0^o	15^o
		FLANGE HT. GREATER THAN 0.35"	0^o	10^o
STIFFENING FLANGES (Non-Attaching) LESS THAN 80^o FLANGE ANGLE		ALL	0^o	10% OF FLANGE ANGLE
PULLEY BRACKETS			0^o - 30'	0^o - 30'
(H) ALL FLANGES ATTACHMENTS AND STIFFENING	LEARJET 40/45 LEARJET 70/75	ALL	2^o	2^o

(H) ADDED: ALL FANGES, ATTACHMENTS AND STIFFENING REQUIREMENTS FOR LEARJET

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3.5 Formed Stiffening Swages

3.5.1. Maximum allowable deviation from actual loft line is +/- 0.030 inches.

3.6 Internal Bend Radi

3.6.1. The maximum allowable deviation from the as lofted internal bend radius is:

- For material up to 0.040” ---------- + 0.020” / - 0.000”

- For material gauge thicker than 0.040” ---------- +1/2 Thickness / - 0.000”

3.7 Flange Width

3.7.1. Refer to Table 3 for maximum allowable deviation on formed flange width.

Table 3: FLANGE WIDTH TOLERANCE

PART CLASSIFICATION	AIRCRAFT PROGRAM	FLANGE WIDTH
SHEET METAL PARTS	ALL EXCEPT DASH 8 - S400	+/- .030 in.
	DASH 8 - S400	+/- .015 in.

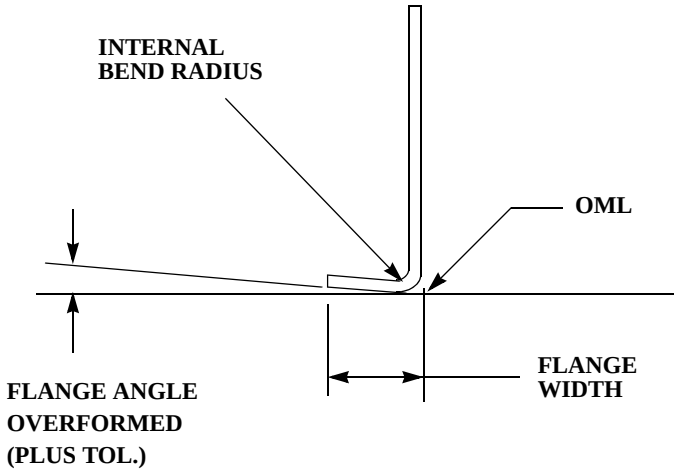

FIGURE 7: FORMED FLANGE (Typ)

A REDRAWN ON NEW DS TEMPLATE
NO TECHNICAL CHANGE

3.8 Joggle

3.8.1. Refer to Figure 8 for limits of tolerance applicable to joggled sheet metal sections;

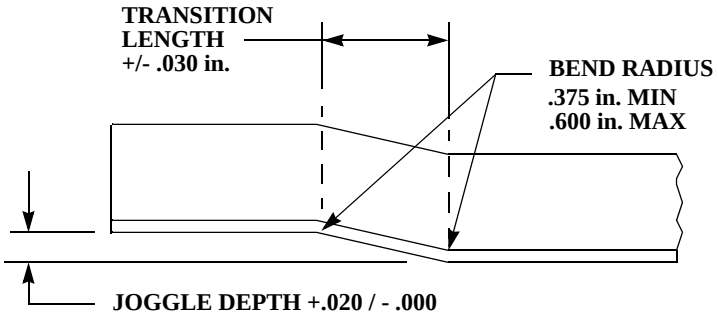

FIGURE 8: TOLERANCES ON JOGGLES

3.9 Contour

3.9.1. Except as noted in 2.9.2., the maximum allowable deviation in contour from the loft OML for all formed sheet metal parts shall be as shown in Table 4..

Table 4: CONTOUR TOLERANCE - SHEET METAL PARTS

PART CLASSIFICATION	AIRCRAFT PROGRAM	CONTOUR
FORMED SHEET METAL PARTS	ALL EXCEPT DASH 8 - S400	+/- .030 in.
	DASH 8 - S400	+/- .020 in.

3.9.2. Formed sheet metal ribs that are held by clips and do not contact the skin, may deviate from contour as shown in Figure 9.

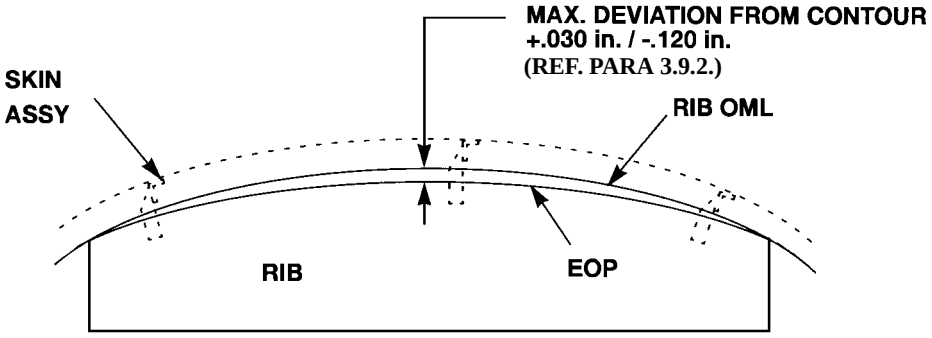

FIGURE 9: CONTOUR TOLERANCE - Sheet Metal Ribs

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Ⓐ REDRAWN ON NEW DS TEMPLATE
NO TECHNICAL CHANGE

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3.10 Lofted Machined Parts

3.10.1. Except as noted in para. 3.10.2. and 3.10.3, the maximum deviation of a lofted, machined part profile (i.e. the part is fabricated to the "Loft Lines" using a router template to guide the router cutter) from the actual loft line, shall be as shown in Table 1 and all lines must fair or blend smoothly.

3.10.2. The tolerance limits on internal and external lug radii on lofted machined parts are shown in Figure 10

3.10.3. Refer to DS121 for machining tolerances applicable to N/C manufacturing methods..

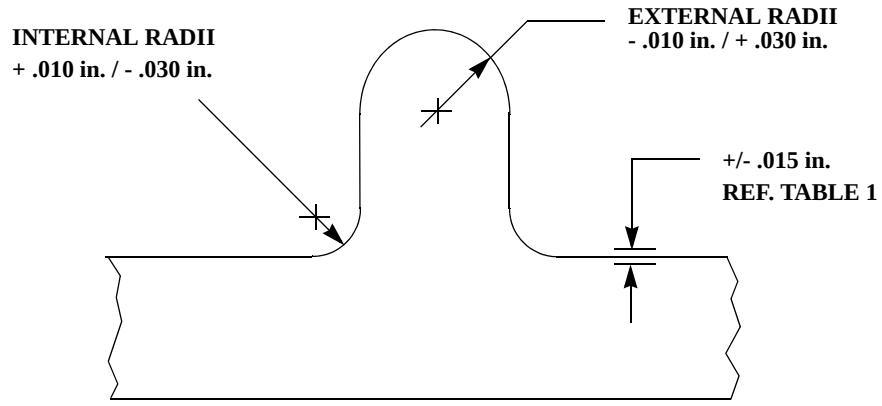

FIGURE 10: LUG RADII TOLERANCES (Lofted Machined Parts)

4.0 FITTING TOLERANCE (Machined and Sheet Metal Parts)

4.1 Machined or sheet metal parts which can be held to contour or pickup position with the application of light finger pressure (2 lbs.), are acceptable for use without rework.

4.2 Unless otherwise specified, the maximum allowable localized force which may be applied to facilitate fitment of sheet metal parts or machined components to one another at faying surfaces shall be:

a) 2 lbs./12 inches for material up to 0.045 inches

(C) b) Allow use of localized force 5 lbs. /12 inches for material thicker than 0.045 inches

c) Forces shall be applied at 12 inch intervals, or proportionately smaller intervals using lower forces (i.e 1/2 specified force at 6 inch intervals, 1/4 force at 3 inch intervals, etc.)

d) Any number of 2 or 5 lb. forces may be applied provided that the 12 inch interval or equivalent as outlined in 4.2.c is maintained.

(C) PARA 4.2 SUB (b) ADDED: "ALLOW USE OF LOCALIZED FORCE ...."

5.0 TUBE BENDING TOLERANCES

5.1 Fabrication Tolerances

5.1.1. Formed tubes are to be within the tolerance limits defined in Table 5 when compared to Master Part or Engineering Digital Definition.

FEATURE	TOLERANCE
ROTATIONAL ANGLE	± 2^{o}
BEND ANGLE	± 0^{o} 30’
END TO END LENGTH	± .050
INDIVIDUAL BEND LENGTH - ARCH LENGTH	± .030
INDIVIDUAL BEND LENGTH - STRAIGHTS BETWEENTANGENTS OF BENDS	± .030
OVERALL LENGTH - FLARED OR FLARELESS END FITTINGS	± .050
OVERALL LENGTH - BEADED END	± .050

Table 5: Formed Tube - Fabrication Tolerances

5.2 Installation Tolerances

5.2.1. **Tube Ends**: Tube assemblies incorporating threaded end fittings (flared or flareless) may be readily checked for correct dimensional accuracy on installation by performing the following checks

a) Place tubing in the proper installation position and loosely connect tubing fittings and clamps by hand. With clamps loose, it must be possible to run tube coupling nuts down by hand until the tube bottoms on the fitting, without forcing the tubing into alignment.

b) If the tube nuts cannot be run down by hand, check for alignment as follows

5.2.1.1 **Angular Mismatch**: The free tube end must be parallel with the fitting within 2 degrees. See Figure 11, Detail 1.

5.2.1.2 **Radial Mismatch**: The free end of the tube must be in line with the fitting within 0.035 inch per 10 inches of tube length from last support clamp. See Figure 11, Detail 2.

5.2.1.3 **Lengthwise Mismatch**: The free tube end must match the fitting cone seat lengthwise within 0.035 inch. See Figure 11, Detail 3 and Detail 4.

(A) TABLE 5 ; REVISED -SEE APPROVL SHEET

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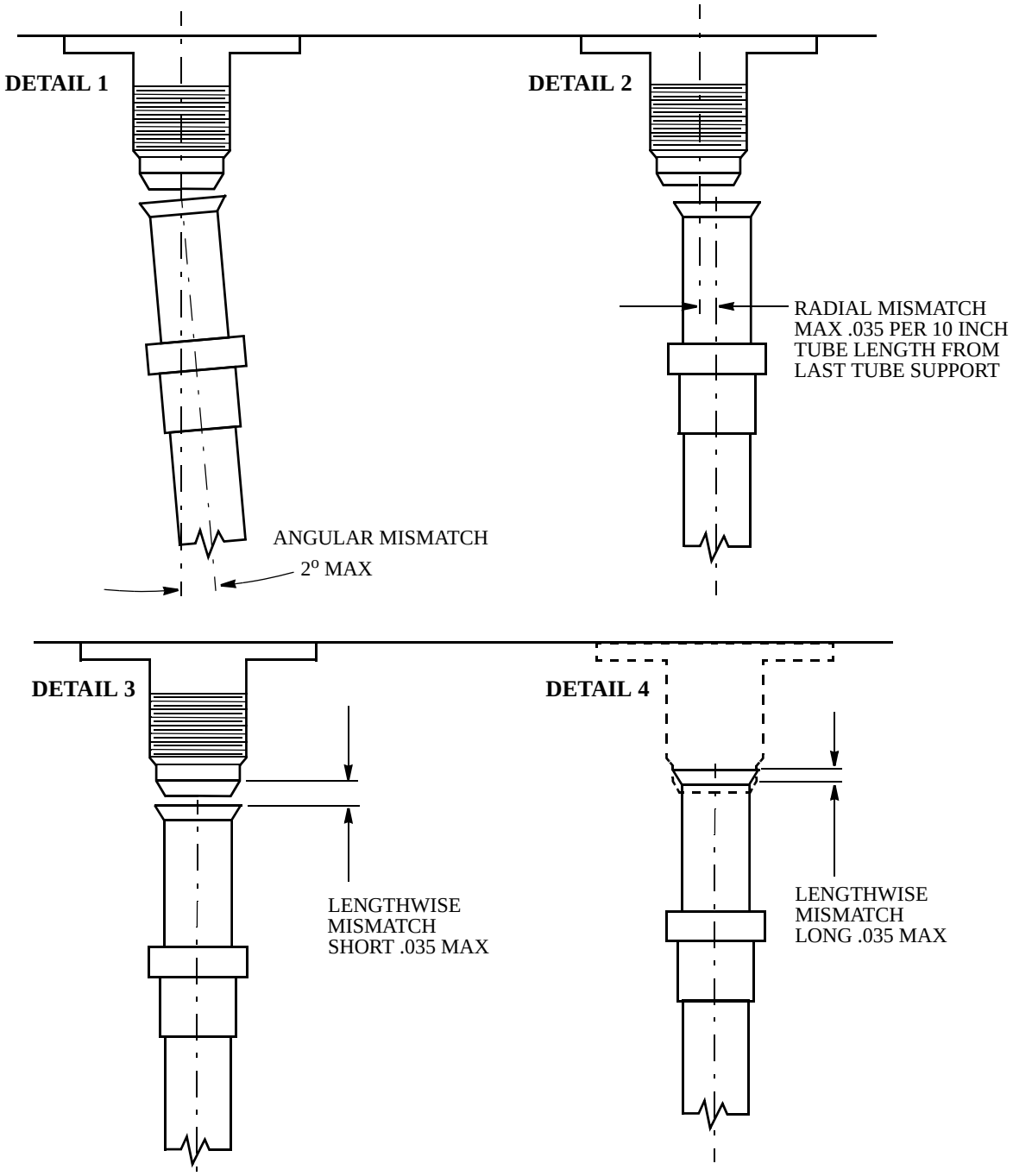

NOTE - ILLUSTRATIONS SHOWN APPLY TO FLARELESS CONNECTIONS AS WELL AS FLARED

FIGURE 11 - TUBE END FITTING INSTALLATION TOLERANCES

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