

Technical Data Assembly Instructions

General Instructions for Assembly of Tube Fittings and Adapters

1. Prior to installation, visually inspect all components for possible contamination, handling damage and presence of O-Rings (if required).
2. Lubricate fitting threads and O-Rings prior to assembly.
3. When installation of system plumbing requires orientation or alignment of fittings, preliminary installation should be performed with all connections hand tight to allow fit check of tubing or mating hose assemblies and to allow proper alignment of fittings.
4. Final tightening sequence for connections should be:
 - A) Port or bulkhead connections.
 - B) Tube/hose assembly connections.
 - C) Tube/hose support brackets and clamps.
5. If leakage occurs following system start up, disassemble and inspect for component damage, misalignment or missing O-Rings.

Tightening Methods

Two methods of final connection tightening are acceptable for tube fittings and adapters. These methods include:

- A) Specified Torque
- B) Flats From Finger Tight

The preferred method is installation to specified torque with a torque wrench, with the exception of tapered pipe thread connections.

Notes

The flats from finger tight (F.F.F.T.) method was developed as a means of dealing with variations in effective torque which resulted, primarily, due to the different lubricity of zinc and cadmium plated components. Today, the use of cadmium plating is not permitted due to environmental reasons. Zinc plating is now the accepted standard coating for hydraulic fittings. This fact eliminates one of the most significant variables associated with installation methods.

Currently, industry standards specify installation at specified torque, with lubricated threads, as the only acceptable method for component qualification testing. This method eliminates many of the variables associated with lubricity variations, "feel" for initial component seating, visual reference for installed "tightness" and the inherent lack of precision in measuring fractional "flats".

For these reasons, it is recommended that the torque method be used whenever practical for installation of hydraulic fittings. When the F.F.F.T. method must be used due to access restrictions or convenience, experienced installation personnel should be utilized.

Procedures

Torque method: Follow the procedures outlined in the following sections. Final installation torque values are as specified in the appropriate tables. **For reference purposes, it is acceptable to mark the seating position and final tightening position of the fitting (see F.F.F.T. procedure) for visual confirmation that proper assembly has been completed.**

F.F.F.T. Method: Procedures for the F.F.F.T. method are outlined in the sections pertaining to the various fitting configurations. Details of this method are described in the section **Method B**. Final tightening of the connection should follow the recommended values listed in Table JA2.

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Assembly Instructions for 37 Degree Tube Fittings and Adapters

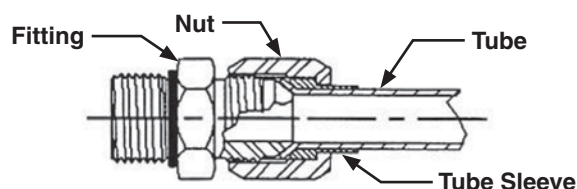


Fig. JA1 37 Degree Tube Fitting Assembly

Method A. Installation Torque

1. Inspect components for damage or contamination.
2. Lubricate assembly.
3. Align tube/hose to mating fitting allowing hand connection. To assure proper alignment, two to three turns of nut should be easily permitted.
4. Tighten tube nut to torque listed in Table JA1.

Table JA1. Assembly Torque, 37 Deg. Tube Fittings			
		37 Deg. Tube / Swivel Nut ¹	
Tube Size	Thread Size	Ft. Lbs.	Nm.
-2	5/16-24	6-7	8-9
-3	3/8-24	8-9	11-12
-4	7/16-20	11-12	15-16
-5	1/2-20	14-15	19-21
-6	9/16-18	18-20	24-28
-8	3/4-16	36-39	49-53
-10	7/8-14	57-63	77-85
-12	1 1/16-12	79-88	107-119
-14	1 3/16-12	94-103	127-140
-16	1 5/16-12	108-113	147-154
-20	1 5/8-12	127-133	172-181
-24	1 7/8-12	158-167	215-226
-32	2 1/2-12	245-258	332-350

1) Lubricated assembly.

Method B. Flats from Finger Tight

1. Inspect components for damage or contamination.
2. Lubricate assembly.
3. Align tube/hose to mating fitting allowing hand connection. To assure proper alignment, two to three turns of nut should be easily permitted.
4. Finger tighten or lightly wrench nut to seat sealing surfaces.
5. Mark nut and adjacent fitting surface to indicate initial seating position. See Fig.JA2.
6. Finish tightening nut by turning the appropriate F.F.T. as indicated in Table JA2.
7. Mark final tightening position on fitting by extending the existing mark from the nut to the adjacent fitting surface. See Fig.JA3.

Table JA2. Flats From Finger Tight Installation Method¹
37 Deg. Tube Fittings

Tube Size	Straight Thread Size	Tube Nut F.F.T.	Swivel Nut F.F.T.
-2	5/16-24	—	—
-3	3/8-24	—	—
-4	7/16-20	2	1.5
-5	1/2-20	2	2
-6	9/16-18	1.5	1.5
-8	3/4-16	1.5	1.25
-10	7/8-14	1.5	1
-12	1 1/16-12	1.25	1
-14	1 3/16-12	1.25	1
-16	1 5/16-12	1	1
-20	1 5/8-12	1	1
-24	1 7/8-12	1	1
-32	2 1/2-12	1	1

1) Recommended for use only when installation by torque method is not practical.

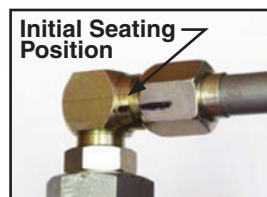


Fig. JA2 Mark Finger Tight Position

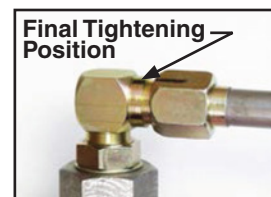


Fig. JA3 Mark Final Tightening Position

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Assembly Instructions for Adjustable O-Ring Port Fittings

1. Inspect components for damage or contamination.
2. Back off locknut from washer.
3. Lubricate O-Ring and threads with light oil or system fluid, install O-Ring in groove on the fitting. See Fig.JA5.
4. Screw stud into the O-Ring port until the washer fully bottoms out on face of the port. See Fig.JA6.
5. Position the fitting as required by backing out (ccw) up to one turn maximum. See Fig.JA7.
6. Maintain fitting orientation with backup wrench while tightening locknut to recommended torque listed in Table JA3. See Fig.JA8

Table JA3. Assembly Torque, SAE J1926-3 Light Duty Stud Ends (Ref. SAE J514 Tube Fittings and Port Plugs)¹

Tube Size	Thread Size	Ft. Lbs.	Nm.
-2	5/16-24	6-7	8-9
-3	3/8-24	7-8	10-11
-4	7/16-20	13-15	18-20
-5	1/2-20	12-21	25-28
-6	9/16-18	22-24	29-33
-8	3/4-16	37-41	50-55
-10	7/8-14	44-49	60-66
-12	1 1/16-12	70-77	95-105
-14	1 3/16-12	92-102	125-138
-16	1 5/16-12	111-221	150-165
-20	1 5/8-12	147-162	200-220
-24	1 7/8-12	155-171	210-231
-32	2 1/2-12	221-243	300-330

1) Lubricated assembly

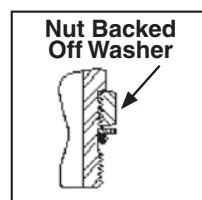


Fig. JA5
Back Off
Nut, Install
Lubricated
O-Ring

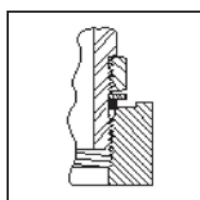


Fig. JA7
Orient Fitting
by Backing
Out Up to
One Turn
Maximum

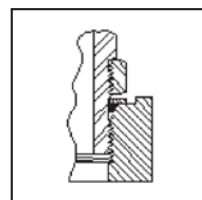


Fig. JA6
Screw Stud
into Port
Until Washer
Bottoms Out
on Port Face

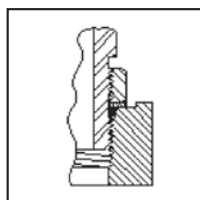


Fig. JA8
Maintain Fitting
Orientation
while Tightening
Locknut to
Recommended
Torque

Assembly Instructions for O-Ring Port Straight Stud Ends

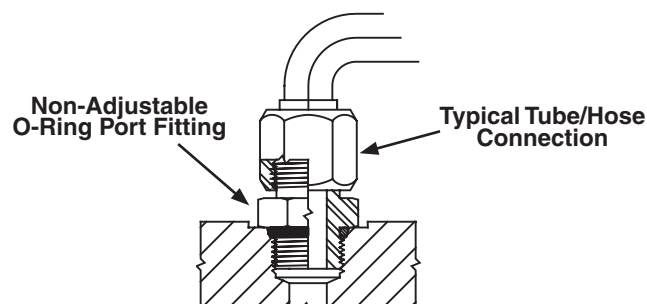


Fig. JA4 Typical Straight Stud End O-Ring Port Installation

1. Inspect components for damage or contamination.
2. Lubricate O-Ring and threads with light oil or system fluid, install O-Ring in groove on the fitting.
3. Screw stud into the O-Ring port and tighten to recommended torque listed in Table JA3.

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Assembly Instructions for NPTF Pipe Fittings

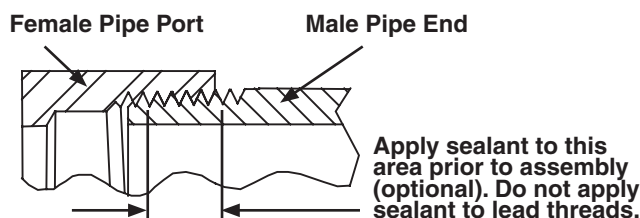


Fig. JA9 NPTF Pipe Assembly

Turns from Finger Tight

1. Inspect components for damage or contamination.
2. Lubricate or apply compatible sealant to male pipe thread.
3. Screw fitting into port and lightly wrench to seat threads.
4. Mark fitting and adjacent surface to indicate initial seating position.
5. For straight fittings, tighten to recommended T.F.F.T. listed in Table JA4. For shape fittings, tighten to minimum recommended T.F.F.T. and turn past to desired orientation. Never loosen to achieve alignment.
6. Mark final tightening position by extending the existing mark from the fitting to the adjacent surface.

Table JA4. Assembly Torque, Adapter Unions and Pipe Fittings (T.F.F.T. for Tapered Pipe Only)¹

Pipe Size	Adapter Unions		Pipe
	Ft. Lbs. Max.	Nm. Max	Tapered Pipe T.F.F.T. ² (Turns)
1/16	—	—	3/4 - 1 3/4
1/8	13	18	3/4 - 1 3/4
1/4	20	27	3/4 - 1 3/4
3/8	25	34	1/2 - 1 1/2
1/2	47	64	1/2 - 1 1/2
3/4	84	114	1/2 - 1 1/2
1	129	175	1/2 - 1 1/2
1 1/4	152	206	1/2 - 1 1/2
1 1/2	152	206	1/2 - 1 1/2
2	300	407	1/2 - 1 1/2

1) Lubricated assembly.

2) Tapered pipe connections use turns from finger tight. Turn past for alignment of shape fittings.

Assembly Instructions for Adapter Unions/ Female NPSM Pipe Swivel Ends

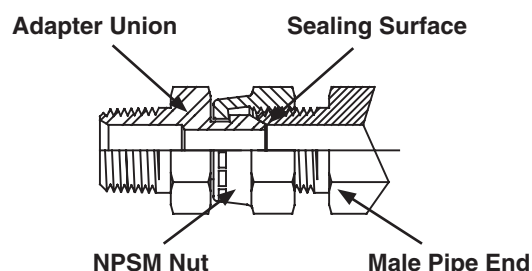


Fig. JA10 Adapter Union Assembly

1. Inspect components for damage or contamination.
2. Check for 30 degree female seat on male pipe end.
3. Lubricate assembly.
4. Align tube/hose to mating swivel allowing hand connection. To assure proper alignment, two to three turns of nut should be easily permitted.
5. Tighten swivel nut to recommended torque listed in Table JA4.

Notes:

1. Refer to the appropriate assembly instruction for adapter union port ends, i.e.: male pipe, female pipe or O-Ring straight thread.
2. Female NPSM pipe swivels seal on the male nose of the female swivel end and the 30 degree female seat on the male pipe end. The NPSM swivel nut uses a straight mechanical pipe thread and is not a sealing member.
3. Ensure that the male pipe end to be assembled has been machined with the optional 30 degree female seat. A standard 45 degree chamfer will not seal properly.

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Technical Data Assembly Instructions

Assembly Instructions for Code 61 and Code 62 - Four Bolt Split Flange Connections

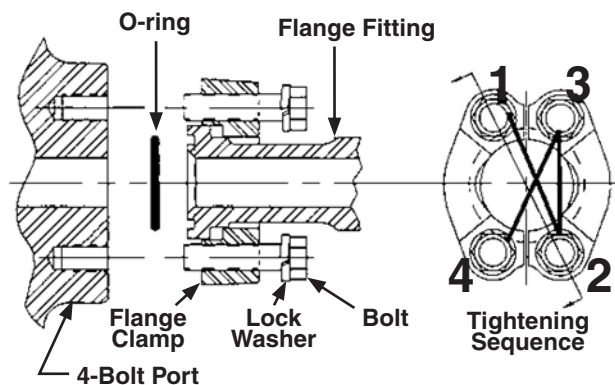


Fig.JA11 Four Bolt Flange Fitting Assembly

1. Inspect components for damage or contamination.
2. Install correct O-Ring in flange groove.
3. Lubricate O-Ring and bolt threads.
4. Align flange and clamp halves to port.
5. Install bolts, hand tighten evenly to seat O-Ring on port face.
6. Gradually tighten bolts in equal increments, alternating in a diagonal pattern, to recommended torque listed in Table JA5 or JA6.