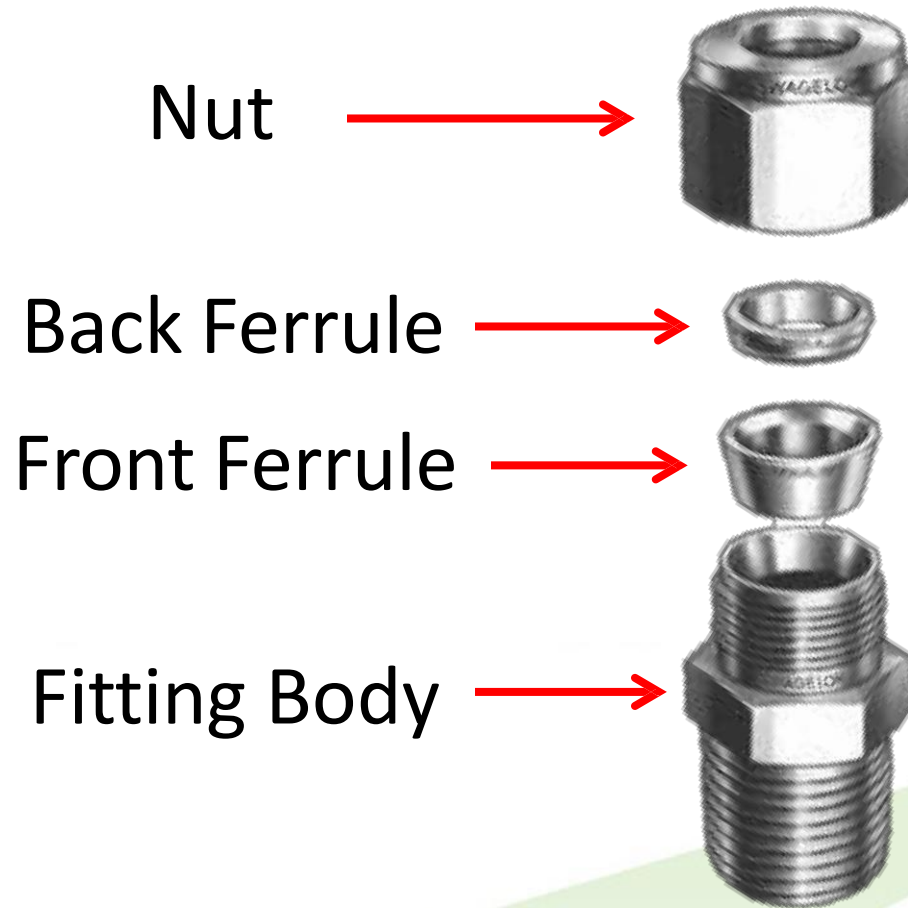


# Swagelok Tube Fittings



# Fitting Components

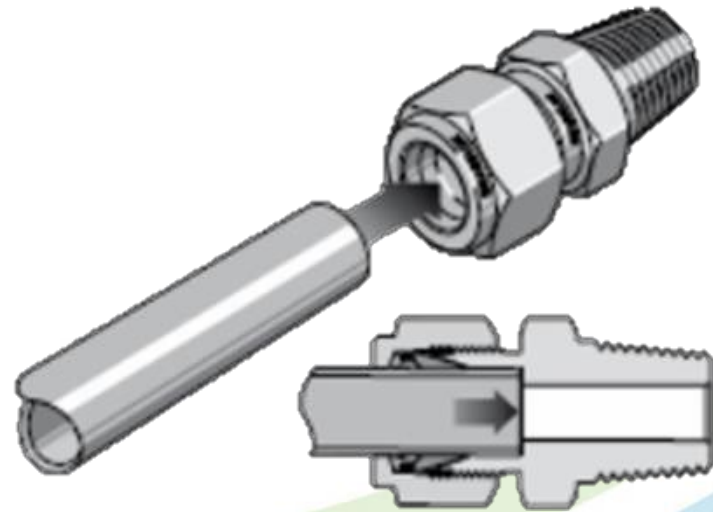


**Ferrule**; a ring or cap, typically a metal one, that strengthens the end of a handle, stick, or tube and prevents it from splitting or wearing.

# Swagelok Tube Fittings

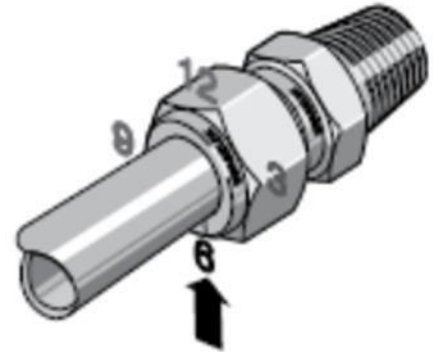
These instructions apply both to traditional fittings and to fittings with the advanced back-ferrule geometry.

- Fully insert the tube into the fitting and against the shoulder; rotate the nut finger-tight.
- High-pressure applications and high safety-factor systems:
- Further tighten the nut until the tube will not turn by hand or move axially in the fitting.



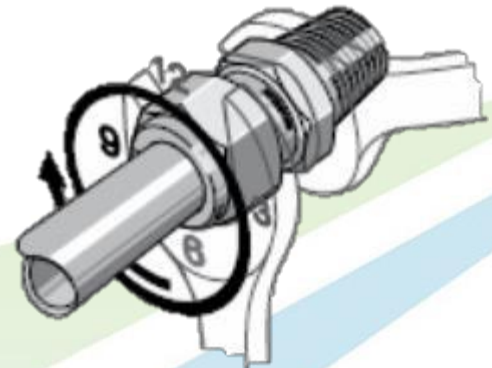
# Swagelok Tube Fittings

Mark the nut at the 6 o'clock position.



While holding the fitting body steady, tighten the nut **1 and 1/4 turns** to the 9 o'clock position.

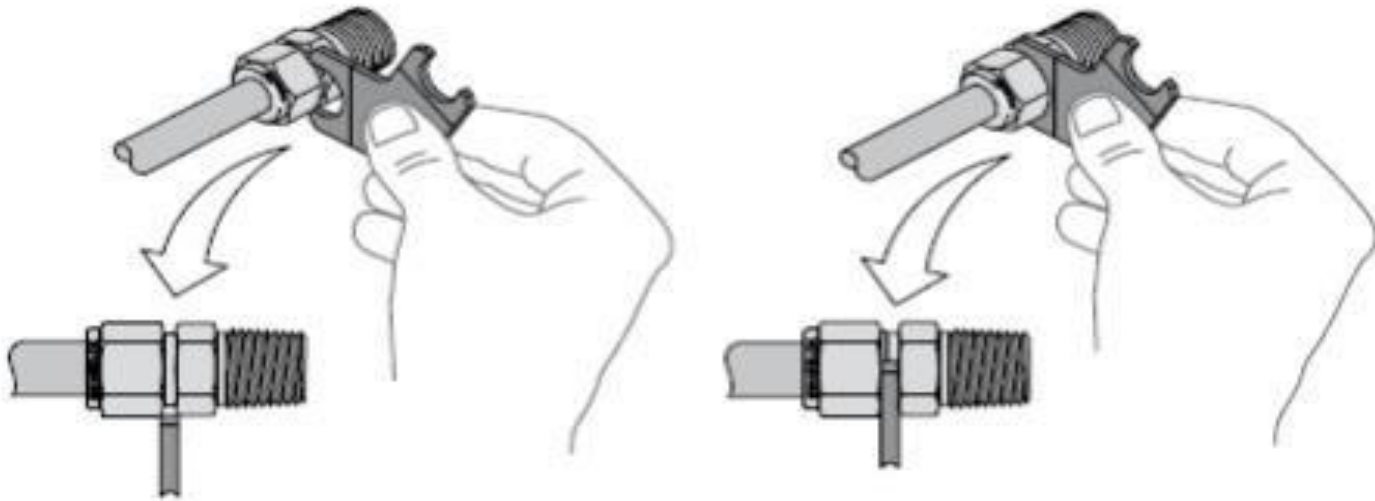
*Note: For 1/16, 1/8, and 3/16 in.; 2, 3, and 4 mm tube fittings, tighten the nut three-quarters turn to the 3 o'clock position.*



# Gauge Ability

On initial installation, the Swagelok gap inspection gauge assures the installer or inspector that a fitting has been sufficiently tightened. Position the Swagelok gap inspection gauge next to the gap between the nut and body.

1. If the gauge **will not** enter the gap, **the fitting is sufficiently tightened.**
2. If the gauge **will** enter the gap, **additional tightening is required.**

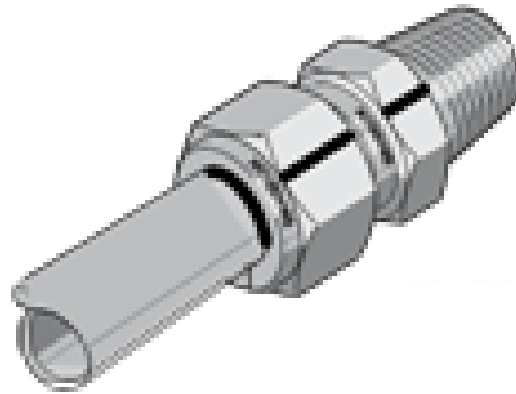


**⚠ WARNING** Always depressurize system before adjusting the tightness of a tube fitting connection.

# Disassembly

You may disassemble and reassemble Swagelok tube fittings many times.

Prior to disassembly, mark the tube at the back of the nut; mark a line along the nut and fitting body flats. *Use these marks to ensure that you return the nut to the previously pulled-up position.*

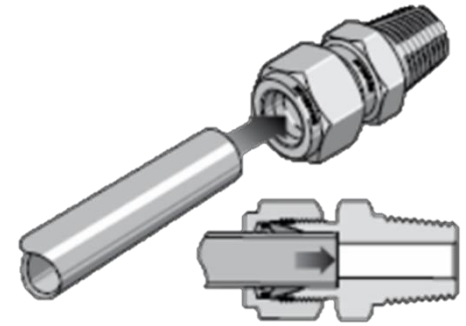


## **⚠️ WARNING**

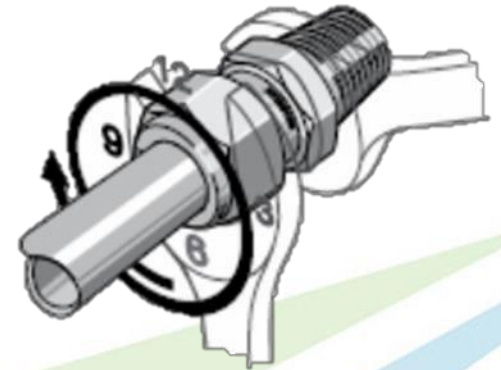
**Always depressurize the system before disassembling a Swagelok tube fitting.**

# Reassembly

Insert the tube with preswaged ferrules into the fitting until the front ferrule seats against the fitting body.



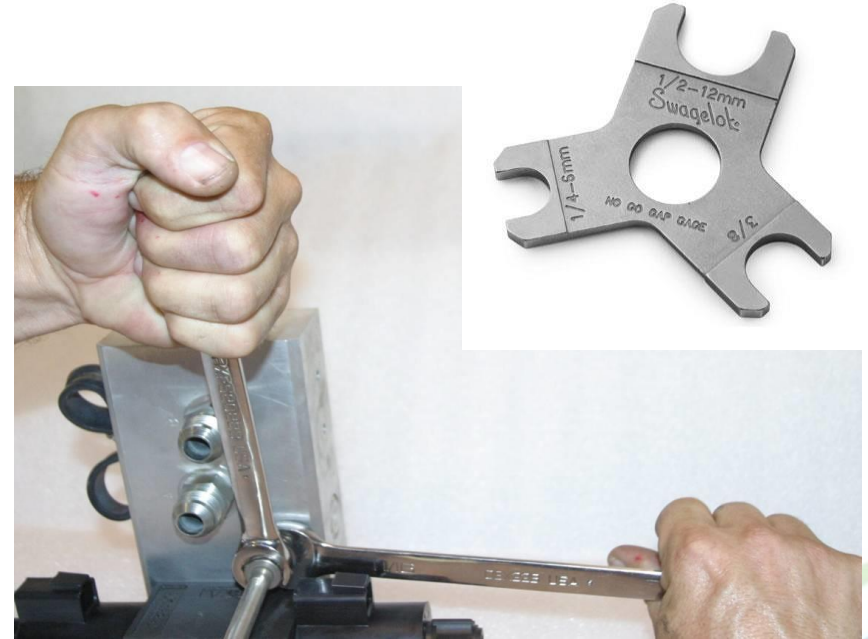
While holding the fitting body steady, rotate the nut with a wrench to the previously pulled-up position, as indicated by the marks on the tube and flats. At this point, you will feel a significant increase in resistance. Tighten the nut slightly.



**Note:** Do not use the Swagelok gap inspection gauge with reassembled fittings.

# High Pressure Fitting Install

- Initial angle torque is 1 ¼ turns after finger snug for new fittings
- Re-installation requires only ¼ turn after finger tight
- Swagelok gap inspection gauges may also be used to ensure proper tightening



**Caution: Do not use sealant on swage or O-ring fittings!**




# Parker O-Ring



# Parker O-Ring Torque Range

SAE Dash Size	Thread Size UN/UNF	Assembly Torque (+10% -0)															
		Non-Adjustable						Adjustable						Plugs			
		Seal-Lok		Triple-Lok Ferulok Pipe Fittings		Seal-Lok Lite		Seal-Lok		Triple-Lok Ferulok		Seal-Lok Lite		Hollow Hex		Hex Head	
		ft.lbs. (in. lbs)	N-m	ft.lbs. (in. lbs)	N-m	ft.lbs. (in. lbs)	N-m	ft.lbs. (in. lbs)	N-m	ft.lbs. (in. lbs)	N-m	ft.lbs. (in. lbs)	N-m	ft.lbs. (in. lbs)	N-m	ft.lbs. (in. lbs)	N-m
2	5/16-24			(85)	10					(60)	7			(30)	3.5	(85)	10
3	3/8-24			(155)	18					(100)	11			(55)	6	(155)	18
4	7/16-20	(310)	35	(260)	29			(180)	20	(180)	20			(120)	13.5	(260)	29
5	1/2-20	(360)	40	(280)	32			(360)	40	(250)	28			(170)	19	(280)	32
6	9/16-18	(420)	46	(350)	40	(260)	29	(420)	46	(350)	40	(260)	30	(410)	46	(350)	40
8	3/4-16	60	80	(620)	70	(350)	40	60	80	(620)	70	(350)	40	60	80	(620)	70
10	7/8-14	100	135	85	115			100	135	85	115			100	135	85	115
12	1 1/16-12	135	185	135	183	65	85	135	185	135	183	65	85	135	185	135	183
14	1 3/16-12	175	235	175	237			175	235	175	237			175	235	175	237
16	1 5/16-12	200	270	200	271	80	110	200	270	200	271	80	110	200	270	200	271
20	1 5/8-12	250	340	250	339			250	340	250	339			250	340	250	339
24	1 7/8-12	305	415	305	414			305	415	305	414			305	415	305	414
32	2 1/2-12	375	510	375	509			375	510	375	509			375	510	375	509

# Gen 2 Parker Fitting Torques

#6 to Soft Metal	20ft-lbf	
#8 to Soft Metal	34ft-lbf	

#6 Fitting to Fitting	30ft-lbf	
#8 Fitting to Fitting	50ft-lbf	

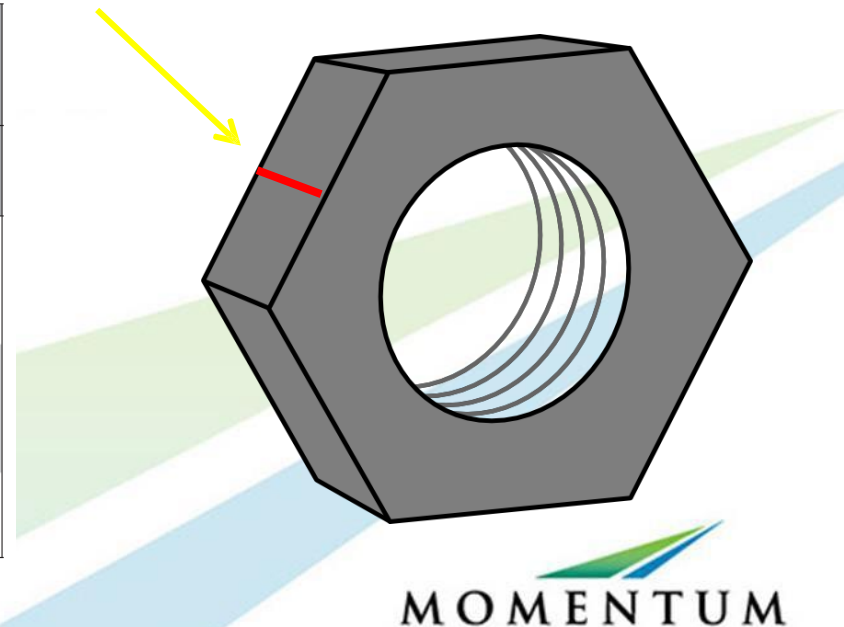
3/8 Tube Nut	30ft-lbf	
1/2 Tube Nut	40ft-lbf	

Application	Target Torque	Wrench Head	Setting on Adjustable	Fixed
			Torque Wrench (6006C PRO)	Torque Wrench
#6 to Soft Metal	20ft-lbf	11/16"	19 ft-lbf	20ft-lbf
#8 to Soft Metal	34ft-lbf	7/8"	31 ft-lbf	34ft-lbf
#6 Fitting to Fitting	30ft-lbf	11/16"	28 ft-lbf	30ft-lbf
#8 Fitting to Fitting	50ft-lbf	7/8"	45 ft-lbf	50ft-lbf
3/8 Tube Nut	30ft-lbf	13/16"	27 ft-lbf	30ft-lbf
1/2 Tube Nut	40ft-lbf	15/16"	36 ft-lbf	40ft-lbf

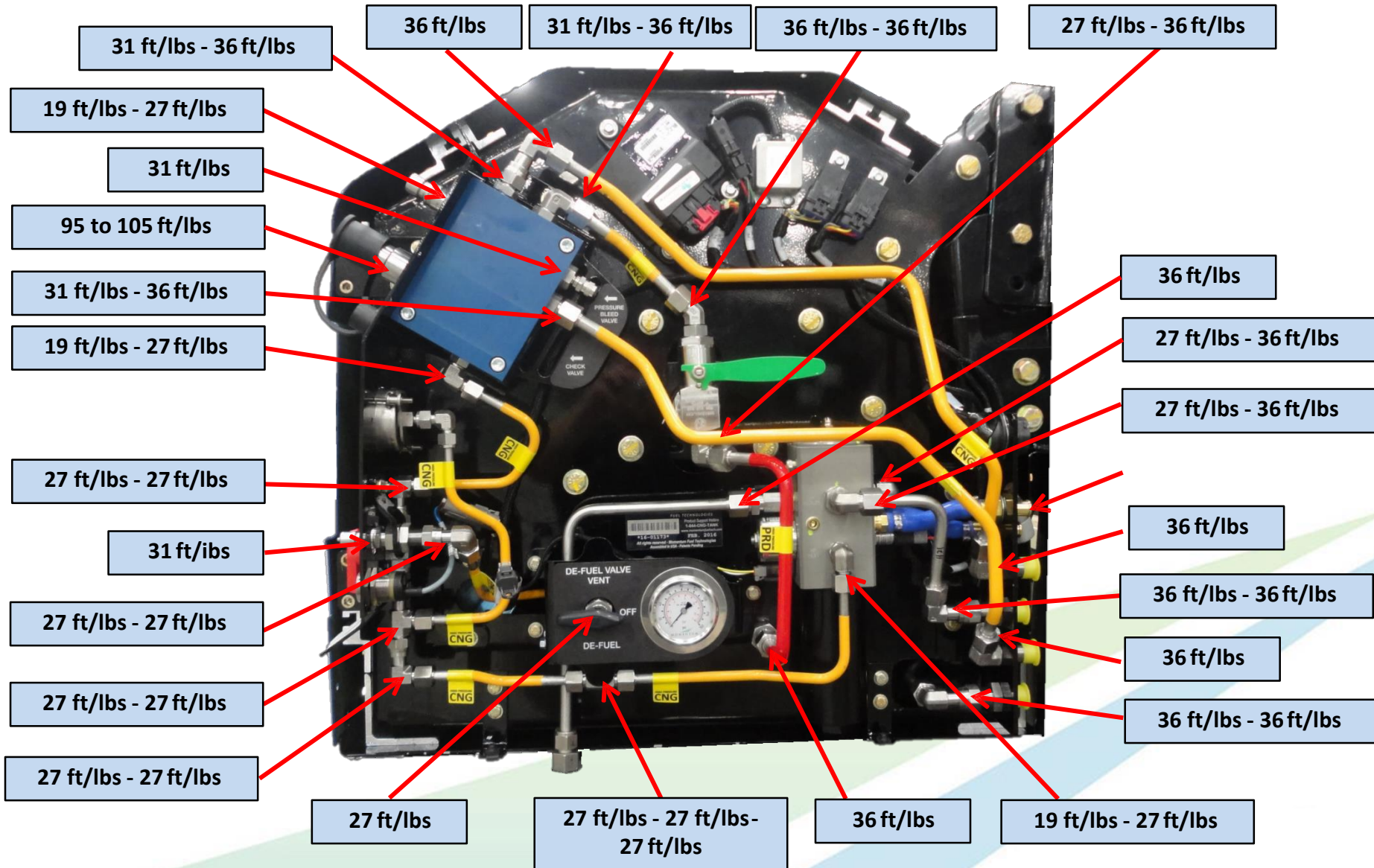
# Parker O-Ring (FFWR)

The torque method of assembly is the preferred method of assembly for Seal-Lok and Seal-Lok Lite fittings. It reduces the risk of human error during assembly that is more prevalent in the Flats From Wrench Resistance(F.F.W.R.) method. To ensure the most accurate assembly of the Seal-Lok fitting, it is strongly recommended that the torque method be utilized.

O.D.		SAE Dash Size	Tube Side Thread Size (UN/UNF)	Tube Side Assembly Torque (+10% -0%)			Flats from Wrench Resistance (F.F.W.R.)	
(in.)	(mm)			in.-lb.	ft.-lb.	N-m	Tube Nuts	Swivel & Hose Ends
1/4	6	-4	9/16-18	220	18	25	1/4 to 1/2	1/2 to 3/4
3/8	8, 10	-6	11/16-16	360	30	40	1/4 to 1/2	1/2 to 3/4
1/2	12	-8	13/16-16	480	40	55	1/4 to 1/2	1/2 to 3/4
5/8	14, 15, 16	-10	1-14	—	60	80	1/4 to 1/2	1/2 to 3/4
3/4	18, 20	-12	1 3/16-12	—	85	115	1/4 to 1/2	1/3 to 1/2
1	22, 25	-16	1 7/16-12	—	110	150	1/4 to 1/2	1/3 to 1/2
1 1/4	28, 30, 32	-20	1 11/16-12	—	150	205	1/4 to 1/2	1/3 to 1/2
1 1/2	35, 38	-24	2-12	—	230	315	1/4 to 1/2	1/3 to 1/2

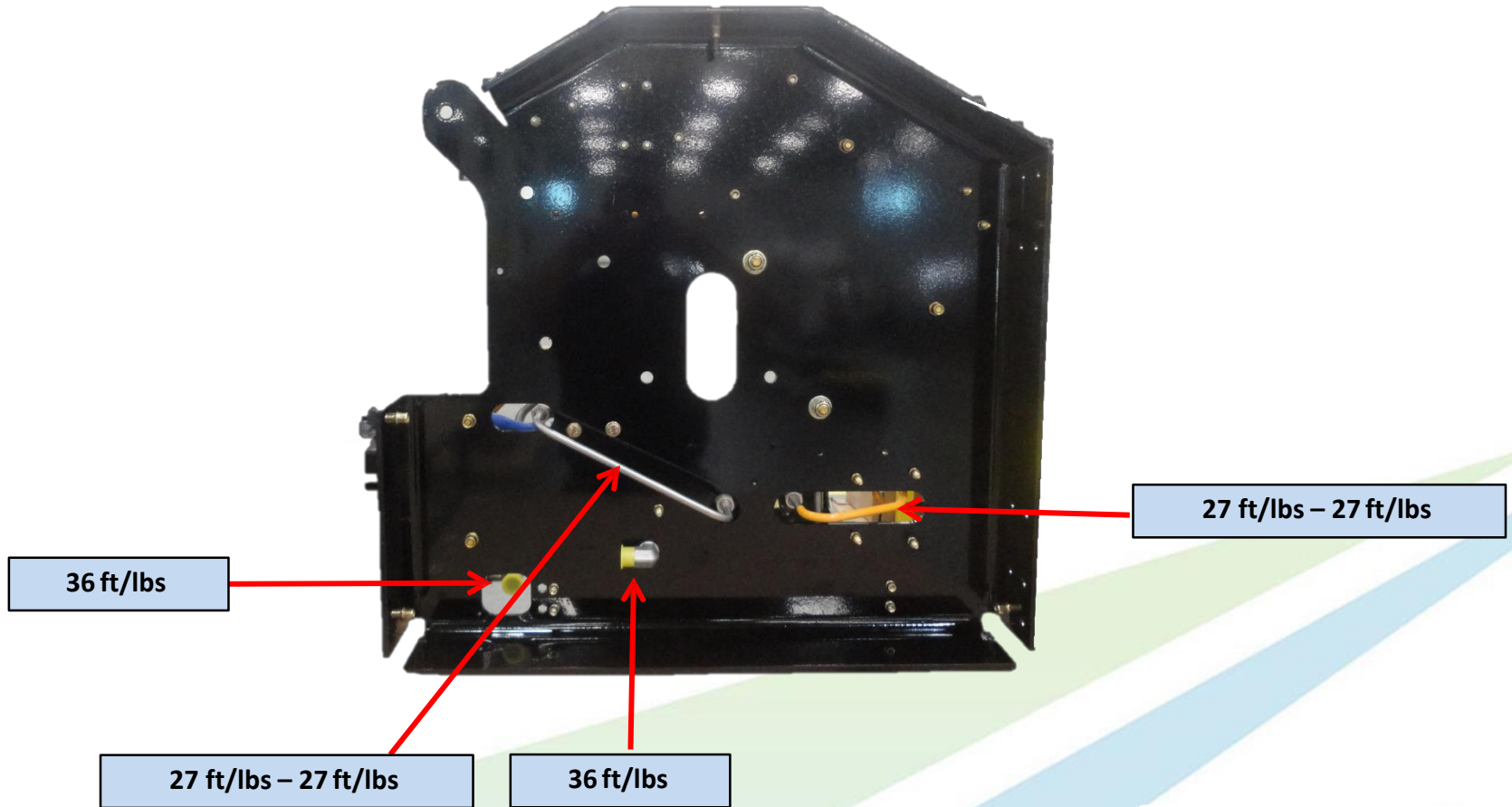


# GEN 2 FFM Fittings

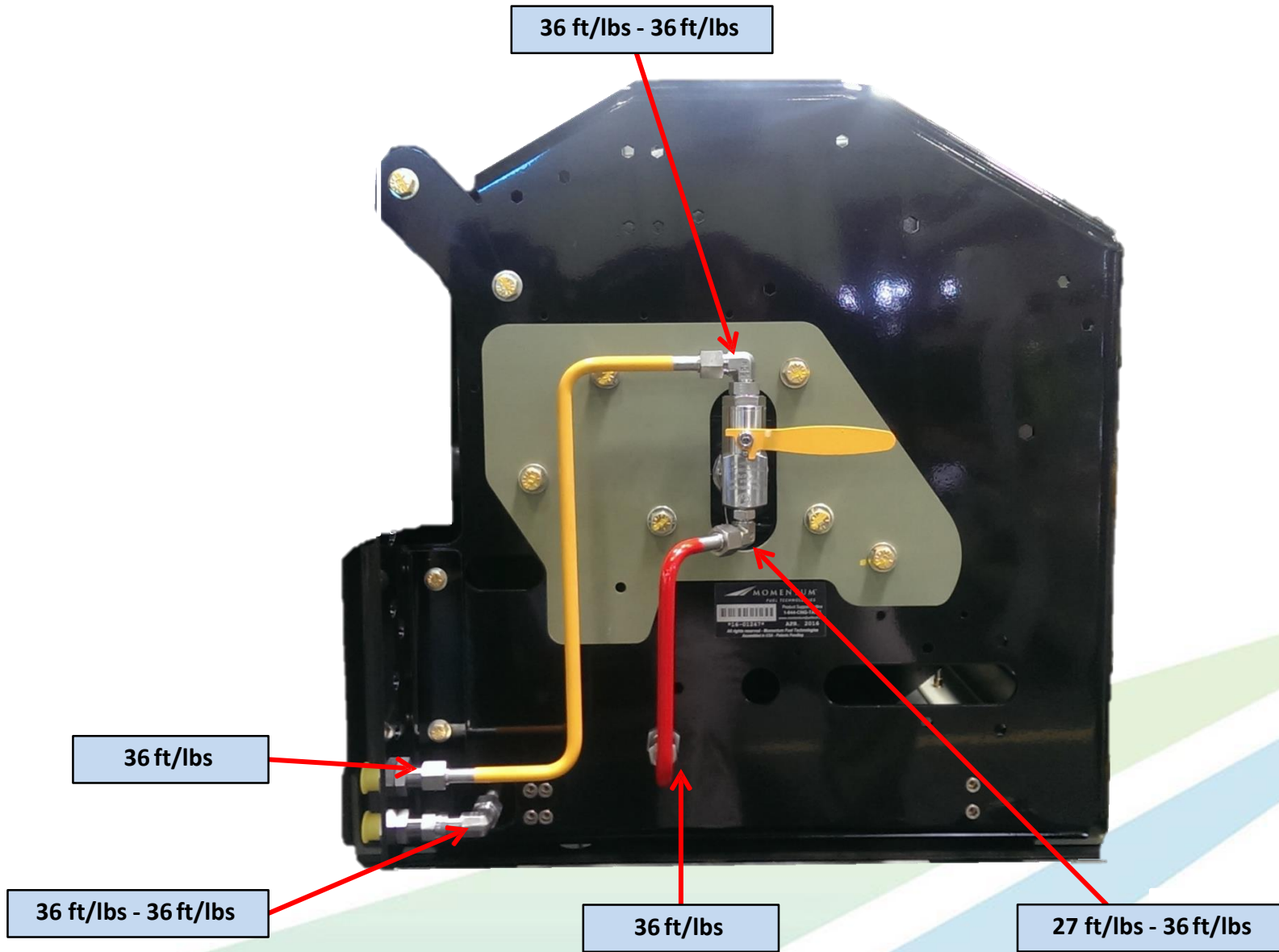




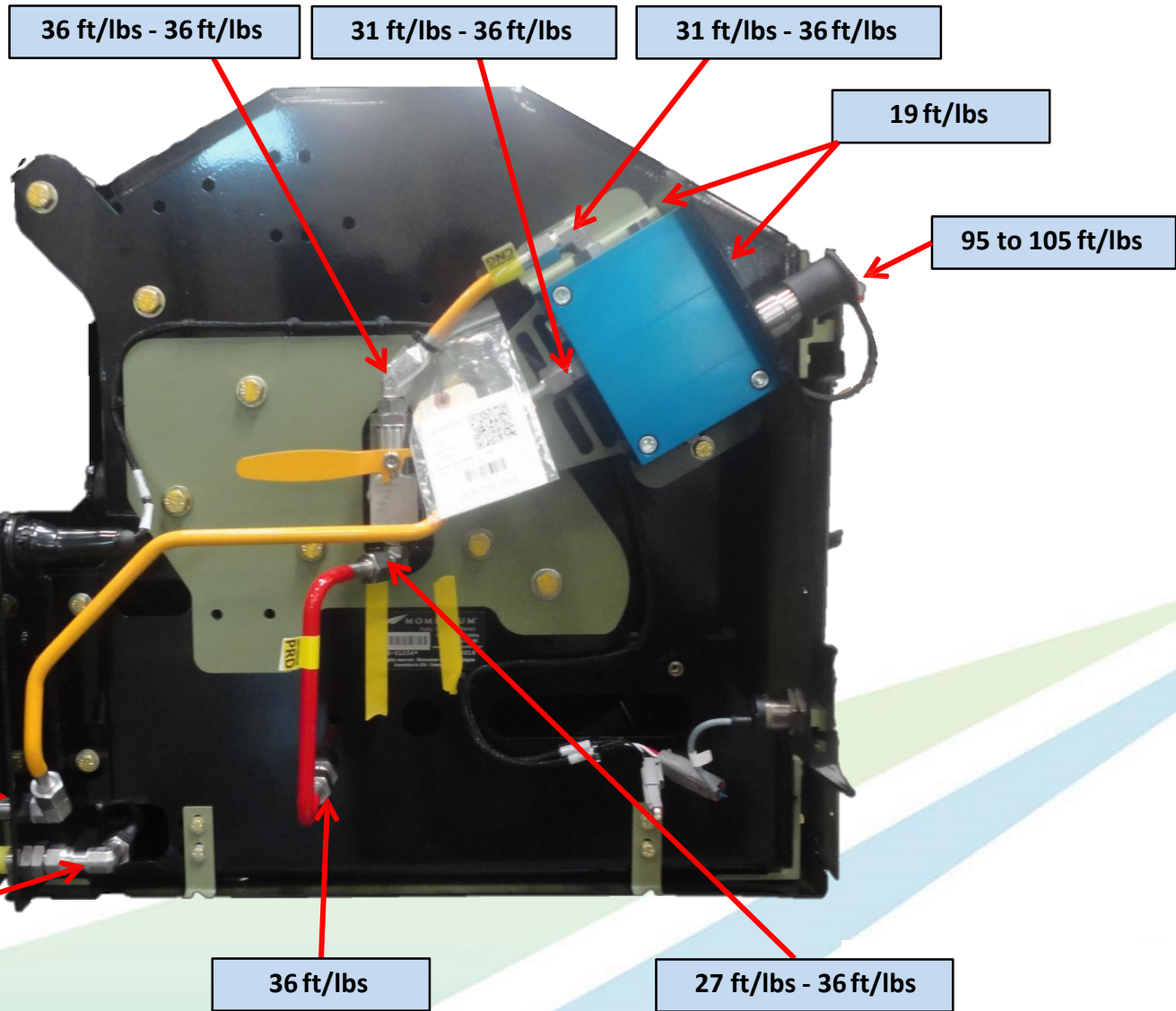
# GEN2 FFM Fitting Back Plate



# GEN 2 Right Side

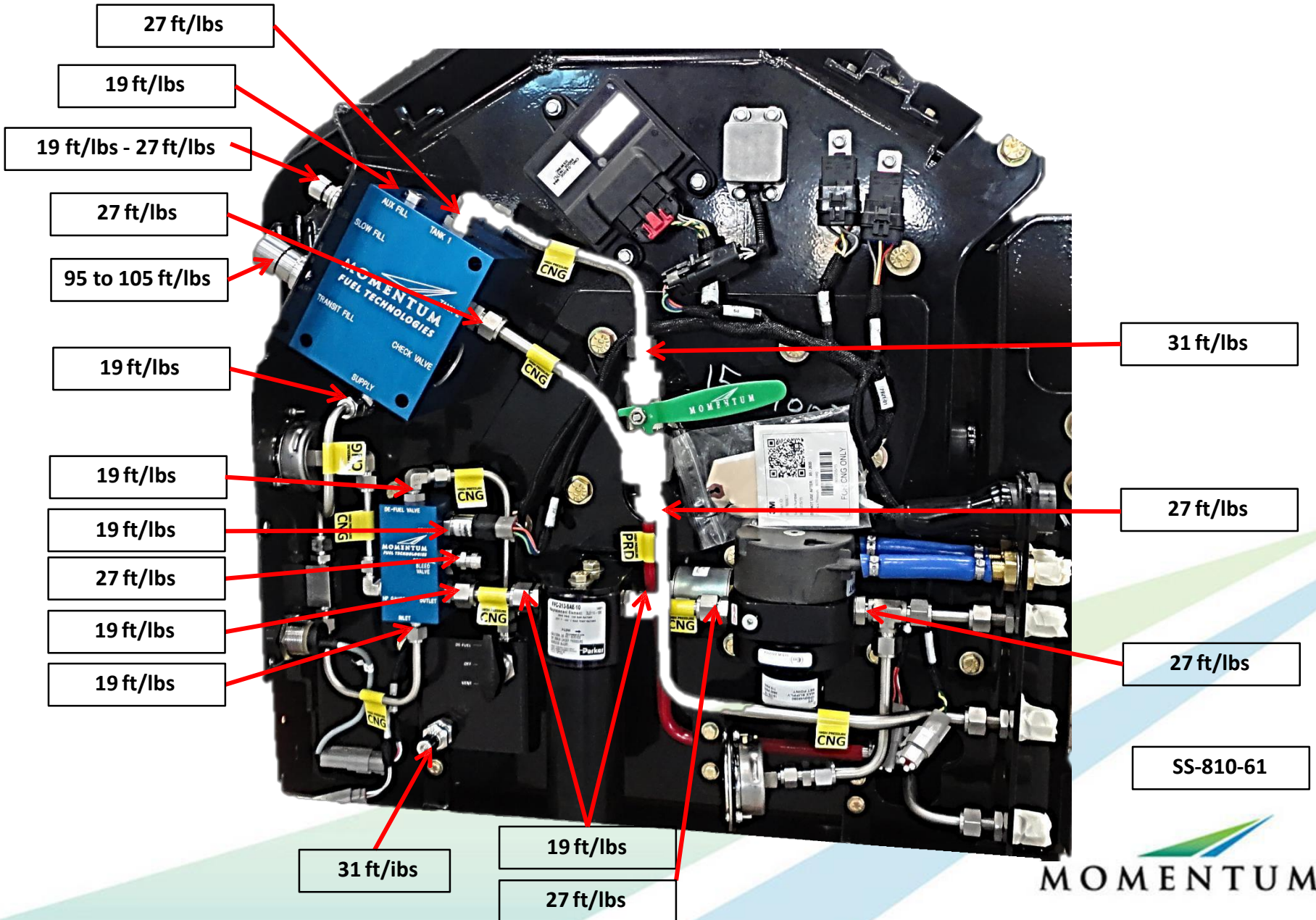


# GEN 2 Right Side Fill

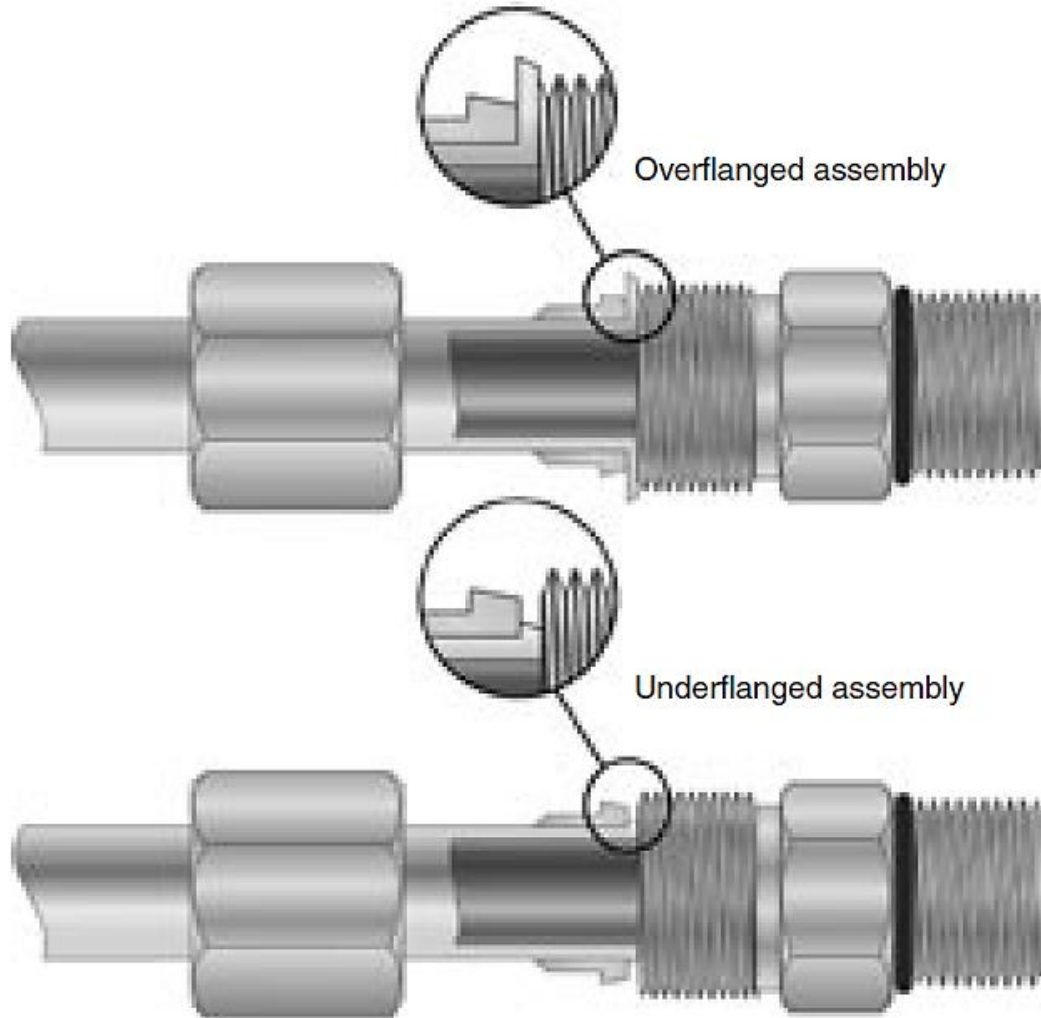




# Gen 1 FMM

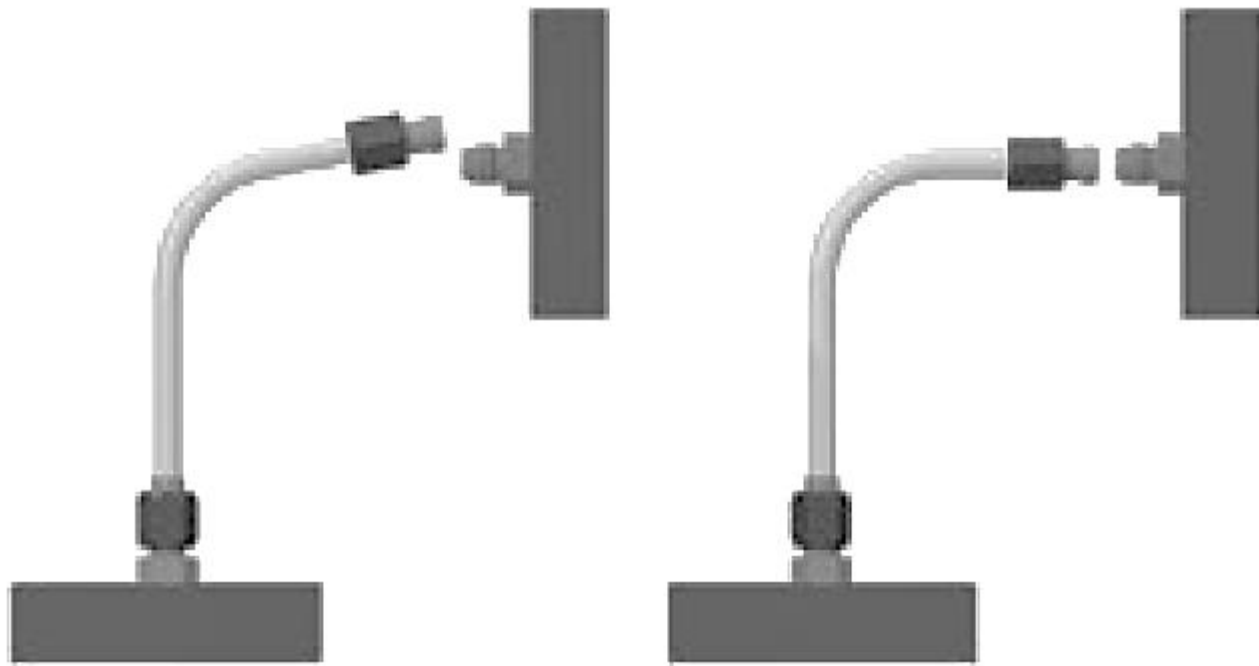


# Parflange Inspection



# Tube Installation

Improper flaring or installation causes over half of the leakage with flared fittings. Thus, proper installation is critical for a trouble free operation.



# Seal-Lok Troubleshooting Guide

CONDITION	PROBABLE CAUSE(S)	RECOMMENDATION
Immediate leakage when system is pressurized	<ul style="list-style-type: none"><li>• Improper tightening of joint</li></ul>	<ul style="list-style-type: none"><li>• Check for O-ring damage and re-tighten connection to the recommended torque value</li></ul>
Under-flanged assembly	<ul style="list-style-type: none"><li>• Undersized tube diameter resulting in tube slippage during flanging</li><li>• Die gripping surface is worn or dirty</li></ul>	<ul style="list-style-type: none"><li>• Verify that the O.D. is correct; if undersized, replace tube.</li><li>• Inspect die gripping surface; if clogged or excessively worn, clean or replace.</li></ul>
Over-flanged assembly	<ul style="list-style-type: none"><li>• Sleeve is positioned incorrectly in die</li></ul>	<ul style="list-style-type: none"><li>• Check for proper positioning of sleeve in die; if over-flanged, replace tubing</li></ul>
Flange out-of-round	<ul style="list-style-type: none"><li>• Tubing was not cut properly</li><li>• Tube was not properly supported during flanging</li><li>• Tubing is eccentric</li></ul>	<ul style="list-style-type: none"><li>• Cut tubing within <math>90^{\circ} \pm 1^{\circ}</math></li><li>• Support tubing so that tube end is perpendicular to tube stop during flanging</li><li>• Replace with quality tubing</li><li>• Replace out-of-round flanges</li></ul>
Cracked flange	<ul style="list-style-type: none"><li>• Tubing too hard</li></ul>	<ul style="list-style-type: none"><li>• Replace tubing using recommended quality tube</li></ul>

# Seal-Lok Troubleshooting Guide

<p>Scored, pitted flange</p>	<ul style="list-style-type: none"> <li>• Improper deburring and cleaning of tube prior to flanging</li> <li>• Flange pin not cleaned and lubricated properly</li> </ul>	<ul style="list-style-type: none"> <li>• Replace flange using proper deburring and cleaning recommendations</li> <li>• Keep flanging pin clean and working surfaces well lubricated.</li> </ul>
<p>Leakage at braze joint</p>	<ul style="list-style-type: none"> <li>• Poor braze joint/improper joint clearance</li> <li>• Mixing of sleeve and tube material</li> <li>• Improper/inadequate flux, braze alloy overrun, or buildup on face</li> <li>• Improper/inadequate braze temperature</li> </ul>	<ul style="list-style-type: none"> <li>• Flux and reheat the joint, remove and replace with new sleeve</li> <li>• Always use steel sleeves with steel tubing and stainless sleeves with stainless tubing</li> <li>• Apply flux liberally to sleeve and tube end prior to brazing. Use recommended flux, braze alloy and brazing temperature.</li> </ul>
<p>Leakage at face-seal end</p>	<ul style="list-style-type: none"> <li>• Misalignment or improper fit</li> <li>• Damaged, pinched, improper, or missing O-ring</li> <li>• Extruded O-ring</li> <li>• Damaged fitting</li> <li>• Braze overflow on sealing surface</li> </ul>	<ul style="list-style-type: none"> <li>• Align tube end and connecting fitting properly before tightening tube nut, holding the flat face of the mating fitting against O-ring while tightening</li> <li>• Replace O-ring, properly installing it in the face seal groove</li> <li>• Replace O-ring and check for proper alignment and pressure surges exceeding rated pressure of fitting; tighten the nut to recommended torque or replace fitting if threads or sealing surface is grossly damaged.</li> <li>• Remove and replace sleeve which has braze overflow on its sealing surface.</li> </ul>



# Fuel Line Bends

Bends in piping or tubing are prohibited if such bends will weaken the pipe or tubing. Bends must be made:

1. Only with tools designed for this purpose.
2. Joints or connections must be located only in accessible locations.
3. Hose, metallic hose, or flexible metal hose may be used in place of piping as specified in next slide.
4. Follow all of the manufactures recommendation for installing fuel lines.



# Bolt Torque Chart

## Torque's

USS/SAE Grade 8 Fasteners Only		
Diameter	Threads Per Inch	Dry Torque-ft. lbs
1/4	20	12
5/16	18	24
3/8	16	45
7/16	14	70
1/2	13	110
9/16	12	150
5/8	11	210
3/4	10	380
7/8	9	600
1	8	910

## Tools

USS/SAE Grade 8 Fasteners Only	
Bolt Diameter	Wrench Size
1/4	7/16
5/16	1/2
3/8	9/16
7/16	5/8
1/2	3/4
9/16	13/16
5/8	15/16
3/4	1-1/8
7/8	1-5/16
1	1-1/2

Metric Class 10.9 Fasteners Only		
Size	Pitch	Dry Torque-Foot Lbs
M8	1.25	28

