

TUBING - REMOVAL/INSTALLATION

EFFECTIVITY: ALL

1. General

A. Always obey these procedures during the removal/installation of tubes:

- (1) System identification.
- (2) Tubing assembly configuration.

CAUTION: REFER TO THE MAINTENANCE MANUAL INSTRUCTIONS, AND FULLY RELEASE PRESSURE FROM THE APPLICABLE SYSTEM BEFORE YOU START THE REMOVAL OF THE TUBE.

- (3) Tubing material identification.

B. For the tubing removal, obey the necessary precautions to prevent fluid spillage; if it occurs, immediately clean the spillage up ([AMM TASK 12-22-00-600-801-A/300](#)).

WARNING: • **FOR OXYGEN TUBING REMOVAL/INSTALLATION, REFER TO AMM TASK 35-10-00-910-801-A/200 AND AMM TASK 35-10-00-910-803-A/200.**

- **FOR FUEL TUBING REMOVAL/INSTALLATION, REFER TO [AMM TASK 28-00-01-000-801-A/400](#) AND [AMM TASK 28-00-01-400-801-A/400](#).**

C. Serviceable nuts and fitting can be used again after the removal of tubing.

D. For the tubing installation, correctly align the fittings and tubing to permit the nuts to be turned down by hand before the wrench tightening. Do not use fitting nuts to pull tubing and/or fittings into alignment.

E. Use the applicable torque wrench for the correct torque application. If it is necessary to use extensions, the torque wrench must be adjusted to make an allowance for the torque value increase or decrease. Refer to the torque connection method in ([AMM MPP 20-10-01/200](#)).

F. Torque values, when given in the Maintenance Manual tasks, have priority over the torque given in this section.

G. Refer to AMM MPP 06-41-01/100, AMM MPP 06-41-02/100, AMM MPP 06-42-00/100, [AMM MPP 06-43-00/100](#), and [AMM MPP 06-44-00/100](#) for access to the tubes.

H. The procedures in this section are given in the sequence below. The tasks identified with (◆) are part of the Scheduled Maintenance Requirements Document (SMRD).

TASK NUMBER	DESCRIPTION	EFFECTIVITY
20-10-03-000-801-A	TUBING - REMOVAL	ALL
20-10-03-400-801-A	TUBING - INSTALLATION	ALL

TASK 20-10-03-000-801-A

EFFECTIVITY: ALL

2. TUBING - REMOVAL

A. General

(1) This procedure gives the instructions to remove tubes.

B. References

REFERENCE	DESIGNATION
AMM TASK 32-00-01-910-801-A/200	LG SAFETY PIN - INSTALLATION AND REMOVAL

C. Zones and Accesses

Not Applicable

D. Tools and Equipment

Not Applicable

E. Auxiliary Items

Not Applicable

F. Consumable Materials

Not Applicable

G. Expandable Parts

Not Applicable

H. Persons Recommended

QTY	FUNCTION	PLACE
1	Does the task	On damaged tubes

I. Preparation

SUBTASK 841-002-A

- (1) On the Circuit Breaker Panel, open the applicable system circuit breaker and attach a DO-NOT-CLOSE tag to it.
- (2) Make sure that the pressure in the related system is fully released.
- (3) Make sure that the safety pins of the landing gears are installed, when the removal procedure is in this area ([AMM TASK 32-00-01-910-801-A/200](#)).

J. Removal (Figure 401) (Figure 402)

SUBTASK 020-002-A

- (1) Get access to the tube/fitting assembly.
- (2) If applicable, remove the clamps, tube clamp blocks, bonding wires that support the tube to be removed, and, if necessary, the adjacent tube.
- (3) Put a container below the tubing (fluid systems only).

(4) Remove the tubes.

CAUTION: • DO NOT ALLOW LINES OR FITTINGS TO BE WITHOUT CAPS: DIRT CAN CAUSE SYSTEM CONTAMINATION, DAMAGE TO COMPONENTS, AND LEAKAGE.

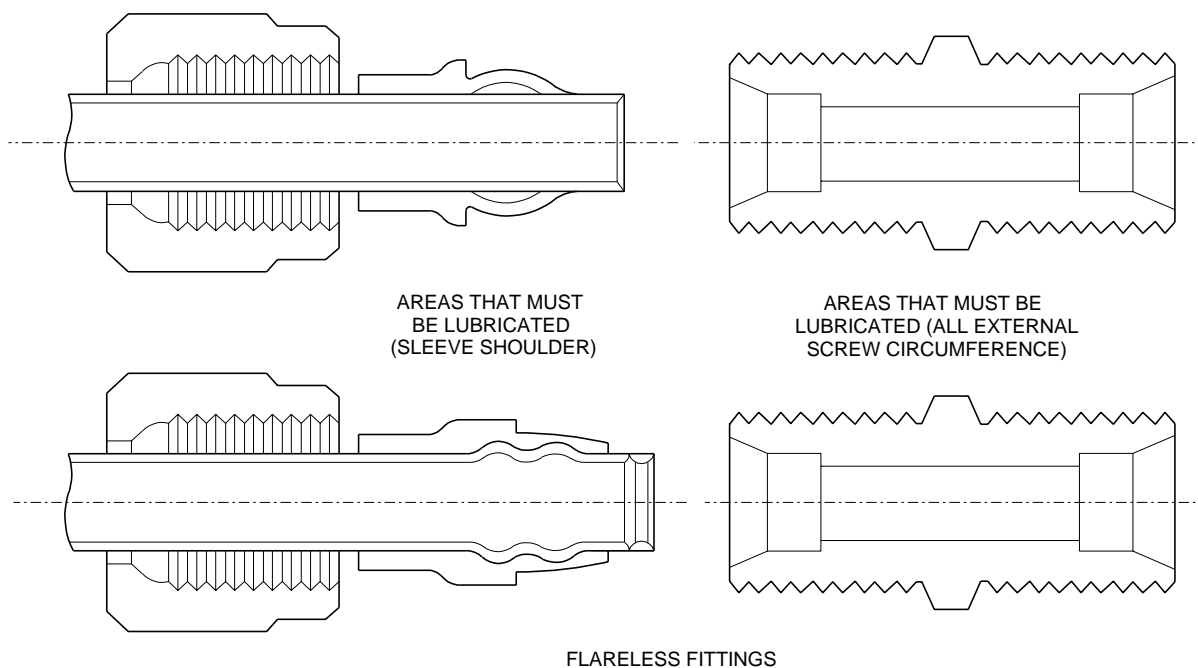
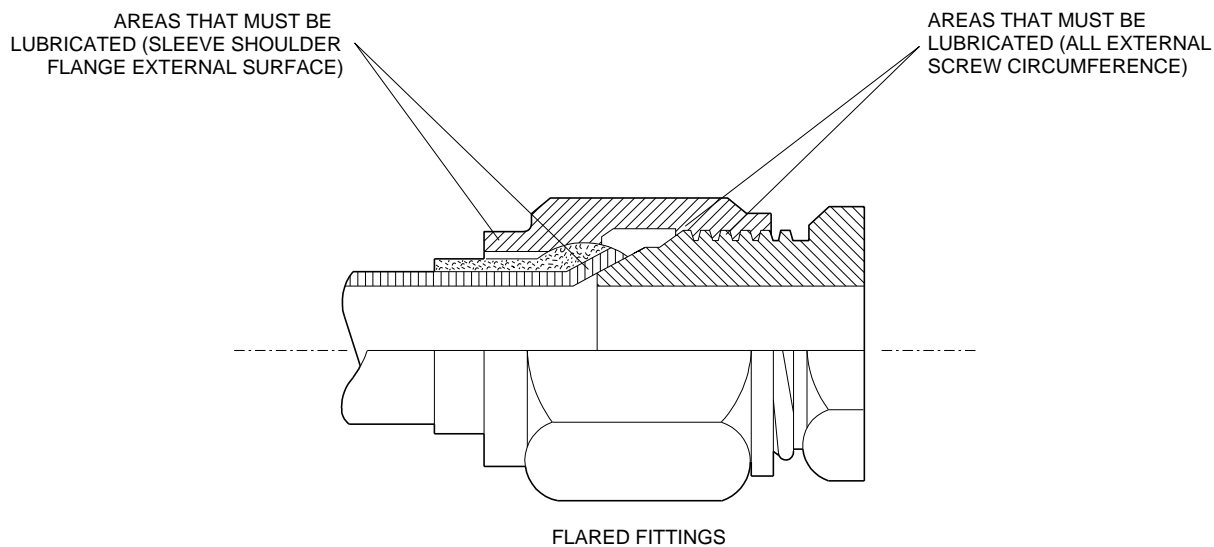
- CLEAN ALL ACCUMULATION OF FLUID FALLEN DOWN.

(5) Install protection caps at the ends of removed tubes and system fittings.

EFFECTIVITY: ALL

Points of Fittings to be Lubricated

Figure 401

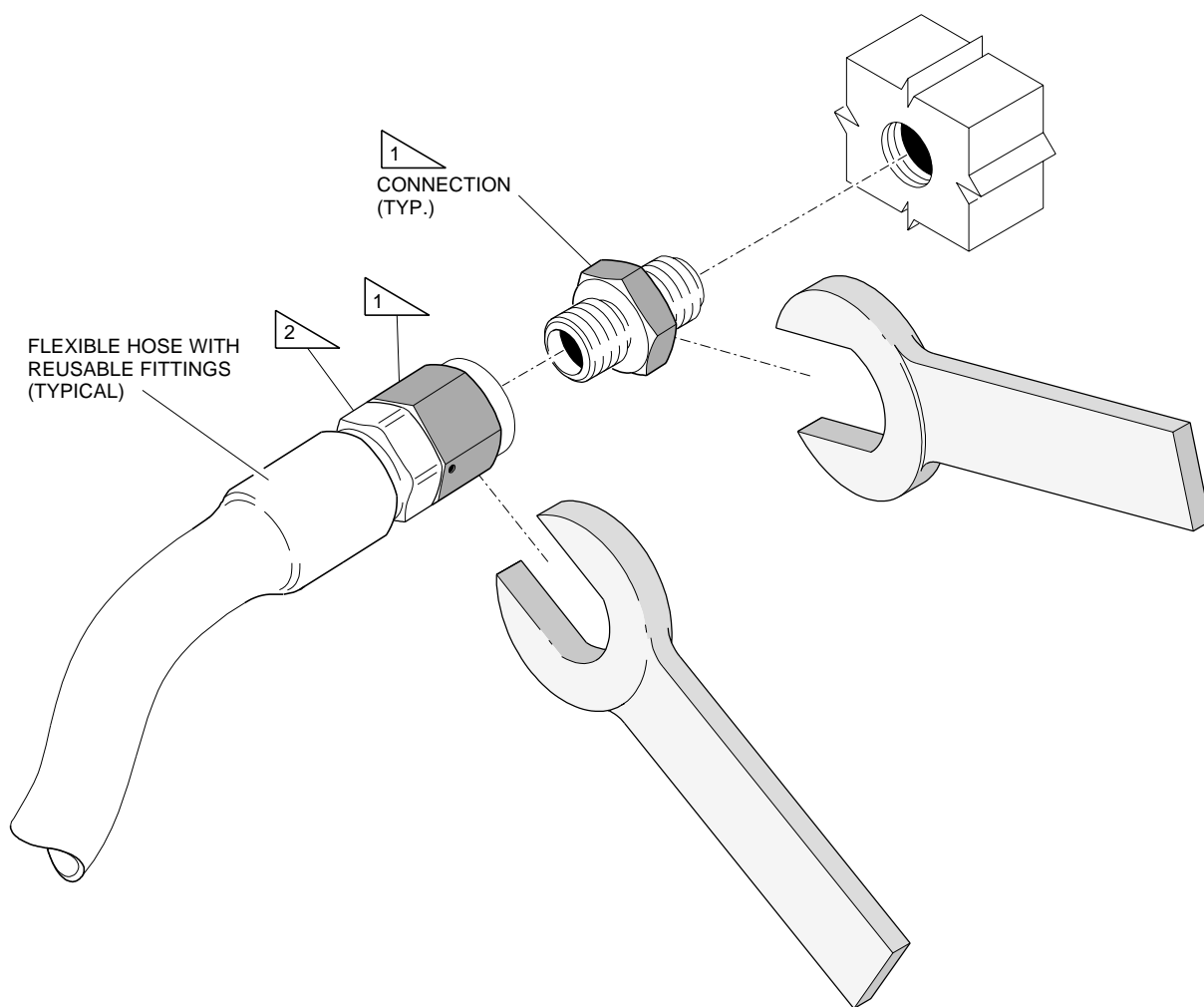


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EFFECTIVITY: ALL

Points of Fitting where to Apply Torque to Tighten Flexible Hoses with Reusable Fittings

Figure 402



1 APPLY REQUIRED TORQUE ONLY TO THE HIGHLIGHTED POINTS.

2 DO NOT APPLY TORQUE TO THIS POINT.

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TASK 20-10-03-400-801-A

EFFECTIVITY: ALL

3. TUBING - INSTALLATION

A. General

(1) This procedure gives the instructions to install the tubes.

B. References

REFERENCE	DESIGNATION
AMM MPP 06-41-01/100	-
AMM MPP 06-42-00/100	-
AMM MPP 06-44-00/100	- COMPONENT LOCATION
AMM TASK 20-13-21-910-802-A/200	ELECTRICAL BONDING PROTECTION - STANDARD PROCEDURES
AMM TASK 29-10-00-860-803-A/200	HYDRAULIC SYSTEM - BLEED OF AIR

C. Zones and Accesses

Not Applicable

D. Tools and Equipment

ITEM	DESCRIPTION	PURPOSE	QTY
Commercially available	Torque wrench (torque ranges - refer to tables 401 and 402)	To install the tubing	
Commercially available	Crowfoot wrenches (Dimensions : 7/16"; 1/2"; 9/16"; 5/8"; 11/16"; 13/16"; 7/8"; 15/16"; 1"; 1 1/16"; 1 1/8"; 1 3/16"; 1 1/4"; 1 5/16"; 1 3/8"; 1 1/2"; 1 5/8"; 1 13/16"; 1 7/8" and 1 15/16")	To install the tubing	
GSE 045	Milliohmmer	To measure the electrical resistance	

E. Auxiliary Items

Not Applicable

F. Consumable Materials

SPECIFICATION (BRAND)	DESCRIPTION	QTY
MIL-G-4343	Pneumatic Grease	AR
TT-M-261	Methyl-ethyl-ketone (MEK)	AR

G. Expandable Parts

Not Applicable

H. Persons Recommended

QTY	FUNCTION	PLACE
1	Does the task	In the repair area

I. Installation (Figure 401) (Figure 402)

SUBTASK 420-002-A

CAUTION: DO NOT TRY TO MAKE A TEFLON HOSE THAT WAS IN SERVICE STRAIGHT AGAIN. TEFLON HOSES CAN GET PERMANENT SETS WHEN EXPOSED TO HIGH PRESSURE OR TEMPERATURE. AN EXCESSIVE BENDING OR TWISTING CAN CAUSE KINKING OR WEAKENING OF THE TUBING WALL.

- (1) Do a check of the tubing for abrasion, kinking, protection, wear, dents, scores, bent, and notches.
- (2) Examine tubing ends, sleeves, and sealing areas of fittings for cleanliness, defects, and contamination that can decrease sealing effectiveness.

CAUTION: DO NOT PERMIT THE PENETRATION OF LUBRICANTS INTO TUBES OR FITTINGS.

- (3) Carefully apply a thin coat of lubricant on the threads of the locking nut and fittings. Refer to item F and Figure 401.
- (4) Put the tubing in the aircraft. Do not apply the final torque to clamps, tubing clamp blocks, and bonding wires, if applicable, to pull the tubing into alignment with the fitting.

NOTE: If the tubing is flexible, carefully prevent kinks as a result of sharp bends or twisting.

- (5) Align the tubes and fittings. Let the tube end stay against the fitting.

CAUTION: TOO MUCH TIGHTENING CAN CAUSE DAMAGE TO THREADS OR MATING PARTS. BEFORE YOU APPLY THE TORQUE, HOLD THE UNION OR FITTING WITH THE CORRECT WRENCH.

- (6) Hold the tube end against and aligned with the fitting. Turn the nut by hand until it touches the sleeve or flange.

- CAUTION:**
- DO NOT USE A TIGHTENING NUT TO PULL THE TUBING INTO ALIGNMENT.
 - DO NOT USE A FLEXIBLE-TUBING-END ADAPTER FOR TORQUE APPLICATION.
 - MAKE SURE THAT THE FLEXIBLE TUBE IS NOT TWISTED BEFORE AND AFTER TORQUE APPLICATION.
 - FOR FLEXIBLE HOSES WITH REUSABLE FITTINGS OF THE TYPE SHOWN IN FIGURE 402, APPLY TORQUE TO THE POINTS SHOWN.

- (7) Hold the union or fitting with the correct wrench and tighten the assembly. Refer to Tables 401, 402, 403, or 404, as applicable, and torque the tightening nut or fitting.

- (8) If it is not possible to use a torque wrench to torque nuts of flareless sleeve tubing, the torque can be applied manually. After that, add a torque of 1/6 to 1/3 (one or two hex flats) turn.
- (9) If applicable, tighten all tubing clamps, tubing clamp blocks, and bonding wires.
- (10) Prepare the surface to install the bonding jumpers as follows:
 - (a) Clean the areas to be bonded with a clean cloth soaked with MEK solvent.
 - (b) Rub the areas with a clean dry cloth before the solvent evaporation.
- (11) Install the bonding jumpers on the hydraulic tubing immediately after the faying surface is cleaned.

CAUTION:

- BONDING OHMIC RESISTANCE IS A VERY IMPORTANT ITEM WHEN THERE IS A LIGHTNING STRIKE.
- MAKE SURE THAT THE CLEARANCE BETWEEN INSTALLED TUBING AND OTHER COMPONENTS (STRUCTURES, WIRING, AND ADJACENT TUBING) IS CORRECT. IT IS NECESSARY TO PREVENT TUBING DAMAGE IN ALL OPERATION CONDITIONS.

- (12) Do the bonding test as follows:
 - (a) Connect the milliohmmeter alligator clip to the nearest ground point given in the table.

Table 401 - GROUND POINTS

GROUND POINTS	ACCESS PANEL/DOOR
Battery-1 negative-cable attachment bracket	Door 113DL (AMM MPP 06-41-01/100)
LH wing-to-stub bonding-jumper attachment bracket	Panel 511AL (AMM MPP 06-44-00/100)
RH wing-to-stub bonding-jumper attachment bracket	Panel 611AR (AMM MPP 06-44-00/100)
APU shunt attachment bracket	Door 312AR (AMM MPP 06-42-00/100)

NOTE: The topics below give details to find the grounding points.

- Battery-1 negative-cable attachment bracket (in the battery compartment).
- LH wing-to-stub bonding-jumper attachment bracket (at the LH-wing leading-edge root). It is necessary to remove the left landing light lens (Panel 511AL) to get access to the bracket.
- RH wing-to-stub bonding-jumper attachment bracket (at the RH-wing leading-edge root). It is necessary to remove the right landing light lens (Panel 611AR) to get access to the bracket.

- APU shunt attachment bracket (in the tail-cone compartment). It is necessary to remove the shunt protection cover to get access to the shunt.
- (b) With the milliohmmeter alligator clip connected to the nearest applicable ground point, put the probe on the bonded hydraulic tube to measure the related resistance.
- (c) The maximum resistance value must be less than 150 milliohms. If the resistance value is greater, remove the bonding jumpers, do steps 9 and 10, then install them and test again.
- (13) Do the corrosion protection of the bonded area. Refer to [AMM TASK 20-13-21-910-802-A/200](#).

J. Follow on

SUBTASK 842-002-A

- (1) Make sure the tube is not be bent.
- (2) Remove all tools, materials, and equipment from the work area.
- (3) Make sure the area is clean.
- (4) On the Circuit Breaker Panel, close the related system circuit breaker, and remove the DO-NOT-CLOSE tag from it.
- (5) Pressurize the related system and do a check for leaks.

NOTE: Most of the hydraulic lines can be pressurized on ground by pressurizing the related hydraulic system (1 or 2). Guidance in the AMM Part I and/or SSM can be used for more determination on the pressurization requirements for the related line. All the safety and preparation procedures must be followed as given in the AMM before you apply the pressurization procedures.

- (6) Do the bleed of the air from the related hydraulic system ([AMM TASK 29-10-00-860-803-A/200](#)).

Table 402 - TIGHTENING TORQUE FOR FLARED FITTING

TUBING SIZE (øD)			TIGHTENING TORQUE (POUNDS X INCHES)			
			TYPE 1		TYPE 2	
			ALUMINUM TUBE OR FLEXIBLE TUBING WITH ALUMINUM FITTING		STEEL & TITANIUM TUBE OR FLEXIBLE TUBING WITH STEEL FITTING ^[1]	
DASH NUMBER	INCHES	MM	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
02	1/8	3.2	20	30	75	85
03	3/16	4.8	25	35	95	105
04	1/4	6.3	50	65	135	150

[1] When aluminum sleeves are used on low pressure steel tubing (500 PSI maximum), torque values must be 20% higher than the values given for aluminum tubing.

Table 402 - TIGHTENING TORQUE FOR FLARED FITTING (Continued)

TUBING SIZE (øD)			TIGHTENING TORQUE (POUNDS X INCHES)			
			TYPE 1		TYPE 2	
			ALUMINUM TUBE OR FLEXIBLE TUBING WITH ALUMINUM FITTING		STEEL & TITANIUM TUBE OR FLEXIBLE TUBING WITH STEEL FITTING ^[1]	
DASH NUMBER	INCHES	MM	MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
05	5/16	7.9	70	90	170	200
06	3/8	9.5	110	130	270	300
08	1/2	12.7	230	260	450	500
10	5/8	15.9	330	360	650	700
12	3/4	19.0	460	500	900	1000
16	1	25.4	500	700	1200	1400
20	1 ¼	31.7	800	900	1520	1680
24	1 ½	38.1	800	900	1900	2100
32	2	50.8	1800	2000	2660	2940

[1] When aluminum sleeves are used on low pressure steel tubing (500 PSI maximum), torque values must be 20% higher than the values given for aluminum tubing.

(7) Table 403 - TIGHTENING TORQUE FOR FLARELESS FITTING

TUBING SIZE (øD)			TIGHTENING TORQUE (POUNDS X INCHES) ±5%		
			TYPE 4 - STAINLESS STEEL AND TI- TANIUM TUBE	TYPE 5 - ALU- MINUM AND ANNEALED STAINLESS STEEL TUBE [1]	TYPE 6 - AL5052 TUBE
			ALL STAIN- LESS STEEL TUBES WITH SIERRACIN SLEEVES	ALUMINUM TUBES WITH SIERRACIN SLEEVES	A15052-0 TUBES WITH MS21922 SLEEVE
			304 1/8H STAINLESS STEEL WITH MS21922	A16061-T6 TUBE AND ANNEALED STAINLESS STEEL TUBE WITH MS21922 SLEEVE	
DASH NUMBER	INCHES	mm	ALL TITANIUM ALLOY TUBES WITH PER- MASWAGE FIT- TINGS	TUBES WITH PERMASW- AGE FIT- TINGS	
03	3/16	4.8	100	80	-
04	1/4	6.3	140	110	110
05	5/16	7.9	190	140	90
06	3/8	9.5	270	170	130
			230 [2]		
08	1/2	12.7	500	280	160
10	5/8	15.9	700	360	240
12	3/4	19.0	900	450	-
16	1	25.4	1200	750	-
20	1 ¼	31.7	1600	900	-
24	1 ½	38.1	2000	900	-

[1] For the specific case of annealed stainless steel tubes dash numbers -6, -10, and -12 with 0.51 mm (0.020 in) wall thickness, tightening torque must be according to Table 404.

[2] The tightening torque value applicable to Permaswage sleeve -6.

Table 404 - SPECIAL TORQUE FOR STAINLESS STEEL TUBES

TUBING SIZE (øD)			WALL THICK- NESS	TIGHTENING TOR- QUE
DASH NUM- BER	INCHES	mm		(POUNDS X INCHES) ±5%

Table 404 - SPECIAL TORQUE FOR STAINLESS STEEL TUBES (Continued)

06	3/8	9.5	0.51 mm (0.020 in)	160
10	5/8	15.9		250
12	3/4	19.0		325

Table 405 - TIGHTENING TORQUE FOR FLARELESS FITTINGS INSTALLED IN
SYSTEM UNITS

TORQUE VALUES FOR FLARELESS FITTINGS USED WITH PACKING				
PREFORMED PACKING			TORQUE (LB.IN) ^[1]	
DASH No. ^[2]	INCHES	MM	MIN.	MAX.
04	1/4	6.3	95	105
05	5/16	7.9	125	135
06	3/8	9.5	155	165
08	1/2	12.7	280	305
10	5/8	15.9	380	405
12	3/4	19.0	550	600
16	1	25.4	800	900

[1] Torque for steel or aluminum flareless fittings.

[2] When the tube dash number is not the same as the packing dash number, apply the torque given for the packing dash number.