Rynglok Fitting System Installation Guide

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1.0 Initial Preparation

1.1 Cutting Tubes

Tubes may be cut using any appropriate cutting tool whether by hand or by a production method. Tube ends should be reasonably square, recognizing that any out-of-squareness condition will detract from the amount of positioning tolerance allowed. (See paragraph 1.4)

1.2 Tube End Preparation

The tube ends should be deburred with appropriate deburring tools on the O.D. and I.D. to prevent damage of the fitting I.D. during tube insertion and to prevent FOD (Foreign Object Damage) from entering and contaminating the fluid system.

1.2.1 Painted Tube End Preparation

Painted tube ends shall be deburred in accordance with paragraph 1.2. Painted tube ends do **not** require the paint to be removed when the tubing O.D. is in accordance with Table 1. The max. tubing O.D. (dim. A) must be held a min. distance (dim. B) per Table 1 for proper fitting installation. If paint removal is necessary, the tube shall be sanded in a radial direction using a mild grit paper. Care should be taken to prevent longitudinal marks. It will be necessary to reclean and remark tube ends. It is recommended to repaint the exposed tubing after installation. Please contact Eaton's Jackson, MI facility at (517) 787-8121 if there are any questions regarding this procedure.

1.3 Pre-applied Tube End Marking

A pair or pairs of marks, (positioning marks and inspection marks) as shown in Figure 1, should be pre-applied with the given dimensions from Table 1 to each prepared tube end prior to fitting installation. A suitable method such as ink stamp, electro-etch, laser, etc. may be used. Should the tube ends be unmarked, the appropriate marks should be applied using Eaton's Aeroquip brand tube marking gauge P/N RTSG0-01-SIZE as shown in Figure 2, and using a suitable permanent ink felt tipped pen.

Notice: Due to the possibility of contaminating titanium tubing, inks which contain lead or free halogens should not be used for marking.

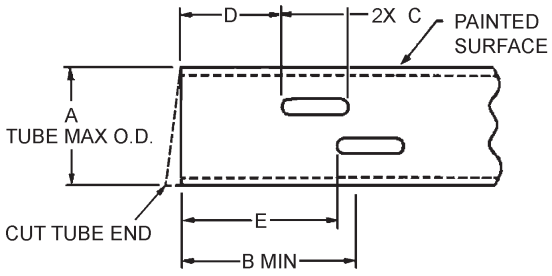


Figure 1

Tube marking using electro-etch, ink stamp, or laser marking.

1.4 Marking Gauge Positioning

The RTSG0-01-SIZE series of marking gauges is common for all pressure classes of Rynglok fittings. The marking gauge should be bottomed on the end of the cut tube. If an out-of-square condition exists, the marking gauge should be positioned toward the end that is most square. This is only for fittings which require shared insertion, such as in the case of a union fitting. This allows minimum tube insertion on the opposite end of a union configuration should the skew end be inserted to the maximum tube insertion condition. (See paragraph 4.1.1 and Figure 7).

(All tubes should be marked prior to assembly in insure proper tube insertions.)

Table 1

Dimensions for electro-etch, ink stamp, or laser marking.

Dash Size	A Max.	B Min.	C ± .005	D ± .005	E ± .005
-03	.190	.453	.300	.453	.644
-04	.254	.525	.300	.525	.717
-05	.316	.588	.300	.588	.780
-06	.379	.656	.300	.656	.843
-07	.441	.730	.300	.730	.918
-08	.505	.773	.350	.773	.963
-09	.567	.836	.350	.836	1.026
-10	.630	.899	.350	.899	1.088
-11	.692	.983	.350	.983	1.175
-12	.755	1.042	.350	1.042	1.232
-13	.817	1.110	.350	1.110	1.303
-14	.880	1.178	.350	1.178	1.369
-15	.942	1.249	.400	1.249	1.448
-16	1.006	1.299	.400	1.299	1.498
-20	1.256	1.572	.400	1.572	1.781
-24	1.507	1.882	.400	1.862	2.086

Figure 2

Application of tube insertion marks using RSTG0-01-SIZE marking gauge and pen.

2.0 Fitting Installation

2.1 Positioning Mark

The installer must use this positioning mark to position the edge of the unswaged fitting "ring" over the marks as shown in Figure 3. 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.

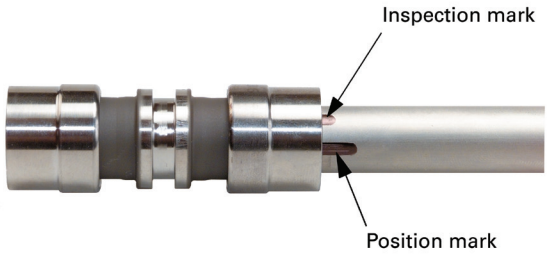


Figure 3

Fitting position for tube insertion

2.1.1 End Fittings

In general, end fittings are designed to have the tube end bottomed into the fitting, and do not have as much positioning allowance. See Figure 5. Even with this condition, the tube end should be marked for inspection purposes to verify that the tube was inserted to at least the minimum insertion depth. Refer to section 7.0 when installing fittings of this type.

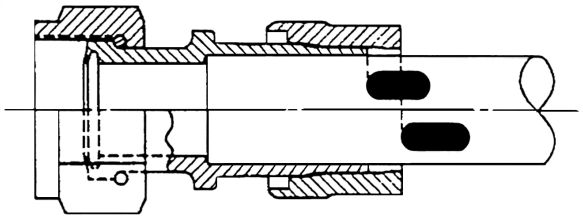


Figure 4

End fitting tube positioning. **Note:** Tube is bottomed into fitting.

3.0 Fitting Assembly

3.1 Assembly Tool Selection

Select the correct size tool (noted on face of tool) and pressure class assembly tool (denoted by color — see Table 2), P/N RTSTX-01-SIZE, where the "X" denotes the pressure class of the fitting. The installer must note the color coding of the fitting "ring" and match this with the color of the movable jaw on the assembly tool.

Table 2

Color Code

Maximum Fitting Operating Pressure – psig (bar)	**Tool Jaw and Fitting Ring**
"8" – 8000 (551.58)	Silver (no color code)
"5" – 5000 (344.73)	Blue
"4" – 4000 (275.79)	Black
"2" – 2000 (137.89)	Green

3.2 Assembly Tool Pressure Connection

Attach the flexible hose with the mating quick disconnect coupling to the nipple at the bottom of the tool, and the nipple end of the hose to the mating quick disconnect coupling on the portable pump. The pump may be a hand pump, Aeroquip brand P/N 10-00400A, a foot-operated air/hydraulic intensifier, Aeroquip brand P/N 10-00401A or a switch operated air/hydraulic intensifier, Aeroquip brand P/N 10-00402TA.

3.3 Tool Installation

With the fitting positioned onto the tube as described in Paragraph 2.0, align the assembly tool to one leg of the fitting, with the "ring" nestled into the movable jaw of the tool and the front opening of the tool bottomed into the fitting body, as shown in Figure 5A. The tool is designed to access the fitting leg from any radial angle as required by the space available.

3.4 Tool Pressurization

Apply 8000-8500 psig (551.58-586.05 bar) hydraulic pressure to the tool to advance the fitting ring to complete the assembly process as shown in Figure 5B. Tool pressure is typically in the 8000-8500 psi (551.58-586.05 bar) range, regardless of fitting size or pressure class, however enough pressure should be used to advance the ring to the full forward position. Once the ring has been advanced, no further pressurization is required.

Note: Fitting must always be fully nested into tool to maximize tool life.

Note: See Section 6.2 for special consideration in swaging pressures when using special "Reversed Tools" with reducer/expander fittings.

3.4.1 Pressure Level

If using the hand pump, the 8000-8500 psig (551.58-586.05 bar) pressure level is assured by the pressure gauge reading. If using a foot operated air/hydraulic intensifier or a switch operated air/hydraulic intensifier, the intensifier will automatically stop when 8000-8500 psig (551.58-586.05 bar) is reached.

When the pressure is released, the movable jaw will return to its original position.

Figure 5A

Tool position before pressurization.

Figure 5B

Tool position during pressurization.

4.0 Assembled Fitting Inspection

4.1 Ring Advancement Inspection

After fitting installation, ring advancement should be verified using the inspection gauge P/N RTSG0-51-SIZE. The inspection gauge should fit over the ring area as shown in Figure 6A. Figure 6B shows an incomplete/incorrect swage.

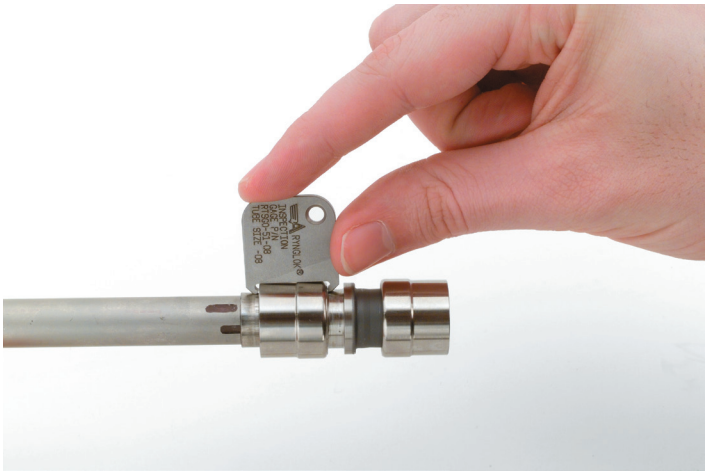


Figure 6A

Complete ring advancement inspection.

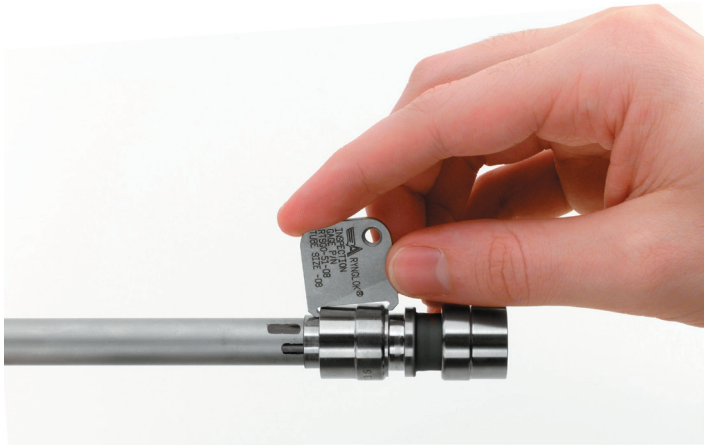


Figure 6B

Complete ring advancement inspection.

4.1.1 Insertion Inspection Mark Position

The inspector should verify that the edge of the fitting is touching or over the insertion inspection marks after assembly as shown in Figure 6A. This is to ensure that the tube was inserted to the required depth.

4.2 Shared Insertion - Unions

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 7. This shared insertion condition is only applicable to unions, which have a through bore to allow placement onto cut lines during repair. All other fittings have a positive stop in each leg, and the entire positioning length is available for each leg.

Note: Under maximum insertion condistions it will not be possible to see the inspection mark until after swage.

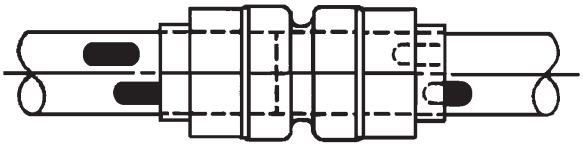


Figure 7

Shared insertion conditions

4.2.1 Over Insertion Condition — Fittings Other Than Unions

All fittings other than unions, are designed with a positive tube stop or bottoming feature which prevents over insertion of the tube end during assembly, as shown in Figure 8. The exceptions are special bulkhead fittings, configurations of fittings with deep bores to save weight, special repair and penetration fittings, etc.. In these circumstances, the tube insertion guidelines and marking must be strictly adhered to in accordance with Figure 6A to ensure proper inspection procedures.

Note: It is necessary that tube marking procedures be adhered to for all Rynglok fittings.

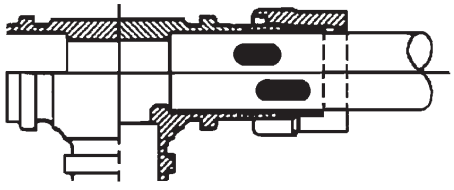


Figure 8

Fittings with over insertion conditions

5.0 Tubing Repair With Rynglok Unions

5.1 Single Union Repair

Repair of a tubing defect can be made by using a single union fitting provided that the length of the defect in the tube as shown in Figure 9 is within the limits specified in Table 4.

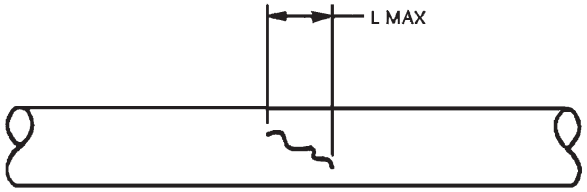


Figure 9

Defect Length

Table 4

Dash Size	Tube Size	L Max.
-03	0.1875	.300
-04	0.2500	.300
-05	0.3125	.300
-06	0.3750	.300
-07	0.4375	.300
-08	0.5000	.350
-09	0.5625	.350
-10	0.6250	.350
-11	0.6875	.350
-12	0.7500	.350
-13	0.8125	.350
-14	0.8750	.350
-15	0.9375	.350
-16	1.0000	.400
-20	1.2500	.400
-24	1.5000	.400

5.1.1 Cutting Through Center of Defect

As shown in Figure 10A, a single cut may be made through the defect and the tube ends prepared as per Paragraph 1.0.

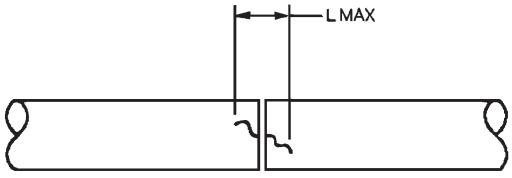


Figure 10A

Cutting through defect

Note: While this method is not considered an ideal repair, it may be preferred in some circumstances. Please note there is a possibility of defect propagation, and for this reason, the union should be positioned equally over the positioning marks of each tube end when the tube ends are in a "butted" condition since the tube insertion inspection marks are made from the end of the tube, not from the ends of the defect.

5.1.2 Cutting Out Defect

Figure 10B shows the preferred method for a single fitting repair where the defect is completely removed, provided the length of the defect is less than "L Max." in Table 4. The tube ends should then be prepared per Paragraph 1.0.

Note: Because of the amount of tubing being removed, this amount will decrease the amount of tube float available for the installer, i.e., if the maximum permissible amount of tubing is cut out, the position of the union over the positioning marks will be in the minimum insertion condition for both fitting ends of the union.

5.2 Two Union Repair

When the length of the defect exceeds "L Max." from Table 4, repairs must be made by cutting out the defective section of tubing, plus additional tubing as shown in Figure 11. The minimum length of tubing to be removed is length "M Min." from Table 5. The removed tubing must be replaced by an equal or slightly shorter length of similar tubing, and installed using two Rynglok unions. Prepare each tube end per Paragraph 1.0.

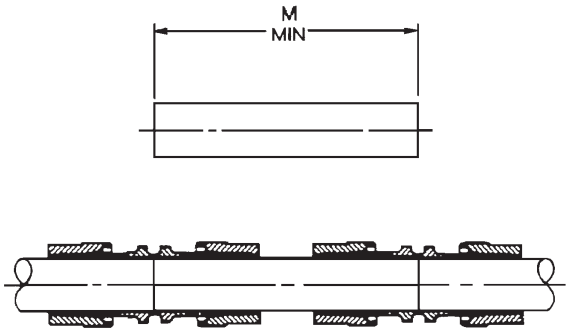


Figure 11

Tube section removal

Note: Rynglok union P/N R80501T-xx, below, is also available for repair use. This fitting is capable of joining tube sections when a longer span is required. Use of this option may allow for a single fitting for repair is some instances.

P/N R80501T

Table 5

Dash Size	Tube Size	M Min.
-03	0.1875	2.14
-04	0.2500	2.38
-05	0.3125	2.51
-06	0.3750	2.64
-07	0.4375	2.77
-08	0.5000	2.92
-09	0.5625	3.05
-10	0.6250	3.18
-11	0.6875	3.44
-12	0.7500	3.56
-13	0.8125	3.71
-14	0.8725	3.88
-15	0.9375	3.99
-16	1.0000	4.15
-20	1.2500	4.81
-24	1.5000	5.42

6.0 Special Consideration

6.1 Using the "Reversed Tool"

When using the RTST(X)R-01-SIZE "Reversed Tool", care must be taken in positioning the tool properly onto the fitting and in positioning the fitting onto the tube because of the relative movement of the movable tool jaw. See Figure 12. The "Reversed Tool" is used in situations where an installation is required at or near a bulkhead or an adjacent fitting or structural member where the "Standard Tool" does not fit. This tool allows the installer the opportunity to swage the fitting end as close as possible to adjacent members.

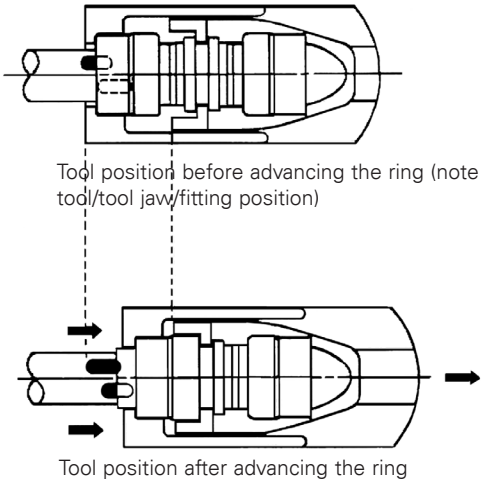


Figure 12

Caution: Note relative movement of the whole tool with respect to the fitting.

6.2 Special Consideration When Using The "Reversed Tool"

When using the "Reversed Tool" with reducer/expander fittings, a special RTST(X)R-51-SIZE "Reversed Tool" is required. The standard "Reversed Tool" is to be used with standard non-reducer/expander fitting configurations, while the special "Reversed Tool" is intended to be used where there is an opposite fitting end or forging body size greater than the dash size of the fitting end being swaged, as shown in Figure 13. These special "Reversed Tools" will be marked with a colored band and the required swage pressures identified on the tool body.

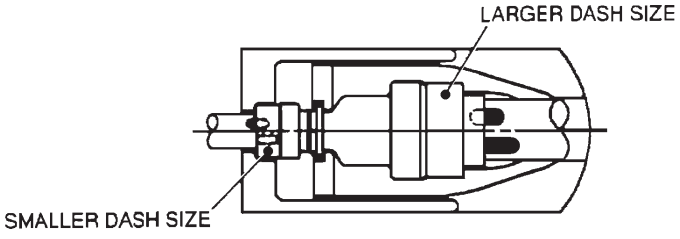


Figure 13

Using the special "Reversed Tool"

Warning: The swage pressures listed on the special "Reversed Tools" must be strictly adhered to, in order to prevent excessive tonnage applied to the fitting which may result in a damaged fitting or fitting failure.

6.3 Special Considerations When Using the -20 and -24 Tools

When using the size -20 and -24 standard and reversed swage tools, a swage bridge attachment is used in conjunction with the standard hand swage tool, see Figures 14A and 14B. The swage bridge is to be oriented and bottomed into the swage tool detents after the insertion of the fitting. The swaging operation shall then proceed as normal. For the standard hand swage tool, the swage bridge is inserted into the movable jaw. **Note:** The swage bridge is connected to the hand swage tool via a flexible lanyard and should not be separated. Proper orientation is noted by the "Front" arrow stamped on top of the swage bridge and by "click" of the detents when the swage bridge is sitting flush on the reliefs on top of the swage tool.

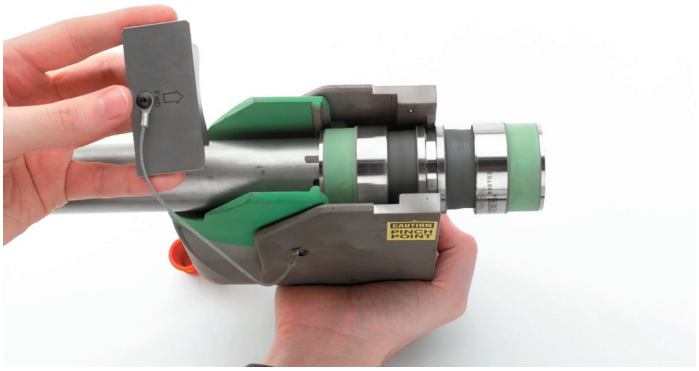


Figure 14A

Swage bridge prior to placement

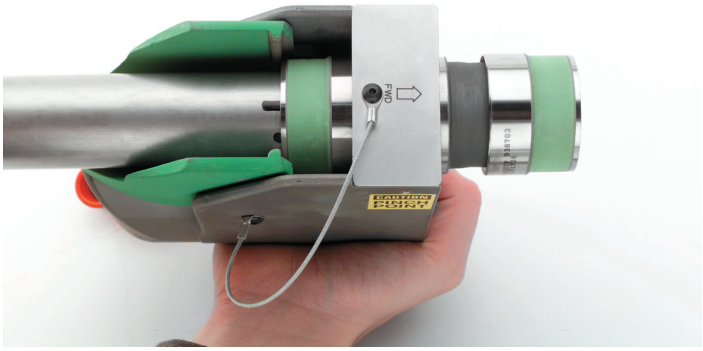


Figure 14B

Correct placement of swage bridge on tool

7.0 Tube Cut Dimensions

When replacing/repairing separable connections with Rynglok fittings the following dimensions should be used for factoring tube cut length.

7.1 Female Arcseal Fitting

Tube cut dimension, as shown in Figure 15, shall use dimensions per Table 6 for proper fitting installation.

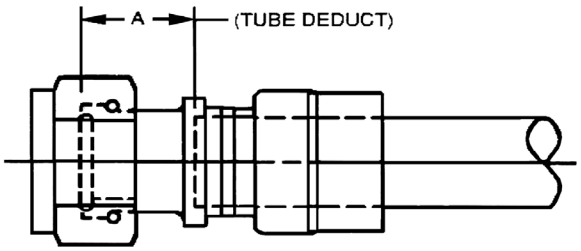


Figure 15

Female ArcSeal tube cut dimensions

Table 6

Part No.	"A" +.030 in.	Part No.	"A" +.030 in.
R81101T03	0.463	R81101T10	.682
R81101T04	0.496	R81101T12	.754
R81101T05	0.513	R81101T16	.837
R81101T06	0.528	R81101T20	.883
R81101T08	0.596	R81101T24	1.023

7.2 Female Flareless Fitting

Tube cut dimension, as shown in Figure 16, shall use dimensions per Table 7 for proper installation.

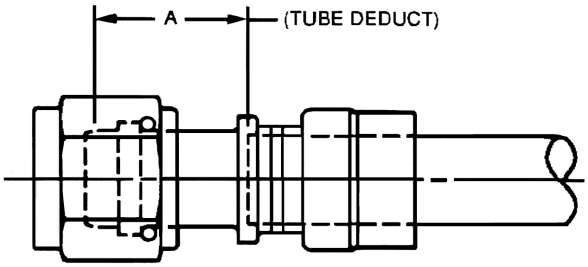


Figure 16

Female flareless tube cut dimensions

Table 7

Part No.	"A" +.030 in.	Part No.	"A" +.030 in.
R82101T03	0.602	R82101T10	.979
R82101T04	0.616	R82101T12	1.004
R82101T05	0.695	R82101T16	1.135
R82101T06	0.726	R82101T20	1.165
R82101T08	0.837	R82101T24	1.395

7.3 Female Flared Fitting

Tube cut dimension, as shown in Figure 17, shall use dimensions per Table 8 for proper installation.

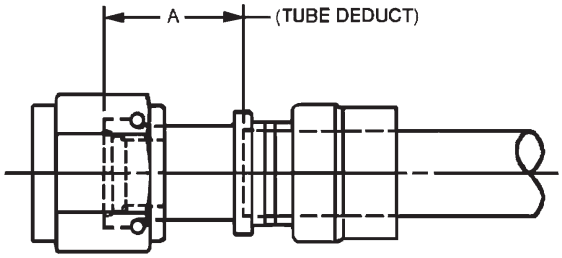


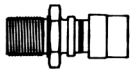
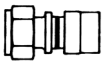
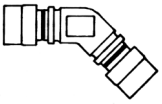
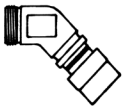
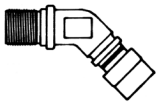
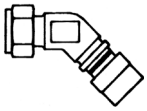
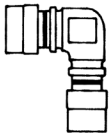
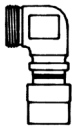
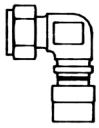
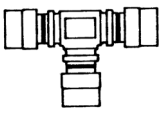
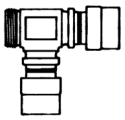
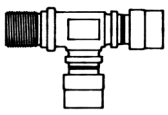
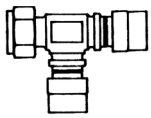
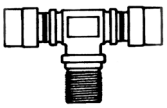
Figure 17

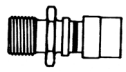
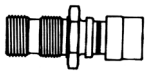
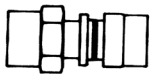
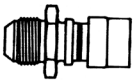
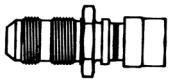
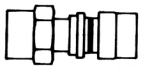
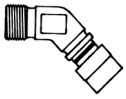
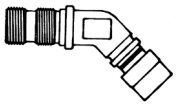
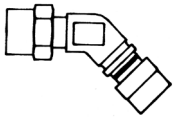
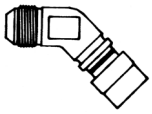
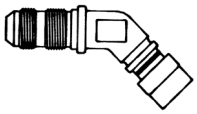
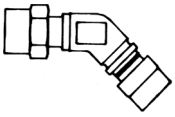
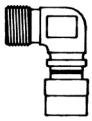
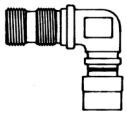
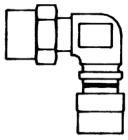
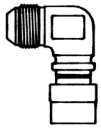
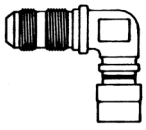
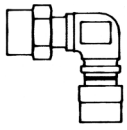
Female flared tube cut dimensions

Table 8

Part No.	"A" +.030 in.	Part No.	"A" +.030 in.
R83101T03	0.662	R83101T10	1.045
R83101T04	0.701	R83101T12	1.085
R83101T05	0.748	R83101T16	1.214
R83101T06	0.779	R83101T20	1.298
R83101T08	0.920	R83101T24	1.477

8.0 Fitting Selection Chart

	PERMANENT TO PERMANENT	PERMANENT TO ARCSEAL™		
		MALE AS85421/1 OR AS85720/1	**MALE BULKHEAD** AS85421/2	**FEMALE** MATES WITH AS85421 & AS85720
UNION				
Non-Reducer	**R80101T( )**	**R81121T( )**	**R81141T( )**	**R81101T( )**
Reducer	**R80151T( )( )**	**R81171T( )( )**	**R81191T( )( )**	**R81151T( )( )**
45° ELBOW				
Non-Reducer	**R80102T( )**	**R81122T( )**	**R81142T( )**	**R81102T( )**
Reducer	**R80152T( )( )**	**R81172T( )( )**	**R81192T( )( )**	**R81152T( )( )**
90° ELBOW				
Non-Reducer	**R80103T( )**	**R81123T( )**	**R81143T( )**	**R81103T( )**
Reducer	**R80153T( )( )**	**R81173T( )( )**	**R81193T( )( )**	**R81153T( )( )**
TEE **(Separable on Run)**				
Non-Reducer	**R80104T( )**	**R81124T( )**	**R81144T( )**	**R81104T( )**
Reducer	**R80154T( )( )( )**	**R81174T( )( )( )**	**R81194T( )( )( )**	**R81154T( )( )( )**
TEE **(Separable on Side)**				
Non-Reducer		**R81126T( )**	**R81146T( )**	**R81106T( )**
Reducer		**R81176T( )( )( )**	**R81196T( )( )( )**	**R81156T( )( )( )**

PERMANENT TO "MS" FLARELESS			PERMANENT TO "AN" FLARED		
MALE MS33514	**MALE BULKHEAD** MS33515	**FEMALE** NAS 1760 MODIFIED	**MALE** AS4395 (MS33656)	**MALE BULKHEAD** AS4396 (MS33657)	**FEMALE** AS1708
					
R82121T( )	**R82141T( )**	**R82101T( )**	**R83121T( )**	**R83141T( )**	**R83101T( )**
R82171T( )( )	**R82191T( )( )**	**R82151T( )( )**	**R83171T( )( )**	**R83191T( )( )**	**R83151T( )( )**
					
R82122T( )	**R82142T( )**	**R82102T( )**	**R83122T( )**	**R83142T( )**	**R83102T( )**
R82172T( )( )	**R82192T( )( )**	**R82152T( )( )**	**R83172T( )( )**	**R83192T( )( )**	**R83152T( )( )**
					
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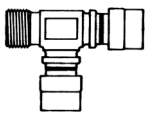
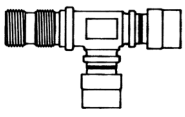
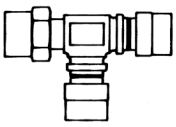
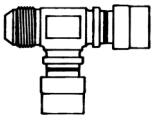
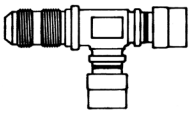
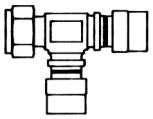
R82173T( )( )	**R82193T( )( )**	**R82153T( )( )**	**R83173T( )( )**	**R83193T( )( )**	**R83153T( )( )**
					
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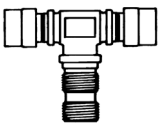
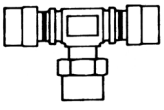
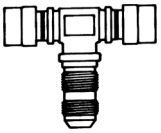
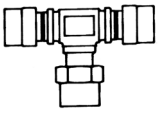
R82174T( )( )( )	**R82194T( )( )( )**	**R82154T( )( )( )**	**R83174T( )( )( )**	**R83194T( )( )( )**	**R83154T( )( )( )**
					
R82126T( )	**R82146T( )**	**R82106T( )**	**R83126T( )**	**R83146T( )**	**R83106T( )**
R82176T( )( )( )	**R82196T( )( )( )**	**R82156T( )( )( )**	**R83176T( )( )( )**	**R83196T( )( )( )**	**R83156T( )( )( )**

Eaton
Aerospace Group
Fluid & Electrical Distribution Division
300 South East Avenue
Jackson, Michigan 49203-1972
Phone: (517) 787 8121
Fax: (517) 789 2947

Eaton
Aerospace Group
9650 Jeronimo Road
Irvine, California 92618
Ph (949) 452 9500
Fax (949) 452 9555
www.eaton.com/aerospace

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March 2013