SENR3130-19 (en-us)
September 2017

Specifications

Torque Specifications

Important Safety Information

Most accidents that involve product operation, maintenance and repair are caused by failure to observe basic safety rules or precautions. An accident can often be avoided by recognizing potentially hazardous situations before an accident occurs. A person must be alert to potential hazards, including human factors that can affect safety. This person should also have the necessary training, skills and tools to perform these functions properly.

Improper operation, lubrication, maintenance or repair of this product can be dangerous and could result in injury or death.

Do not operate or perform any lubrication, maintenance or repair on this product, until you verify that you are authorized to perform this work, and have read and understood the operation, lubrication, maintenance and repair information.

Safety precautions and warnings are provided in this manual and on the product. If these hazard warnings are not heeded, bodily injury or death could occur to you or to other persons.

The hazards are identified by the “Safety Alert Symbol” and followed by a “Signal Word” such as “DANGER”, “WARNING” or “CAUTION”. The Safety Alert “WARNING” label is shown below.

⚠ WARNING

The meaning of this safety alert symbol is as follows:

Attention! Become Alert! Your Safety is Involved.

The message that appears under the warning explains the hazard and can be either written or pictorially presented.

A non-exhaustive list of operations that may cause product damage are identified by “NOTICE” labels on the product and in this publication.

Caterpillar cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this publication and on the product are, therefore, not all inclusive. You must not use this product in any manner different from that considered by this manual without first satisfying yourself that you have considered all safety rules and precautions applicable to the operation of the product in the location of use, including site-specific rules and precautions applicable to the worksite. If a tool, procedure, work method or operating technique that is not specifically recommended by Caterpillar is used, you must satisfy yourself that it is safe for you and for others. You should also ensure that you are authorized to perform this work, and that the product will not be damaged or become unsafe by the operation, lubrication, maintenance or repair procedures that you intend to use.

The information, specifications, and illustrations in this publication are on the basis of information that was available at the time that the publication was written. The specifications, torques, pressures, measurements, adjustments, illustrations, and other items can change at any time. These changes can affect the service that is given to the product. Obtain the complete and most current information before you start any job. Cat dealers have the most current information available.

⚠ WARNING

When replacement parts are required for this product Caterpillar recommends using Cat replacement parts.

Failure to follow this warning may lead to premature failures, product damage, personal injury or death.

In the United States, the maintenance, replacement, or repair of the emission control devices and systems may be performed by any repair establishment or individual of the owner's choosing.

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General Information

SMCS Code: 7553

⚠ WARNING

Mismatched or incorrect fasteners can result in damage or malfunction, or personal injury.

Take care to avoid mixing metric dimensioned fasteners and inch dimensioned fasteners.

Introduction to Torque

“Torque” is measured in terms of force and distance. Force is the amount of pushing or pulling applied at the end of the lever. Distance is the length of the lever that is being used. Torque values are given in the following units: NEWTON meters (N·m), pound inches (lb in), and pound feet (lb ft)

This manual is intended to provide the operator with a reference. This manual will provide the standard torque settings for the following: bolts, nuts, plugs, fittings, and clamps.

Exceptions to these torques are given in the Service Manual, if necessary.

Be sure to use a torque wrench that has the proper range. Torque wrenches must be used properly in order to ensure that the correct torque is applied. Always use a smooth pull for torque wrenches. Do not jerk a torque wrench. Do not use adapters that change the length of the torque wrench. For the correct use of your torque wrench, refer to the instructions that were packaged with your torque wrench. For more information on the correct use of torque wrenches, refer to Special Publication, SEBV0516, “An Introduction to Torque”. This publication is available on the Caterpillar Media Information Center (CMIC) and through the normal literature distribution system at your local Cat ® dealer.

Prior to installation of any hardware, ensure that components are in near new condition. Bolts and threads must not be worn or damaged. Threads must not have burrs or nicks. Hardware must be free of rust and corrosion. Clean reused fasteners with a noncorrosive cleaner. Lightly lubricate the threads of reused fasteners. Lightly lubricate the mating surface of the head of reused fasteners. Other applications for lubricating fasteners may also be specified in the Service Manual. The Service Manual may also specify the use of sealants and compounds.

Note: Do not use sealants that are not specified in the Service Manual. Do not use compounds that are not specified in the Service Manual. Clean old compound from the bolt and from the hole before installation.

Torque-Turn

The torque-turn method is used when precise control over clamping force is required. There is an initial torque and an additional turn. The initial torque is required to bring all parts of the joint into contact. The additional turn provides the desired clamping force. Ensure that all fasteners have been torqued before you perform the additional turns. Turn the fastener according to the specified amount. The specified amount will normally be equal to or greater than 90°. The specified amount will normally be in 30° increments. Turns of 120° or 180° are preferred. Turns of 120° or 180° are easily measured by the points of the hex head of the fastener. Lubrication may be specified in order to reduce the effort that is required for the final turn. The use of the torque-turn method will allow the following:

- Increase the life of the fastener.
- Maximize the potential clamping force of a fastener.

Typical applications are the following:

- Track bolts
- Sprocket bolts
- Connecting rod bolts
- Engine Cylinder Heads
- Drive Shaft bolts

Note: Too much tension on the bolt will cause the bolt to be stretched beyond the point of yield. The bolt will be permanently stretched. The bolt will loosen the grip on the parts that are being fastened. If the bolt is tightened again, the bolt will break. Do not reuse bolts that have been permanently stretched.

Torque Sequence

Unless the bolt tightening sequence is specified by the Service Manual, the fasteners should be tightened in a cross pattern. Use Step 1 through Step 5 unless the tightening sequence is specified:

1. Hand tighten all fasteners. Larger fasteners may require the use of a small hand wrench.
2. Torque all fasteners to 40% of full torque.
3. Torque all fasteners to 70% of full torque.
4. Torque all fasteners to full torque by using a cross pattern. Large flanges may require additional passes.

5. Apply at least one final full torque to all fasteners in a clockwise direction until all torque is uniform. Large flanges may require additional passes.

Note: Final torque may be a turn.

Torque Marking (Best Practices)

Basic Process

1. Torque all bolts in the joint to a low torque or a snug torque.

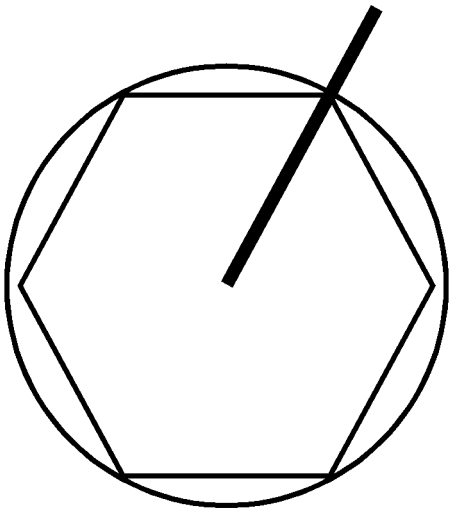

Illustration 1 g06223465

2. Mark bolt head corner to abutment.

3. Tighten bolt to specified torque.

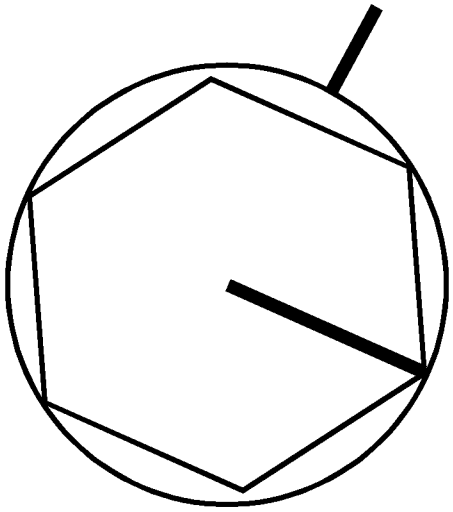

Illustration 2 g06223468

4. Verify that the lines are broken.

Circular Process

1. Torque all bolts in the joint to a low torque or a snug torque.

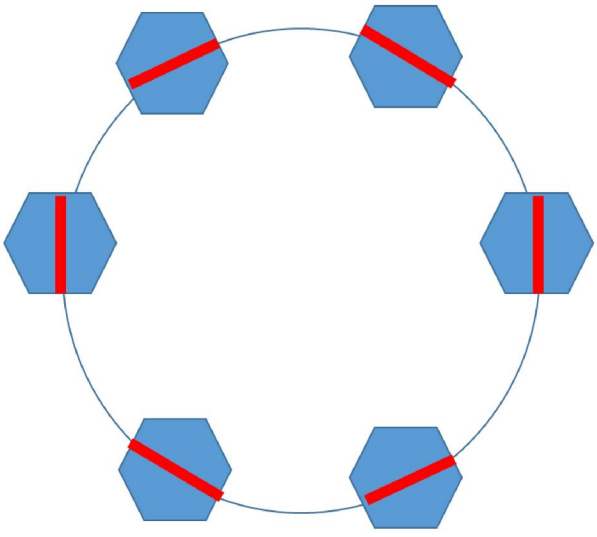

Illustration 3 g06223470

2. Mark bolt heads in a circular pattern.

3. Tighten bolt to specified torque.

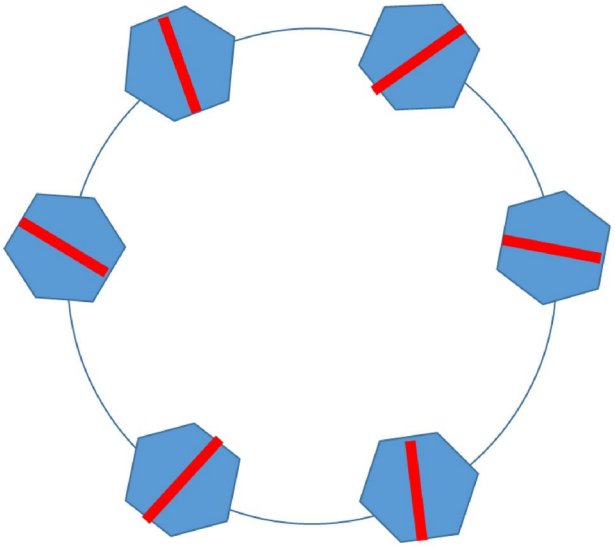

Illustration 4 g06223472

4. Verify that the lines are no longer in a circular pattern.

Torque-Turn

Torque-Turn applies to fasteners that need turned to a set angle after the initial torque is applied.

1. Torque the fastener to the initial torque.

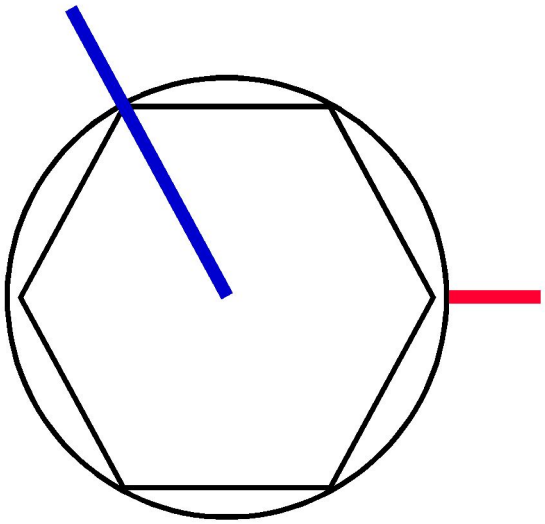

Illustration 5 g06241021

Example of 120° torque angle

2. Mark a line on the fastener and on the abutment.
3. Mark another line in a different color at the required angle on the abutment.
4. Turn the fastener to the appropriate torque angle.

Note: Marking the socket and aligning the mark on the socket with the original starting mark can aide in turning the fastener to the correct angle.

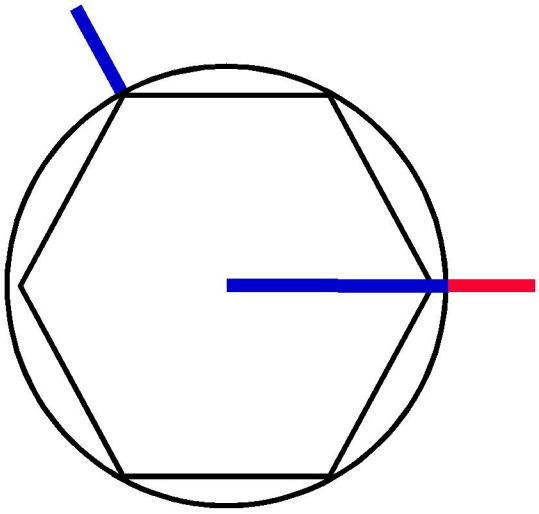

Illustration 6 g06241028

Example of 120° torque angle

5. Verify the mark on the fastener is in-line with the torque angle mark.

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Metric (ISO) Fasteners

SMCS Code: 7553

Metric (ISO) Nuts and Bolts

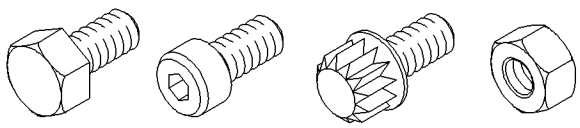

Illustration 7 g00909614

Note: The following table has the recommended standard torque values for metric nuts and bolts for use on all Caterpillar equipment and Mitsubishi engines.

Table 1

Thread Size mm	Torque
M6	12 ± 3 N·m (105 ± 27 lb in)
M8	28 ± 7 N·m (250 ± 62 lb in)
M10	55 ± 10 N·m (41 ± 7 lb ft)
M12	100 ± 20 N·m (75 ± 15 lb ft)
M14	160 ± 30 N·m (120 ± 22 lb ft)
M16	240 ± 40 N·m (175 ± 30 lb ft)
M20	460 ± 60 N·m (340 ± 44 lb ft)
M24	800 ± 100 N·m (590 ± 75 lb ft)
M30	1600 ± 200 N·m (1180 ± 150 lb ft)
M36	2800 ± 350 N·m (2060 ± 260 lb ft)

Note: The following table has the recommended standard torque values for metric nuts and bolts for use on Perkins engines.

Table 2

Thread Size mm	Torque
M6	5 N·m (44 lb in)
M8	22 N·m (195 lb in)
M10	44 N·m (32 lb ft)
M12	78 N·m (60 lb ft)
M14	124 N·m (90 lb ft)
M16	177 N·m (130 lb ft)
M18	200 N·m (150 lb ft)
M20	400 N·m (300 lb ft)
M24	790 N·m (580 lb ft)

Note: The difference between Caterpillar standard torque values and Perkins standard torque values are due to different classes of fasteners. Caterpillar uses class 10.9 fasteners. Perkins uses class 8.8 fasteners. The different class of fasteners have different tensile strengths.

Metric (ISO) Machine Screws

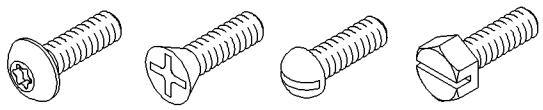

Illustration 8 g00908932

Table 3

Thread Size mm	Torque
M2.5	0.40 ± 0.10 N·m (3.5 ± 0.9 lb in)
M3	0.70 ± 0.15 N·m (6.2 ± 1.3 lb in)
M4	1.70 ± 0.40 N·m (15.1 ± 3.5 lb in)
M5	3.30 ± 0.70 N·m (29.2 ± 6.2 lb in)

Hex Button Head Screw and Set Screws

Illustration 9 g01186742

Table 4

Thread Size mm	Torque
M3	.6 ± .1 N·m (5 ± 0.9 lb in)
M4	2 ± .3 N·m (18 ± 3 lb in)
M5	4 ± .5 N·m (35 ± 4 lb in)
M6	6 ± 1 N·m (55 ± 9 lb in)
M8	15 ± 2 N·m (135 ± 18 lb in)
M10	30 ± 7 N·m (265 ± 62 lb in)
M12	50 ± 10 N·m (37 ± 7 lb ft)
M14	80 ± 15 N·m (60 ± 11 lb ft)
M16	125 ± 20 N·m (90 ± 15 lb ft)
M20	250 ± 40 N·m (185 ± 30 lb ft)

(continued)

(Table 4, contd)

M24	425 ± 50 N·m (310 ± 37 lb ft)
M30	850 ± 100 N·m (620 ± 75 lb ft)
M36	1500 ± 200 N·m (1100 ± 150 lb ft)

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English (SAE) Fasteners

SMCS Code: 7553

English (SAE) Nuts and Bolts

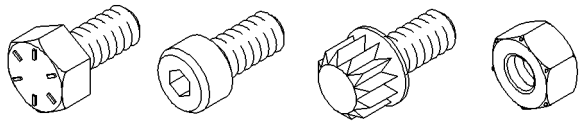

Illustration 10 g00908911

Table 5

Thread Size Inch	Torque
1/4	12 ± 3 N·m (105 ± 27 lb in)
5/16	25 ± 6 N·m (220 ± 53 lb in)
3/8	47 ± 9 N·m (35 ± 7 lb ft)
7/16	70 ± 15 N·m (50 ± 11 lb ft)
1/2	105 ± 20 N·m (75 ± 15 lb ft)
9/16	160 ± 30 N·m (120 ± 22 lb ft)
5/8	215 ± 40 N·m (160 ± 30 lb ft)
3/4	370 ± 50 N·m (275 ± 37 lb ft)
7/8	620 ± 80 N·m (460 ± 60 lb ft)
1	900 ± 100 N·m (660 ± 75 lb ft)
1 1/8	1300 ± 150 N·m (960 ± 110 lb ft)
1 1/4	1800 ± 200 N·m (1320 ± 150 lb ft)
1 3/8	2400 ± 300 N·m (1780 ± 220 lb ft)
1 1/2	3100 ± 350 N·m (2280 ± 260 lb ft)

English (SAE) Machine Screws

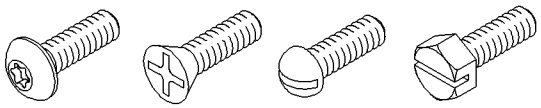

Illustration 11 g00908932

Table 6

Thread Size No.	Torque
No. 4 (.112)	**0.50 ± 0.10 N·m (4.4 ± 0.9 lb in)**
No. 5 (.125)	**0.70 ± 0.15 N·m (6.2 ± 1.3 lb in)**
No. 6 (.138)	**0.90 ± 0.20 N·m (8.0 ± 1.8 lb in)**
No. 8 (.164)	**1.70 ± 0.40 N·m (15.0 ± 3.5 lb in)**
No. 10 (.190)	**2.30 ± 0.50 N·m (20.4 ± 4.4 lb in)**
No 12 (.216)	3.40 ± 0.70 N·m (30.1 ± 6.2 lb in)

Hex Button Head Screw and Set Screws

Illustration 12 g01186972

Table 7

Thread Size inch	Torque
# 4 & #5	.6 ± .1 N·m (5 ± 0.9 lb in)
#6 & #8	2 ± .3 N·m (18 ± 3 lb in)
#10 & #12	4 ± .5 N·m (35 ± 4 lb in)
1/4	6 ± 1 N·m (55 ± 9 lb in)
5/16	13 ± 3 N·m (115 ± 27 lb in)
3/8	25 ± 6 N·m (220 ± 53 lb in)
7/16	40 ± 8 N·m (20 ± 6 lb ft)
1/2	60 ± 12 N·m (44 ± 9 lb ft)
9/16	85 ± 15 N·m (65 ± 11 lb ft)

(continued)

(Table 7, contd)

5/8	115 ± 20 N·m (85 ± 15 lb ft)
3/4	200 ± 40 N·m (150 ± 30 lb ft)
7/8	325 ± 40 N·m (240 ± 30 lb ft)
1	500 ± 65 N·m (370 ± 48 lb ft)
1 1/8	700 ± 90 N·m (520 ± 65 lb ft)
1 1/4	1000 ± 125 N·m (740 ± 90 lb ft)
1 3/8	1300 ± 150 N·m (960 ± 110 lb ft)
1 1/2	1700 ± 200 N·m (1260 ± 150 lb ft)

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Ground Engaging Tool (G.E.T.) Fasteners

SMCS Code: 7553

Ground Engaging Tools (G.E.T.) are secured by many types of bolts. Refer to Table 8 for the correct torque for the following combinations of fasteners for G.E.T.:

- Plow bolts and nuts
- Hex head bolts and nuts

Table 8

Thread Size Inch	Torque(1)	
	N·m	lb ft
5/8 inch	270 ± 40	200 ± 30
3/4 inch	475 ± 60	350 ± 45
7/8 inch	750 ± 90	550 ± 65
1 inch	1150 ± 150	850 ± 110
1 1/4 inch	2300 ± 300	1700 ± 220

(1) These values are only for Caterpillar bolts for cutting edges.

⚠ WARNING

Personal injury can result when installing plow bolts. The appropriate safety equipment must be worn when striking the plow bolts. To avoid injury to your eyes and ears, wear protective glasses and hearing protection during this procedure.

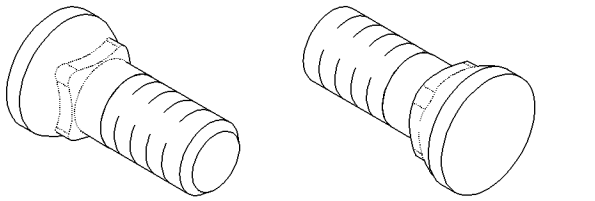

Illustration 13 g00909058

View of a typical plow bolt

Plow bolts must be installed properly. Refer to the following procedure for the correct installation of plow bolts.

1. Clean all surfaces that contact the bolt. Remove all occurrences of the following conditions:rust, paint, nicks and burrs
2. Tighten the nut to the correct torque. Refer to Table 8 for the correct torque.
3. Use a hammer to strike the head of the bolt. The bolt must be struck with significant force.

Note: The head of the bolt may be recessed below the mounting surface. Use a suitable punch in order to transfer the hammer blow to the bolt head.

4. Tighten the nut to the correct torque. Refer to Table 8 for the correct torque.

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Installation of Fittings

SMCS Code: 7553

Note: The tightening sequence of the threaded adapters that attaches a tube assembly or hose assembly to the machine is critical to the proper function of the machine. The sealing surfaces of the tube assembly or hose assembly should be secured squarely. The sealing surfaces of the tube assembly or hose assembly should be tightened to the serviced component (control valve, cylinder, hydraulic motor, etc.). Perform this procedure prior to the final tightening of any clamps or clips that are used in order to fasten the tube assembly or the hose assembly to the machine.

Fittings have different connections. Fittings may have two different ends. Be sure to use the proper torque for the end of the fitting that is used. The following list contains some common types of fittings.

Protective caps and plugs should not be removed until the connector is ready to be assembled. All sealing surfaces should be free of contamination and damage. If a connector is damaged before or after assembly, it should be replaced.

- Straight Thread O-Ring (STOR)

- O-Ring Face Seal (ORFS)
- Tapered Pipe Thread (NPT and NPTF)
- 37 Degree Flare Fitting
- 45 Degree Flare Fitting
- Inverted Flare Fitting
- Hydraulic Four Bolt Flange

Installation of Hydraulic Four Bolt Flange

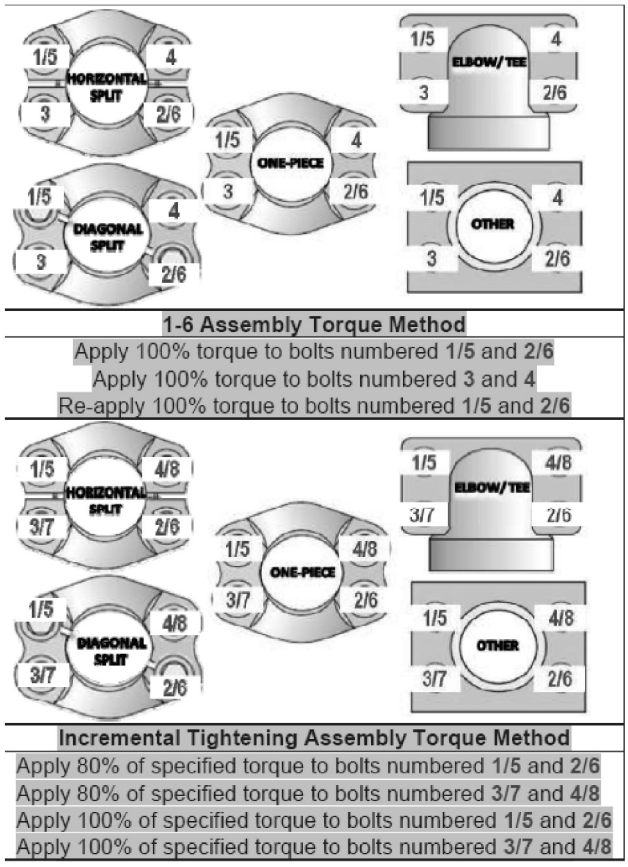

Illustration 14 g02724217

1. Position the flanges parallel over the port.

2. Evenly install bolts hand-tight, keeping the gap between flanges at a minimum.

3. Put the hose in a position so that the hose does not contact the machine or with another hose.

4. Tighten using one of the assembly torque values for bolts, used in Illustration 14 for proper torque sequence of various flange fittings.

5. Start the engine.

6. Move the implement control levers to all of the positions.

7. Look at the hose during movement of the implement. Ensure that the hose is not in contact with the machine or with other hoses.

Note: For hoses that cross an articulation hitch, check for contact during articulation. For hoses that connect to the steering system, check for contact during steering.

8. Shut off the engine.

9. If the hose contacts other hoses or the machine during the test, loosen the bolts and reposition the hose. Repeat steps 3 through 8 until there is no contact.

Installation of Adjustable STOR Fittings

This type of fitting is used in many applications. One end of the fitting will be an adjustable STOR fitting. The other end will be different. Always use the same installation procedure for the STOR end. Adjustable STOR fittings can be positioned before tightening.

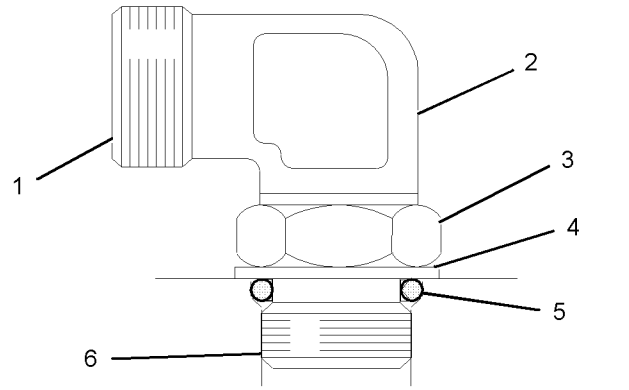

Illustration 15 g01848653

Elbow body assembly

(1) End that connects to the tube or hose
(2) Fitting body
(3) Locknut
(4) Backup washer
(5) O-ring seal
(6) End that is assembled to the mating part

1. Put locknut (3), backup washer (4) and O-ring seal (5) as far away from the threads as possible. Hold these components in this position. Turn the fitting into the mating part. Turn the fitting until backup washer (4) contacts the surface of the mating part.

Note: Excessive use of the wrench will distort the washer. Distortion of the washer will prevent proper sealing.

2. Put the fitting assembly in the correct position. loosen fitting (2) until the correct assembly position is achieved. Do not loosen the fitting more than 360 degrees. Install the tube or hose hand tight in order to verify the orientation of the fitting. Tighten the fitting (2) to the torque that is shown in the correct chart for the fitting that is used. Tighten locknut (3) to the torque that is shown in the correct chart for the fitting that is used. Use a backup wrench, when the locknut is tightened.

Note: Torque the fitting prior to the locknut.

Note: If the fitting is not adjustable, the hex on the body replaces the locknut. To install this type of fitting, tighten the hex against the face of the mating part.

Excessive tightening of the connectors can cause failure. Connectors that are under tightened can also cause failures. The following failures occur:

- Excessive tightening can expand a loose ferrule into the nut. This will cause the ferrule to lock up in the nut and the nut will not function properly.
- Excessive tightening can split the nut on the end of the tube or can split the ferrule.
- Excessive tightening can gall or excessive tightening can strip the threads of the nut.

Note: If the above conditions occur due to excessive tightening, the damaged fluid connector must be scrapped and the fluid connectors must be replaced.

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Straight Thread O-Ring Fittings

SMCS Code: 7553

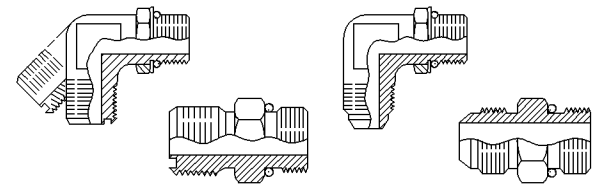

Illustration 16 g00911924

Note: For torques for plugs, refer to Specifications, “Plugs”.

Note: Straight Thread O-Ring fittings for medium pressure usage will have shorter threaded ends than high-pressure fittings. The torque value for medium pressure Straight Thread O-Ring fittings will be lower than the torque values that are required for Straight Thread O-Ring fittings for high-pressure fittings.

Table 9

Ferrous Straight Thread O-Ring Fitting Torques for Mating with Ferrous Materials Medium Pressure use Fittings		
Nominal Outer Diameter of the Tube	**Thread Size Inch**	**Standard Torque**
3.18 mm (0.125 inch)	5/16 - 24	10 ± 2 N·m (89 ± 18 lb in)
4.76 mm (0.188 inch)	3/8 - 24	13 ± 2 N·m (115 ± 18 lb in)
6.35 mm (0.250 inch)	7/16 - 20	30 ± 5 N·m (266 ± 44 lb in)
7.94 mm (0.312 inch)	1/2 - 20	30 ± 5 N·m (266 ± 44 lb in)
9.52 mm (0.375 inch)	9/16 - 18	40 ± 6 N·m (30 ± 4 lb ft)
12.70 mm (0.500 inch)	3/4 - 16	80 ± 12 N·m (59 ± 9 lb ft)
15.88 mm (0.625 inch)	7/8 - 14	110 ± 17 N·m (81 ± 13 lb ft)
19.05 mm (0.750 inch)	1 1/16 - 12	130 ± 20 N·m (96 ± 15 lb ft)
22.22 mm (0.875 inch)	1 3/16 - 12	200 ± 30 N·m (148 ± 22 lb ft)

(continued)

(Table 9, contd)

Ferrous Straight Thread O-Ring Fitting Torques for Mating with Ferrous Materials Medium Pressure use Fittings		
Nominal Outer Diameter of the Tube	**Thread Size Inch**	**Standard Torque**
25.40 mm (1.000 inch)	1 5/16 - 12	180 ± 27 N·m (133 ± 20 lb ft)
31.75 mm (1.250 inch)	1 5/8 - 12	300 ± 45 N·m (221 ± 33 lb ft)
38.10 mm (1.500 inch)	1 7/8 - 12	350 ± 53 N·m (258 ± 39 lb ft)
50.80 mm (2.000 inch)	2 1/2 - 12	420 ± 63 N·m (310 ± 46 lb ft)

Note: Use 50 percent of the torque values from Table 9 when the fitting or the port material is nonferrous.

Note: Straight Thread O-Ring fittings for high-pressure usage will have longer threaded ends than medium pressure fittings. The torque value for high-pressure Straight Thread O-Ring fittings will be higher than the torque values that are required for Straight Thread O-Ring fittings for medium pressure fittings.

Table 10

Ferrous Straight Thread O-Ring Fittings Torques for Mating with Ferrous Materials High Pressure use Fittings		
Nominal Outer Diameter of the Tube	**Thread Size Inch**	**Standard Torque**
4.76 mm (0.188 inch)	3/8 - 24	20 ± 3 N·m (177 ± 27 lb in)
6.35 mm (0.250 inch)	7/16 - 20	30 ± 5 N·m (266 ± 44 lb in)
7.94 mm (0.312 inch)	1/2 - 20	45 ± 7 N·m (33 ± 5 lb ft)
9.52 mm (0.375 inch)	9/16 - 18	55 ± 8 N·m (41 ± 6 lb ft)
12.7 mm (0.500 inch)	3/4 - 16	100 ± 15 N·m (74 ± 11 lb ft)
15.88 mm (0.625 inch)	7/8 - 14	140 ± 21 N·m (103 ± 15 lb ft)
19.05 mm (0.750 inch)	1 1/16 - 12	220 ± 33 N·m (162 ± 24 lb ft)
22.22 mm (0.875 inch)	1 3/16 - 12	260 ± 39 N·m (192 ± 29 lb ft)
25.40 mm (1.000 inch)	1 5/16 - 12	350 ± 53 N·m (258 ± 39 lb ft)

(continued)

(Table 10, contd)

31.75 mm (1.250 inch)	1 5/8 -12	400 ± 60 N·m (295 ± 44 lb ft)
38.10 mm (1.500 inch)	1 7/8 - 12	420 ± 63 N·m (310 ± 46 lb ft)
50.80 mm (2.000 inch)	2 1/2 - 12	500 ± 75 N·m (369 ± 55 lb ft)

Note: Use 50 percent of the torque values from Table 10 when the fitting or the port material is nonferrous.

Table 11

Metric Ferrous Straight Thread O-Ring Fittings Torques for Mating with Ferrous Materials Medium Pressure use Fittings		
Ref Nominal Outer Diameter of the Tube	**Thread Size**	**Standard Torque Tolerance**
4 mm	M8 X 1	10 ± 2 N·m (89 ± 18 lb in)
5 mm	M10 X 1	17 ± 3 N·m (150 ± 27 lb in)
6 mm	M12 X 1.5	30 ± 5 N·m (266 ± 44 lb in)
8 mm	M14 X 1.5	35 ± 5 N·m (26 ± 4 lb ft)
10 mm	M16 X 1.5	45 ± 7 N·m (33 ± 5 lb ft)
12 mm	M18 X 1.5	50 ± 8 N·m (37 ± 6 lb ft)
16 mm	M22 X 1.5	80 ± 12 N·m (59 ± 9 lb ft)
20 mm	M27 X 2	120 ± 18 N·m (89 ± 13 lb ft)
22 mm	M30 X 2	160 ± 24 N·m (118 ± 18 lb ft)
25 mm	M33 X 2	180 ± 27 N·m (133 ± 20 lb ft)
30 mm	M42 X 2	260 ± 39 N·m (192 ± 29 lb ft)
38 mm	M48 X 2	300 ± 45 N·m (221 ± 33 lb ft)
50 mm	M60 X 2	350 ± 53 N·m (258 ± 39 lb ft)

Note: Use 50 percent of the torque values from Table 11 when the fitting or the port material is nonferrous.

Table 12

Metric Ferrous Straight Thread O-Ring Fittings Torques for Mating with Ferrous Materials High Pressure use Fittings		
Ref Nominal Outer Diameter of the Tube	**Thread Size**	**Standard Torque Tolerance**
5 mm	M10 X 1	20 ± 3 N·m (177 ± 27 lb in)
6 mm	M12 X 1.5	40 ± 6 N·m (30 ± 4 lb ft)
8 mm	M14 X 1.5	50 ± 8 N·m (37 ± 6 lb ft)
10 mm	M16 X 1.5	60 ± 9 N·m (44 ± 7 lb ft)
12 mm	M18 X 1.5	80 ± 12 N·m (59 ± 9 lb ft)
16 mm	M22 X 1.5	140 ± 21 N·m (103 ± 15 lb ft)
20 mm	M27 X 2	220 ± 33 N·m (162 ± 24 lb ft)
22 mm	M30 X 2	260 ± 39 N·m (192 ± 29 lb ft)
25 mm	M33 X 2	350 ± 53 N·m (258 ± 39 lb ft)
30 mm	M42 X 2	400 ± 60 N·m (295 ± 44 lb ft)
38 mm	M48 X 2	420 ± 63 N·m (310 ± 46 lb ft)
50 mm	M60 X 2	500 ± 75 N·m (369 ± 55 lb ft)

Note: Use 50 percent of the torque values from Table 12 when the fitting or the port material is nonferrous.

i05212431

Plugs

SMCS Code: 7553

Straight Thread O-Ring Plugs

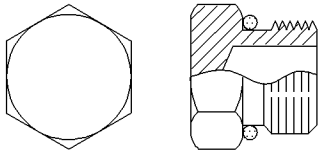

Illustration 17 g00911999

Table 13

Ferrous Straight Thread O-Ring Plug Torques for Mating with Ferrous Materials		
Thread Size Inch	**Internal Hex Plug Torque**	**External Hex Plug Torque**
5/16	7 ± 1 N·m (62 ± 9 lb in)	13 ± 2 N·m (115 ± 18 lb in)
3/8	13 ± 2 N·m (115 ± 18 lb in)	20 ± 3 N·m (177 ± 27 lb in)
7/16	20 ± 3 N·m (177 ± 27 lb in)	40 ± 6 N·m (30 ± 4 lb ft)
1/2	25 ± 4 N·m (221 ± 35 lb in)	45 ± 7 N·m (33 ± 5 lb ft)
9/16	45 ± 7 N·m (33 ± 5 lb ft)	60 ± 9 N·m (44 ± 7 lb ft)
3/4	80 ± 12 N·m (59 ± 9 lb ft)	100 ± 15 N·m (74 ± 11 lb ft)
7/8	110 ± 17 N·m (81 ± 13 lb ft)	130 ± 20 N·m (96 ± 15 lb ft)
1 1/16	180 ± 27 N·m (133 ± 20 lb ft)	220 ± 33 N·m (162 ± 24 lb ft)
1 3/16	220 ± 33 N·m (162 ± 24 lb ft)	260 ± 39 N·m (192 ± 29 lb ft)
1 5/16	300 ± 45 N·m (221 ± 33 lb ft)	350 ± 53 N·m (258 ± 39 lb ft)
1 5/8	350 ± 53 N·m (258 ± 39 lb ft)	400 ± 60 N·m (295 ± 44 lb ft)
1 7/8	420 ± 63 N·m (310 ± 46 lb ft)	420 ± 63 N·m (310 ± 46 lb ft)
2 1/2	500 ± 75 N·m (369 ± 55 lb ft)	500 ± 75 N·m (369 ± 55 lb ft)

Note: Use 50 percent of the torque values from Table 13 when the fitting or the port material is nonferrous.

Table 14

Metric Ferrous Straight Thread O-Ring Plug Torques for Mating with Ferrous Materials		
Thread Size Metric	**Internal Hex Plug Torque**	**External Hex Plug Torque**
M8	10 ± 2 N·m (89 ± 18 lb in)	10 ± 2 N·m (89 ± 18 lb in)
M10	17 ± 3 N·m (150 ± 27 lb in)	20 ± 3 N·m (177 ± 27 lb in)
M12	25 ± 4 N·m (221 ± 35 lb in)	35 ± 5 N·m (26 ± 4 lb ft)
M14	45 ± 7 N·m (33 ± 5 lb ft)	45 ± 7 N·m (33 ± 5 lb ft)
M16	55 ± 8 N·m (41 ± 6 lb ft)	55 ± 8 N·m (41 ± 6 lb ft)
M18	70 ± 11 N·m (52 ± 8 lb ft)	90 ± 13 N·m (66 ± 10 lb ft)
M20	80 ± 12 N·m (59 ± 9 lb ft)	110 ± 17 N·m (81 ± 13 lb ft)
M22	100 ± 15 N·m (74 ± 11 lb ft)	130 ± 20 N·m (96 ± 15 lb ft)
M27	180 ± 27 N·m (133 ± 20 lb ft)	220 ± 33 N·m (162 ± 24 lb ft)
M30	220 ± 33 N·m (162 ± 24 lb ft)	260 ± 39 N·m (192 ± 29 lb ft)
M33	300 ± 45 N·m (221 ± 33 lb ft)	350 ± 53 N·m (258 ± 39 lb ft)
M42	350 ± 53 N·m (258 ± 39 lb ft)	400 ± 60 N·m (295 ± 44 lb ft)
M48	420 ± 63 N·m (310 ± 46 lb ft)	420 ± 63 N·m (310 ± 46 lb ft)
M60	500 ± 75 N·m (369 ± 55 lb ft)	500 ± 75 N·m (369 ± 55 lb ft)

Note: Use 50 percent of the torque values from Table 14 when the fitting or the port material is nonferrous.

Drain Plugs with Straight Threads

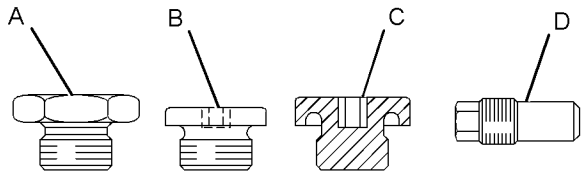

Illustration 18 g01848045

Note: Plug (A), plug (B) and plug (C) are used with a gasket. Conical seal plug (D) does not use a gasket.

Table 15

Type of Plug	Thread Size Inch	Torque
A	1/2 - 13	20 ± 3 N·m (177 ± 27 lb in)
	5/8 - 11	35 ± 5 N·m (26 ± 4 lb ft)
	3/4 - 12 3/4 - 16	50 ± 8 N·m (37 ± 6 lb ft)
	7/8 - 14 1 1/8 - 12	70 ± 11 N·m (52 ± 8 lb ft)
B	1 5/16 - 12 1 1/2 - 12	90 ± 13 N·m (66 ± 10 lb ft)
	2 - 12	130 ± 20 N·m (96 ± 15 lb ft)
C	1 1/8 - 12	70 ± 11 N·m (52 ± 8 lb ft)
	1 5/16 - 12	90 ± 13 N·m (66 ± 10 lb ft)
D	1/2 - 20	13 ± 2 N·m (115 ± 18 lb in)
	7/8 -14	55 ± 8 N·m (41 ± 6 lb ft)
	1 3/8 -13	90 ± 13 N·m (66 ± 10 lb ft)
	1 1/2 - 12	110 ± 17 N·m (81 ± 13 lb ft)

Note: Use 50 percent of the torque values from Table 15 when the fitting or the port material is nonferrous.

i05213389

O-Ring Face Seal Fittings

SMCS Code: 7553

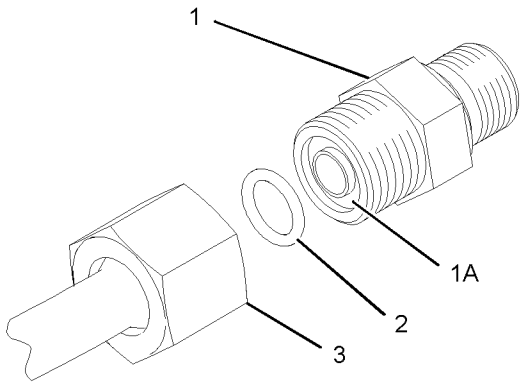

Illustration 19 g01848710

O-ring face seal fitting (ORFS fitting)

(1) O-ring face seal connector
(1A) O-ring groove
(2) O-ring seal
(3) Nut for the O-ring face seal

Table 16

Ferrous ORFS Fitting	
Thread Size Inch	**Torque**
9/16 - 18	27 ± 4 N·m (239 ± 35 lb in)
11/16 - 16	45 ± 5 N·m (33 ± 4 lb ft)
13/16 - 16	65 ± 10 N·m (48 ± 7 lb ft)
1 - 14	110 ± 17 N·m (81 ± 13 lb ft)
1 13/16 - 12	140 ± 21 N·m (103 ± 15 lb ft)
1 7/16 - 12	220 ± 33 N·m (162 ± 24 lb ft)
1 11/16 - 12	300 ± 45 N·m (221 ± 33 lb ft)
2 - 12	350 ± 53 N·m (258 ± 39 lb ft)

Note: Use 50 percent of the torque values from Table 16 when the fitting or the port material is nonferrous.

i05213391

Bulkhead Nuts

SMCS Code: 7553

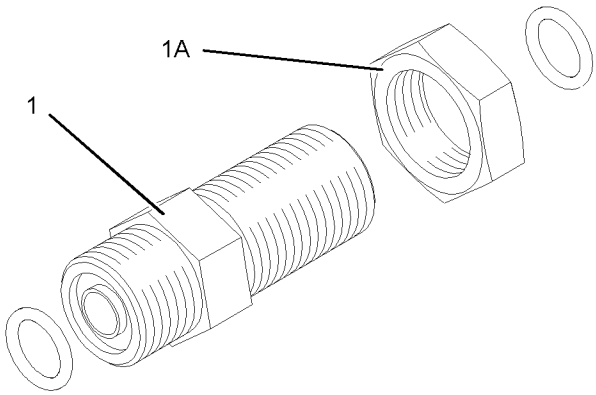

Illustration 20 g01848733

(1) Bulkhead connector
(1A) Bulkhead nut

Note: The bulkhead connector may have different connections. The type of fluid connection does not affect the torque for nut (1A).

Note: When you assemble the fluid connection, do not use the bulkhead nut (1A) as leverage for a backup wrench. Use the hex on the body (1) of the connector for leverage.

Table 17

Thread Size Inch	Torque for O-ring Face Bulkhead Nuts
9/16	45 ± 7 N·m (33 ± 5 lb ft)
11/16	80 ± 12 N·m (59 ± 9 lb ft)
13/16	100 ± 15 N·m (74 ± 11 lb ft)
1	130 ± 20 N·m (96 ± 15 lb ft)
1 3/16	180 ± 27 N·m (133 ± 20 lb ft)
1 7/16	350 ± 53 N·m (258 ± 39 lb ft)
1 11/16	420 ± 63 N·m (310 ± 46 lb ft)
2	500 ± 75 N·m (369 ± 55 lb ft)

Table 18

Thread Size Inch	Torque for 37 degree Flare Bulkhead Nuts
5/16	13 ± 2 N·m (115 ± 18 lb in)
3/8	17 ± 3 N·m (150 ± 27 lb in)
7/16	30 ± 5 N·m (266 ± 44 lb in)

(continued)

(Table 18, contd)

1/2	35 ± 5 N·m (26 ± 4 lb ft)
9/16	40 ± 6 N·m (30 ± 4 lb ft)
3/4	70 ± 11 N·m (52 ± 8 lb ft)
7/8	100 ± 15 N·m (74 ± 11 lb ft)
1 1/16	160 ± 24 N·m (118 ± 18 lb ft)
1 3/16	180 ± 27 N·m (132 ± 20 lb ft)
1 5/16	260 ± 39 N·m (192 ± 29 lb ft)
1 5/8	350 ± 53 N·m (258 ± 39 lb ft)
1 7/8	400 ± 60 N·m (295 ± 44 lb ft)
2 1/2	500 ± 75 N·m (369 ± 55 lb ft)

i05213411

Flare Fittings

SMCS Code: 7553

The torques in Table 19 are for 37 degree flare fittings. The torques in Table 20 are for 45 degree flare fittings and 45 degree inverted flare fittings.

37 Degree Flare Fittings

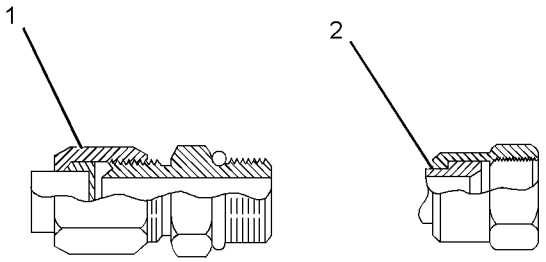

Illustration 21 g01848048

(1) 37 degree flare fitting
(2) Swivel nuts

Table 19

Nuts for 37 Degree Flare Fittings		
Nominal Outer Diameter of the Tube	**Thread Size Inch**	**Standard Torque**
3.18 mm (0.125 inch)	5/16 - 24	10 ± 2 N·m (89 ± 18 lb in)
4.76 mm (0.188 inch)	3/8 - 24	13 ± 2 N·m (115 ± 18 lb in)
6.35 mm (0.250 inch)	7/16 - 20	20 ± 3 N·m (177 ± 27 lb in)
7.94 mm (0.312 inch)	1/2 - 20	25 ± 4 N·m (221 ± 35 lb in)
9.52 mm (0.375 inch)	9/16 - 18	30 ± 5 N·m (266 ± 44 lb in)
12.70 mm (0.500 inch)	3/4 - 16	60 ± 9 N·m (44 ± 7 lb ft)
15.88 mm (0.625 inch)	7/8 - 14	90 ± 13 N·m (66 ± 10 lb ft)
19.05 mm (0.750 inch)	1 1/16 - 12	120 ± 18 N·m (89 ± 13 lb ft)
22.22 mm (0.875 inch)	1 3/16 - 12	130 ± 20 N·m (96 ± 15 lb ft)
25.40 mm (1.000 inch)	1 5/16 - 12	160 ± 24 N·m (118 ± 18 lb ft)
31.75 mm (1.250 inch)	1 5/8 - 12	260 ± 39 N·m (192 ± 29 lb ft)
38.10 mm (1.500 inch)	1 7/8 - 12	260 ± 39 N·m (192 ± 29 lb ft)
50.80 mm (2.000 inch)	2 1/2 - 12	350 ± 53 N·m (258 ± 39 lb ft)

Note: Use 50 percent of the torque values from Table 19 when the fitting or the port material is nonferrous.

45 Degree Flare and Inverted Flare Fittings

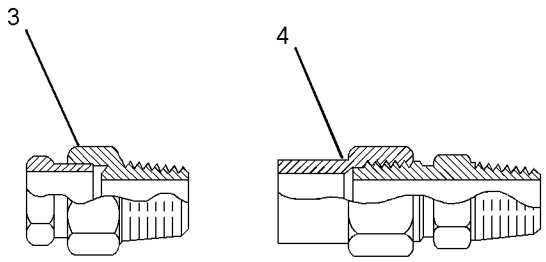

Illustration 22 g03335997

(3) Inverted Flare Fittings
(4) 45 Degree Flare Fittings

Table 20

45 Degree Flare Fittings and 45 Degree Inverted Flare Fittings		
Nominal Outer Diameter of the Tube	**Thread Size Inch**	**Standard Torque**
3.18 mm (0.125 inch)	5/16	7 ± 1 N·m (62 ± 9 lb in)
4.76 mm (0.188 inch)	3/8	10 ± 2 N·m (89 ± 18 lb in)
6.35 mm (0.250 inch)	7/16	13 ± 2 N·m (115 ± 18 lb in)
7.94 mm (0.312 inch)	1/2	20 ± 3 N·m (177 ± 27 lb in)
9.52 mm (0.375 inch)	5/8	35 ± 5 N·m (26 ± 4 lb ft)
11.11 mm (0.438 inch)	11/16	35 ± 5 N·m (26 ± 4 lb ft)
12.70 mm (0.500 inch)	3/4	40 ± 6 N·m (30 ± 4 lb ft)
15.88 mm (0.625 inch)	7/8	55 ± 8 N·m (41 ± 6 lb ft)
19.05 mm (0.750 inch)	1 1/16	100 ± 15 N·m (74 ± 11 lb ft)
22.22 mm (0.875 inch)	1 1/4	110 ± 17 N·m (81 ± 13 lb ft)

i05215253

Air Conditioning Fittings

SMCS Code: 7553

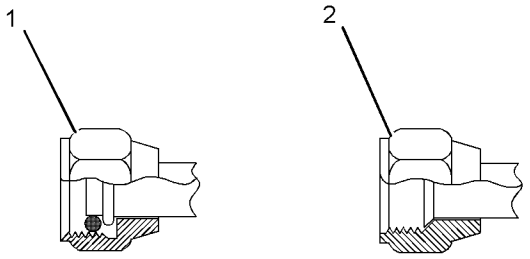

Illustration 23 g01848052

(1) O-ring seal
(2) 45 degree flare fitting

Table 21

Air Conditioning Fittings			
Thread Size Inch	**O-Ring Fitting End**	**45 Degree Flare Fitting End**	
	Torque	**Torque for Steel Tubes**	**Torque for Aluminum Tubes**
5/8	13 ± 2 N·m (115 ± 18 lb in)	30 ± 5 N·m (266 ± 44 lb in)	25 ± 4 N·m (221 ± 35 lb in)
3/4	25 ± 4 N·m (221 ± 35 lb in)	50 ± 8 N·m (37 ± 6 lb ft)	35 ± 5 N·m (26 ± 4 lb ft)
7/8 1	40 ± 6 N·m (30 ± 4 lb ft)	60 ± 9 N·m (44 ± 7 lb ft)	40 ± 6 N·m (30 ± 4 lb ft)
1 1/16	45 ± 7 N·m (33 ± 5 lb ft)	70 ± 11 N·m (51 ± 8 lb ft)	50 ± 8 N·m (37 ± 6 lb ft)

Table 22

Quick Disconnect Air Conditioning Fittings	
Thread Size Inch	**Torque**
7/8	45 ± 7 N·m (33 ± 5 lb ft)
1 1/4	60 ± 9 N·m (44 ± 7 lb ft)

i04562529

Air Brake Fittings

SMCS Code: 7553

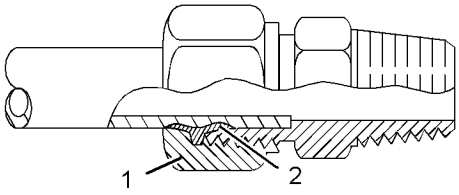

Illustration 24 g01848737

Put nut (1) and sleeve (2) over the tube. Push the tube into the counterbore of the fitting body as far as possible. There are two methods that may be used to tighten the nut. Tighten the nut with one of two methods.

- Tighten nut (1) to the torque that is specified in Table 23 .
- Tighten nut (1) by the number of turns that is specified in Table 23 . The number of turns is for the turns after the nut is finger tight.

Table 23

Nominal Outer Diameter of the Tube	Torque	Turn Tightening	
		Nonmetallic Tubing	Copper Tubing
6.35 mm (0.250 inch)	11 ± 3 N·m (97 ± 27 lb in)	3	2
9.53 mm (0.375 inch)	20 ± 3 N·m (175 ± 27 lb in)	4	2
12.70 mm (0.500 inch)	35 ± 6 N·m (26 ± 4 lb ft)	4	2
15.88 mm (0.625 inch)	40 ± 6 N·m (30 ± 4 lb ft)	3 1/2	3
19.05 mm (0.750 inch)	50 ± 6 N·m (37 ± 4 lb ft)	3 1/2	3

Note: Clean the connectors and the seals and lubricate the connectors and seals by using Refrigerant Mineral Oil. This is a special oil that is compatible with R−134a.

i06542139

Tapered Pipe Thread Fittings

SMCS Code: 7553

Torque is based on the diameter of the thread. The torque values are identical for coarse threads and fine threads.

Note: The following table has the recommended standard torque value for tapered pipe thread fitting for use on all Caterpillar equipment and Mitsubishi engines. Use Table 24 as a general recommendation only. Actual values may vary due to variations in the material of the connector. Actual values may vary due to variations in the characteristics of the threads.

Table 24

Tapered Pipe Thread Fittings		
Diameter of the Pipe Thread (Inch)	Standard Torque	
	Assembly Turns after Hand Tight	Torque
1/16	2	10 ± 2 N·m (89 ± 18 lb in)
1/8	2	17 ± 3 N·m (150 ± 27 lb in)
1/4	2	25 ± 4 N·m (221 ± 35 lb in)
3/8	2	40 ± 6 N·m (30 ± 4 lb ft)
1/2	2	55 ± 8 N·m (41 ± 6 lb ft)
3/4	2	70 ± 11 N·m (52 ± 8 lb ft)
1	1 1/2	100 ± 15 N·m (74 ± 11 lb ft)
1 1/4	1 1/2	110 ± 17 N·m (81 ± 13 lb ft)
1 1/2	1 1/2	120 ± 18 N·m (89 ± 13 lb ft)
2	1 1/2	160 ± 24 N·m (118 ± 18 lb ft)

Note: Use 50 percent of the torque values from Table 24 when fitting, plug, or the port material is nonferrous.

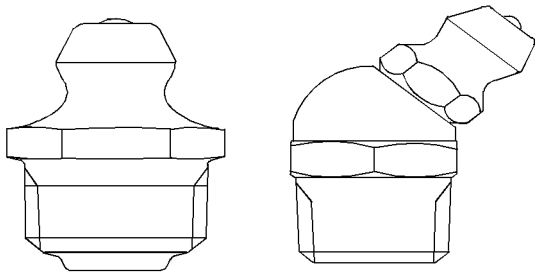

Illustration 25 g06015417

Table 25

Grease Fittings (Zerk Fittings)		
Diameter of the Pipe Thread (Inch)	**Assembly Turns after Hand Tight**	**Torque**
1/8–27 PTF Special Short	Torque Values Specified in Table 24	
1/8–27 NPTF		
1/4–28 SAE-LT	8.5 ± 1 N·m (75.23 ± 8.85 lb in)	6 N·m (53.11 lb in)

Note: Torque values listed above are recommended when assembling a steel fitting to a steel port. Other materials require additional validation.

1. Torque values for tapered external pipe threads (e. g., NPT, NPTF, BSPT) mated with NPSF or BSPP straight internal pipe threads shall use 50% of the value and tolerance shown in Table 24 . Values for NPSM connections are shown in Table 24 .

Note: “Turns After Hand Tight” method shall not be used for straight internal pipe threads.

2. Apply thread sealant to male tapered pipe threads, unless one of the following conditions exists:

- Connector is a lubrication (grease) connector.
- Connector is used in non water-cooled exhaust-related engine parts.
- On pipe threads which have pre-applied sealants.

Connector is mated with an NPSM swivel nut.

3. Hand-tighten swivel nut/connector to connector/port.

4. Apply assembly torque by using the "Assembly Turns after Hand Tight" values or the "Dynamic Assembly Torque" values from Table 24 .

5. One clockwise rotation past the "Maximum Assembly Torque" is allowed for orientation.

i04563054

Miscellaneous Fittings

SMCS Code: 7553

Hi Duty Tube Fittings (Shear Sleeve)

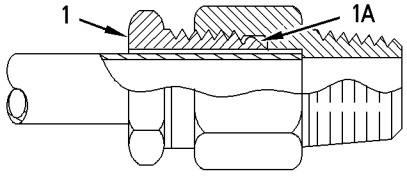

Illustration 26 g00909648

Put nut (1) over the tube and push the tube into the counterbore of the fitting body as far as possible. Turn the nut with a wrench until a small decrease in torque is felt. The small decrease in torque indicates that the sleeve (1A) has been broken off the nut. Hold the tube in order to prevent the tube from turning. Tighten the nut for an additional 1 1/2 turns.

SAE Flareless Fittings

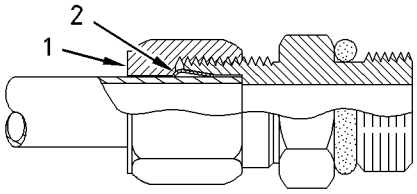

Illustration 27 g00909647

Installing a New Flareless Fitting

Put nut (1) and sleeve (2) over the tube. The head end of the sleeve should be next to the nut. The head end has a shoulder. The nut will be seated against this shoulder when the nut is tightened. Push the tube into the counterbore of the fitting body as far as possible. Turn nut (1) clockwise until the sleeve grips the tube. The sleeve must prevent all movement of the tube. Tighten the nut for an additional 1 1/4 turns. The sleeve should be seated and the sleeve should give a locking action.

Installing a Used Flareless Fitting

Less turns are required for a used fitting. Put nut (1) and sleeve (2) over the tube. The head of the sleeve should be next to the nut. Push the tube into the counterbore of the fitting body as far as possible. Tighten the nut until a sudden increase in torque is felt. Next, tighten the fitting for an additional 1/6 to 1/3 turn in order to seat the sleeve.

Flex Fittings

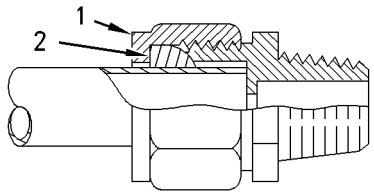

Illustration 28 g00909645

Put nut (1) and sleeve (2) over the tube and push the tube into the counterbore of the fitting body as far as possible. Tighten the nut until the nut is against the hex part of the fitting body.

i06704854

Hose Clamps

SMCS Code: 7553

Worm Drive Band Type Clamps

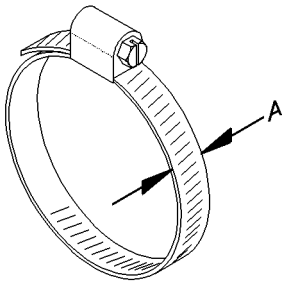

Illustration 29 g00910017

Table 26

Width (A) of Clamp	Torque for New Hose
7.5 mm (0.3 inch) or greater	1.4 ± 0.3 N·m (12 ± 3 lb in)
12 mm (0.5 inch) or greater	4.5 ± 0.7 N·m (40 ± 6 lb in)

(continued)

(Table 26, contd)

Width (A) of Clamp	Torque for New Hose
14 mm (0.6 inch) or greater	7.5 ± 1 N·m (66 ± 9 lb in)
Width (A) of Clamp	**Torque for Reused Hose(1)**
7.5 mm (0.3 inch) or greater	0.8 ± 0.3 N·m (7 ± 3 lb in)
12 mm (0.5 inch) or greater	3.0 ± 0.5 N·m (27 ± 4 lb in)
14 mm (0.6 inch) or greater	4.5 ± 0.7 N·m (40 ± 6 lb in)

(1) Use this value when the hose is reused. The clamp may be new or reused.

Constant Torque Hose Clamps

Use a constant torque hose clamp in place of any worm drive band type clamp. Ensure that the constant torque hose clamp is the same size as the worm drive band type clamp. Due to extreme temperature changes, the hose will heat set. Heat setting can cause worm drive band type clamps to loosen. Loose hose clamps can result in leaks. There have been reports of component failures that have been caused by worm drive band type clamps that have loosened. The constant torque hose clamp will help prevent these failures.

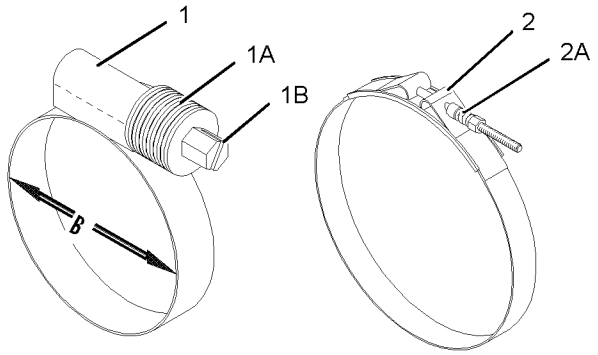

Illustration 30 g03076961

(1) Constant Torque Hose Clamp (Belleville Washer)
(2) Constant Torque Hose Clamp (Tee bolt and Spring)

Use a torque wrench for proper installation of all constant torque hose clamps. There are two types of constant torque hose clamps: Belleville washer (1) and Tee bolt and spring (2)

When the constant torque hose clamp (Belleville washer) (1) is assembled correctly, the Belleville washers (1A) are nearly collapsed flat. The proper torque for screw (1B) is based on the diameter (B) of the clamp. Refer to the following table for the correct torque.

Table 27

Constant Torque Hose Clamps		
Clamp Type	**Diameter (B)**	**Standard Torque**
Constant Torque Hose Clamp (Belleville Washer) (1)	Up to 50.8 mm (2 inch)	7.5 ± 1 N·m (65 ± 10 lb in)
	Greater than 50.8 mm (2 inch)	11 ± 1 N·m (95 ± 10 lb in)
Constant Torque Hose Clamp (Tee bolt and Spring) (2)	N/A	7.5 ± 1 N·m (65 ± 10 lb in)

Wave Liner Clamps

The wave liner worm drive clamp is a clamp with a special liner. this liner has a "v grove" that causes greater pressure points on the hose. This greater compression will offer better sealing capability at the hose connection.

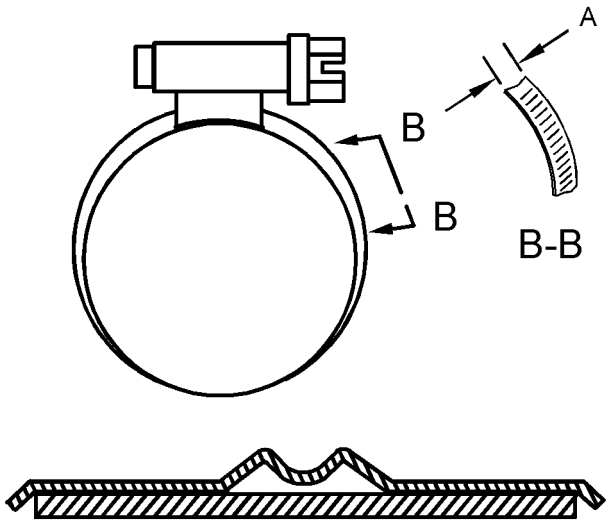

Illustration 31 g03869499

Table 28

Width (A) of Clamp	Torque for New Hose
14 mm (0.6 inch) or greater	7.5 ± 1 N·m (66.4 ± 8.9 lb in)

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Tie Rods

SMCS Code: 4318

Locking nuts used to orient rod assemblies shall be torqued according to the torque specifications in the chart below.

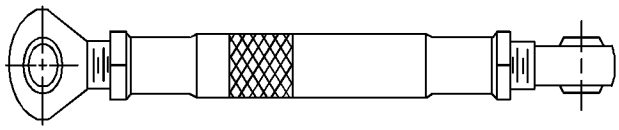

Illustration 32 g03876778

Table 29

Tie Rods		
Thread Size Metric	**Thread Size Inch**	**Dynamic Torque Values These Values Apply to the Jam Nuts on Swaged Tube Assemblies**
M5	No. 10 (.190)	4.5 ± 1 N·m (40 ± 9 lb in)
M6	1/4	6 ± 1 N·m (53 ± 9 lb in)
M8	5/16	7 ± 1 N·m (62 ± 9 lb in)
M10	3/8	10 ± 2 N·m (88.5 ± 17.7 lb in)
-	7/16	17 ± 3.4 N·m (150.5 ± 30.1 lb in)
M12	1/2	20 ± 4 N·m (177 ± 35 lb in)
M14	9/16	25 ± 5 N·m (221 ± 44 lb in)
M16	5/8	25 ± 5 N·m (221 ± 44 lb in)
M18	11/16	35 ± 7 N·m (25.8 ± 5.2 lb ft)
	3/4	35 ± 7 N·m (25.8 ± 5.2 lb ft)
M20	13/16	40 ± 8 N·m (29.5 ± 5.9 lb ft)
M22	7/8	45 ± 9 N·m (33.2 ± 6.6 lb ft)
M24	1	60 ± 12 N·m (44.3 ± 8.9 lb ft)
M27	1 1/16	40 ± 14 N·m (29.5 ± 10.3 lb ft)
M30	1 3/16	80 ± 16 N·m (59.0 ± 11.8 lb ft)
M33	1 5/16	110 ± 22 N·m (81.1 ± 16.2 lb ft)

(continued)

(Table 29, contd)

M36	1-7/16	120 ± 24 N·m (88.5 ± 17.7 lb ft)
M40	1 5/8	140 ± 28 N·m (103.3 ± 20.7 lb ft)
M42	1-11/16	160 ± 32 N·m (118.0 ± 23.6 lb ft)
M48	1 7/8	180 ± 36 N·m (132.8 ± 26.6 lb ft)
M50	2	200 ± 40 N·m (147.5 ± 29.5 lb ft)
M64	2 1/2	220 ± 44 N·m (162.3 ± 32.5 lb ft)

i06269753

Cable

SMCS Code: 5154

To prevent undesired assembly twisting use two wrenches. Use one wrench as a torque wrench and the other wrench as a backup wrench. Using two wrenches, hold the assembly in the desired position to prevent assembly movement and tighten the locknut suing the values from the figure below.

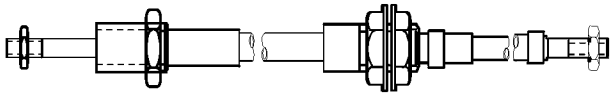

Illustration 33 g03876780

Table 30

Cable		
Thread Size Metric	**Thread Size Inch**	**Standard Torque Use 50% if the Torque Values Listed When the Hub Fitting is Nonferrous**
M5x0.8	10-32	4.5 ± 1 N·m (39.8 ± 8.9 lb in)
M6x1	1/4-28	6 ± 1 N·m (53.1 ± 8.9 lb in)
M8x1.25	5/16-24	7 ± 1.4 N·m (62 ± 12.4 lb in)
M10x1.5	3/8-24	10 ± 2 N·m (88.5 ± 17.7 lb in)
	7/16-20 or 7/16-28	17 ± 3 N·m (150.5 ± 26.6 lb in)

(continued)

(Table 30, contd)

M12x1.75	1/2-20	18 ± 3 N·m (159.3 ± 26.6 lb in)
M14x2	9/16-12 or 9/16-18	27 ± 3 N·m (239.0 ± 26.6 lb in)
M16x2	5/8-18	27 ± 3 N·m (239.0 ± 26.6 lb in)
M18x1.5	11/16-16	35 ± 5 N·m (25.8 ± 3.7 lb ft)
	3/4-16	35 ± 5 N·m (25.8 ± 3.7 lb ft)
M20x2.5	13/16-16	40 ± 5 N·m (29.5 ± 3.7 lb ft)
M22x2.5	7/8-14 or 7/8-20	45 ± 5 N·m (33.2 ± 3.7 lb ft)
M24x3	1-14	60 ± 6 N·m (44.3 ± 4.4 lb ft)

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