



# AEROSPACE STANDARD

**AS5959****REV. B**Issued 2006-03  
Revised 2013-12

Superseding AS5959A

## Axially Swaged Fittings, Installation and Inspection Procedure

### RATIONALE

Added tooling part numbers for size -20 to the tables, deleted style P inspection gages, add anodize as tube installation marking and updated figures.

## 1. SCOPE

### 1.1 Purpose

This procedure establishes the instructions to prepare tube ends and install and inspect axially swaged permanent tube fittings qualified to AS5958. This procedure is applicable when specified on the engineering drawing or in the procurement document.

## 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 International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), [www.sae.org](http://www.sae.org).

AS5958 Fittings, Axially Swaged Tube with Flareless Separable, Fluid System for Operating Pressures Up to and Including 5080 psi (35 000 kPa), Specification for

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### 3. TOOLING AND GAGING VERIFICATION REQUIREMENTS

#### 3.1 Tooling and Gaging Verification

Prior to the listing of new gaging and tooling numbers in this procedure, the fitting/tooling system supplier shall demonstrate the interchangeability/capability by assembling and gaging two sample fittings of each size of each manufacturer listed in the PRI-QPL 5958. The assembled fittings shall be tested to and pass the AS5958 impulse test requirements. Potential suppliers shall submit a plan to demonstrate interchangeability/capability to the Performance Review Institute (PRI), G-3 Fluid Distribution, Qualified Products Group (QPG), at PRI, 161 Thorn Hill Rd, Warrendale, PA 15086-7527. The QPG will grant approval for the suppliers numbers and name be added for the applicable tools or gages after demonstrating interchangeability/capability.

### 4. GENERAL

#### 4.1 Dimensions

All dimensions in this specification are in inches.

#### 4.2 Tube End Preparation

The tube ends shall be cut square as defined in Figure 1. The tube ends, I.D. and O.D., shall be free of burrs.

#### 4.3 Tube Condition - Sealing Area

The tube sealing area shall be in accordance with the tubing specification finish requirement. There shall be no scratches or other handling damage marks. This area shall be clean and free of paint, glue or any other foreign substance.

#### 4.4 Tube Marking

##### 4.4.1 Pre-Applied Tube End Marking

At least one pair of marks, (positioning marks and inspection marks) as shown in Figure 1, shall be pre-applied with the given dimensions from Table 1 to each prepared tube end prior to fitting installation. A suitable permanent method such as ink stamp, anodize, or electro-etch, etc., may be used. Should the tube ends be unmarked, the appropriate marks shall be applied using tube marking gage as shown in Figures 2A and 2B, and using a suitable permanent ink felt tipped pen such as Sanford Sharpie TEC (Trace Element Certified) marker no. 13401.

NOTE 1: Due to the possibility of contaminating titanium tubing, inks which contain lead, 25 ppm maximum, or free halogens, 225 ppm combined maximum, should not be used for marking.

NOTE 2: See Table 2 for suppliers of marking gages.

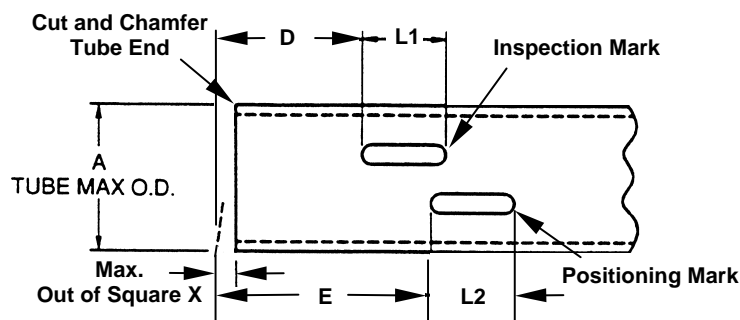


FIGURE 1 - TUBE MARKING USING INK STAMP, ANODIZE, OR ELECTRO-ETCH

TABLE 1 - DIMENSIONS FOR INK STAMP OR ELECTRO-ETCH (INCH)

Dash Size	Dia "A" Max.	Inspection Mark Length (L1)	Positioning Mark Length (L2)	D $\pm 0.010$	E $\pm 0.010$	Max. Out of Square "X"
-04	0.253	0.300	0.300	0.330	0.402	0.003
-06	0.378	0.300	0.300	0.518	0.619	0.003
-08	0.504	0.350	0.350	0.663	0.794	0.005
-10	0.629	0.350	0.350	0.899	1.088	0.005
-12	0.754	0.350	0.350	1.042	1.232	0.005
-16	1.004	0.400	0.400	1.299	1.498	0.012
-20	1.254	0.400	0.400	1.572	1.781	0.015

#### 4.4.2 Marking Gage Positioning

The marking gage should be bottomed on the end of the tube.



FIGURE 2A - APPLICATION OF TUBE INSPECTION MARKS USING MARKING GAGE AND PEN AS LISTED IN TABLE 2

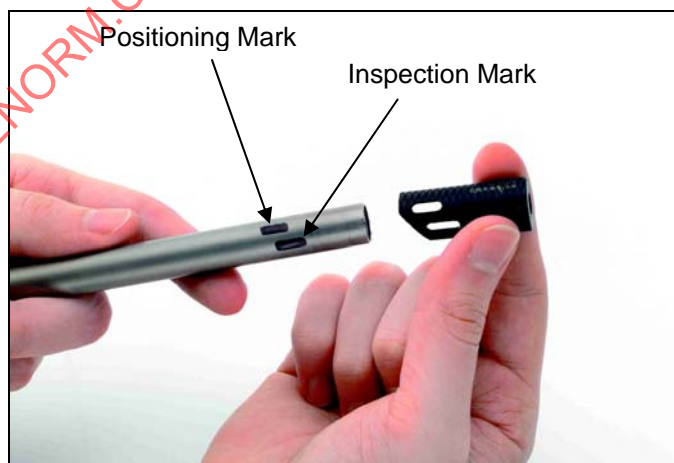


FIGURE 2B - TUBE INSPECTION MARKS AFTER REMOVING MARKING GAGE

FIGURE 2

TABLE 2 - MARKING GAGES

Dash Size	Gage Number	Supplier
-04	LTSG0-01-04	CAGE Code 00624
-04	DAT08AEMT5004	CAGE Code 14798
-06	LTSG0-01-06	CAGE Code 00624
-06	DAT08AEMT5006	CAGE Code 14798
-08	LTSG0-01-08	CAGE Code 00624
-08	DAT08AEMT5008	CAGE Code 14798
-10	RTSG0-01-10	CAGE Code 00624
-10	DAT08AEMT5010	CAGE Code 14798
-12	RTSG0-01-12	CAGE Code 00624
-12	DAT08AEMT5012	CAGE Code 14798
-16	RTSG0-01-16	CAGE Code 00624
-16	DAT08AEMT5016	CAGE Code 14798
-20	RTSG0-01-20	CAGE Code 00624
-20	DAT08AEMT5020	CAGE Code 14798

NOTE: Approved Suppliers

CAGE Code 00624 – Eaton Aeroquip , 300 S. East Ave, Jackson Michigan, 49203

CAGE Code 14798 – Designed Metal Connections, dba, Permaswage 14800 S. Figueroa, Gardena, California, 90248

Alternate suppliers may be added after demonstrating interchangeability in accordance with 3.1 of this standard.

## 5. FITTING INSTALLATION AND ASSEMBLY

### 5.1 Fitting Installation

#### 5.1.1 Positioning Mark

Locate the edge of the unswaged fitting “ring” over the positioning mark as shown in Figures 3A and 3B. The length of the positioning mark is the amount of positioning tolerance allowed. The edge of the fitting “ring” may be anywhere along the length of the positioning mark.

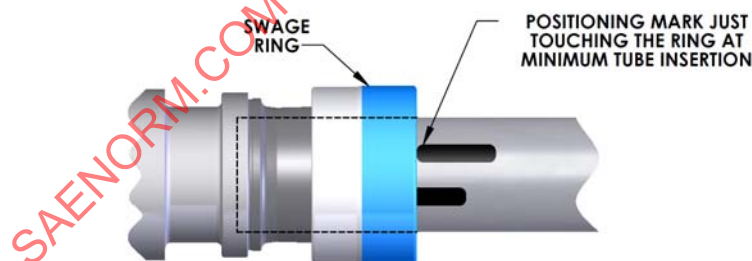


FIGURE 3A - POSITIONING MARK AT MINIMUM TUBE INSERTION

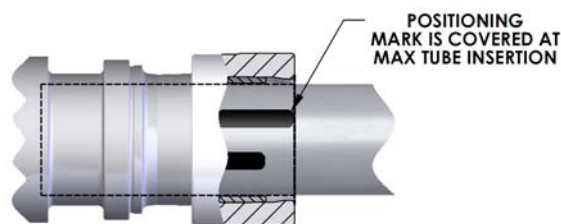


FIGURE 3B - POSITIONING MARK AT MAXIMUM TUBE INSERTION

FIGURE 3

### 5.1.2 End Fittings

In general, end fittings have a tube stop and do not have as much positioning allowance (see Figure 4). Even with this condition, the tube end shall be marked for inspection purposes to verify that the tube was inserted to at least the minimum insertion depth.

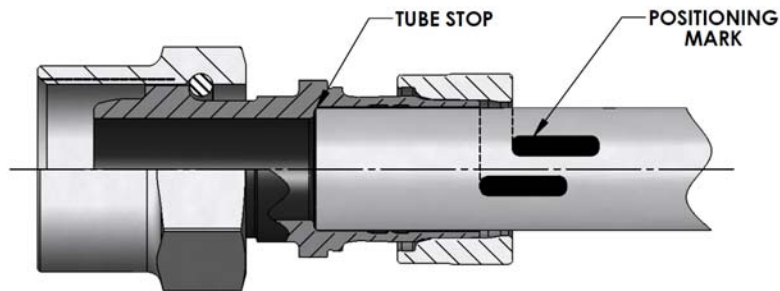


FIGURE 4 - END FITTINGS TUBE POSITIONING  
(NOTE: TUBE IS BOTTOMED INTO THE FITTING)

### 5.1.3 Shared Insertion

In the case of unions, the tube insertion allowance is shared by each leg of the union. If one tube end is inserted to maximum depth, then the opposite tube end can only be inserted to a minimum depth as shown in Figure 5. This shared insertion condition is only applicable to unions, which have a through bore to allow placement onto cut lines during repair.

NOTE: Under maximum insertion conditions, it will not be possible to see the Inspection mark until after swaging.

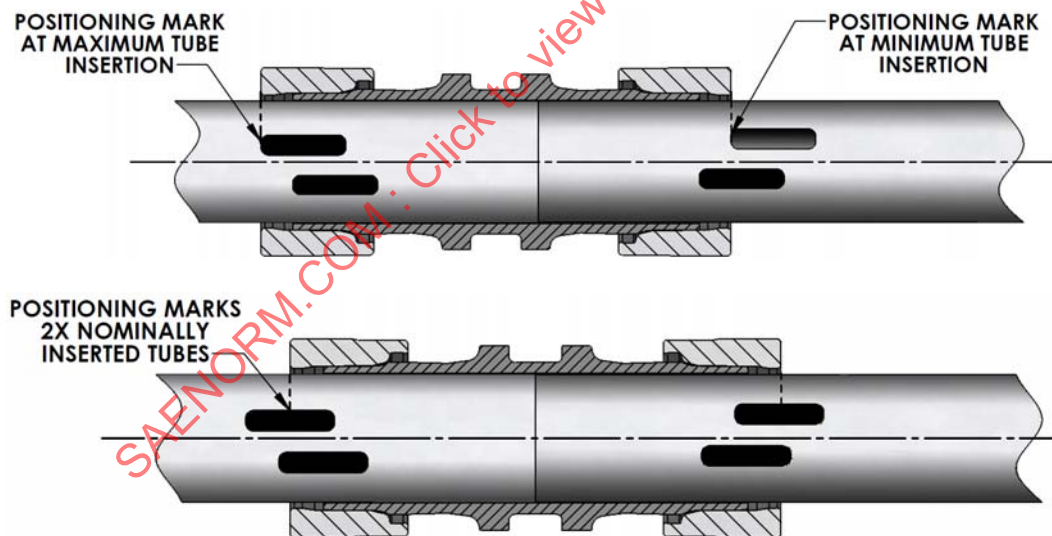


FIGURE 5 - EXAMPLES OF ACCEPTABLE SHARED  
TUBE INSERTION CONDITIONS FOR UNIONS BEFORE SWAGING

## 5.2 Fitting Assembly

### 5.2.1 Swage Tool Selection

Select the correct assembly tool based on fitting size. Figure 6 shows a typical axial swage tool. Table 3 lists available assembly tooling by fitting size.

NOTE: In all cases, the blue color code of the fitting shall match the color of the tool.

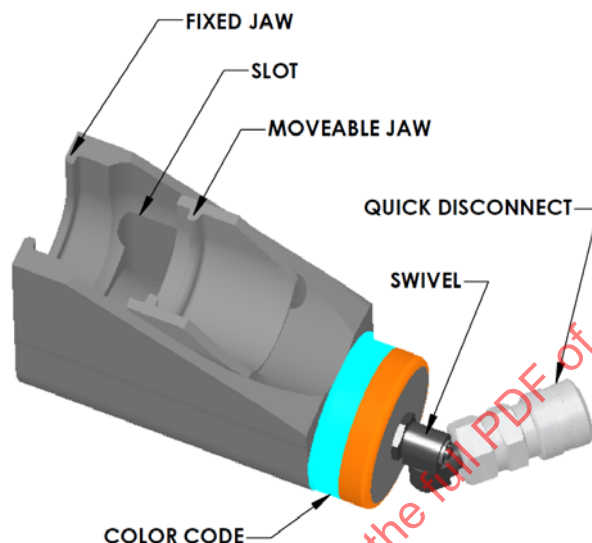


FIGURE 6 - AXIAL SWAGE TOOL

TABLE 3 - TOOLS

Dash Size	Recommended Tool	Tool Direction	Supplier
-04	RTL5-02S-04	Universal*	CAGE Code 00624
-04	DAT08AETA5004	Universal*	CAGE Code 14798
-06	RTL5-02S-06	Universal*	CAGE Code 00624
-06	DAT08AETA5006	Universal*	CAGE Code 14798
-08	RTL5-02S-08	Universal*	CAGE Code 00624
-08	DAT08AETA5008	Universal*	CAGE Code 14798
-10	RTL5-01S-10	Forward	CAGE Code 00624
-10	RTL5R01S-10	Reverse	CAGE Code 00624
-10	DAT08AETA5010	Universal*	CAGE Code 14798
-12	RTL5-01S-12	Forward	CAGE Code 00624
-12	RTL5R01S-12	Reverse	CAGE Code 00624
-12	DAT08AETA5012	Universal*	CAGE Code 14798
-16	RTL5-01S-16	Forward	CAGE Code 00624
-16	RTL5R01S-16	Reverse	CAGE Code 00624
-16	DAT08AETA5016	Universal*	CAGE Code 14798
-20	RTL5-02S-20	Universal*	CAGE Code 00624
-20	DAT08AETA5020	Universal*	CAGE Code 14798

\* Universal – Capable of both directions

Alternate suppliers may be added after demonstrating interchangeability in accordance with 3.1 of this standard.

### 5.3 Fitting Installation

With the fitting positioned onto the tube as described in 5.1, select the proper tool for the application. The ring "forward/push" motion tool is the preferred tool for most applications, however, a ring "reverse/pull" motion is required for some applications where there is a lack of tooling space.

For the forward/push motion, align the swage tool to one leg of the fitting so that the "ring" is nested into the movable jaw of the tool and the front opening of the tool is bottomed into the "fitting body" as shown in Figure 7B.

For the reverse/pull motion, align the swage tool to one leg of the fitting so that the "fitting body" is bottomed in the movable jaw and the "ring" is nested into the tooling body as shown in Figure 7A. However, not all shared fittings can be swaged in the reverse/pull position. See Figure 7C for an example.

#### 5.3.1 Tool Pressurization

The hydraulic pressure sources are available from the suppliers listed in Table 4. Apply hydraulic pressure (10 000 psi ) to the tool to advance the fitting ring or fitting body to complete the assembly process as shown in Figure 8. The swage is complete when the ring has advanced enough to meet the inspection gage length as listed in Table 5.

**WARNING:** Assembly tools operate under high-pressure hydraulic loads. The tools have moveable jaw and extreme loads can be applied to close the jaw relative to the tool body. Operate with care to avoid "pinch points" that could result in injury to the hand or fingers.

**CAUTION:** Fitting must always be fully nested into tool to maximize tool life. Failure to seat the fitting into the bottom of the tool jaw will cause excessive loading of the tool flanges and could result in damaging the fitting and/or premature failure of the tooling jaw.

TABLE 4 - PRESSURE SUPPLY SUPPLIERS

Pressure Supply Description	Part Number	Supplier
Hand Operated Pump	10-00400A	CAGE Code 00624
Hand Operated Pump	DLT05MAPM100	CAGE Code
	0	14798
Foot-Operated Air/Hydraulic Intensifier	10-00401A	CAGE Code 00624
Foot-Operated Air/Hydraulic Intensifier	DLT03MAPP1000	CAGE Code 14798
Switch-Operated Air/Hydraulic Intensifier	10-00402TA	CAGE Code 00624
Switch-Operated Air/Hydraulic Intensifier	DLT02MAPP1000	CAGE Code 14798
Battery Operated 24VDC	DLT06MAPE3000	CAGE Code 14798

Alternate suppliers may be added after demonstrating interchangeability in accordance with 3.1 of this standard.

#### 5.3.2 Re-Engagement of Tooling (if necessary)

If it is determined that the ring has not been fully advanced in the initial swage process, the fitting can be reinserted into the tool jaw and the swage process can be repeated. The fitting should be fully nested into the tool jaw, and if possible, it is recommended that the tool be rotated to the opposite side of the initial tool placement. This will help to distribute the tool pressure about the contact surfaces on the fitting. Input the pump pressure at 10 000 psi, to fully advance the ring.



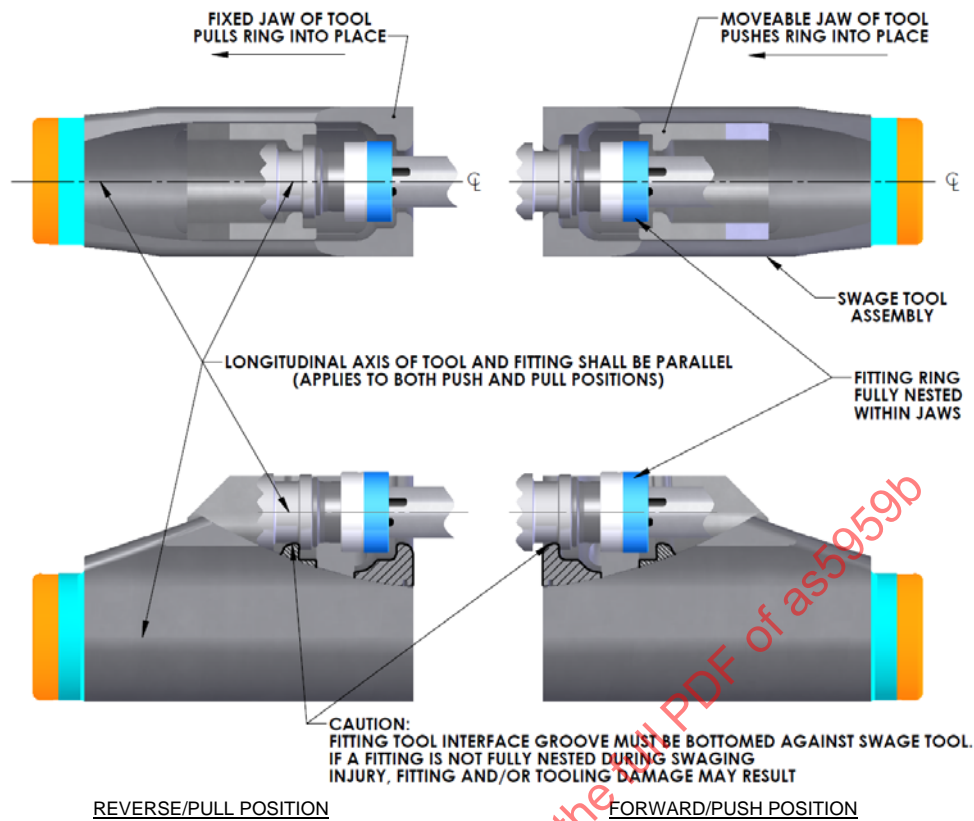


FIGURE 7A

FIGURE 7B

FIGURE 7A &amp; 7B - AXIAL SWAGE TOOL POSITION BEFORE ACTIVATION

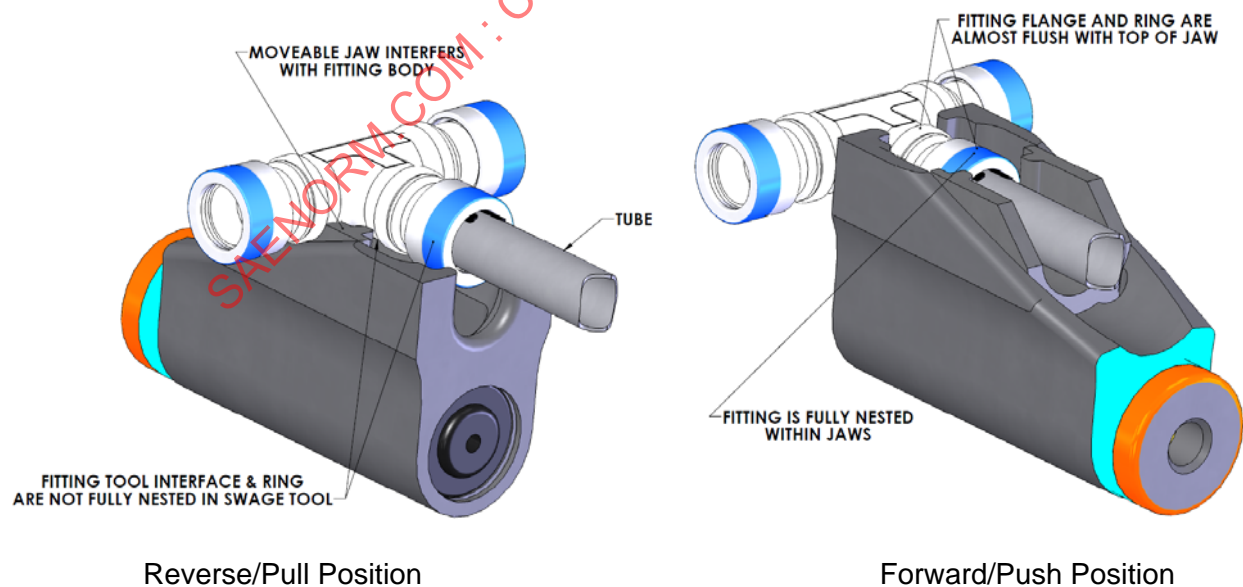


FIGURE 7C - AN EXCEPTION TO USING SWAGE TOOLING IN THE REVERSE/PULL POSITION

FIGURE 7