Emer PRD Replacement for Gillig CNG Fuel Systems with Type 4 Cylinders and Manual Cylinder Valves

ENP-735 REV C

June 7, 2020

1. Introduction

Agility Fuel Solutions LLC (Agility®) has determined that pressure relief devices (PRDs) manufactured by Emer™ may fail to operate as designed. This issue has been reported to the National Highway Traffic and Safety Administration (NHSTSA Recall No. 20E-019). Impacted parts include Emer™ p/n PRD2302T-004 (Agility® p/n 10306997) used in Agility® compressed natural gas (CNG) fuel systems produced from October 6, 2016, to April 1, 2020.

PRDs are essential for safe vehicle operation and must be replaced if non-compliant. Agility® personnel have identified fuel system top level part numbers supplied for Gillig buses containing recalled Emer™ PRDs as original equipment manufacturer (OEM) equipment.

Agility® has engineered two retrofit kits for fuel systems equipped with Type 4 cylinders and manual cylinder valves to replace recalled Emer™ PRDs. The two retrofit kits replace 85-in. and 120-in. fuel system plumbing with PRDs manufactured by VTI and new PRD supply and vent tubes.

Agility® created this instructional document to guide trained CNG fuel system service technicians in the removal, replacement, and reporting of affected Emer™ PRDs.

1.1. Warning Messages and Symbols used in this document

⚠ DANGER

Will cause death or severe injuries if procedures are not followed.

⚠WARNING

Could cause death or severe injuries if procedures are not followed.

⚠CAUTION

Could cause minor or moderate injuries if procedures are not followed.

NOTICE

Practices not related to physical injury. Includes procedures to prevent vehicle damage as well as hints to help an operation or procedure go smoothly.

Critical Characteristic

Procedure directly affects safety of vehicle users, people nearby and maintenance personnel, or regulatory compliance.

Manufacturing Characteristic

- *A product feature solely used to improve manufacturability or maintain process control ·*
- *A process parameter or step that has a significant effect on achieving a Critical Characteristic or Significant Characteristic, or maintaining material identification/traceability.*

2. Affected Units

Agility® top level system part numbers as follows:

25518000 - Roof Mount, 156 DGE, 2084 L, 8 Tanks, Gillig, Type 4
25520000 - Roof Mount, 185 DGE, 2474 L, 8 Tanks, Gillig, Type 4
25522000 - Roof Mount, 126 DGE, 1692 L, 8 Tanks, Type 4, Gillig

3. Tools and Supplies Required

Fall protection equipment	Safety glasses
Safety ladder	Defueling hose with nozzle**
NGV1 fuel receptacle adapter*	Shop towels
Swagelok® preswage tool	Combination and socket wrenches
Torque wrench	Swagelok® Snoop leak detection solution
Permanent marker	Agility® reporting form FT.0320
Torque Seal marker	Agility go-nogo gauge, p/n TD 400394
Camera / phone camera	Zip lock bag *(NOTE: supplied by Agility with bulk replacement PRD shipment—use for PRD return)*
Flashlight	

**may be required for defueling on some FMMs*

***If not provided at CNG fueling facility*

3.1. PRD retrofit kits

NOTICE

Before beginning work, verify proper quantity of the appropriate Agility® PRD retrofit kit is on hand.

Agility® fuel system part numbers and corresponding retrofit kit part numbers are as follows:

Fuel system p/n	QTY required Kit, Retrofit, Gillig, 120" tanks PRD Retrofit, p/n 25519031	QTY required Kit, Retrofit, Gillig, 85" tanks PRD Retrofit, p/n 25519030
25518000	1	1
25519000	1	1
25520000	2	n/a
25521000	2	n/a
25522000	n/a	2

Verify proper part composition and quantity for each kit according to the following content lists and drawings:

Kit contents: Kit, Retrofit, Gillig, 120" tanks PRD Retrofit, p/n 25519031. *Figure 1*			
Item	**p/n**	**Description**	**QTY**
1	10200065	Fitting, Tube, Connector, 1/2-in. Tube OD, 9/16-18 Male SAE, SS	2
2	10200208	Fitting, Tube, Tee, 1/2-in. Tube OD, 1/2-in. Tube OD, 1/2-in. Tube OD, SS	2
3	10200238	Fitting, Tube, Adapter, 1/2-in. Tube OD, 9/16-18 Male SAE, SS	2
4	10200563	Fitting, JIC, Straight, -8 Male JIC, 1/2-20 Male SAE, Steel	4
5	10300513	T-PRD, VTI, Remote, PRD 1	4
6	10701508	Tube Clamp Kit, 1/2-in., Double Mounting Hole, -40F to 212F	6
7	10702147	P-Clip, 1/2-in., Rubber Clamp	2
8	25519028	Tube Subassembly, 25519420, PRD to Vent	1
9	25519029	Tube Subassembly, 25519421, PRD To Vent	1
10	25519037	Tube Subassembly, 25519429, PRD to Vent	1
11	25519038	Tube Subassembly, 25519430, PRD To Vent	1
12	25519123	Bracket, tube clamp	2
13	25519416	Tube, Formed, HP Fuel, 1/2-in. X .049-in., Tee to PRD	2
14*	25519039	Hardware, Retrofit Kit	1
15	10602157	Decal, System, Danger Live High Pressure PRD Line	4
16	10602442	Decal, PRD Vent Line, Caution	8

**Not shown*

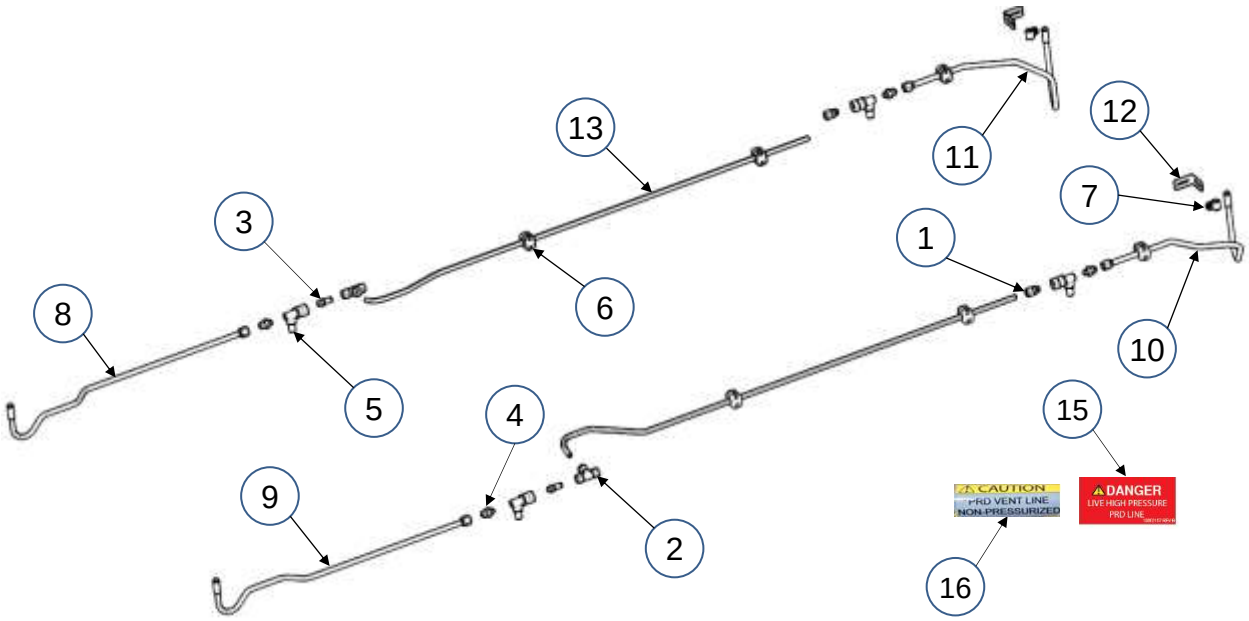


Figure 1.
Kit, Retrofit, Gillig, 120" tanks PRD Retrofit, p/n 25519031.

Kit contents: Kit, Retrofit, Gillig, 85" tanks PRD Retrofit, p/n 25519030. *Figure 2*			
Item	**p/n**	**Description**	**QTY**
1	10200065	Fitting, Tube, Connector, 1/2-in. Tube OD, 9/16-18 Male SAE, SS	2
2	10200208	Fitting, Tube, Tee, 1/2-in. Tube OD, 1/2-in. Tube OD, 1/2-in. Tube OD, SS	2
3	10200238	Fitting, Tube, Adapter, 1/2-in. Tube OD, 9/16-18 Male SAE, SS	2
4	10200563	Fitting, JIC, Straight, -8 Male JIC, 1/2-20 Male SAE, Steel	4
5	10300513	T-PRD, VTI, Remote, PRD 1	4
6	10701508	Tube Clamp Kit, 1/2-in., Double Mounting Hole, -40F to 212F	6
7	10702147	P-Clip, 1/2-in., Rubber Clamp	2
8	25519026	Tube Subassembly, 25519414, PRD to Vent	1
9	25519027	Tube Subassembly, 25519415, PRD To Vent	1
10	25519037	Tube Subassembly, 25519429, PRD to Vent	1
11	25519038	Tube Subassembly, 25519430, PRD To Vent	1
12	25519123	Bracket, tube clamp	4
13	25519417	Tube, Formed, HP Fuel, 1/2-in. X .049-in., Tee to PRD	2
14*	25519039	Hardware, Retrofit Kit	1
15	10602157	Decal, System, Danger Live High Pressure PRD Line	4
16	10602442	Decal, PRD Vent Line, Caution	8

**Not shown*

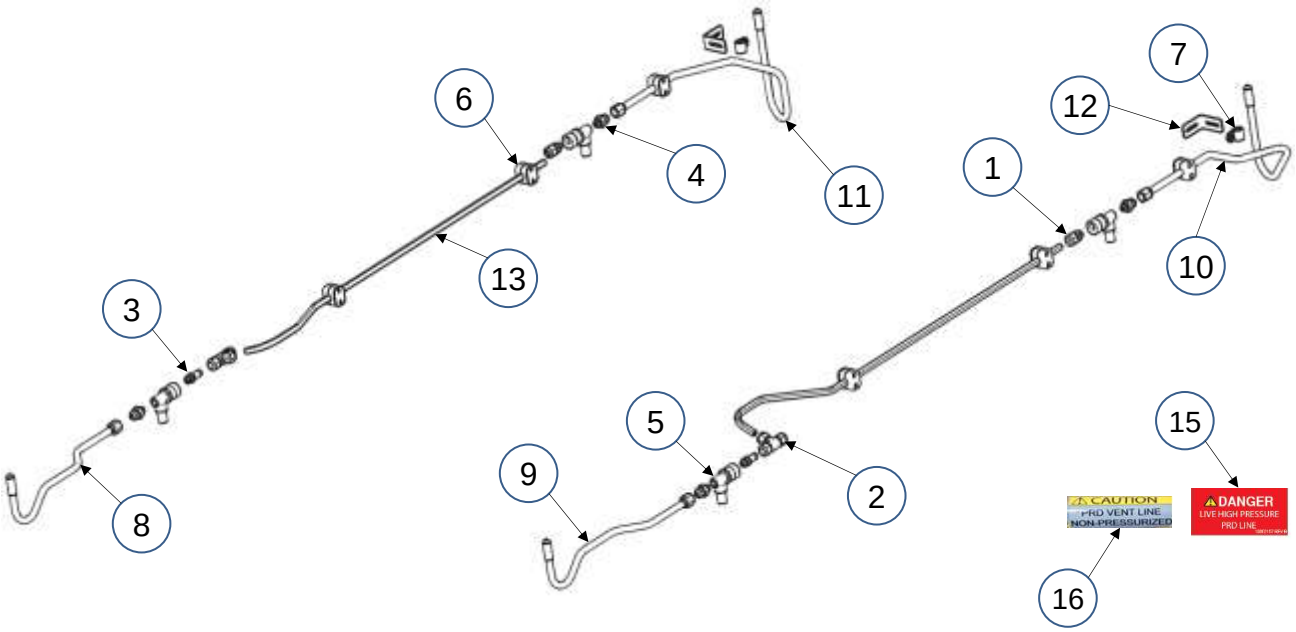


Figure 2.
Kit, Retrofit, Gillig, 85" tanks PRD Retrofit, p/n 25519030

4. Parts Location Identification

Refer to the appropriate fuel system illustration to locate the affected Emer™ PRDs in fuel system plumbing for 85-in. and 120-in. cylinders. *Figures 3 and 4*

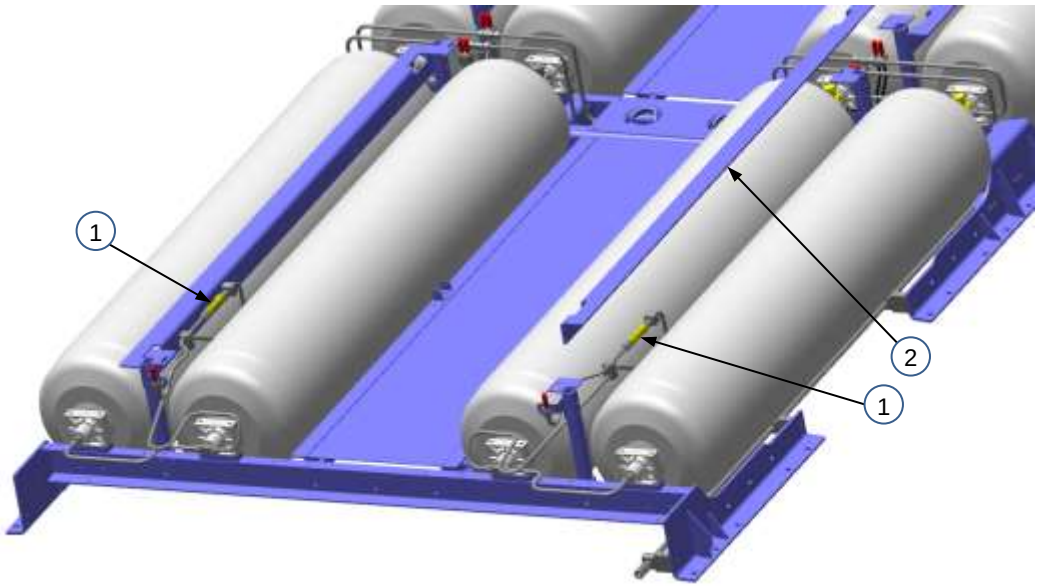


Figure 3.
Locations of Emer™ PRDs (1) in 85-in. cylinder fuel system plumbing. NOTE: PRD bracket (2) elevated for clarity.

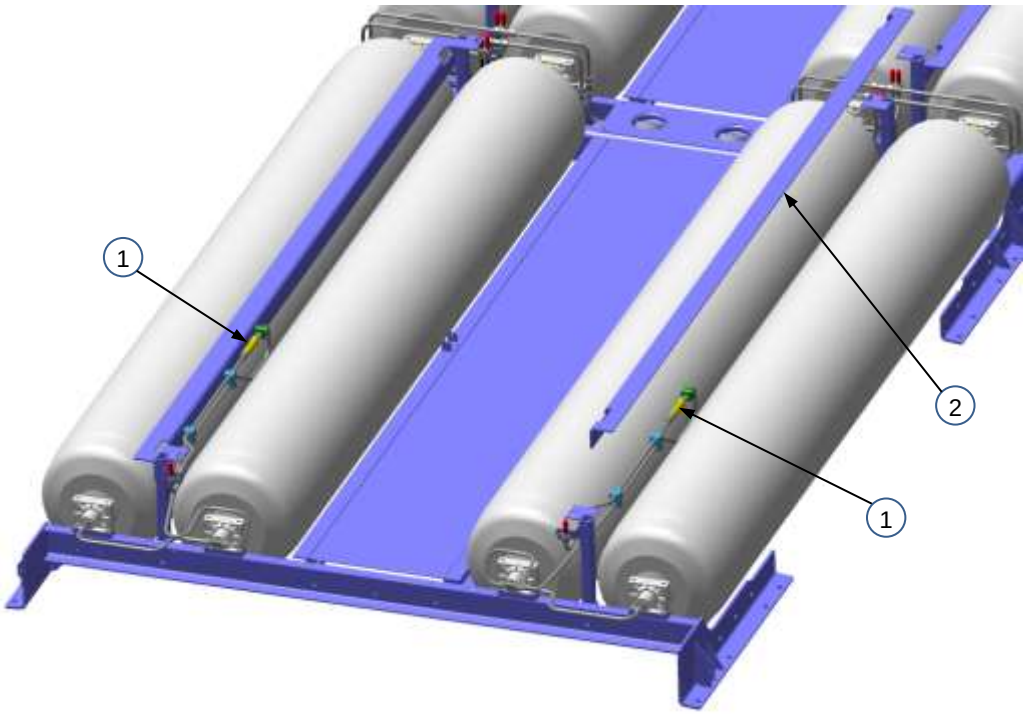
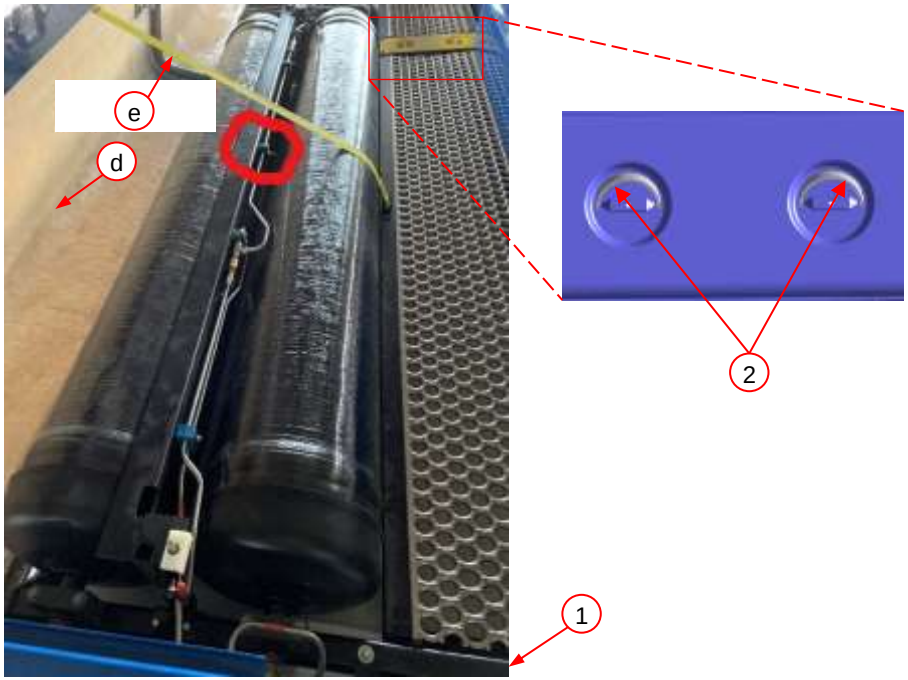


Figure 4.
Locations of Emer™ PRDs (1) in 120-in. cylinder fuel system plumbing. NOTE: PRD bracket (2) elevated for clarity

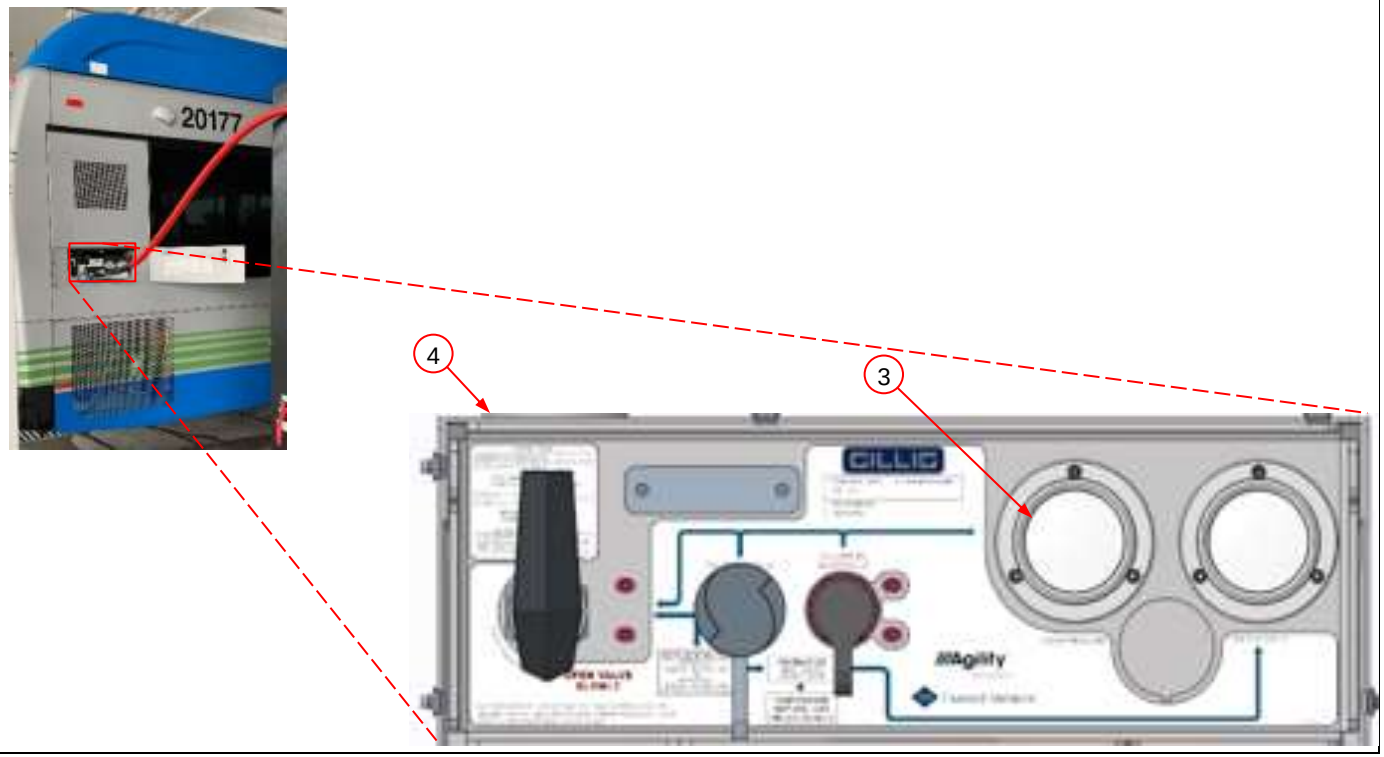
5. Corrective Action / Procedure

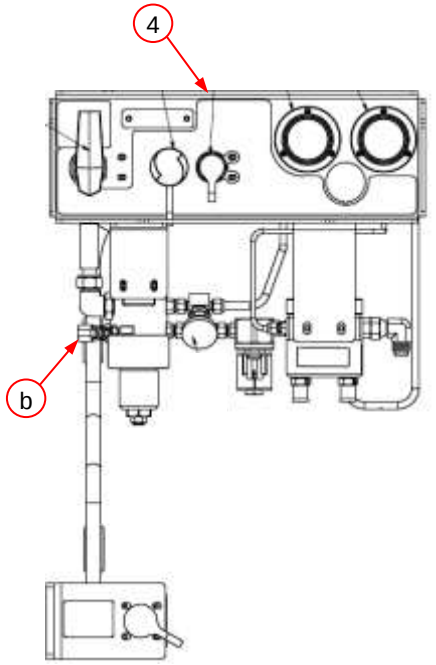
5.1. Preliminary Safety Preparation

1	**⚠WARNING**		2	**⚠WARNING**	
WHAT	Set parking brake and secure vehicle with wheel chocks *(not shown)*.		WHAT	Attach a lock and tag *(not shown)* to block vehicle ignition.	
WHY	Worker safety.		WHY	Prevent vehicle start during repair procedure.	
3	**⚠WARNING**				
WHAT	Secure a safety ladder in either of the following locations: A. Inside bus hatch opening B. Rear of bus exterior				
WHY	Worker safety.				

4	1. Open fuel system roof pod doors (d). **⚠WARNING** 2. Secure fall protection equipment to facility fall protection apparatus *(not shown)*. If no fall restraint is present at the facility, secure fall protection equipment *(not shown)* to fall restraint lanyard attachment points (2). **⚠WARNING** 3. Secure doors open with door retention strap (e). *Refer to vehicle OEM instructions.* **⚠WARNING** ***Always reattach fall PPE when resuming work on the roof mount portion of the fuel system.***	
WHY	Worker safety.	

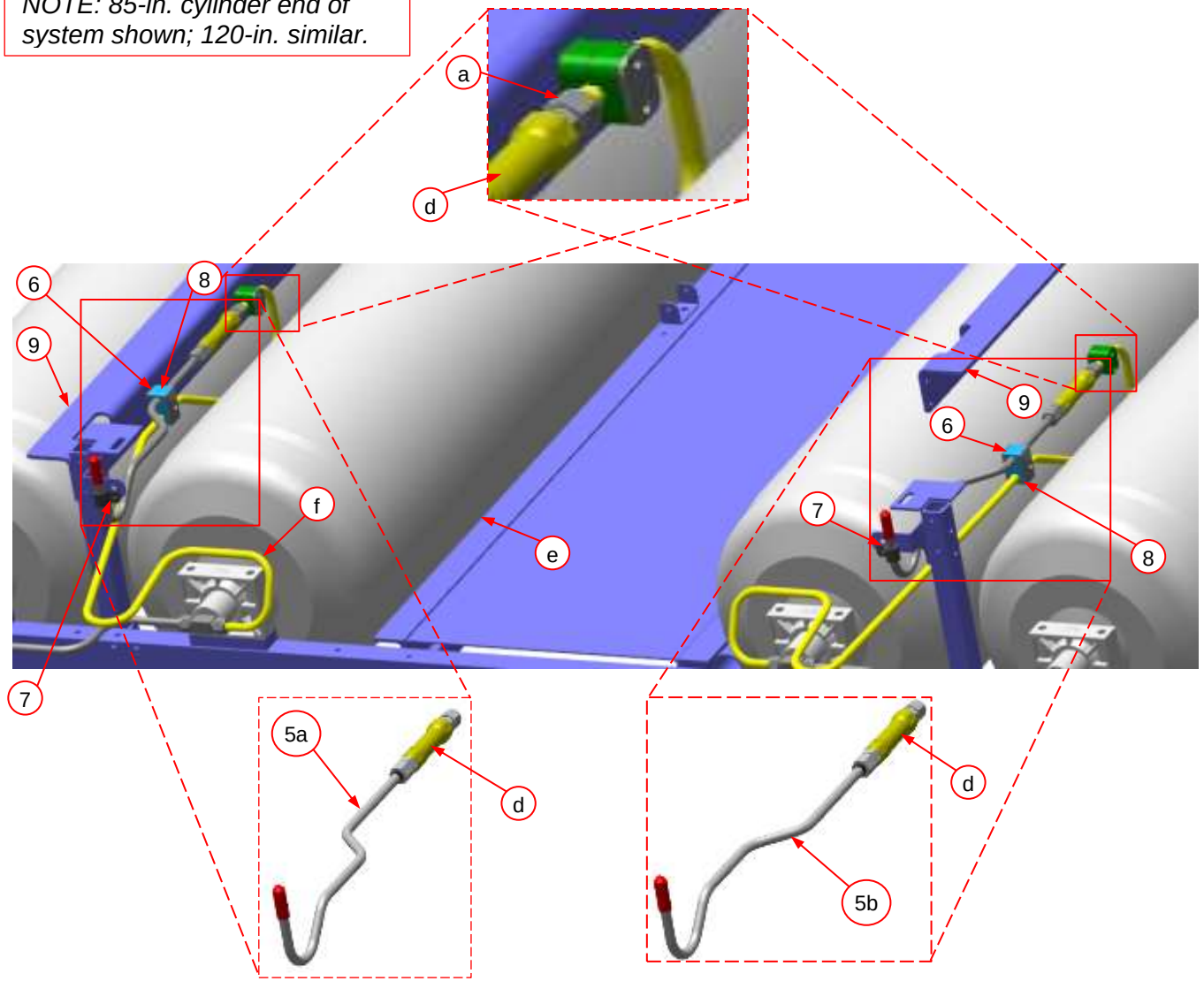
5.2. Prior to defueling

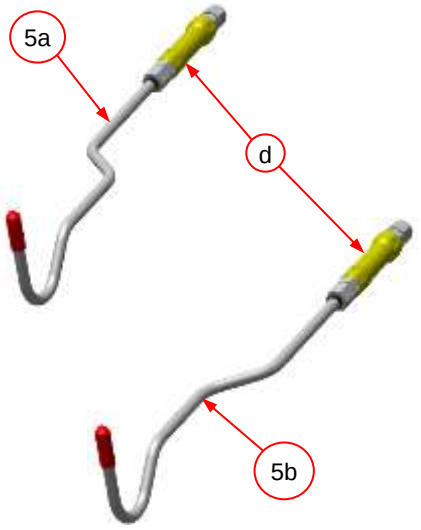
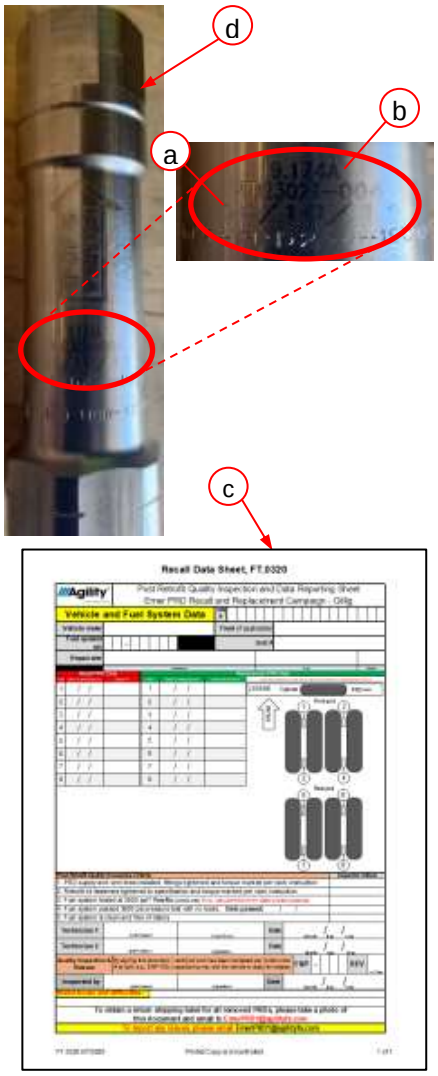
1	**⚠WARNING** Verify all eight cylinder valves (circled) are open.	
WHAT		
WHY	Ensure cylinders can be properly defueled.	
2	Check high pressure gauge (3) on fuel management module (FMM) (4) to verify amount of fuel in the system. **IMPORTANT:** If vehicle has no fuel onboard, proceed to Step 10.	
WHAT		
WHY		

3	*If not already defueled:* Defuel bus according to local facility regulations and procedure. *If required:* Use defuel hose kit. **⚠WARNING** ***Only trained CNG fuel systems technicians may perform system defueling.*** **NOTICE** *If required:* Use appropriate defuel nozzle adapter.		4	**⚠WARNING** Relieve any remaining system pressure by slowly opening the FMM (4) bleed valve (b).	
WHY	PRD supply tubes to be removed are pressurized “live” lines.		WHY		

5.3. Remove Emer PRDs

1	1.Use two wrenches to loosen nut fittings (a) on each Emer™ PRD (d). 2.Use wrenches to remove fasteners securing the following items: A. P-clip (7) B. Dual tube clamp (8) C. Plate (6) C Retain all clips, clamps, plates and fasteners for reuse. **NOTICE** ▪ ***Support PRD and PRD vent assembly while removing clips and clamps.*** ▪ ***Avoid contact with cylinders (e) or PRD supply tube (f).*** 3. Carefully remove Emer™ PRDs (d) and PRD vent tubes (5a) and (5b) from each PRD bracket (9) as complete assemblies. 4. Repeat for all plug end cylinders on all roof mount pods.	*NOTE: 85-in. cylinder end of system shown; 120-in. similar.*
WHY	Protect cylinders and PRD plumbing from damage.	



2	Use a pair of wrenches to remove all Emer™ PRDs (d) from PRD vent tubes (5a) and (5b). **NOTICE** ***Dispose of PRD vent tubes (5a) and (5b) according to facility guidelines.***		3	c Use form FT.0320 (c) to record the following data for each Emer™ PRD (d) removed: A. Date of Manufacture (a) B. Batch number (b)	
WHAT			WHAT		
WHY	PRD vent tubes will not be reused.		WHY	Required for retrofit kit component and repair tracking and, if applicable, installer reimbursement.	

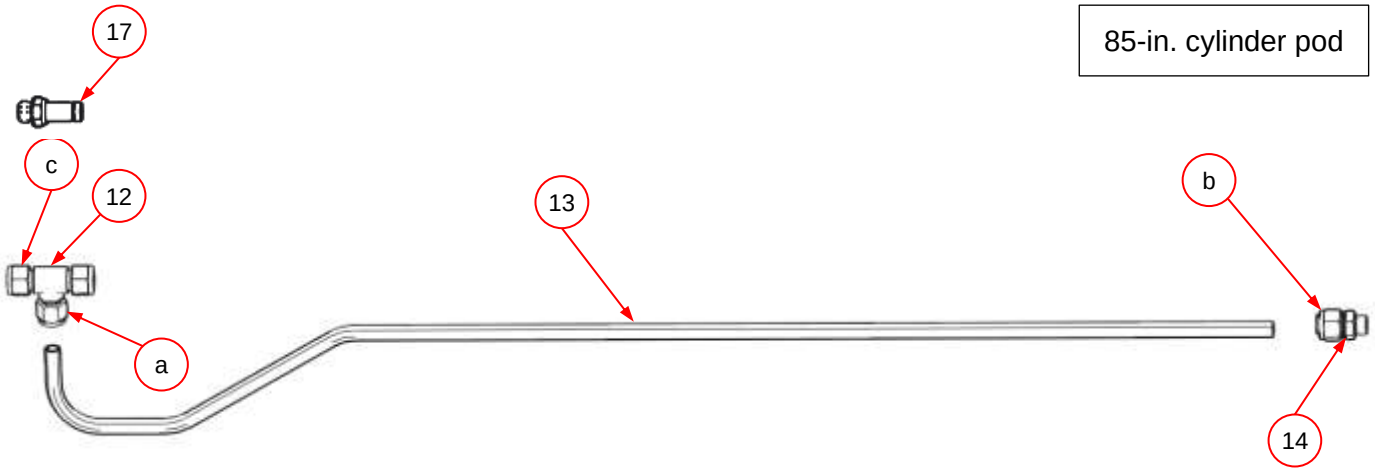
4 WHAT	Place all removed Emer™ PRDs in zip lock bag provided with bulk retrofit kit shipment. **NOTICE** ***Place only PRDs from one vehicle in each zip lock bag.*** ***Bag must be labeled with the following:*** ***1. Fleet*** ***2. VIN*** ***3. Fuel system s/n***				
WHY	1. Bag helps prevent PRD contamination. 2. Agility is collecting all PRDs removed; return material authorization (RMA) instructions appear below.				

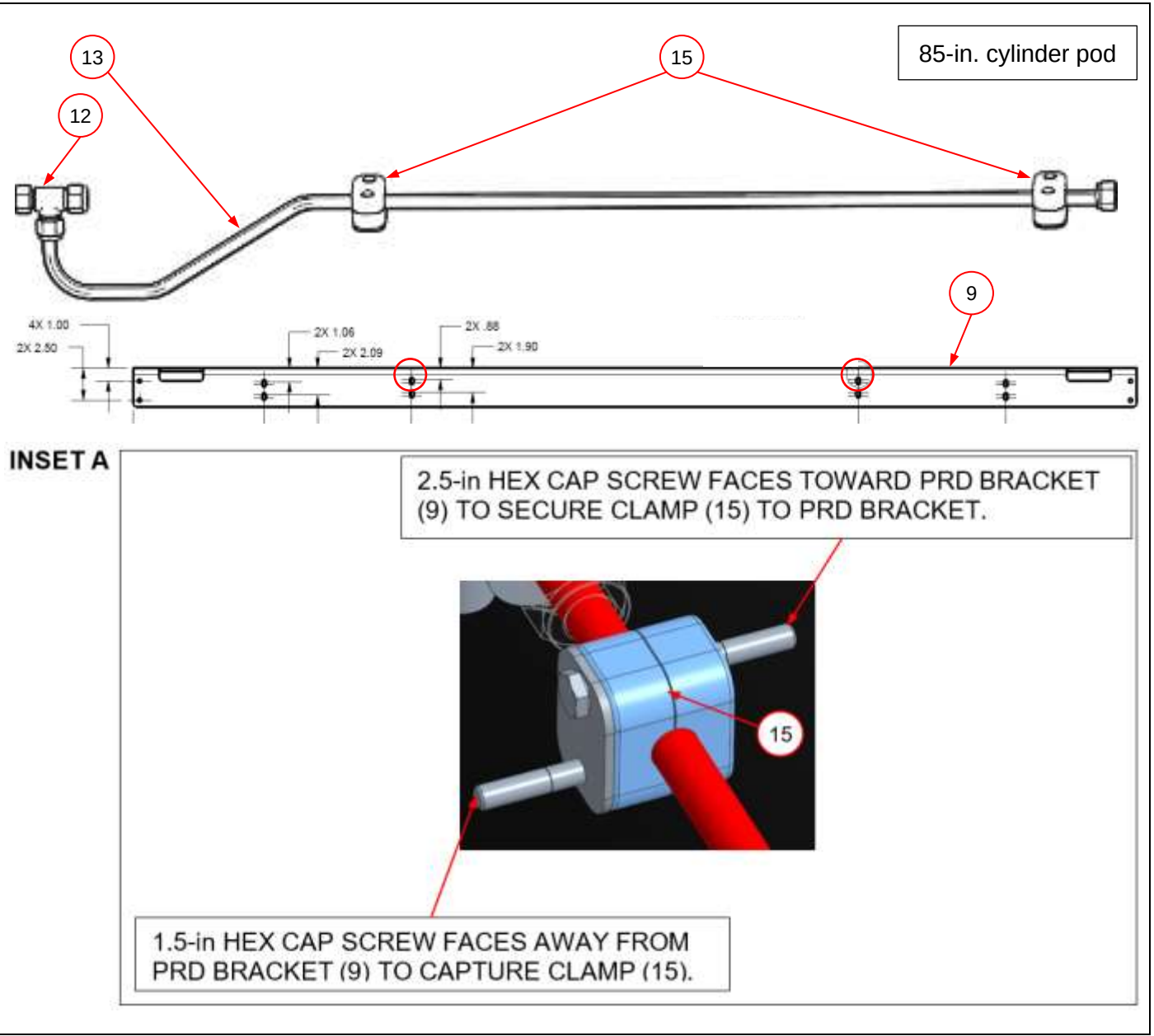
5.4. Install PRD retrofit kits

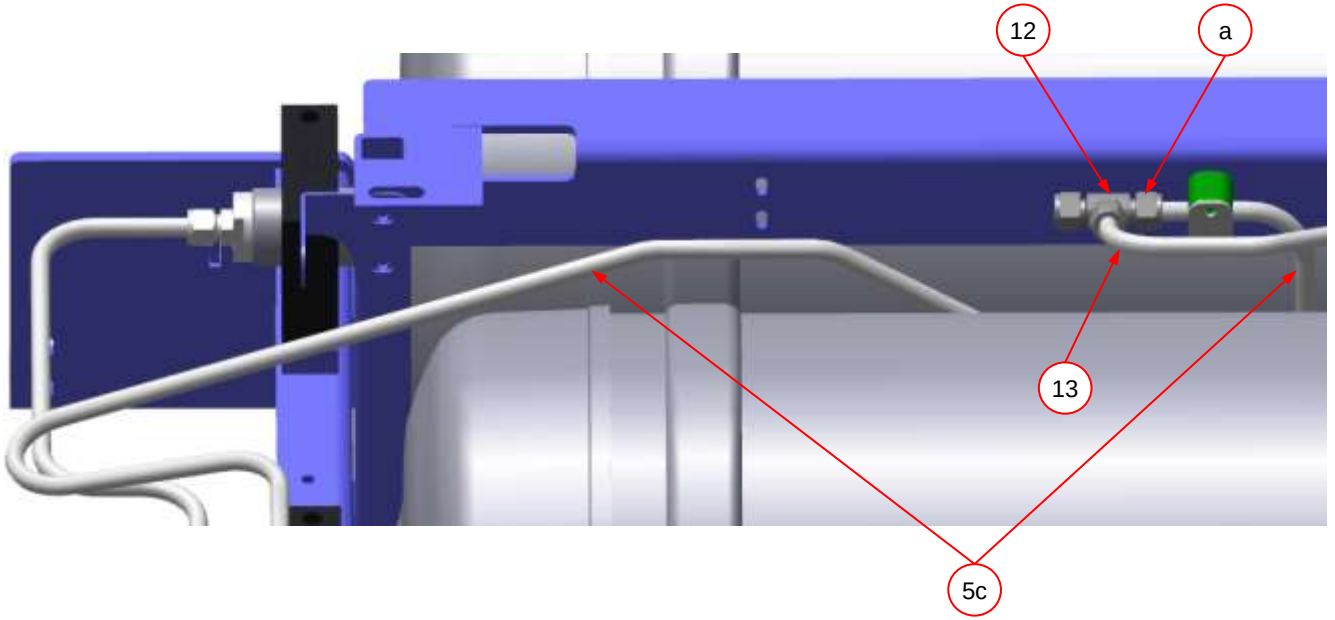
5.4.1. Kit, Retrofit, Gillig, 85" tanks PRD Retrofit, p/n 25519030, installation instructions

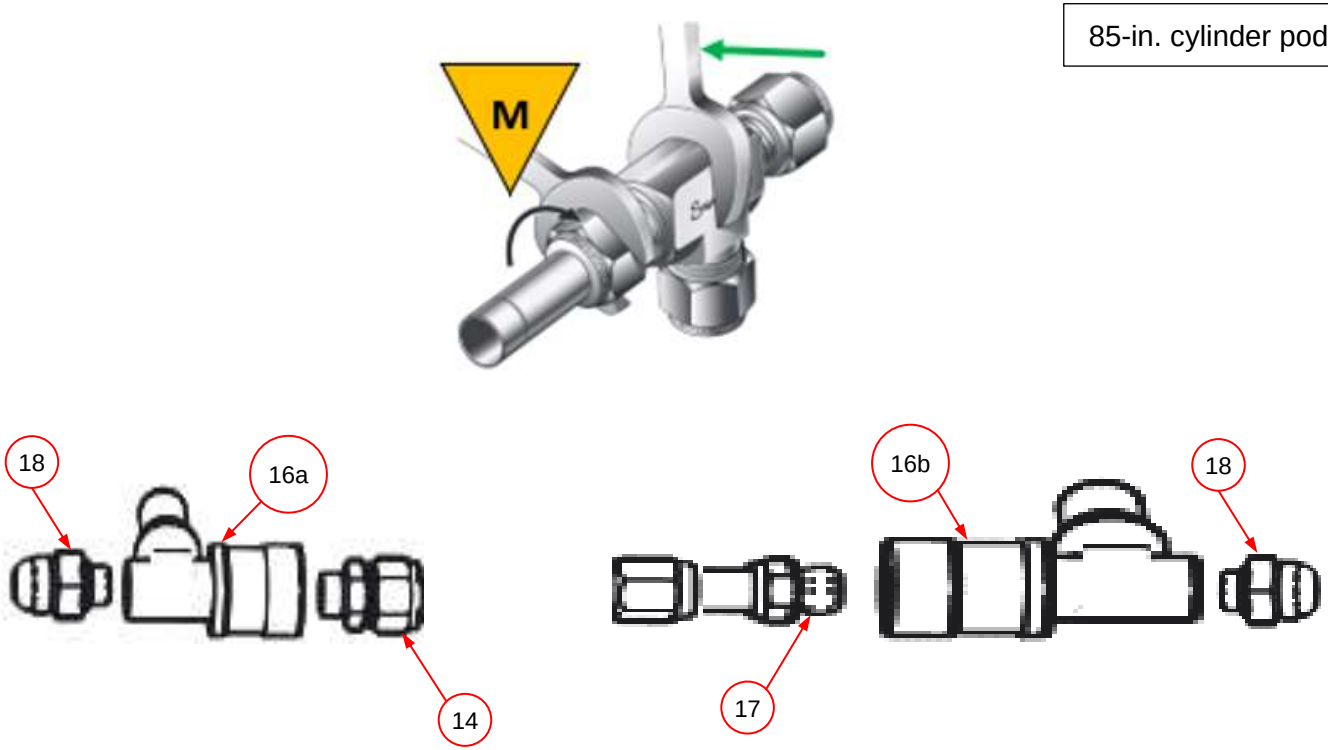
NOTICE

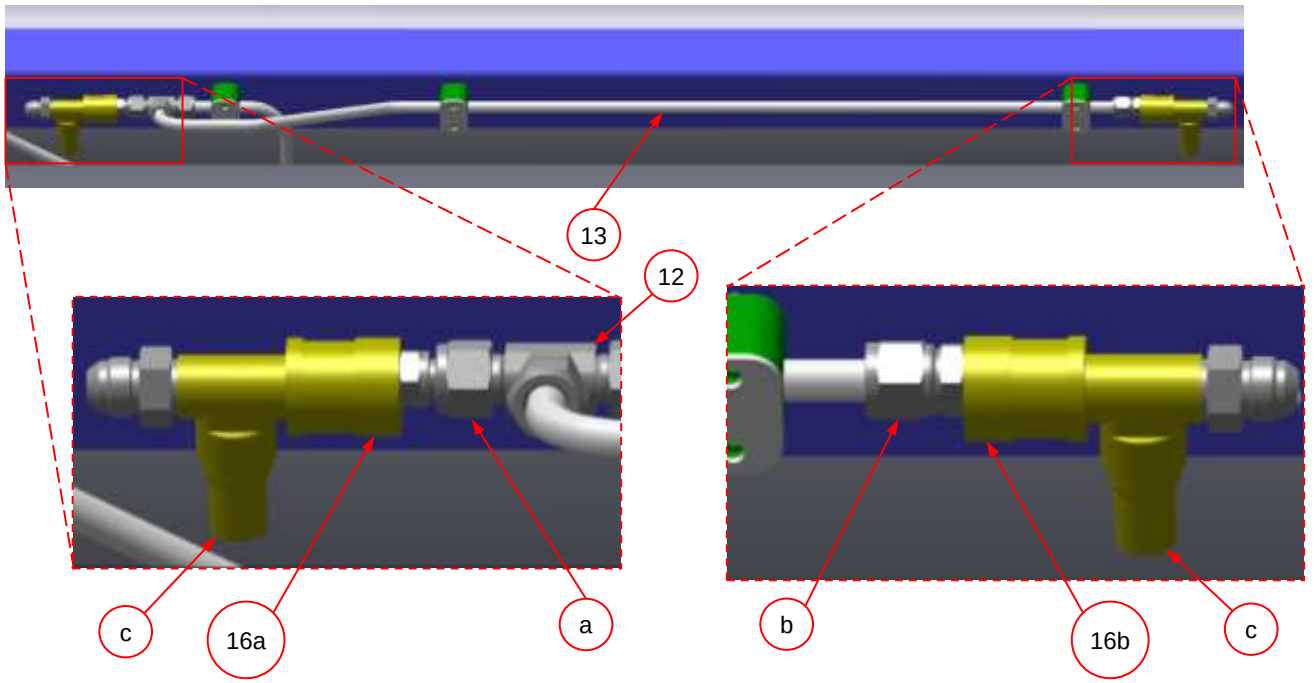
Always perform installation steps in the order specified.

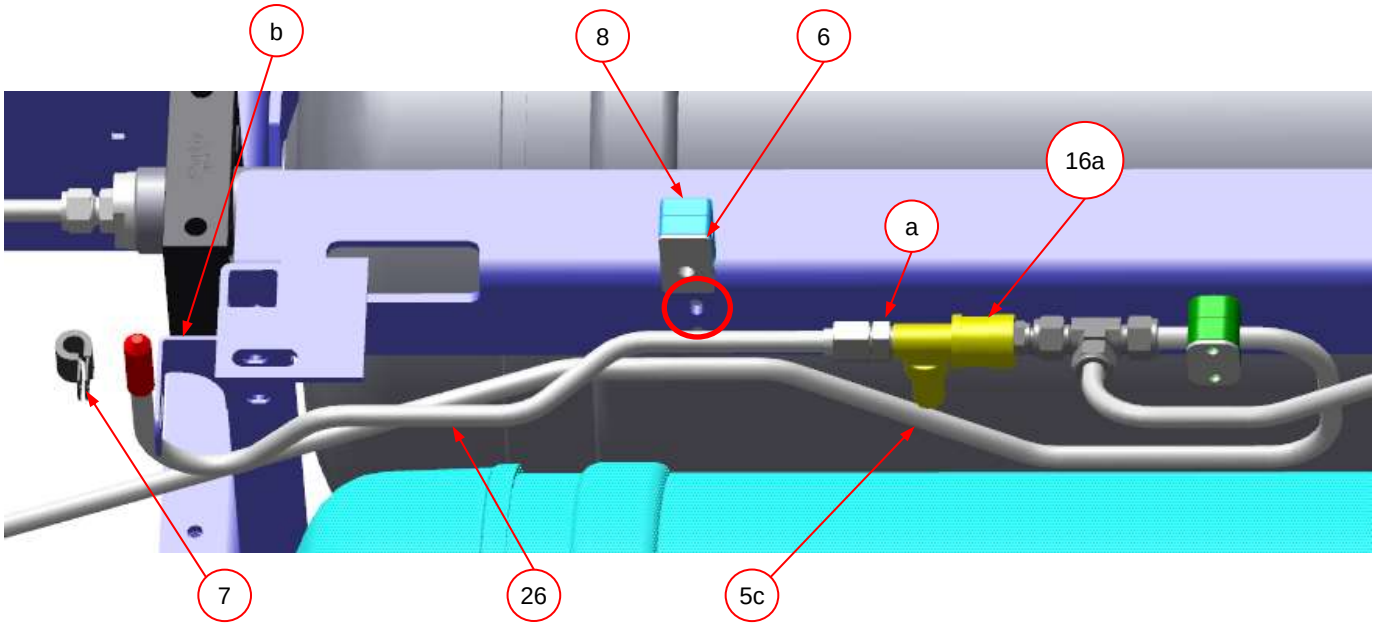
1 WHAT	1. Install ferrules *(not visible)* and nut (a) from tee fitting (12), p/n 10200208, on PRD tube, (13), p/n 25519417. 2. Install ferrules *(not visible)* and nut (b) from tube fitting (14), p/n 10200065, on PRD tube, (13). 3. Install ferrules *(not visible)* and nut (c) from tee fitting (12), p/n 10200208, on tube adapter fitting, (17), p/n 10200238. **NOTICE** ***Refer to Appendix A: WI.0197 Manual Swaging of Swagelok Fittings.***	
WHY		

2 WHAT	1. Install tee fitting (12), p/n 10200208, on PRD tube, (13). **NOTICE** ***Tighten fitting finger tight; fittings will be tightened at a later step.*** 2. Install two tube clamp kits (15), p/n 10701508, on PRD tube, (13). 3. Insert one 1.5-in. hex cap screw (a), p/n 10760200-0150, and one 2.5-in. hex cap screw (b), p/n 10760200-0120, into each tube clamp kit (15), as shown in INSET A. 4. Install one flat washer, p/n 10761000, and one flange top nut, p/n 10763000 *(not shown)* on each hex cap screw inserted. 5. Secure clamps (15) at existing holes *(circled)* on PRD bracket (9). **NOTICE** ***To ease component installation, leave fasteners loose.***	
WHY	Support PRD vent lines.	

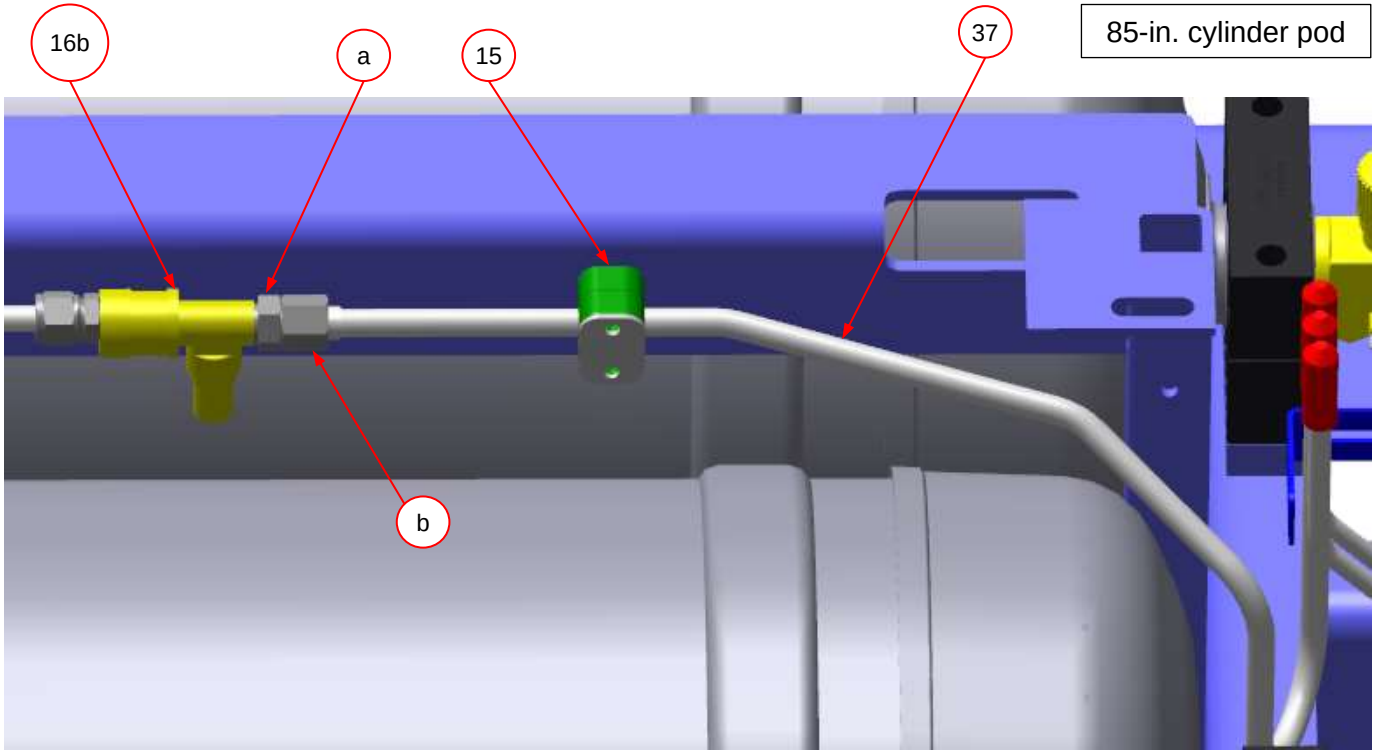
3	Install PRD supply tube (5c) nut fitting (a) at tee fitting (12) of PRD tube (13). **NOTICE** ***Tighten fitting finger tight; fitting will be torqued at a later step.***	85-in. cylinder pod 
WHAT		
WHY		

4 WHAT	M ***Always use a backing wrench on the main fitting while using a wrench to install another fitting.*** 1. Install tube adapter fitting (17), p/n 10200238 on VTI PRD (16b), p/n 10300513. C ***Torque fitting (17) to 26 ft-lbs (35.25Nm)*** 2. Install straight fitting (18), p/n 10200563, on VTI PRD (16a), p/n 10300513. 3. Install straight fitting (18), p/n 10200563, on VTI PRD (16a), p/n 10300513. C ***Torque fittings (18) to 18.5 ft-lbs (25Nm).*** 4. Install tube fitting (14), p/n 10200065, on VTI PRD (16a), p/n 10300513. C ***Torque fitting (14) to 45 ft-lbs (61Nm).***	85-in. cylinder pod 
WHY		

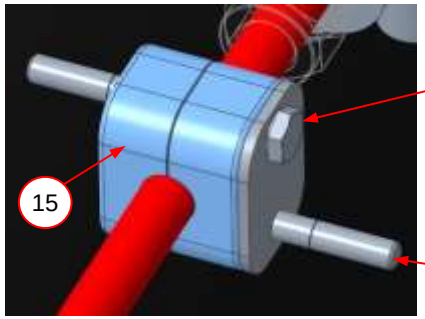
5	1. Install VTI PRD (16a) assembly inlet fitting (a) on PRD supply tube (13) at tee fitting (12). 2. Install VTI PRD outlet fitting (16b) on straight fitting (b) on other end of PRD supply tube (13). **NOTICE** ***Tighten fittings finger tight; fittings will be torqued at a later step.*** ***PRD ports (c) must be oriented 90° down from the flow of system tubing as shown.***	85-in. cylinder pod 
WHAT		
WHY		

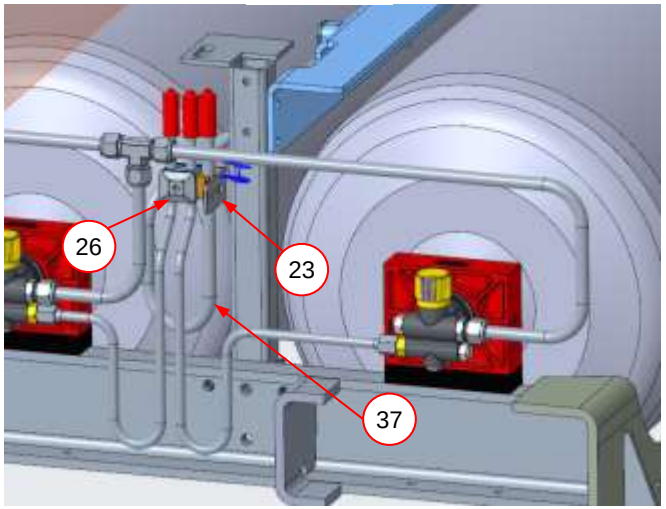
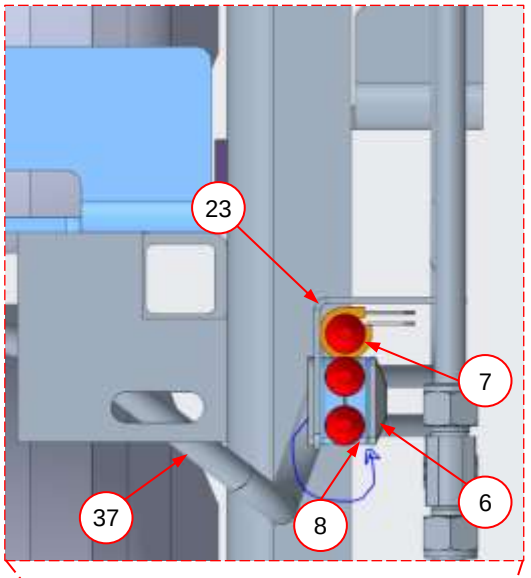
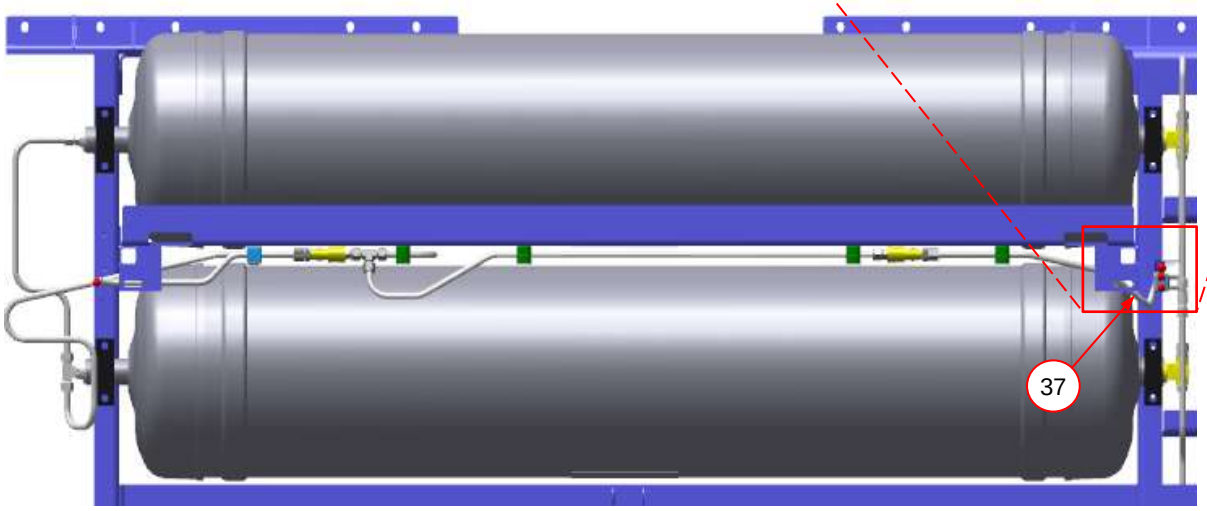
6a WHAT	1. Install PRD vent tube (26), p/n 25519026, on PRD (16a) fitting (a). **NOTICE** ***Tighten nut fitting finger tight; fittings will be tightened at a later step.*** 2. Slip dual tube clamp (8), on PRD vent tube (26), and on PRD vent tube (5a). 3. Use dual tube clamp (8) fasteners *(not visible)* to secure plate (6) and PRD vent tube (26), to PRD bracket (9) at hole *(circled).* 4. Slide P-clip on PRD vent tube (26) and use existing fastener to secure P-clip (7) to P-clip bracket (b). **NOTICE** ***Tighten fasteners finger tight; fasteners will be torqued at a later step.***	85-in. cylinder pod 
WHY		

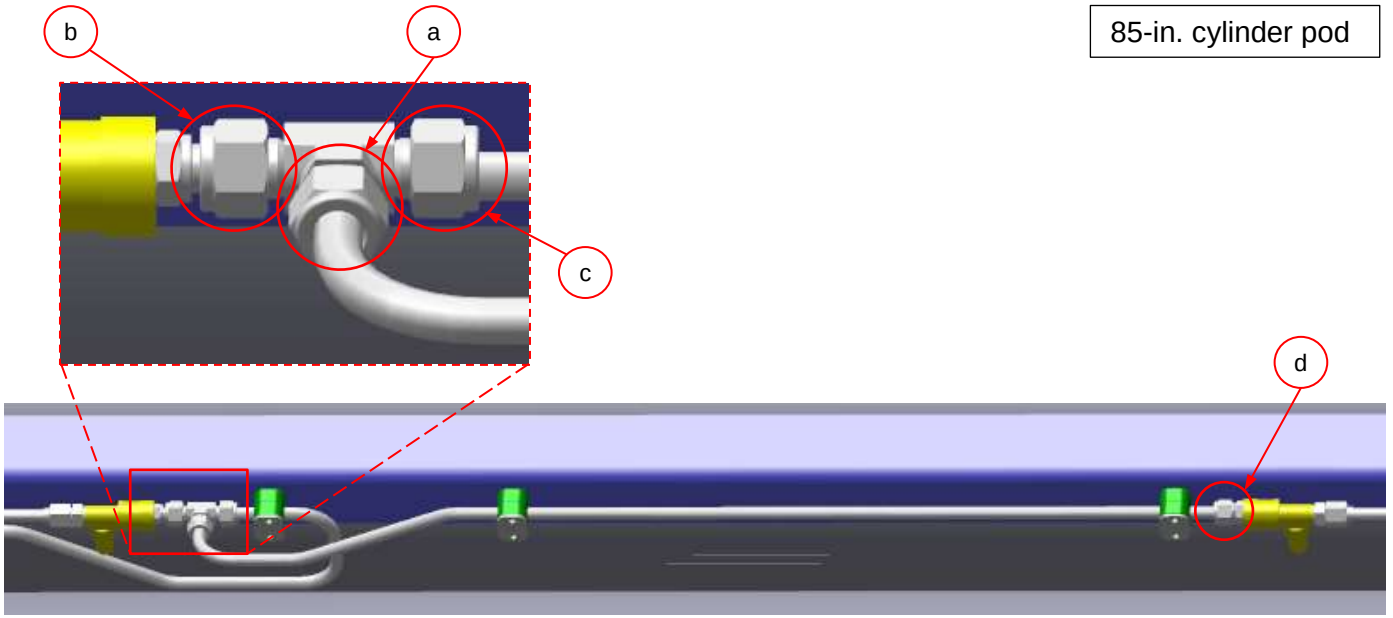
6b WHAT	1. Install PRD vent tube (37), p/n 25519037, on PRD (16b) fitting (a). **NOTICE** ***Tighten nut fitting (b) finger tight; fitting will be tightened at a later step.*** 2. Slip tube clamp kit (15), on PRD vent tube (37). 3. Insert one 1.5-in. hex cap screw, p/n 10760200-0150, and one 2.5-in. hex cap screw, p/n 10760200-0120, into each tube clamp kit (15), as shown in INSET A. 4. Install one flat washer, p/n 10761000, and one flange top nut, p/n 10763000 *(not shown)* on each hex cap screw inserted in previous sub step. 5. Secure PRD vent tube (37) to PRD bracket (9) at hole. **NOTICE** ***Tighten fasteners finger tight; fasteners will be torqued at a later step.***
WHY	

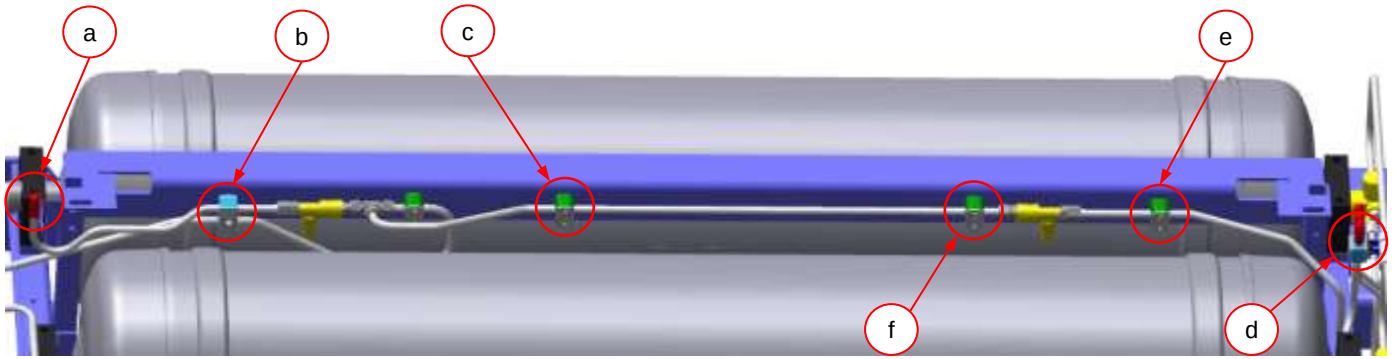


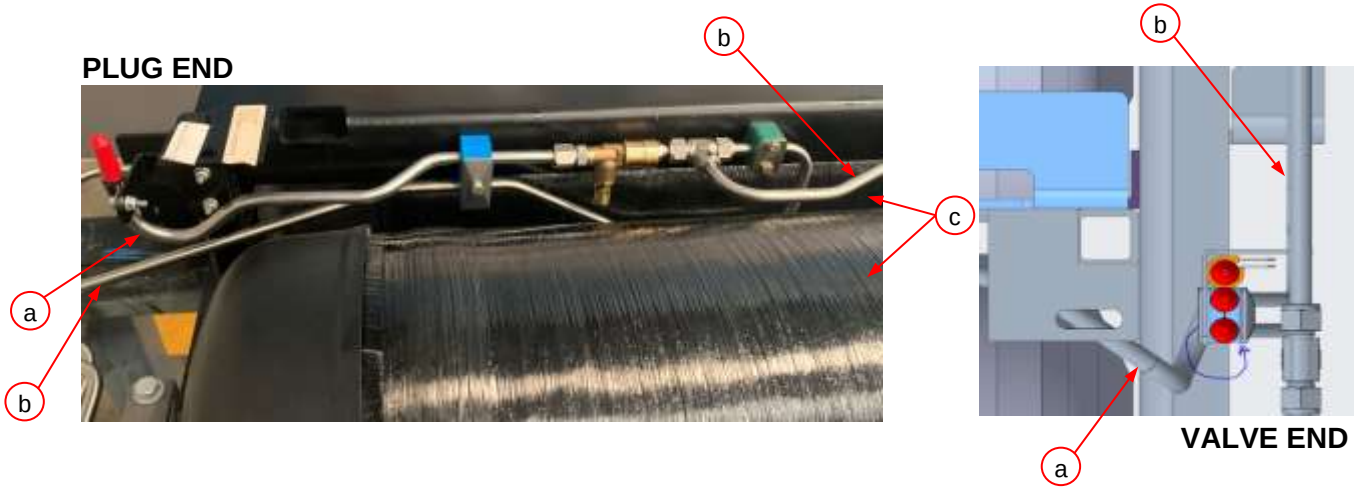
INSET A

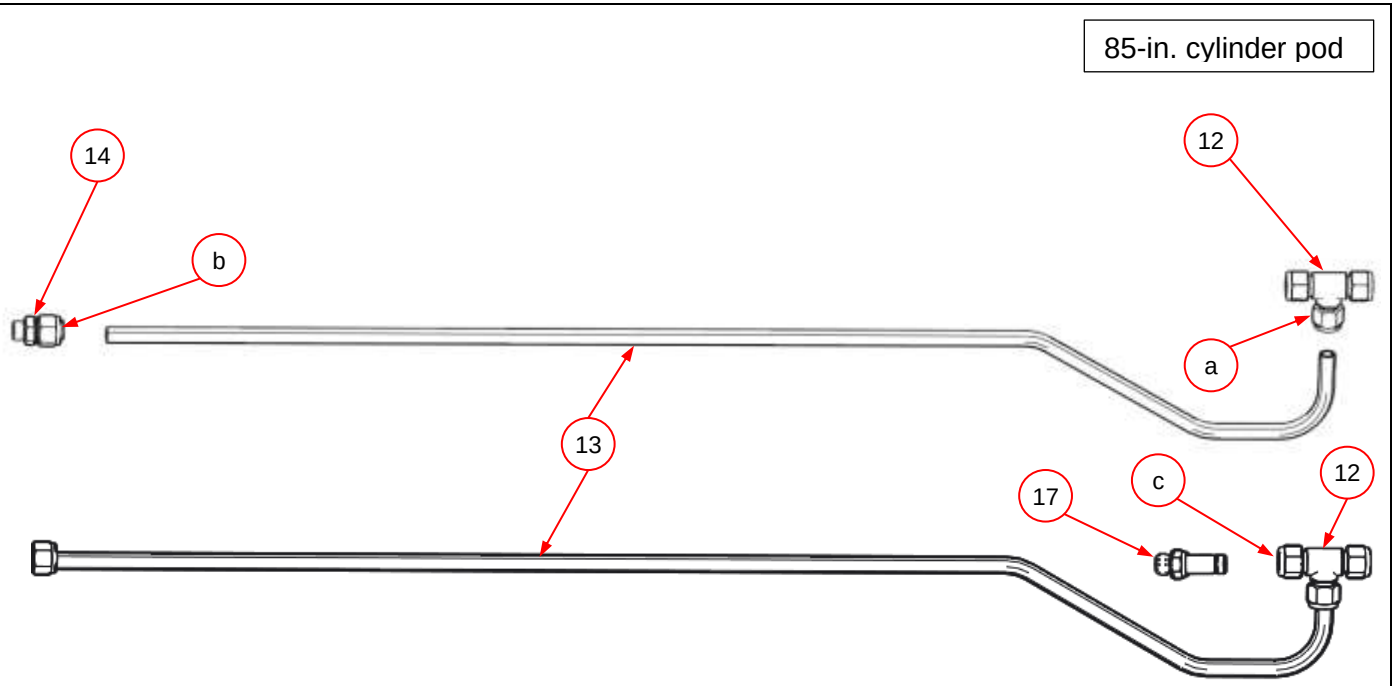


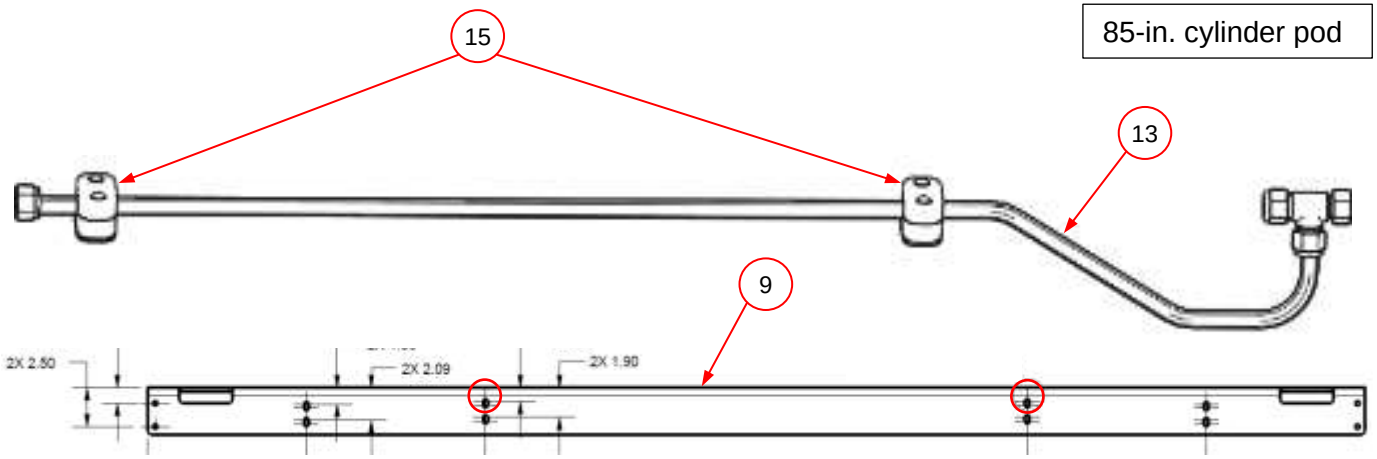
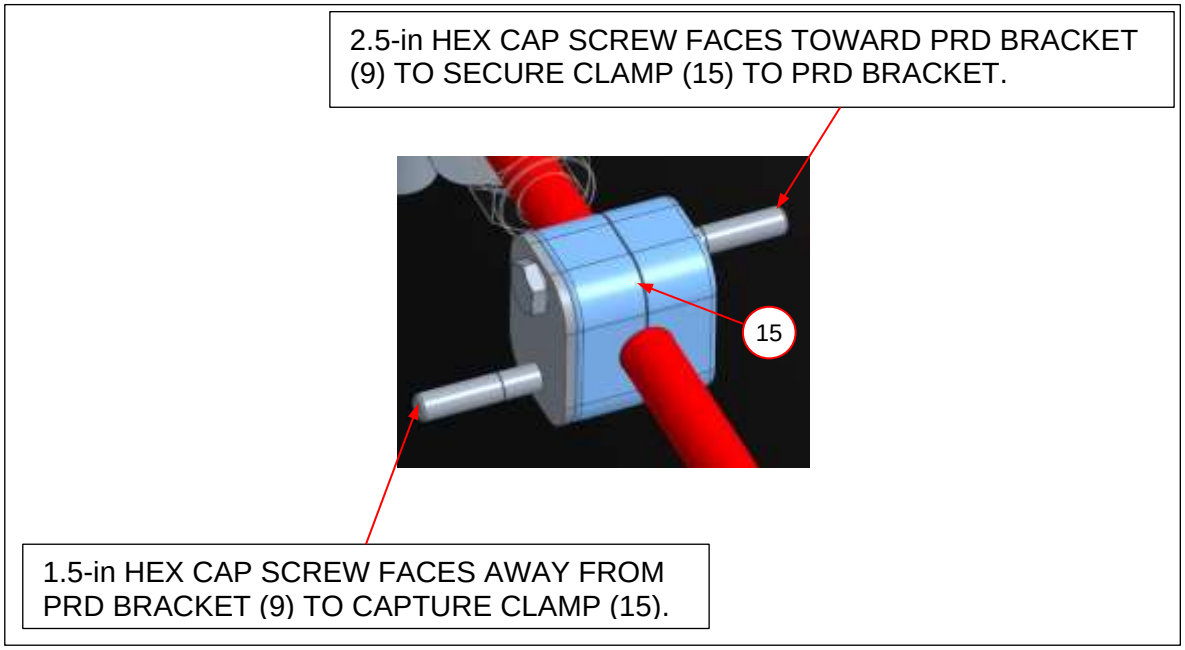
7	1. Install tube clamp bracket (23), p/n 25519123, on existing double tube clamp (8) using the double tube clamp fasteners *(not shown).* 2. Install P-clip (7), p/n 10702147, on PRD vent tube (37), p/n 25519037, and secure to bracket (23), p/n 25519123 using one hex cap screw, p/n 10760200-0100, one flat washer, p/n 10761000, and one flange top nut, p/n 10761300. **NOTICE** ***Tighten fasteners finger tight; fasteners will be tightened at a later step.***	85-in. cylinder pod **VIEW A**   
WHY	System specification.	

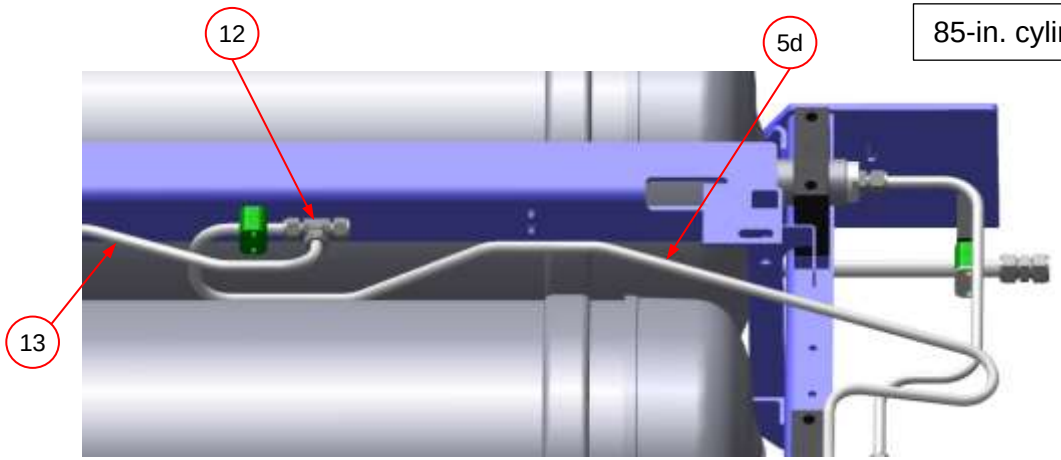
8a	c Use two wrenches to tighten 1/2-in. Swagelok® fitting nuts indicated in the following sequence: 1. (a) 2. (b) 3. (c) 4. (d) ***Tighten 1/2-in. Swagelok® fittings per Appendix B WI.0441.***	
WHAT		
WHY	System specification.	
8b	c Use two wrenches to tighten SAE / JIC fitting nuts at the locations indicated in the following sequence: 1. (e) 2. (f) ***Tighten SAE / JIC fittings to 45 ft-lbs (61Nm).***	
WHAT		
WHY	System specification.	

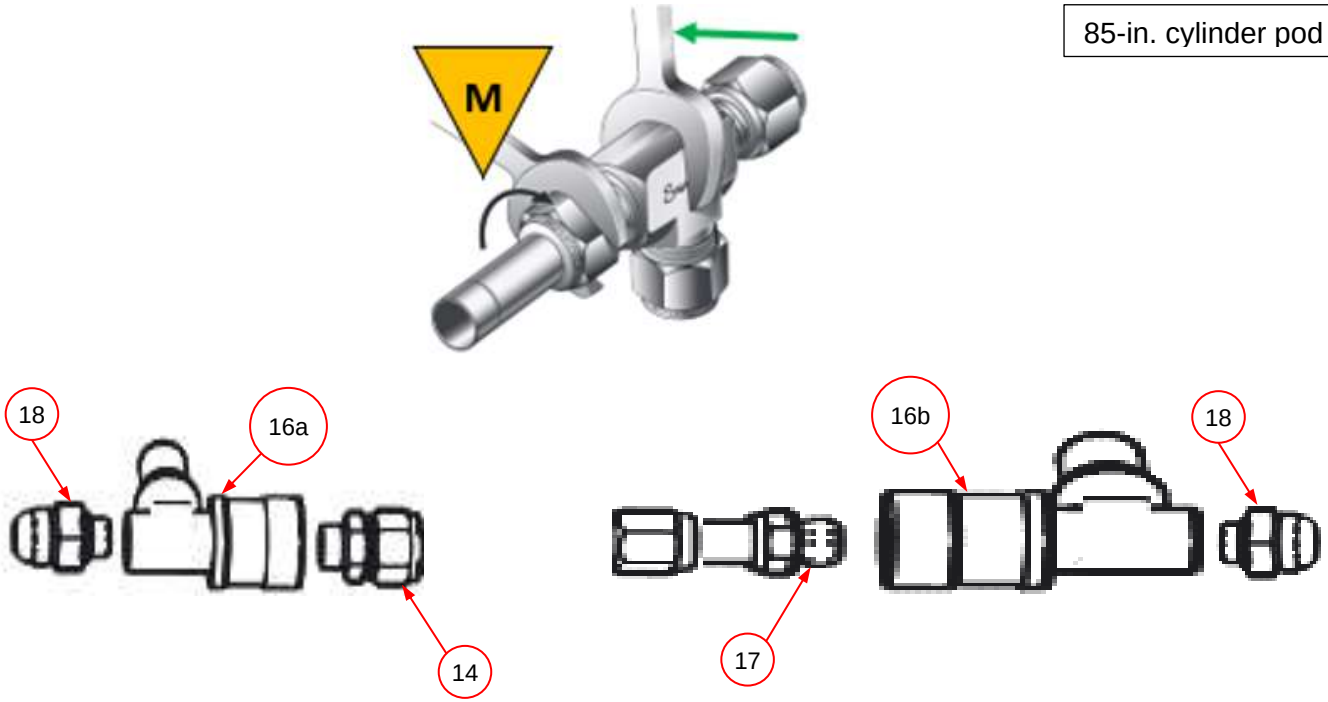
9	c Tighten clamp fasteners at all clamp locations *(circled)* using the following sequence: 1. (a) 2. (b) 3. (c) 4. (d) 5. (e) 6. (f) ***Tighten fasteners to* 8 ft-lbs (11Nm).**	85-in. cylinder pod 
WHY	System specification. **NOTICE** ***Proper tightening sequence is crucial to system performance.***	

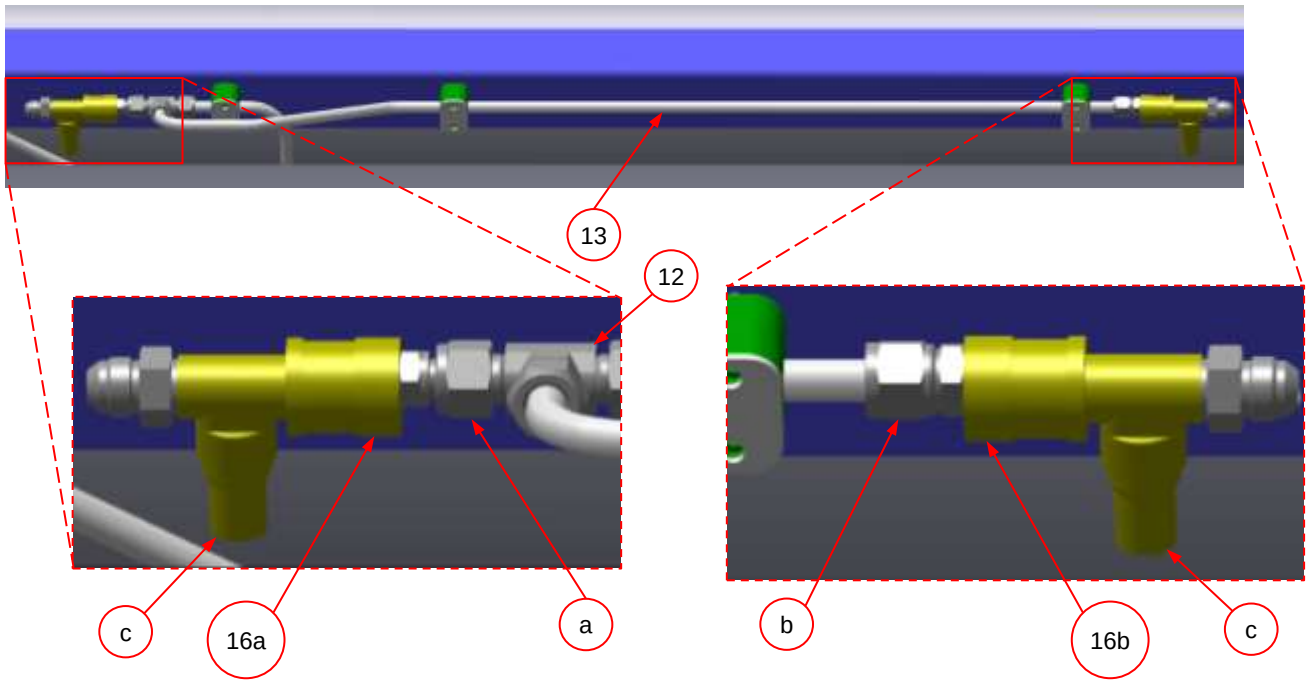
10 WHAT	c 1. Verify clearance between PRD vent tubes (a) and live high pressure PRD vent tubes (b) is 3/8-in. minimum. c 2. Verify clearance between all system plumbing and cylinders (c) is 3/8-in. minimum. **NOTICE** ***If required: Adjust tube clips and clamps as necessary and repeat Step 10.***	85-in. cylinder pod **PLUG END**  **VALVE END**
WHY	Prevent fuel line damage.	

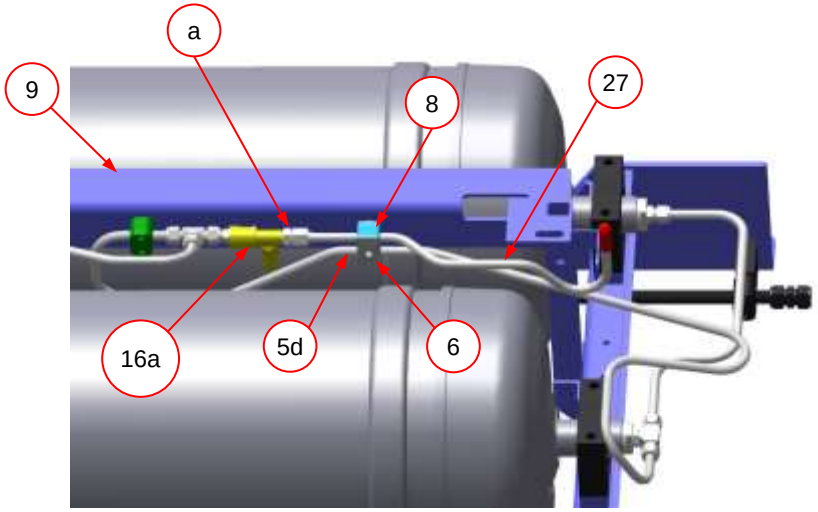
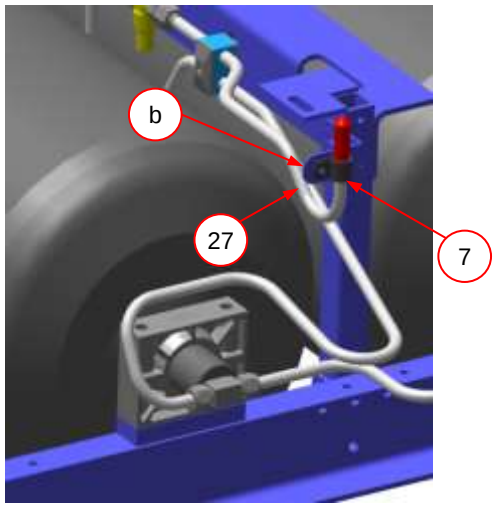
11 WHAT	1. Install ferrules *(not visible)* and nut (a) from tee fitting (12), p/n 10200208, on PRD vent tube, (13), p/n 25519417. 2. Install ferrules *(not visible)* and nut (b) from tube fitting (14), p/n 10200065, on straight end of PRD vent tube (13). 3. Install ferrules *(not visible)* and nut (c) from tee fitting (12), p/n 10200208, on tube adapter fitting, (17), p/n 10200238. **NOTICE** ***Refer to Appendix A: WI.0197 Manual Swaging of Swagelok Fittings.*** 4. Install tee fitting (12), p/n 10200208, on PRD vent tube (13), p/n 25519417. **NOTICE** ***Tighten fitting finger tight; fittings will be tightened at a later step.***	
WHY		

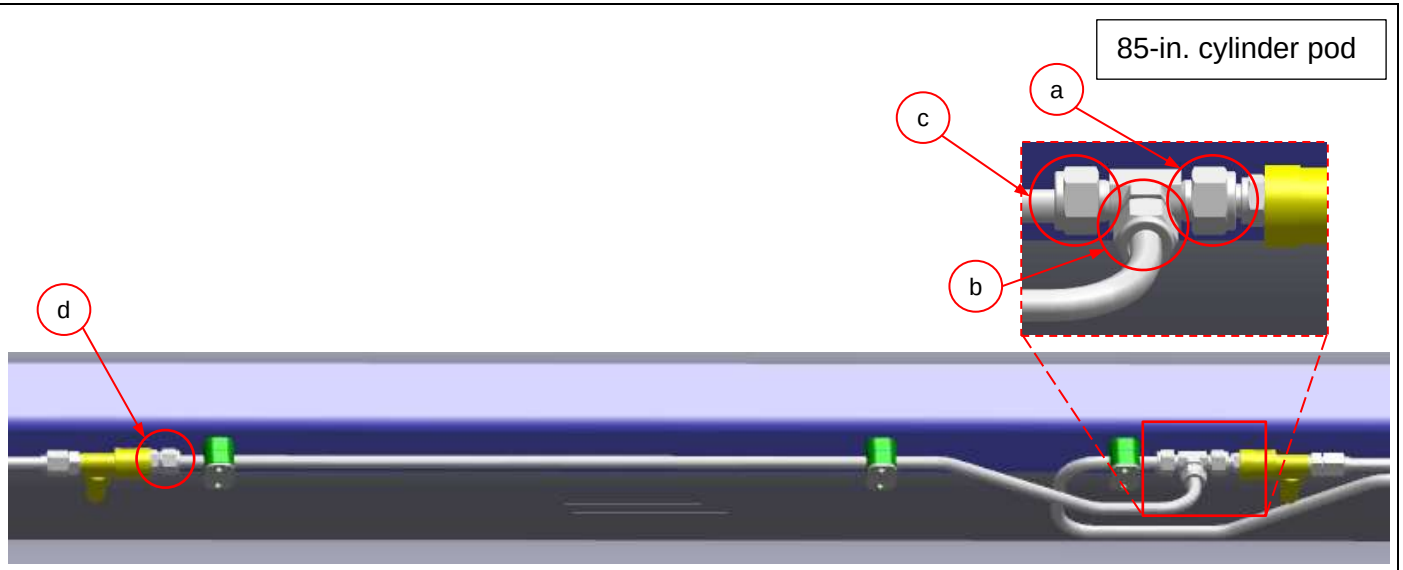
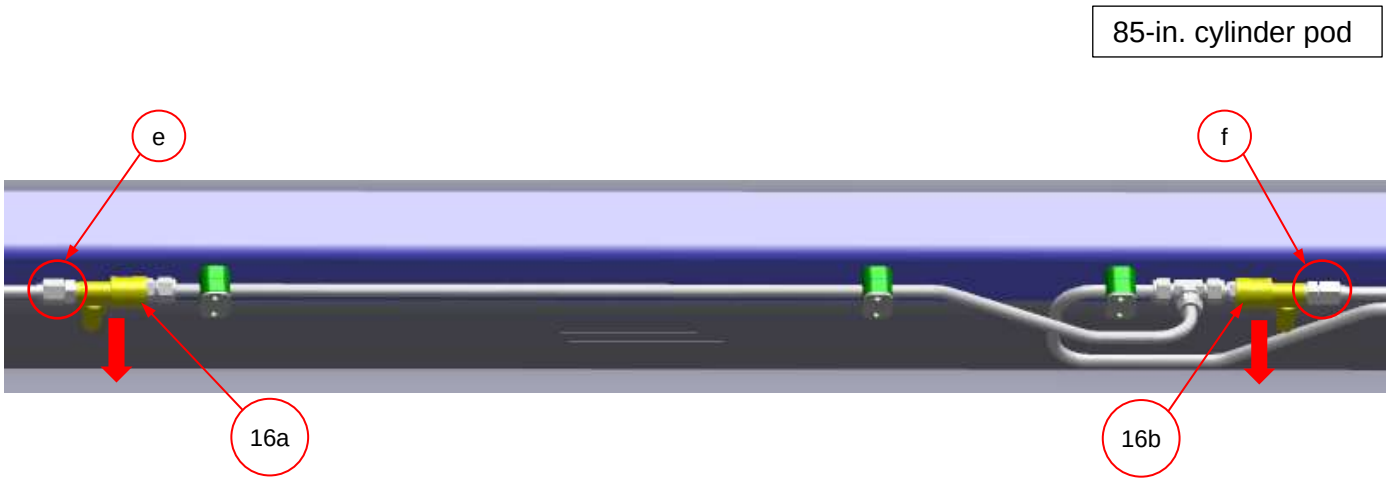
12 WHAT	1. Install two tube clamp kits (15), p/n 10701508, on Tube, Formed, HP Fuel, 1/2-in. X .049 -in., Tee to PRD, (13), p/n 25519417. 2. Insert one 1.5-in. hex cap screw, p/n 10760200-0150, and one 2.5-in. hex cap screw, p/n 10760200-0120, into each tube clamp kit (15), as shown in INSET A. 3. Install one flat washer, p/n 10761000, and one flange top nut, p/n 10763000 *(not shown)* on each hex cap screw inserted in previous sub step. 4. Secure PRD vent tube (13) to PRD bracket (9) at holes *(circled).* **NOTICE** ***To ease component installation, do not tighten fasteners completely; fasteners will be torqued at a later step***	 **INSET A** 
WHY	Support PRD vent lines.	

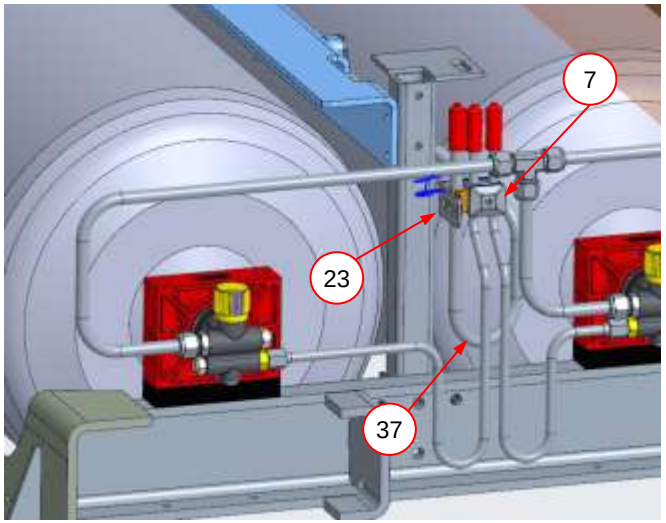
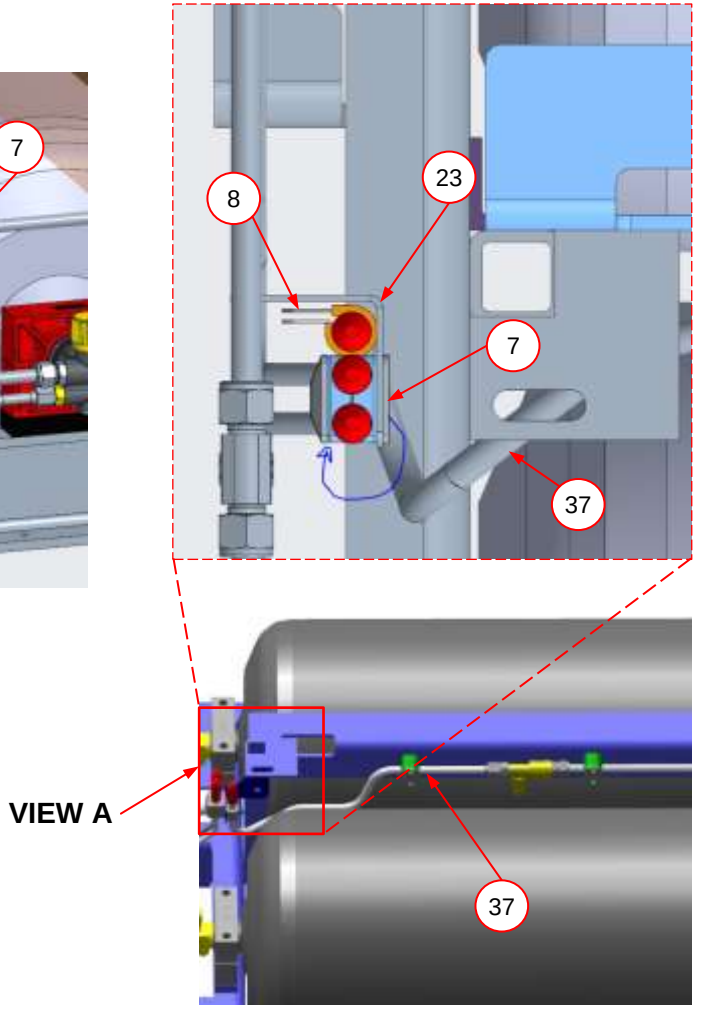
13	Install PRD supply tube (5d) on PRD supply tube (13) at tee fitting (12). **NOTICE** ***Tighten fitting finger tight; fitting will be tightened at a later step.***	 85-in. cylinder pod
WHAT		
WHY		

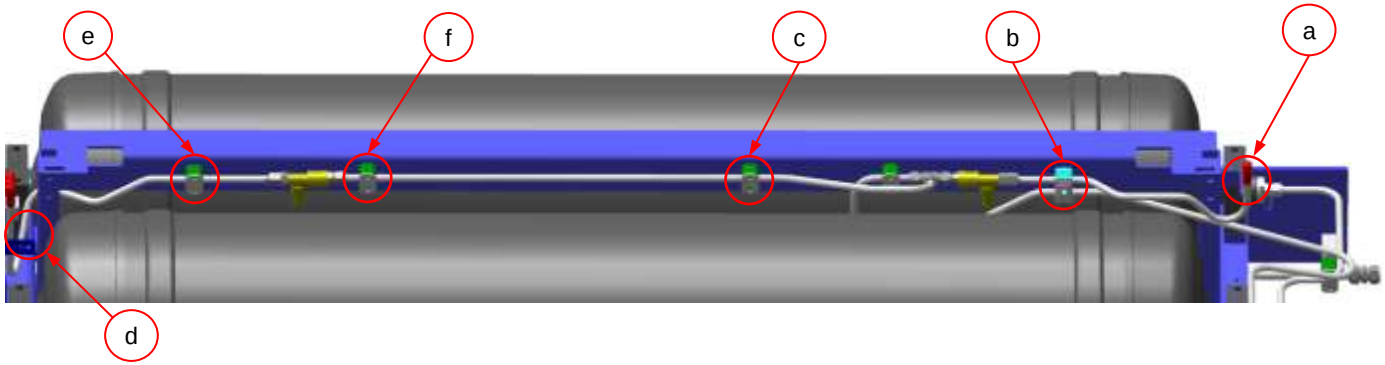
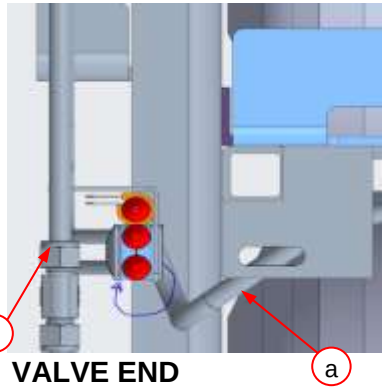
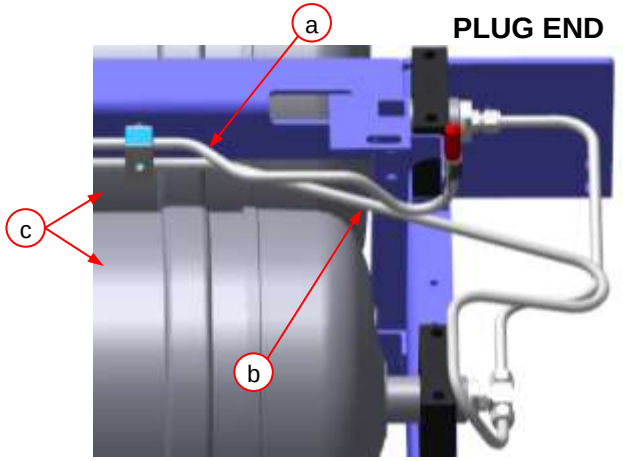
14 WHAT	M ***Always use a backing wrench on the main fitting while using a wrench to install another fitting.*** 5. Install tube adapter fitting (17), p/n 10200238 on VTI PRD (16b), p/n 10300513. C ***Torque fitting (17) to* 26 ft-lbs (35.25Nm)** 6. Install straight fitting (18), p/n 10200563, on VTI PRD (16a), p/n 10300513. 7. Install straight fitting (18), p/n 10200563, on VTI PRD (16a), p/n 10300513. C ***Torque fittings (18) to* 18.5 ft-lbs (25Nm).** 8. Install tube fitting (14), p/n 10200065, on VTI PRD (16a), p/n 10300513. C ***Torque fitting (14) to* 45 ft-lbs (61Nm).**	85-in. cylinder pod 
WHY		

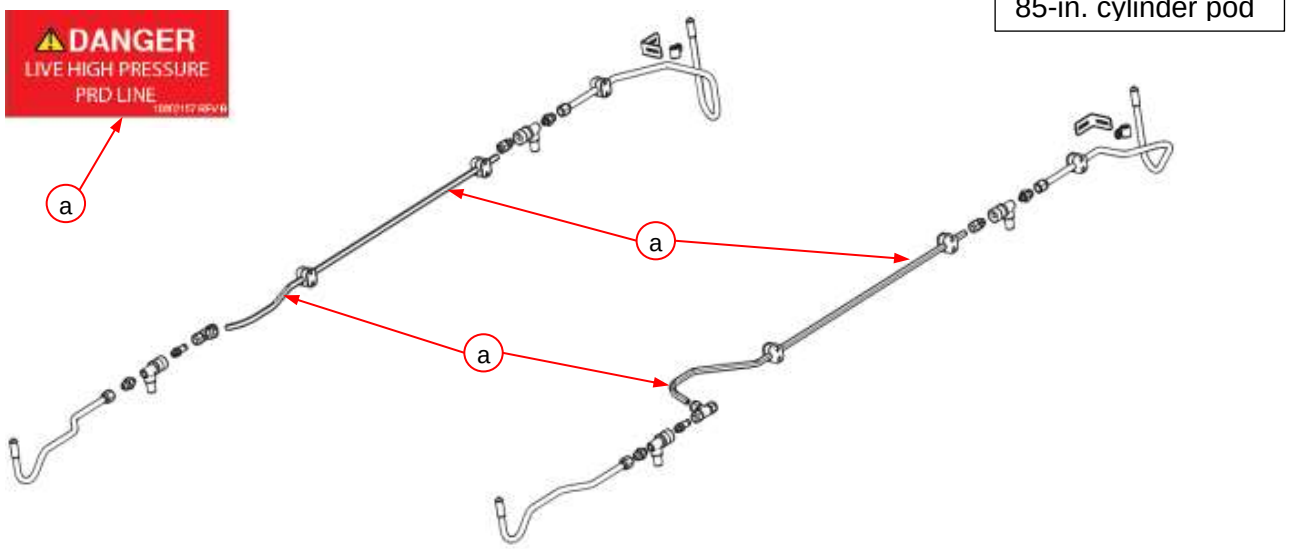
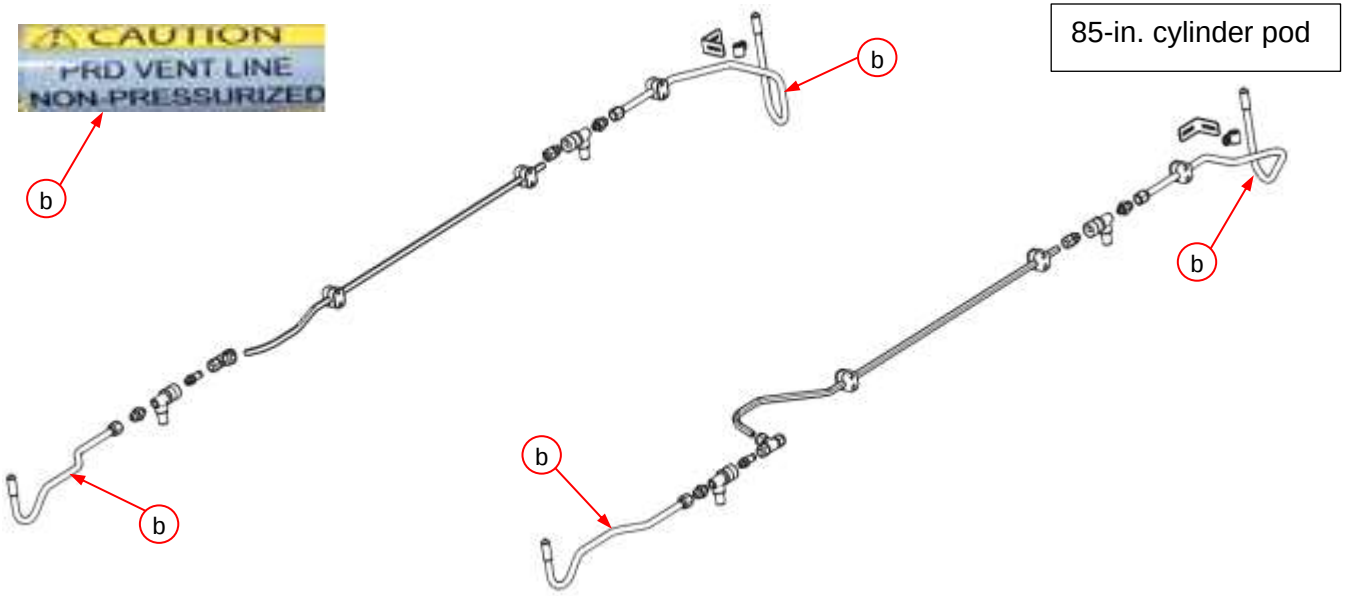
15	1. Install VTI PRD (16a) assembly inlet fitting (a) on PRD supply tube (13) at tee fitting (12). 2. Install VTI PRD outlet fitting (16b) on straight fitting (b) on other end of PRD supply tube (13).	85-in. cylinder pod
WHAT	**NOTICE** ***Tighten fittings finger tight; fittings will be torqued at a later step.*** ***PRD ports (c) must be oriented 90° down from the flow of system tubing as shown.***	
WHY		

16	1. Install PRD vent tube (27), p/n 25519027, on PRD (16a) fitting (a). **NOTICE** ***Tighten fittings finger tight; fittings will be torqued at a later step.*** 2. Use dual tube clamp, (8) and plate (6), to secure PRD supply tube (5d) to PRD vent tube (27). 3. Slip P-clip (7) on PRD vent tube (27). 4. Attach P-clip (7) to P-clip bracket (b) using existing fasteners *(not visible).* **NOTICE** ***Tighten fasteners finger tight; fasteners will be torqued at a later step.***	85-in. cylinder pod  
WHY		

17 a WHAT	▼c Use two wrenches to tighten 1/2-in. Swagelok® nut fittings at four locations *(circled)* in the following sequence: 1. (a) 2. (b) 3. (c) 4. (d) ***Tighten Swagelok® nut fittings per Appendix B WI 0441***	
WHY	System specification.	
17 b WHAT	▼c A. Use two wrenches to tighten SAE / JIC nut fittings at two locations *(circled)* in the following sequence: 1. (e) 2. (f) ***Tighten SAE / JIC nut fittings to* 45 ft-lbs (61Nm).** ▼c B. Verify vent ports of VTI PRDs (16a) and (16b) are pointed down *(arrows).*	
WHY	System specification.	

18	1. Install tube clamp bracket (23), p/n 25519123, on existing double tube clamp (7) using the double tube clamp fasteners *(not shown).* 2. Install P-clip (8), p/n 10702147 on PRD vent tube (37), p/n 25519037. 3. Install P-clip (8) on tube clamp bracket (23) using one hex cap screw, p/n 10760200-0100, one flat washer, p/n 10761000, and one flange top nut, p/n 10761300. **NOTICE** ***Tighten fasteners finger tight; fasteners will be tightened at a later step.***	85-in. cylinder pod **VIEW A**  
WHY	PRD vent tubes may need to be adjusted for clearance.	

19	c Tighten fasteners at clamp and clip locations *(circled)* using the following sequence: 1. (a) 2. (b) 3. (c) 4. (d) 5. (e) 6. (f) ***Tighten fasteners to* 8 ft-lbs (11Nm).**	85-in. cylinder pod 
WHAT		
WHY	System specification.	
20	c 1. Verify clearance between PRD vent tubes (a) and live high pressure PRD supply tubes (b) is 3/8-in. minimum. c 2. Verify clearance between all system plumbing and cylinders (c) is 3/8-in. minimum. **NOTICE** ***If required: Adjust clamps as necessary and repeat Step 20.***	85-in. cylinder pod  **VALVE END**  **PLUG END**
WHAT		
WHY	Prevent fuel line damage.	

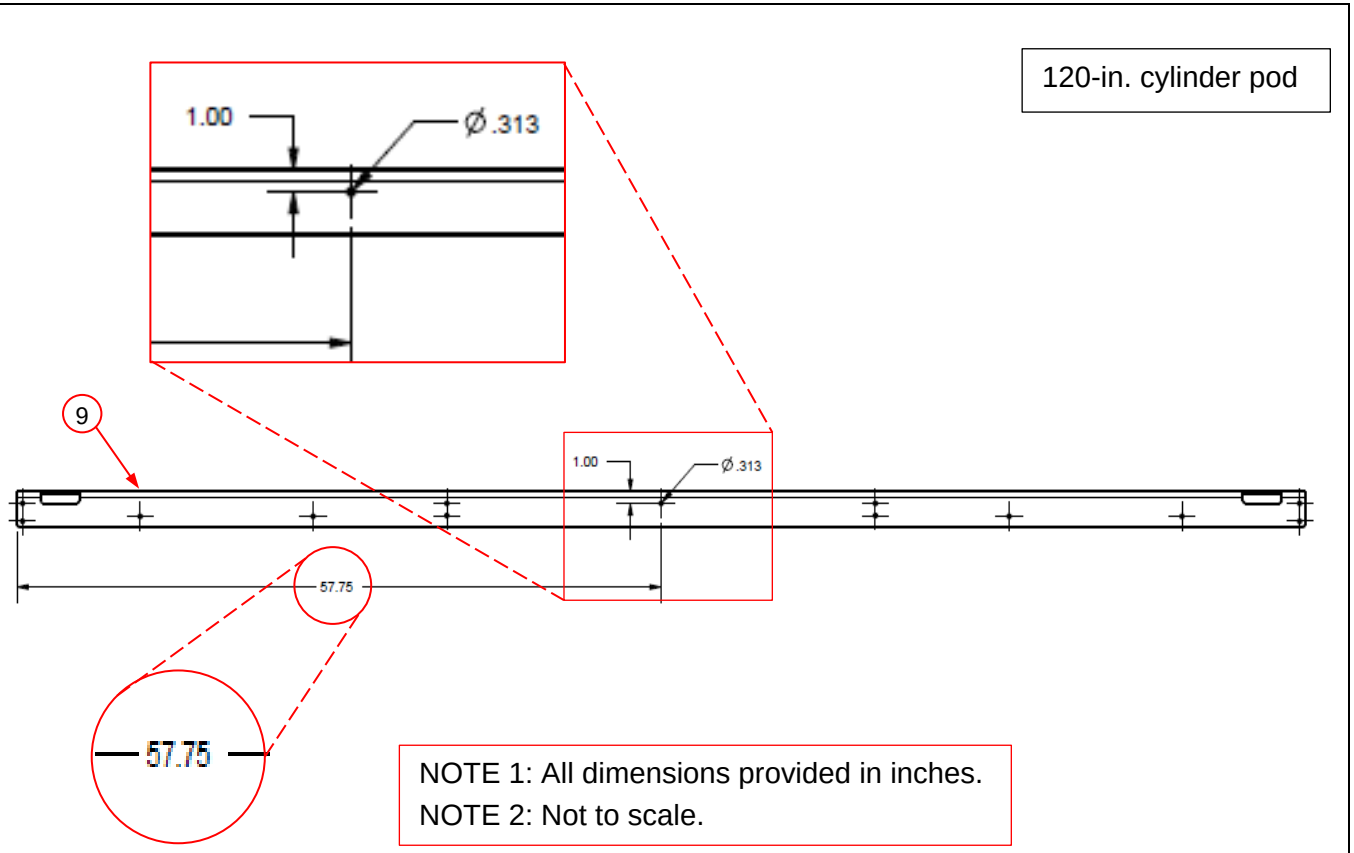
21	c Apply two Decal, System, Danger Live High Pressure PRD Line (a), p/n 10602157, to PRD supply tubes as indicated.	
WHAT		
WHY	Operator and first responder safety.	
22	c Apply four Decal, PRD Vent Line, Caution (b), p/n 10602442, to midpoint of PRD vent tubes as indicated.	
WHAT		
WHY	Operator and first responder safety.	

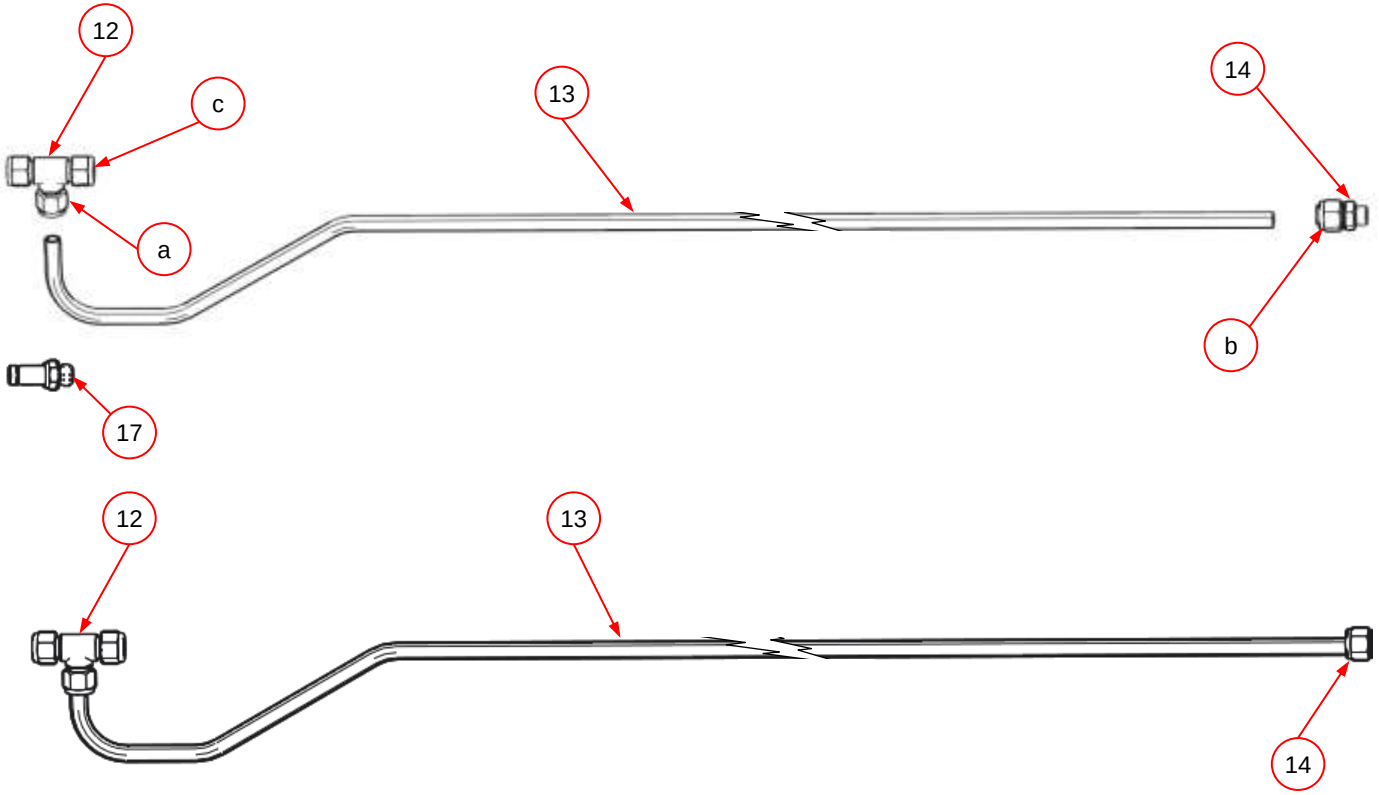
5.4.2. Kit, Retrofit, Gillig, 120" tanks PRD Retrofit, p/n 25519031, installation instructions

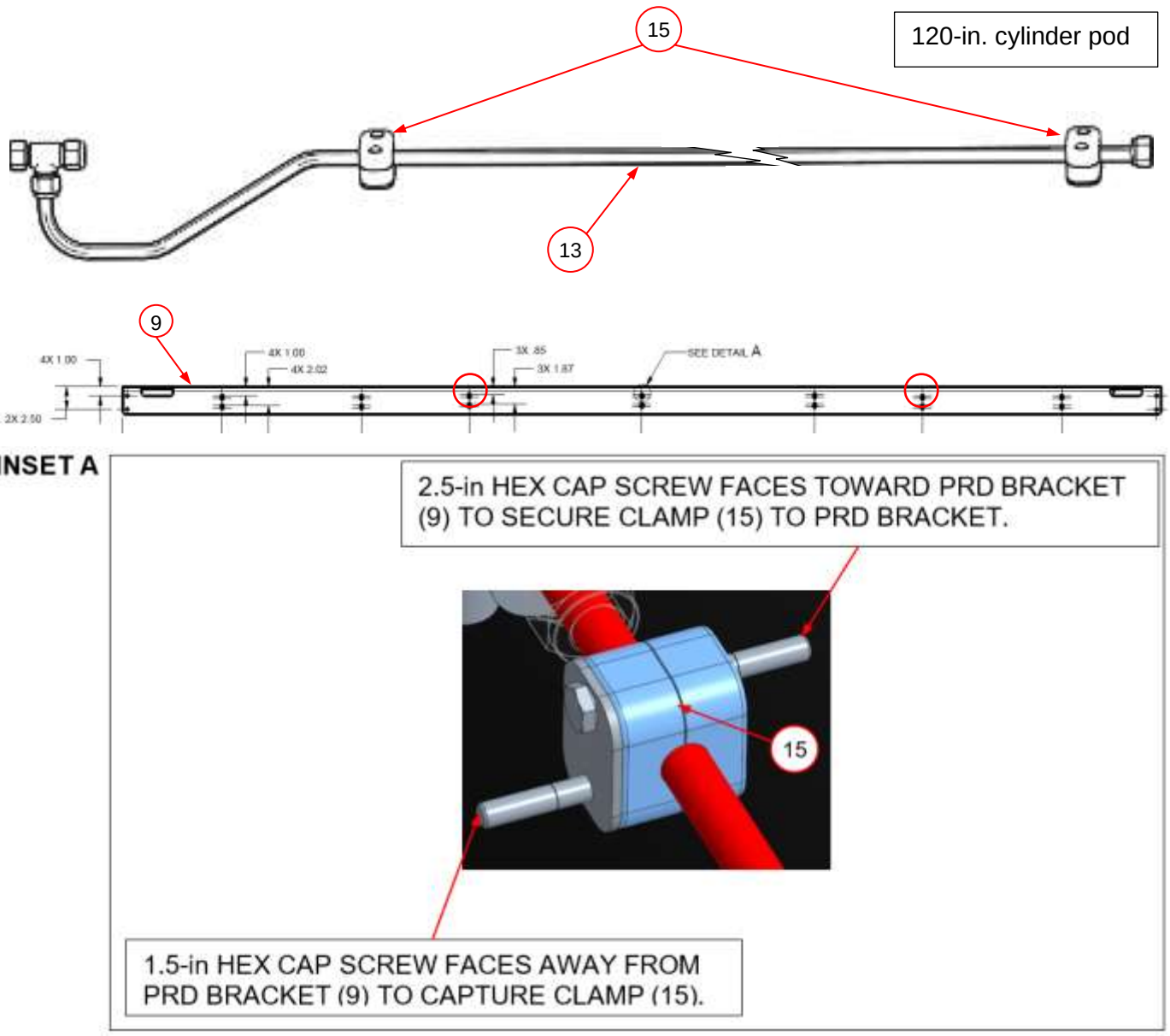
NOTICE

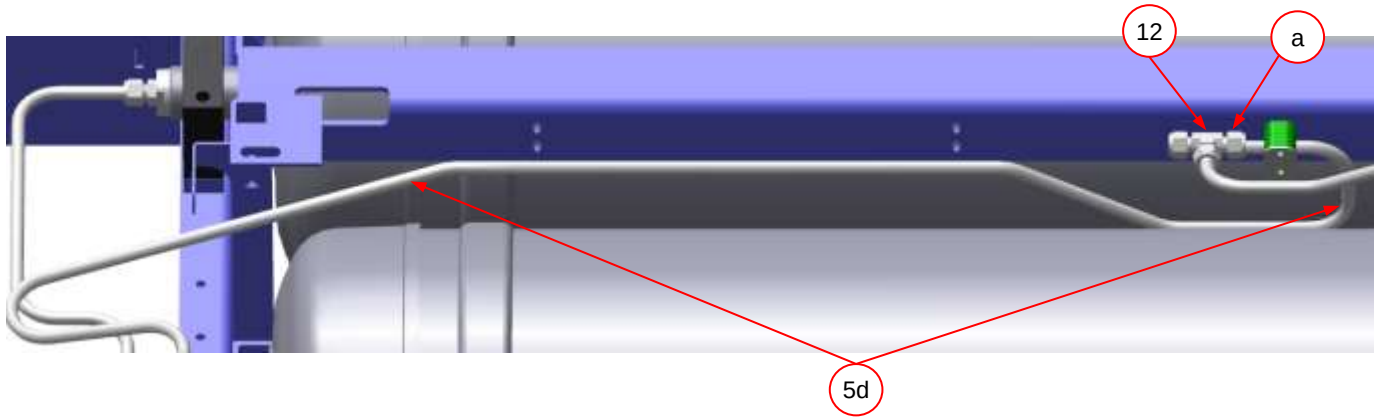
Always perform installation steps in the order specified.

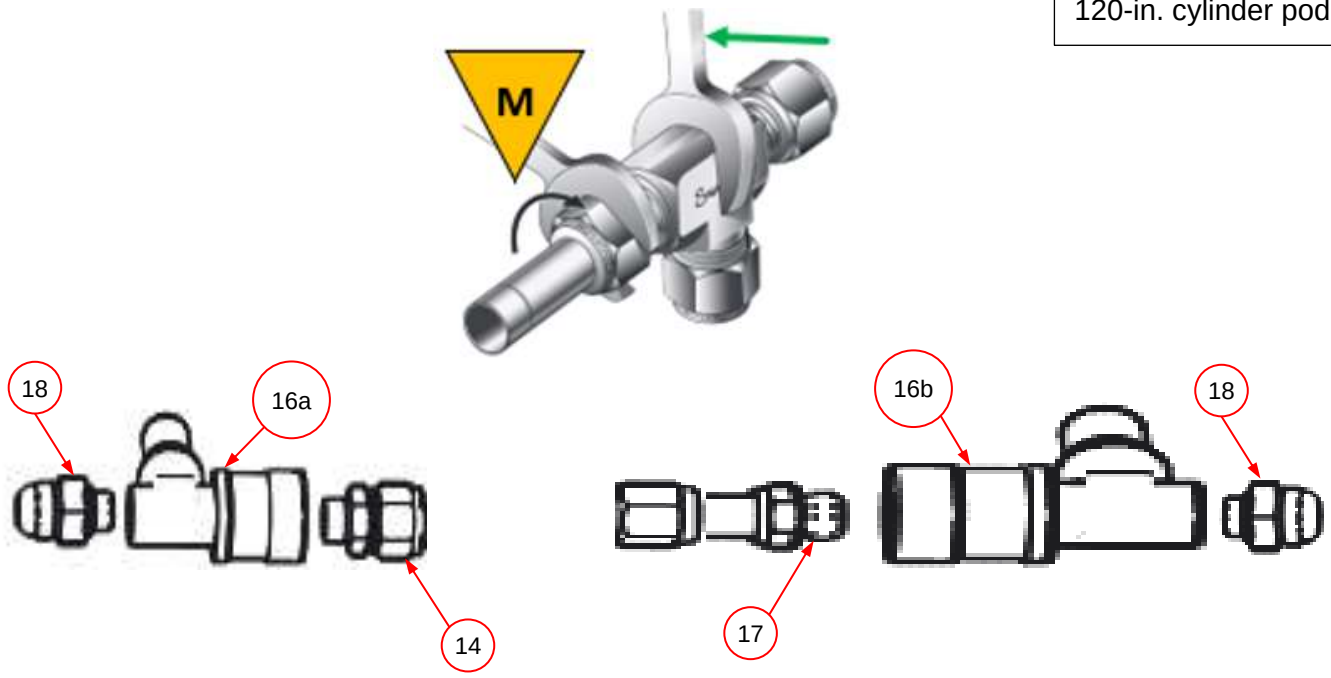
1	WHAT	C Use a 5/16-in. drill bit to drill one mounting hole at the midpoint (DETAIL A) of each of the 120-in. PRD brackets (9). **NOTICE** ***While drilling, carefully place a section of a wood 2x4 behind the hole location to prevent cylinder damage.***
	WHY	Additional mounting holes are required to secure clamps to support PRD vent system.

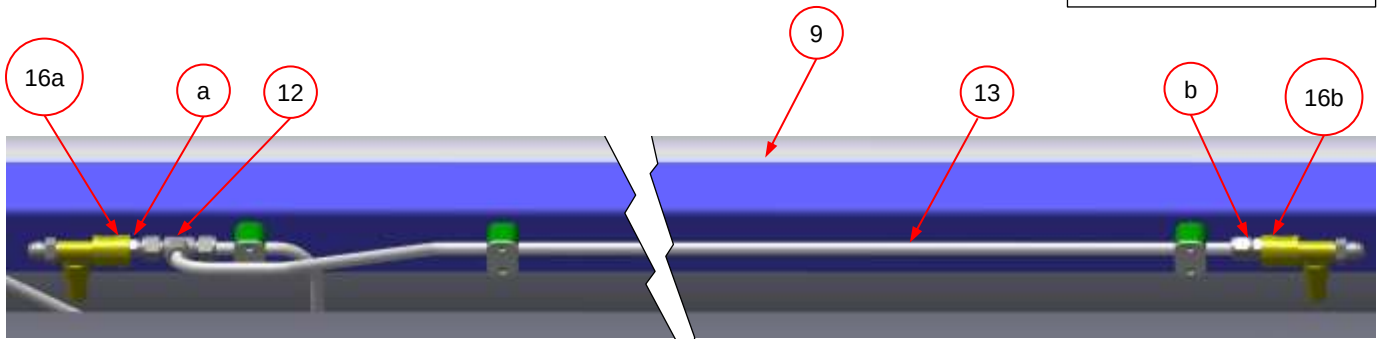


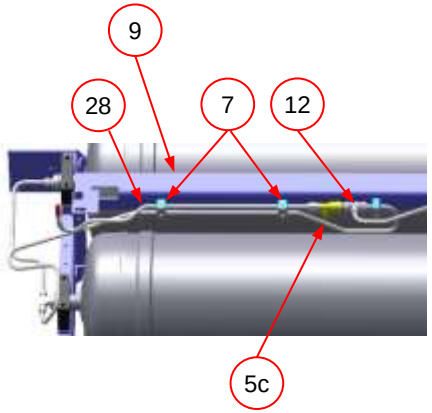
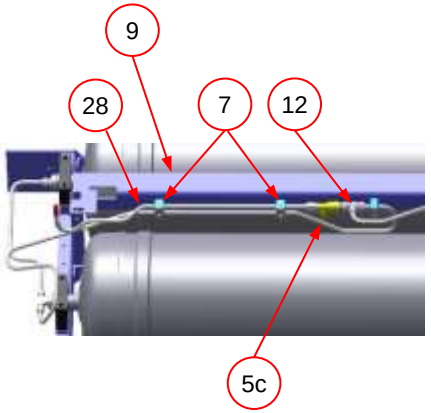
2 WHAT	1. Install ferrules *(not visible)* and nut (a) from tee fitting (12), p/n 10200208, on PRD vent tube (13), p/n 25519416. 2. Install ferrules *(not visible)* and nut (b) from tube fitting (14), p/n 10200065, on straight end of PRD vent tube (13). 3. Install ferrules *(not visible)* and nut (c) from tee fitting (12), p/n 10200208, on tube adapter fitting, (17), p/n 10200238. **NOTICE** ***Refer to Appendix A: WI.0197 Manual Swaging of Swagelok Fittings.*** 4. Install tee fitting (12), p/n 10200208, on PRD vent tube, (13), p/n 25519416. **NOTICE** ***Tighten fitting finger tight; fittings will be tightened at a later step.***	120-in. cylinder pod 
WHY		

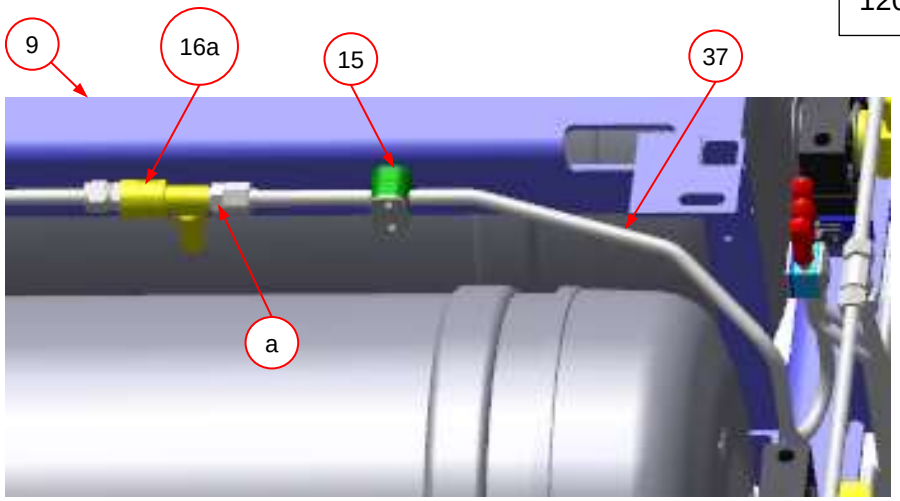
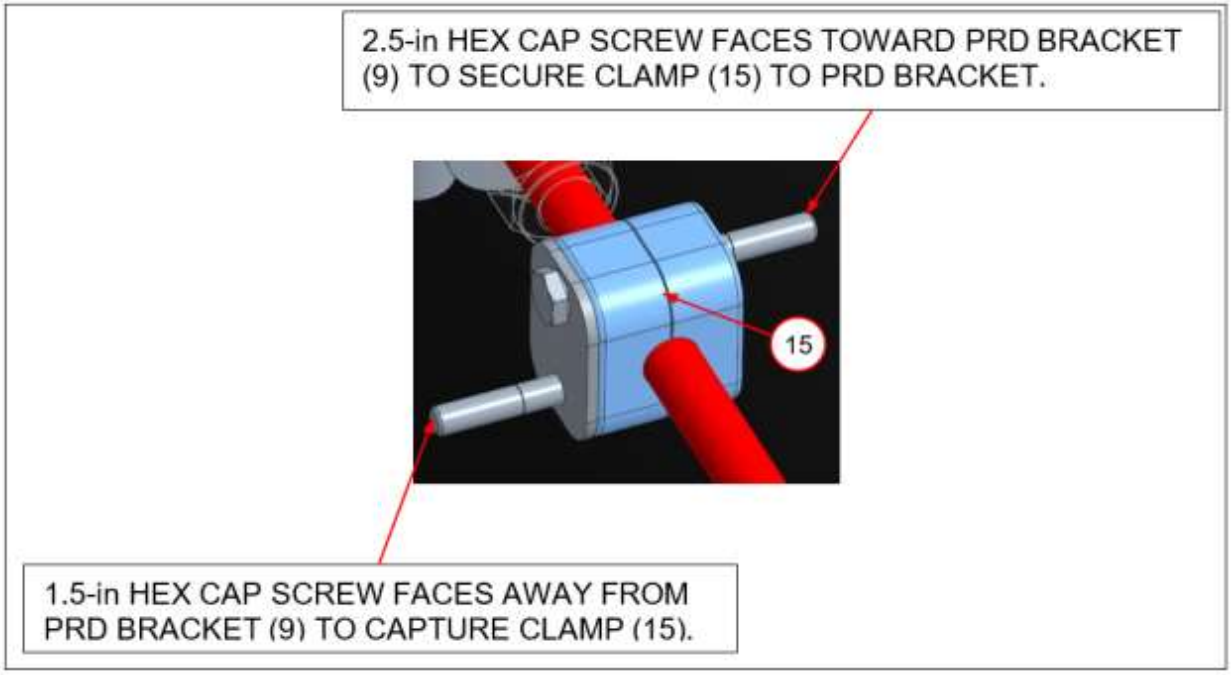
3	1. Install two tube clamp kits (15), p/n 10701508, from retrofit kit on PRD tube, (13), p/n 25519417. 2. Insert one 1.5-in. hex cap screw (a), p/n 10760200-0150, and one 2.5-in. hex cap screw (b), p/n 10760200-0120, into each tube clamp kit (15), as shown in INSET A. 3. Install one flat washer, p/n 10761000, and one flange top nut, p/n 10763000 *(not shown)* on each hex cap screw inserted in previous sub step. 4. Secure PRD vent tube (13) to PRD bracket (9) at holes *(circled).* **NOTICE** ***To ease component installation, do not tighten fasteners completely; fasteners will be tightened at a later step.***	
WHY	Support PRD vent lines.	

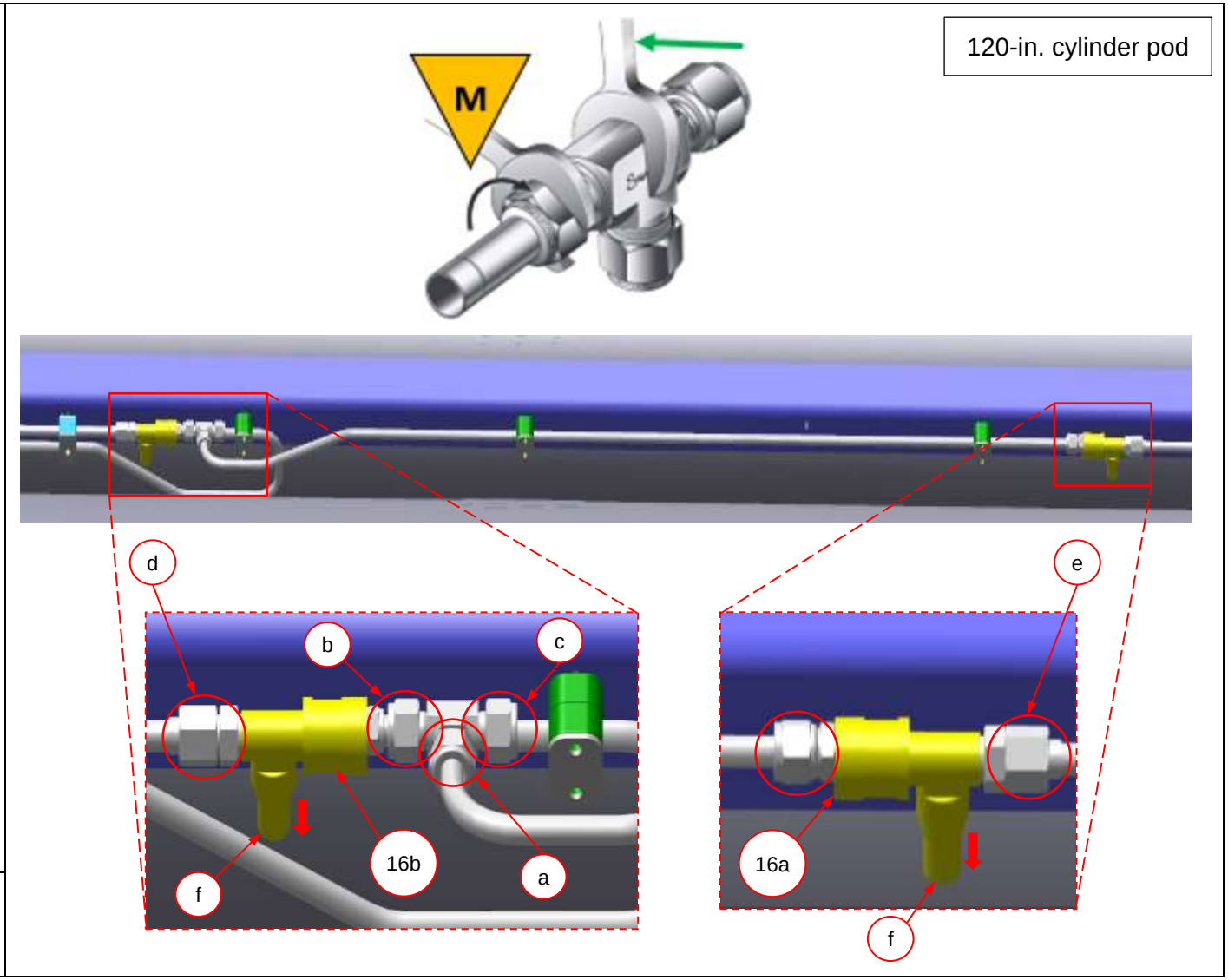
4 WHAT	Install PRD vent supply tube (5d) on tee fitting (12) nut fitting (a). **NOTICE** ***Tighten fittings finger tight; fittings will be tightened at a later step.***	120-in. cylinder pod 
WHY		

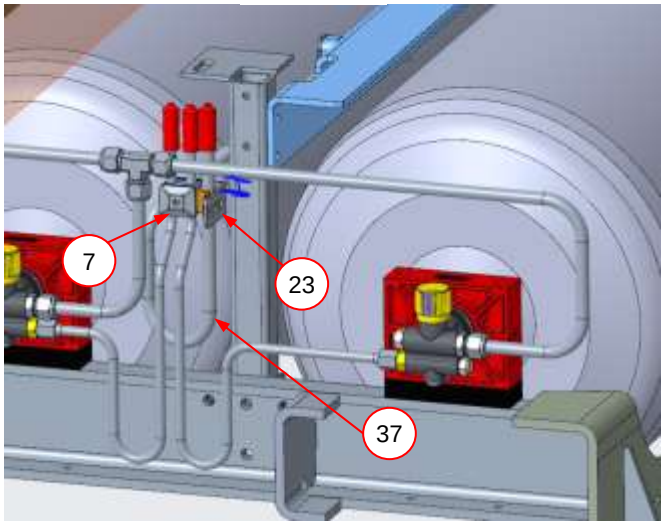
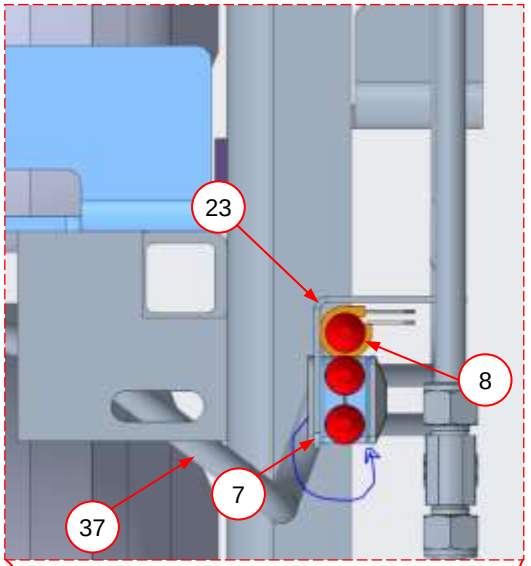
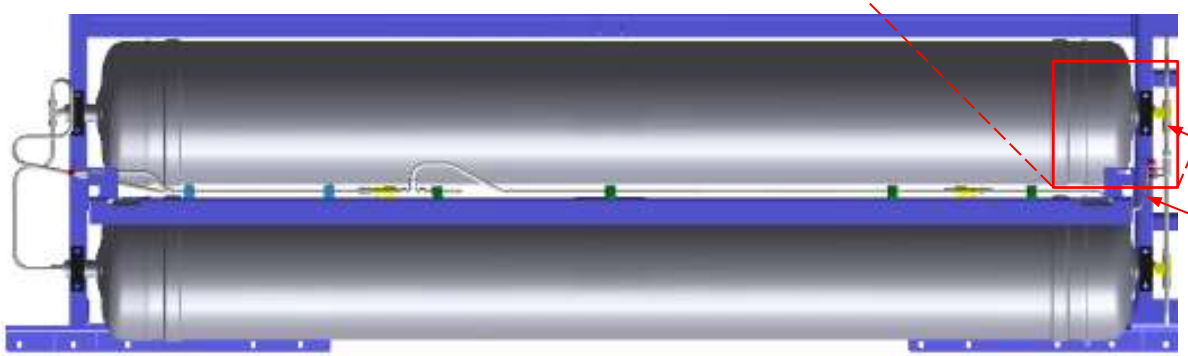
5 WHAT	M ***Always use a backing wrench on the main fitting while using a wrench to install another fitting.*** 1. Install tube adapter fitting (17), p/n 10200238 on VTI PRD (16b), p/n 10300513. C ***Torque fitting (17) to 26 ft-lbs (35.25Nm)*** 2. Install straight fitting (18), p/n 10200563, on VTI PRD (16a), p/n 10300513. 3. Install straight fitting (18), p/n 10200563, on VTI PRD (16a), p/n 10300513. C ***Torque fittings (18) to 18.5 ft-lbs (25Nm).*** 4. Install tube fitting (14), p/n 10200065, on VTI PRD (16a), p/n 10300513. C ***Torque fitting (14) to 45 ft-lbs (61Nm).***	120-in. cylinder pod 
WHY		

6	1. Install VTI PRD (16a) assembly inlet fitting (a) on PRD supply tube (13) at tee fitting (12). 2. Install VTI PRD (16b) outlet fitting (b) on straight end of PRD supply tube (13). **NOTICE** ***Tighten fittings finger tight; fittings will be torqued at a later step.***	
WHAT		
WHY		

7	1. Install PRD vent tube (28), p/n 25519028, on tee fitting (12). **NOTICE** ***Tighten fittings finger tight; fittings will be tightened at a later step.*** 2. Install two Tube Clamp Kits, 1/2-in., Double Mounting Hole (7), p/n 10701508, from retrofit kit on PRD vent tube (28), and PRD supply tube (5c). 3. Use dual tube clamp (7) fasteners *(not visible)* from to secure clamps to PRD bracket (9). **NOTICE** ***Tighten fasteners finger tight; fasteners will be tightened at a later step.***	120-in. cylinder pod 	8	1. Slip P-clip (8) removed earlier on PRD vent tube (28), p/n 25519028. 2. Secure P-clip (8) to P-clip bracket (b) using existing hardware. **NOTICE** ***Tighten fasteners finger tight; fasteners will be tightened at a later step.***	120-in. cylinder pod 
WHY			WHY		

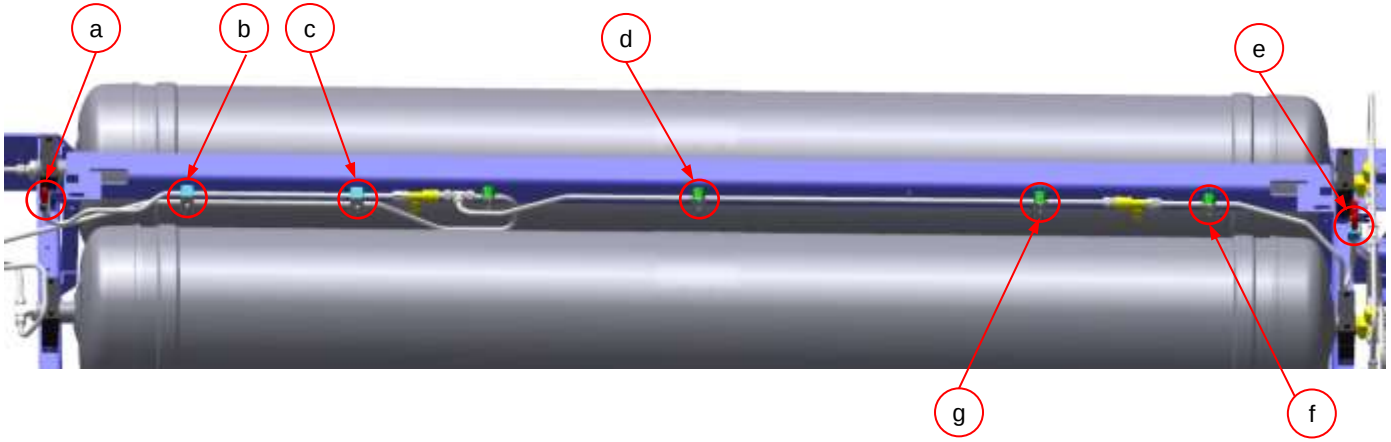
9	1. Install nut fitting of PRD vent tube (37) on VTI PRD (16a) outlet fitting (a). **NOTICE** ***Tighten fitting finger tight; fitting will be tightened at a later step.*** 2. Install tube clamp kit (15), p/n 10701508, on PRD vent tube (37). 3. Use tube clamp kit (15) fasteners *(not visible)* from to secure clamp to PRD bracket (9) at existing hole using clamp kit fasteners as shown in INSET A. **NOTICE** ***Tighten fasteners finger tight; fasteners will be tightened at a later step.***	120-in. cylinder pod  **INSET A** 
WHY		

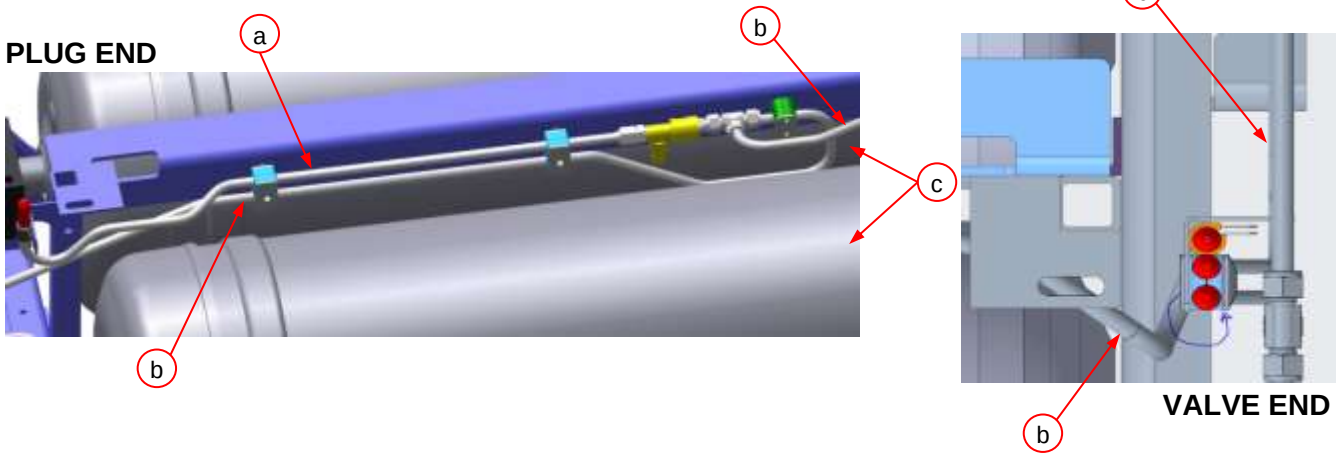
10	1. Use two wrenches to tighten Swagelok® nut fittings in the following sequence: 1. (a) 2. (b) 3. (c) c ***Tighten Swagelok® fittings per Appendix B WI.0441.*** 2. Use two wrenches to tighten SAE / JIC fitting nuts in the following sequence: 1. (d) 2. (e) c ***Torque SAE / JIC fittings to* 45 ft-lbs (61Nm).** c 3. Verify vent ports (f) of VTI PRDs (16a) and (16b) are pointed down *(arrows).*	
WHY	System specification.	

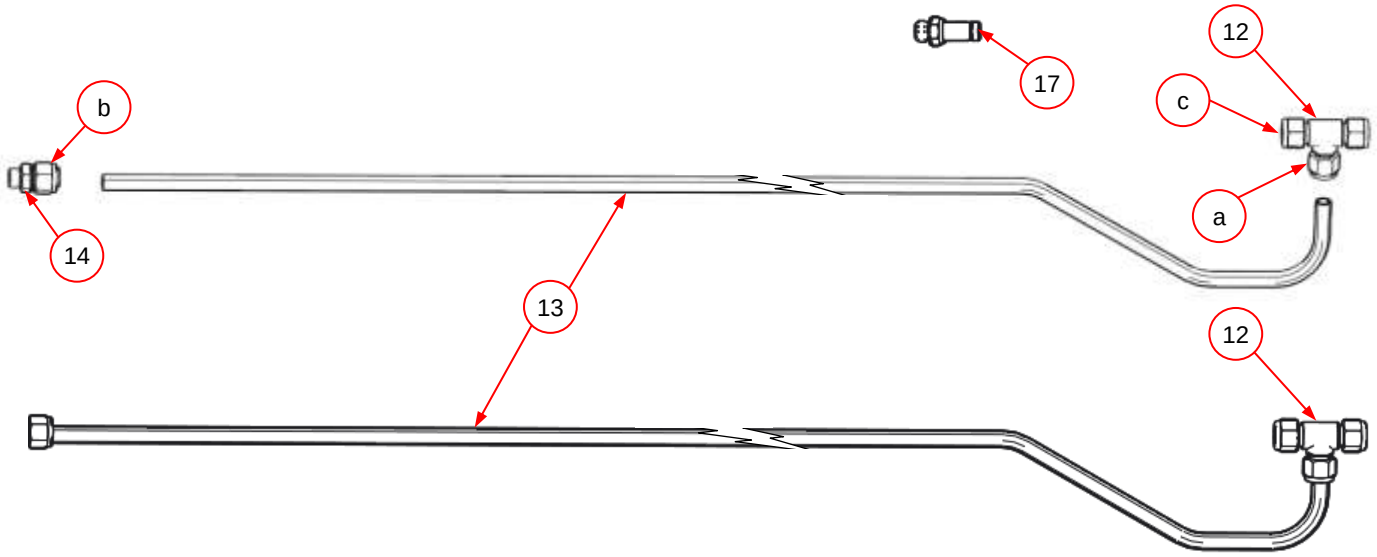
11	1. Install tube clamp bracket (23), p/n 25519123, to existing double tube clamp (7). 2. Slip P-clip (8), p/n 10702147, on PRD vent tube (37), p/n 25519037. 3. Install P-clip (8) on tube clamp bracket (23), p/n 25519123, using one hex cap screw, p/n 10760200-0100, one flat washer, p/n 10761000, and one flange top nut, p/n 10761300. **NOTICE** ***Tighten fasteners finger tight; fasteners will be tightened at a later step.***	120-in. cylinder pod **VIEW A**   
WHY	System specification.	

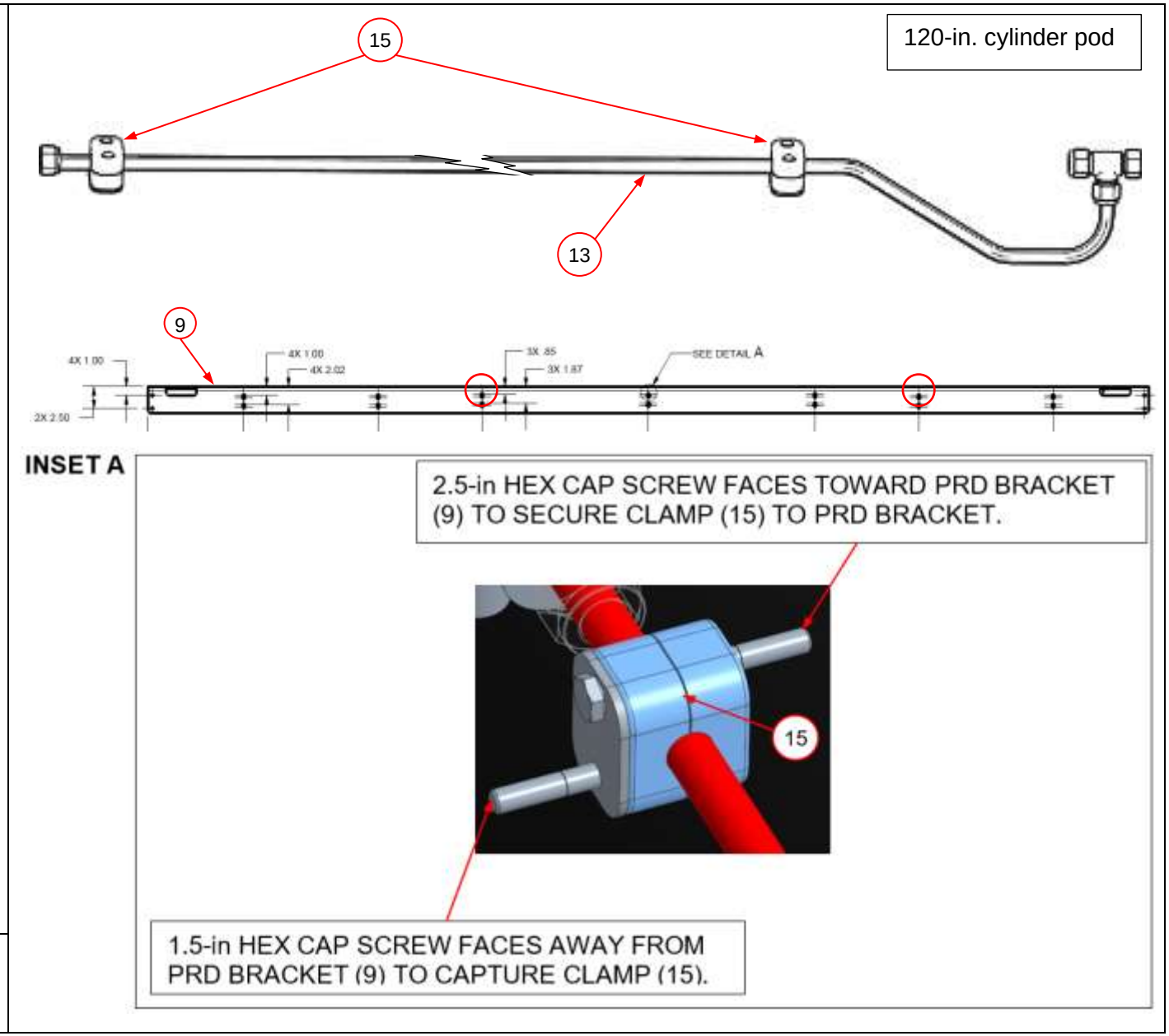
12	c Tighten clamp fasteners at all clamp locations *(circled)* using the following sequence: 1. (a) 2. (b) 3. (c) 4. (d) 5. (e) 6. (f) 7. (g) ***Tighten fasteners to* 8 ft-lbs (11Nm).**
WHAT	
WHY	System specification. **NOTICE** ***Proper tightening sequence is crucial to fuel system integrity.***

120-in. cylinder pod

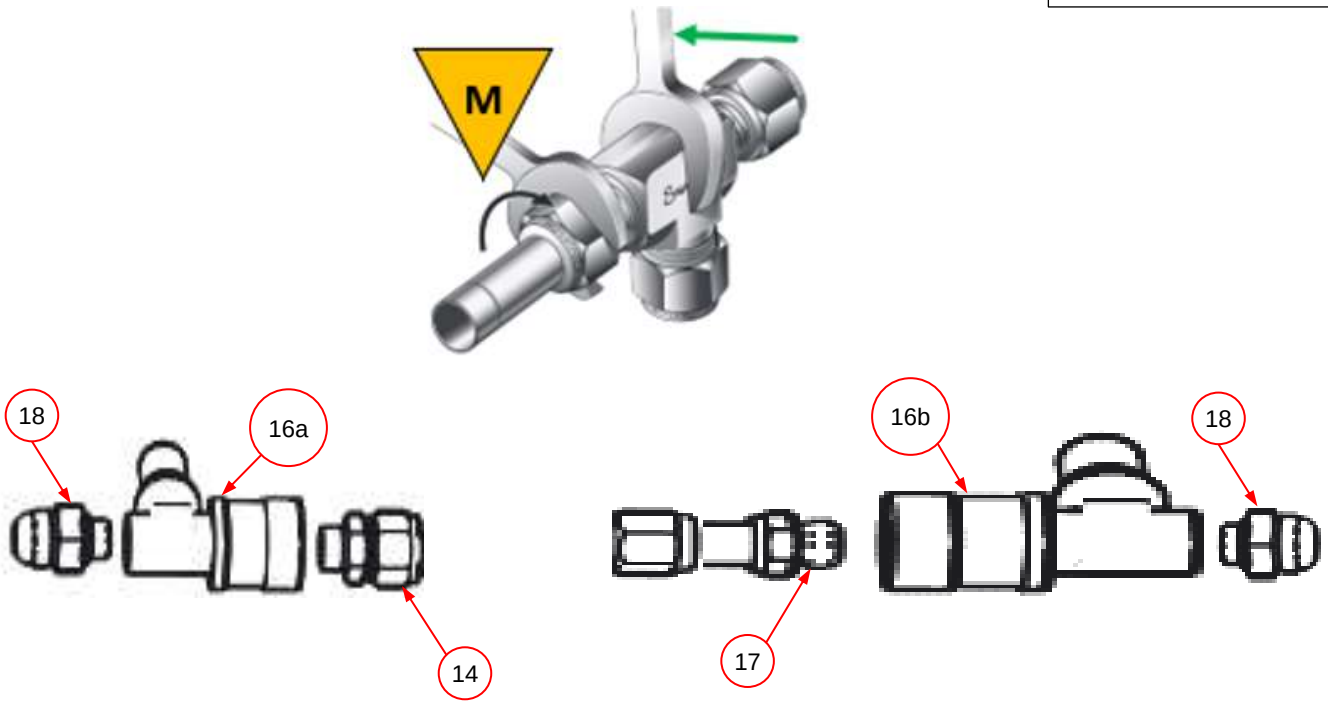


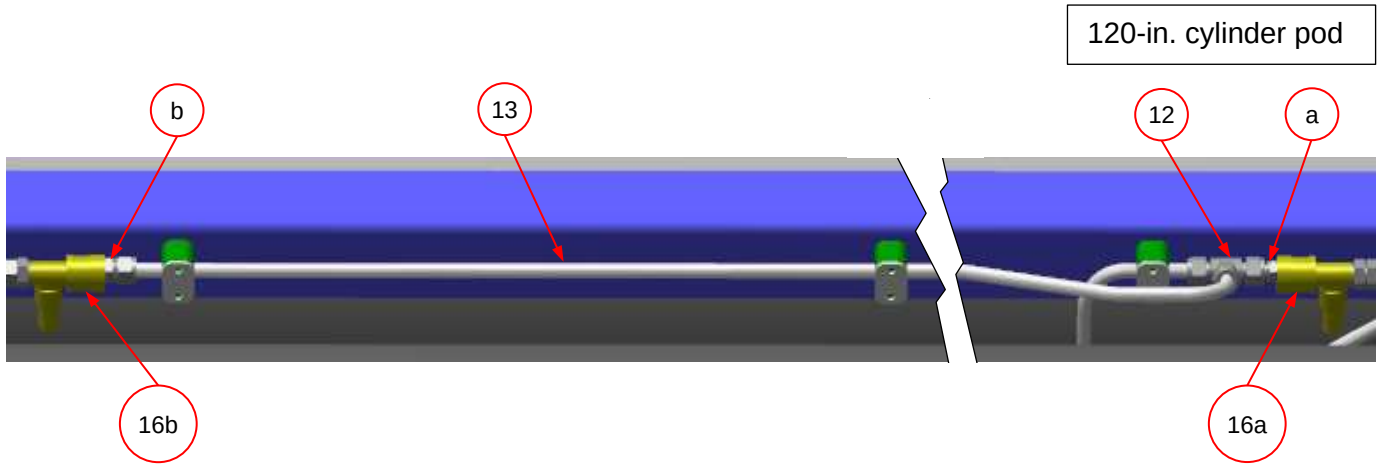
13	c 1. Verify clearance between PRD vent tubes (a) and live high pressure PRD vent tubes (b) is 3/8-in. minimum. c 2. Verify clearance between all system plumbing and cylinders (c) is 3/8-in. minimum. **NOTICE** ***If required: Adjust clamps as necessary and repeat Step 11.***	120-in. cylinder pod 
WHY	Prevent fuel line damage.	

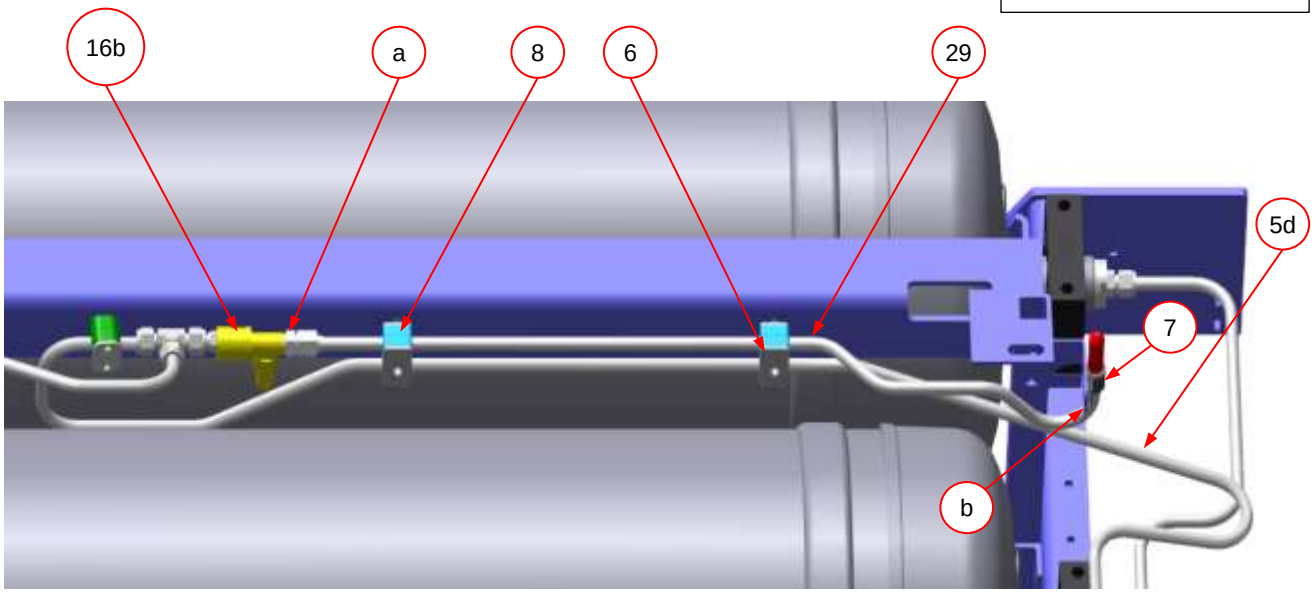
14 WHAT	1. Install ferrules *(not visible)* and nut (a) from tee fitting (12), p/n 10200208, on PRD vent tube (13), p/n 25519416. 2. Install ferrules *(not visible)* and nut (b) from tube fitting (14), p/n 10200065, on straight end of PRD vent tube (13). 3. Install ferrules *(not visible)* and nut (c) from tee fitting (12), p/n 10200208, on tube adapter fitting, (17), p/n 10200238. **NOTICE** ***Refer to Appendix A: WI.0197 Manual Swaging of Swagelok Fittings.*** 4. Install tee fitting (12), p/n 10200208, on PRD vent tube, (13), p/n 25519416. **NOTICE** ***Tighten fitting finger tight; fitting will be tightened at a later step.***	120-in. cylinder pod 
WHY		

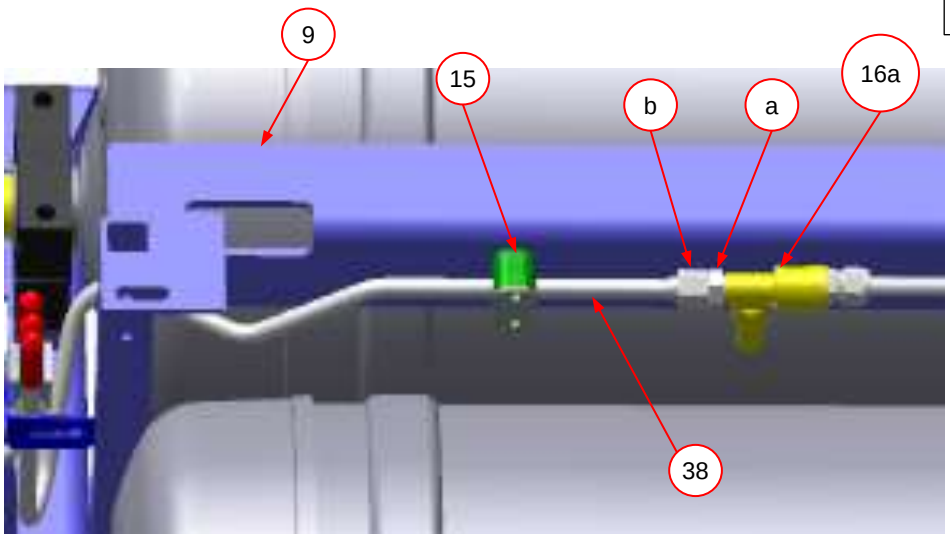
15	1. Install two tube clamp kits (15), p/n 10701508, from retrofit kit on PRD tube, (13), p/n 25519417. 2. Insert one 1.5-in. hex cap screw (a), p/n 10760200-0150, and one 2.5-in. hex cap screw (b), p/n 10760200-0120, into each tube clamp kit (15), as shown in INSET A. 3. Install one flat washer, p/n 10761000, and one flange top nut, p/n 10763000 *(not shown)* on each hex cap screw inserted in previous sub step. 4. Secure PRD vent tube (13) to PRD bracket (9) at holes *(circled).* **NOTICE** ***To ease component installation, do not tighten fasteners completely; fasteners will be torqued at a later step.***	
WHY	Support PRD vent lines.	

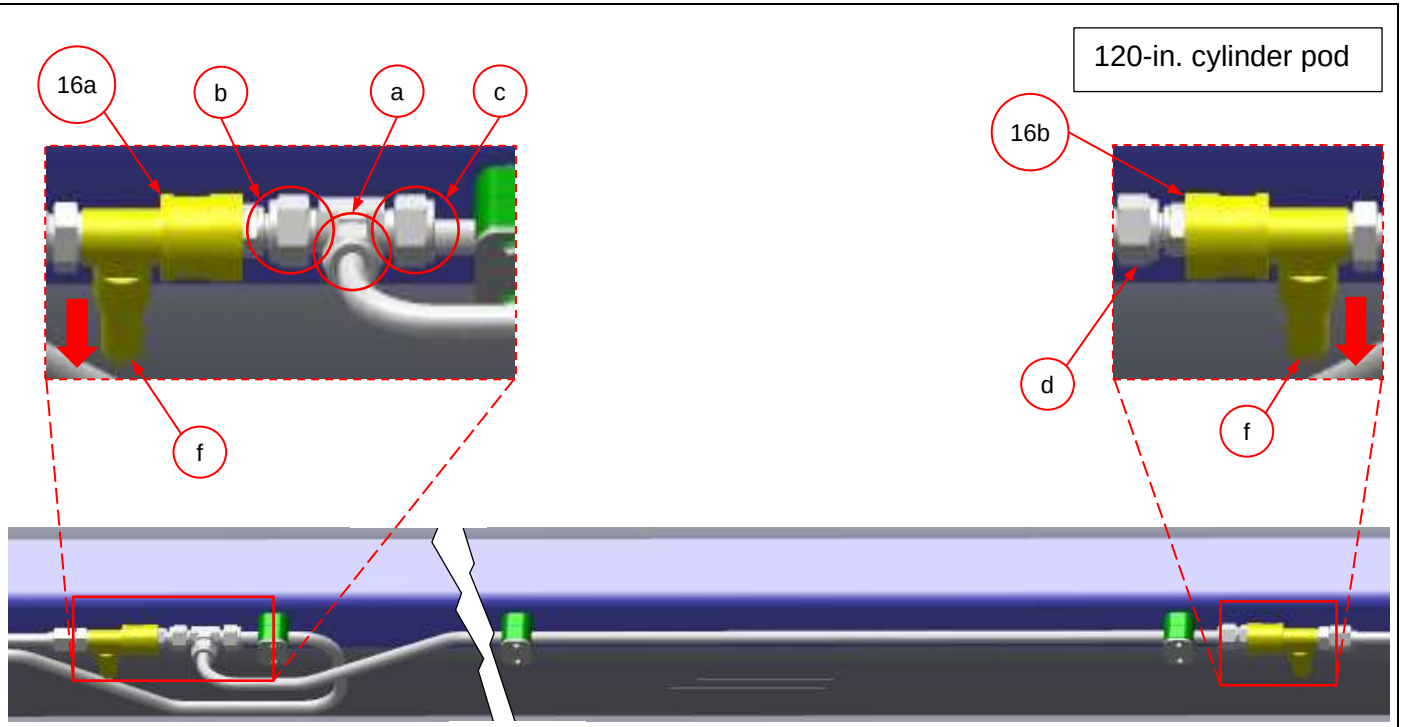
16	Install PRD vent supply tube (5d) on tee fitting (12) at nut fitting (a).	120-in. cylinder pod
WHAT	**NOTICE** ***Tighten fitting (a) finger tight; fitting will be tightened at a later step.***	
WHY		

17		
WHAT	M ***Always use a backing wrench on the main fitting while using a wrench to install another fitting.*** 1. Install tube adapter fitting (17), p/n 10200238 on VTI PRD (16b), p/n 10300513. C ***Torque fitting (17) to 26 ft-lbs (35.25Nm)*** 2. Install straight fitting (18), p/n 10200563, on VTI PRD (16a), p/n 10300513. 3. Install straight fitting (18), p/n 10200563, on VTI PRD (16a), p/n 10300513. C ***Torque fittings (18) to 18.5 ft-lbs (25Nm).*** 4. Install tube fitting (14), p/n 10200065, on VTI PRD (16a), p/n 10300513. C ***Torque fitting (14) to 45 ft-lbs (61Nm).***	120-in. cylinder pod 
WHY		

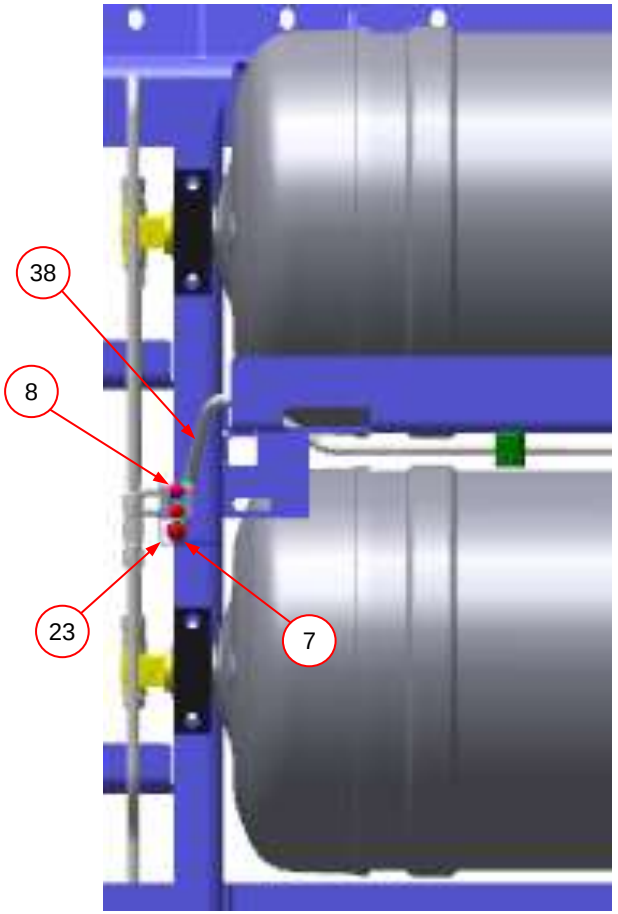
18	1. Install VTI PRD (16a) assembly inlet fitting (a) on PRD supply tube (13) at tee fitting (12). 2. Install VTI PRD (16b) outlet fitting (b) on straight end of PRD supply tube (13) nut fitting. **NOTICE** ***Tighten fittings finger tight; fittings will be torqued at a later step.***	
WHY		

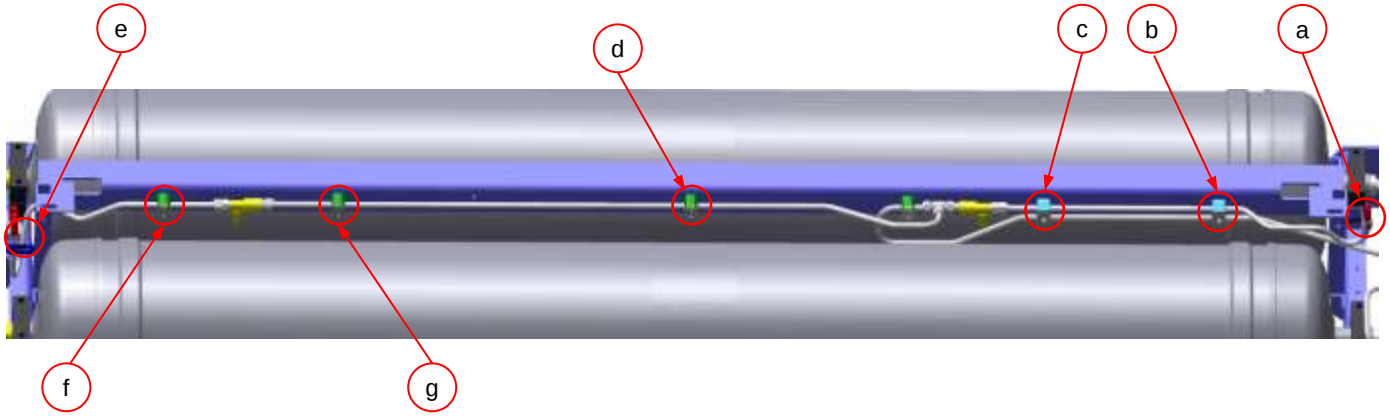
19 WHAT	1. Install PRD vent tube (29), p/n 25519027, on VTI PRD (16b) fitting (a). **NOTICE** ***Tighten nut fitting finger tight; fittings will be tightened at a later step.*** 2. Slip two dual tube clamps (8) on PRD vent tube (29), and on PRD supply tube (5d). 3. Use dual tube clamp (8) fasteners *(not visible)* to secure two clamps (8) and two plates (6), to PRD bracket (9) at hole *(circled).* 4. Slide P-clip (7) on PRD vent tube (29) and use existing fastener to secure P-clip (7) to P-clip bracket (b). **NOTICE** ***Tighten fasteners finger tight; fasteners will be torqued at a later step.***	120-in. cylinder pod 
WHY		

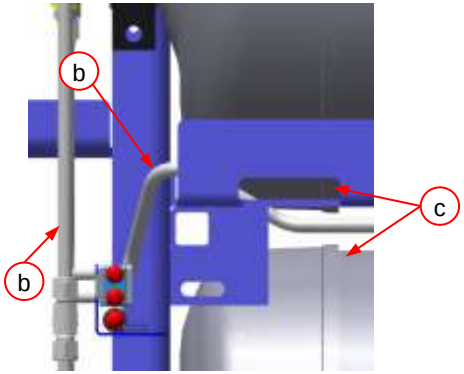
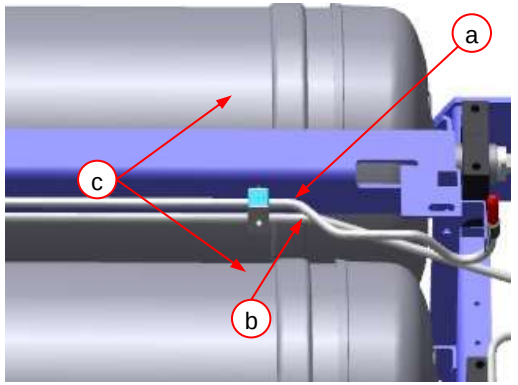
20 WHAT	1. Install nut fitting (b) of PRD vent tube (38) on VTI PRD (16a) outlet fitting (a). **NOTICE** ***Tighten fitting finger tight; fitting will be tightened at a later step.*** 2. Install tube clamp kit (15), p/n 10701508, on PRD vent tube (38). 3. Use tube clamp kit (15) fasteners *(not visible)* from to secure clamp to PRD bracket (9). **NOTICE** ***Tighten fasteners finger tight; fasteners will be tightened at a later step.***	120-in. cylinder pod 
WHY		

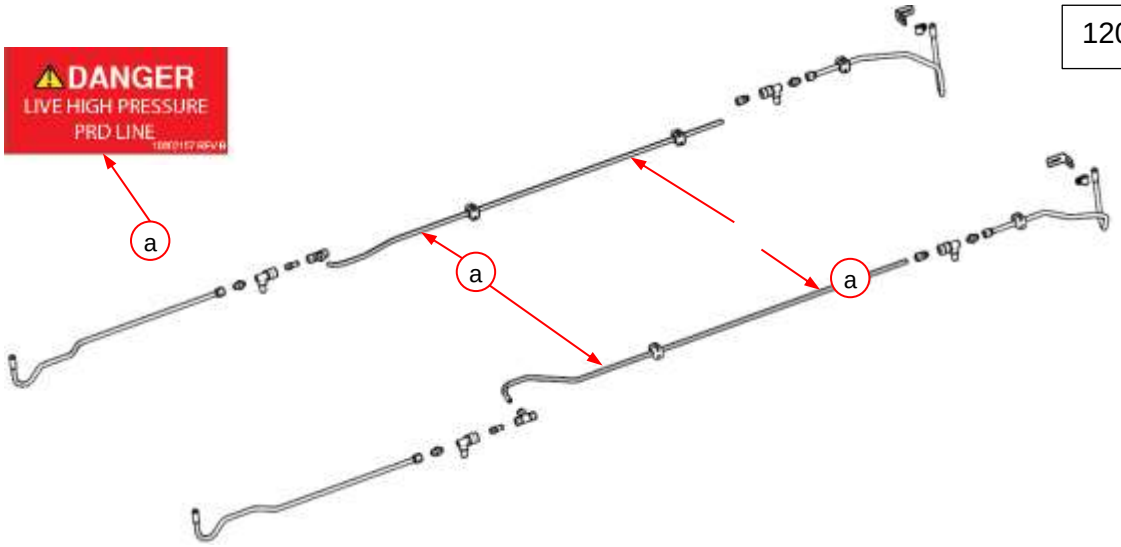
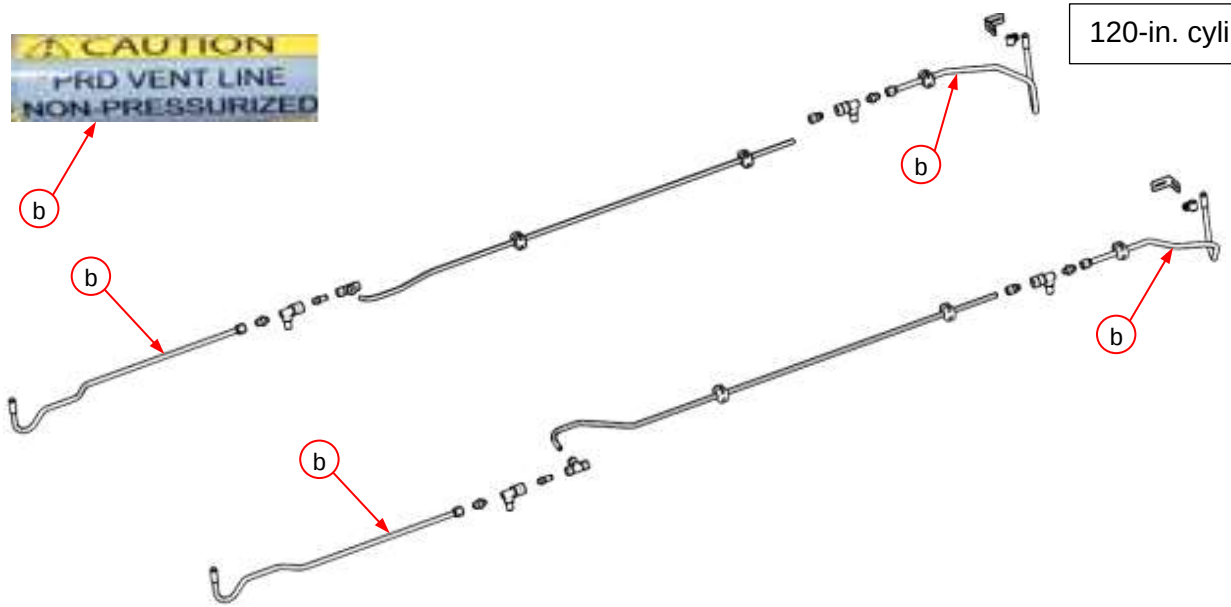
21 WHAT	c A. Use two wrenches to tighten 1/2-in. Swagelok® nut fittings at four locations in the following sequence: 1. (a) 2. (b) 3. (c) 4. (d) ***Tighten 1/2-in. Swagelok® nut fittings per Appendix B WI.0441.*** c B. Verify vent ports (f) of VTI PRDs (16a) and (16b) are pointing down *(arrows).*	
WHY	System specification.	

22	▼C Use two wrenches to tighten SAE / JIC fittings at two locations *(circled)* in the following sequence: 1. (a) 2. (b) ***Tighten SAE / JIC fittings to* 45 ft-lbs (61Nm).**	120-in. cylinder pod 
WHY	System specification.	

23 WHAT	1. Install tube clamp bracket (23), p/n 25519123, on existing double tube clamp (7). 2. Slip P-clip (8), p/n 10702147, on PRD vent tube (38), p/n 25519038. 3. Install P-clip (8) on tube clamp bracket (23), p/n 25519123 using one hex cap screw, p/n 10760200-0100, one flat washer, p/n 10761000, and one flange top nut, p/n 10761300. **NOTICE** ***Tighten fasteners finger tight; fasteners will be tightened at a later step.***	120-in. cylinder pod 
WHY	System specification.	

24	c Tighten clamp fasteners at all clip and clamp locations *(circled)* using the following sequence: 1. (a) 2. (b) 3. (c) 4. (d) 5. (e) 6. (f) 7. (g) ***Tighten fasteners to* 8 ft-lbs (11Nm).**	120-in. cylinder pod 
WHY	System specification. **NOTICE** ***Proper tightening sequence is crucial to fuel system integrity.***	

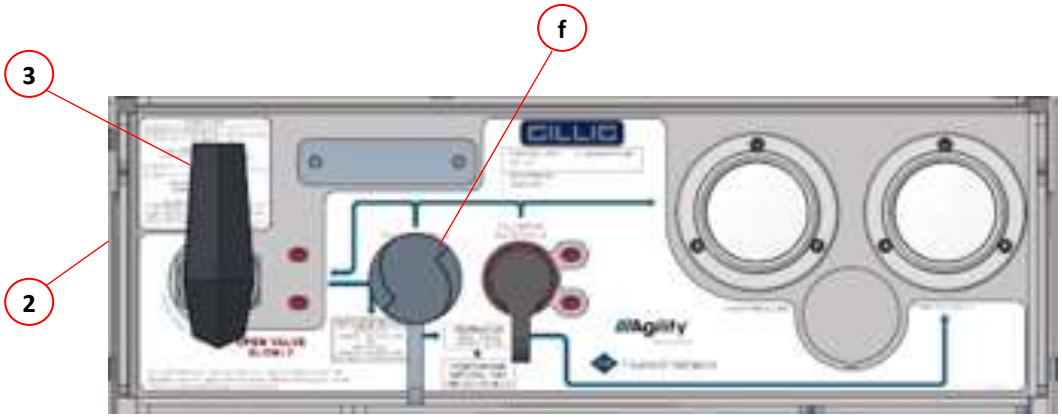
25 WHAT	c 1. Verify clearance between PRD vent tubes (a) and live high pressure PRD supply tubes (b) is 3/8-in. minimum. c 2. Verify clearance between all system plumbing and cylinders (c) is 3/8-in. minimum. **NOTICE** ***If required: Adjust clamps as necessary and repeat Step 22.***	120-in. cylinder pod **VALVE END**  **PLUG END** 
WHY	Prevent fuel line and cylinder damage.	

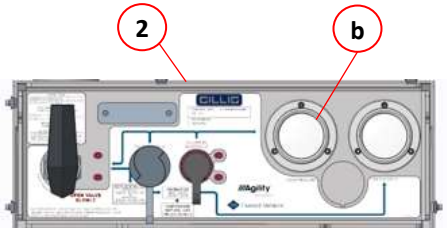
26	c Apply quantity four Decal, System, Danger Live High Pressure PRD Line (a), p/n 10602157, to PRD supply tubes as indicated.	 120-in. cylinder pod
WHY	Operator and first responder safety.	
27	c Apply quantity four Decal, PRD Vent Line, Caution (b), p/n 10602442, to midpoint of PRD vent tubes as indicated.	 120-in. cylinder pod
WHY	Operator and first responder safety.	

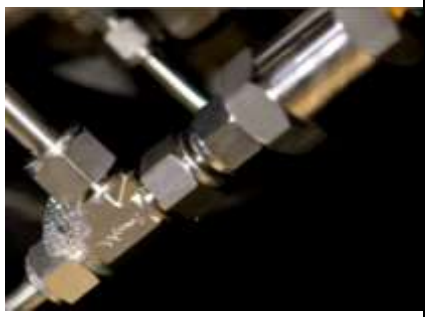
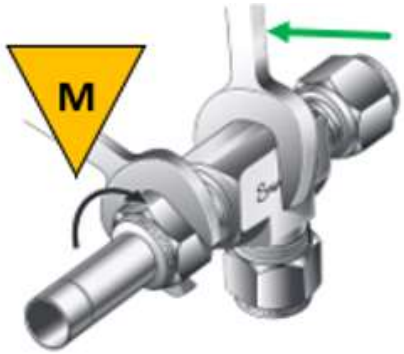
5.4.3. Check PRD vent tube outlet clearance

1			2		
WHAT	c 1. Gently close one fuel system roof pod door. 2. Visually verify proper clearance between plug end PRD vent tube cap (f) and door opening *(circled).* 3. Visually verify proper clearance between valve end PRD vent tube caps (f) and door opening *(circled).* **⚠WARNING** ***PRD vent tubes cannot protrude above the top of the pod door.*** If PRD vent tube caps protrude above the pod door opening, fuel system plumbing must be adjusted to achieve proper clearance.	 	WHAT	Repeat Step 1 for each roof pod door.	
WHY	Verify proper PRD vent tube position.		WHY	Verify proper PRD vent tube position.	

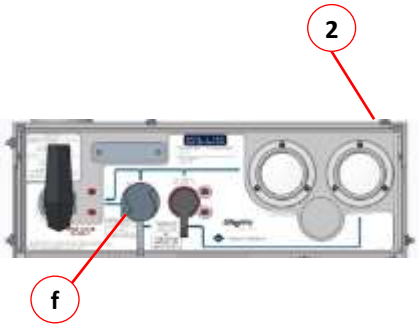
5.5. System Leak Check Procedure

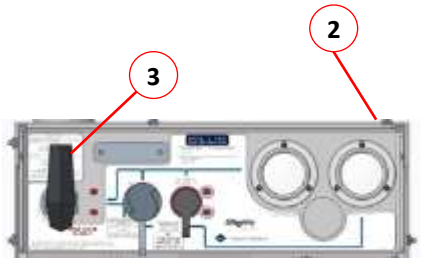
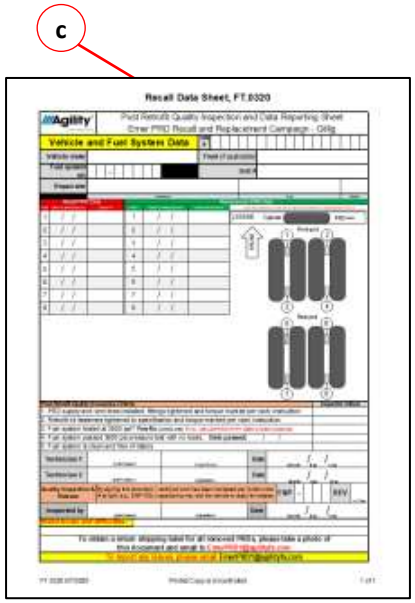
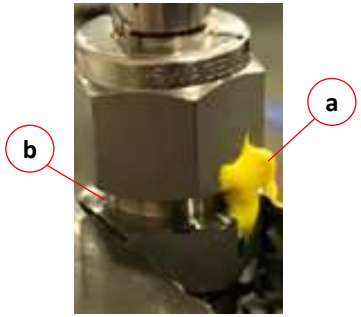
1	1. Turn 1/4-turn manual shut off valve (3) on the FMM (2) to the OPEN position. **⚠WARNING** 2. Select the appropriate CNG fuel nozzle and/or adaptor for the FMM (2) fuel fill receptacle (not visible). 3. Remove fuel fill receptacle dust cap (f). 4. Begin fueling the vehicle with CNG using a regulated fuel supply. C ***Open nozzle valve slowly and regulate gas delivery to prevent connector from icing and reducing or blocking fuel flow.*** **⚠WARNING** ***Follow all local and facility fueling regulations and procedures.***	
WHY	Test fuel system integrity.	

2	Monitor FMM (2) high pressure gauge (b) to verify when system pressure reaches 500 psi to 510 psi (3.45MPa to 3.52MPa) and stop pressurization.		3	C Leak test all fuel and PRD tubes and fitting connections using Swagelok Snoop® leak detection solution or equivalent.	
WHAT	⚠WARNING ***1. If a hissing sound is heard coming from fuel system fittings during filling, stop the fill immediately.*** ***2. Try to isolate the sound and spray Swagelok Snoop® on the suspected location to check for bubble formation.***		WHAT		
WHY	Subjects fuel system to partial operating pressure.		WHY	Approved leak detection solution for visual inspection of system leaks.	

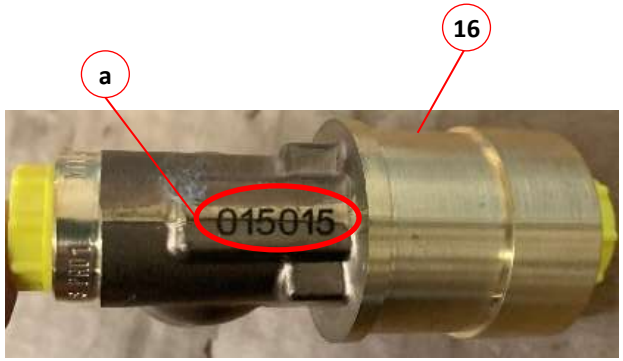
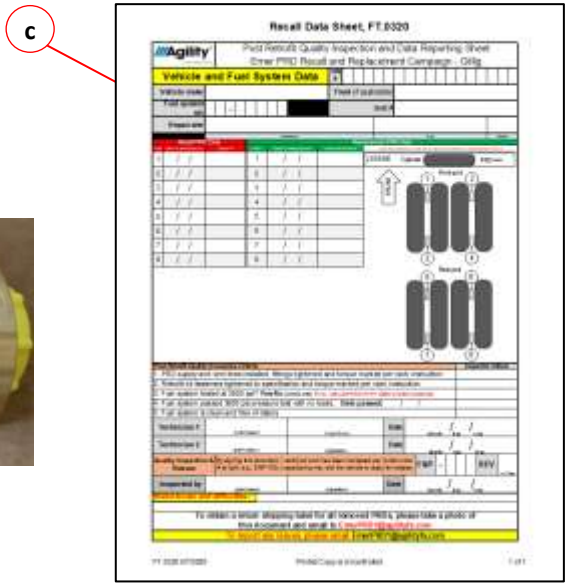
<table>
<tr><td>4</td><td>1. Begin at one end the of the fuel system and work methodically to spray all fuel line fittings with Swagelok Snoop® or equivalent.
2. Allow at least 10 minutes to elapse before checking the integrity of fitting connections.</td><td rowspan="2"> 
</td><td>5</td><td>If a leak is audible or icing, condensation, foam, or bubbles appear at a fitting connection the fitting connection must be inspected.
⚠WARNING
Fuel system must be defueled prior to investigating any leak. Refer to OEM procedure to defuel system.</td><td rowspan="2">  </td></tr>
<tr><td>WHAT</td><td>WHY</td><td></td><td>WHAT</td><td>WHY</td></tr>
<tr><td>6</td><td>Re-tighten leaking fitting(s) discovered during Step 5.
C
1. For JIC fittings, refer to p/n specific tightening instructions.
2. For compression fittings, tighten fitting according to Appendix B.</td><td rowspan="2"> 
</td><td>7</td><td>Repeat Steps 1 and 2 to repressurize the system.</td><td rowspan="2"></td></tr>
<tr><td>WHAT</td><td>WHY</td><td></td><td>WHAT</td><td>WHY</td></tr>
</table>

8	Spray leaking fitting again with Swagelok Snoop® or equivalent and allow at least 10 minutes to elapse before checking for bubble formation.		9	C *If leaking fitting is fixed,* proceed to test any remaining fitting connections.	
WHY			WHY		
10	**⚠WARNING** *If leak is not fixed,* the fuel system must be defueled to replace the fitting. C ***Perform OEM defuel procedure.***		11	Inspect tubing, fittings, ferrules, and nuts at the site of the leak for perforations, cracks, assembly defects, or other damage. C ***Any damaged components must be replaced.***	
WHY			WHY		
12	Replace any related components at the fitting junction as required. C ***Follow fitting installation directions in Appendix 2.***		13	Repressurize fuel system by repeating Step 1 and Step 2.	
WHY			WHY		

14	C		15	Turn FMM 1/4-turn manual shut off valve (3) counterclockwise to the OPEN position.	
WHAT	Spray new fitting junction with Swagelok Snoop® or equivalent to retest for leaks.		WHAT		
WHY			WHY	Allow fuel into system.	
16	C		17	C	
WHAT	Repeat pressure test procedure stopping the fill when fuel system pressure reaches 2000 psi to 2100 psi (13.79MPa to 14.48MPa).		WHAT	Repeat pressure test procedure stopping the fill when fuel system pressure reaches 3600 psi to 3700 psi (24.8MPa to 25.5MPa) and repeat leak checking all connections until the entire fuel system is confirmed leak free.	
WHY	Subjects fuel system to partial operating pressure.		WHY	Subjects fuel system to full operating pressure.	
18	C		19	Replace dust cap (f) on FMM (2) fuel fill receptacle *(not visible).*	
WHAT	*If fuel system is leak free or if defueling is required,* close flow valve on CNG dispense nozzle *(not shown)* and carefully disconnect fill nozzle *(not shown)* from FMM fuel fill receptacle.		WHAT		
WHY			WHY	Vehicle will not start if dust cap is not in place.	

20	*If not open,* turn FMM (2) 1/4-turn manual shut off valve (3) counterclockwise to the OPEN position.		21	C Use shop towels to clean Swagelok Snoop® or equivalent from the fuel system.	
WHY	Allow gas to flow throughout fuel system.		WHY	Customer satisfaction.	
22	C When the pressure test is completed successfully, use form FT.0320 (c) to record the result and the date on which the fuel system passed the 3600 psi test.		23	Apply Torque Seal (a) to all fitting junctions (b).	
WHY	Verify safe and proper fuel system pressure specification.			System quality specification.	

5.6. Reporting and Return Procedure

1 WHAT	c 1. Use form FT.0320 (c) to record the serial number (a) and the location of each VTI replacement PRD (16), p/n 10300513,within the fuel system. 2. Inspect fuel system repairs per the quality assurance criteria specified in FT.0320. **NOTICE** *Use a flashlight to aid serial number identification in low light.* 3. Use a camera or camera phone to take a photo of completed form FT.0320 (c). 4. Submit photo of completed form FT.0320 (c) to the email address indicated on the form to receive a Return Material Authorization (RMA) shipping label.	 
WHY	Required for retrofit kit component and repair tracking and, if applicable, installer reimbursement.	

2	Repeat Section 5. Corrective Action / Procedure for all vehicles subject to the Emer™ PRD recall on hand until all repairs are complete.		3	C 1. Pack all removed PRDs (still bagged by VIN), in one box. If the quantity of PRDs is too large for a single box, use additional boxes but ship them all using the same RMA. *If possible:* reuse the box in which the replacement PRDs were shipped. 2. Apply RMA label obtained from Agility® to the box. 3. Use a permanent marker to write RMA number on exterior of each shipping box.	
WHAT			WHAT		
WHY			WHY	Required for repair return tracking and, if applicable, installer reimbursement.	

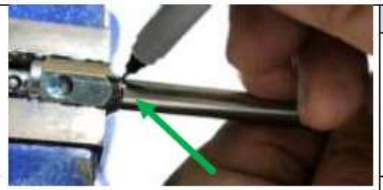
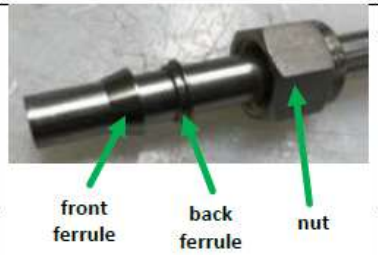
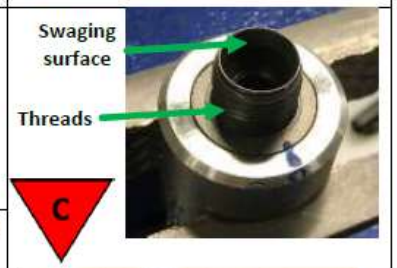
Appendix A. WI.0197 Manual Swaging of Swagelok Fittings

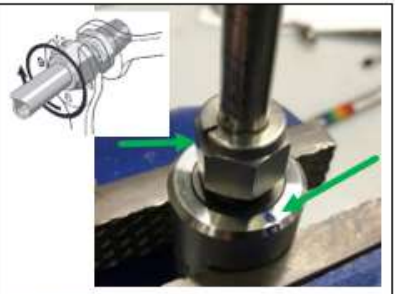
Manual Swaging of Swagelok Fittings

Standard Work Instruction

Scope: Manual swaging of Swagelok fittings onto:

- 1/4", 3/8" and 1/2" OD tubing (Steps 1-10)
- Swagelok port connectors and port adaptors (Steps 4-10 only)

1	WHAT	Place tube end fully into depth marking tool (DMT). Mark the tube with a fine-tipped Sharpie. **M**		2	WHAT	Use magnification to verify that nut and ferrules have Swagelok markings (NOT Parker). **C**	
	WHY	The DMT line corresponds to the nut's location after swaging in step 8.			WHY	Swagelok fittings and ferrules may NOT be interchangeable with other manufacturers. They may not swage or seal properly.	
3	WHAT	Install nut and ferrules onto the tube. Verify that they are in the proper order and orientation. **C**		4	WHAT	At the beginning of the shift, use magnified ring light and fingertip to inspect swaging die for damage, pitting and debris. If damaged, replace the die. If dirty, clean by hand with a nylon brush and cloth.	 **C**
	WHY	This is critical for proper swage strength and leak-tightness.			WHY	A damaged or dirty swaging die could lead to damage to the ferrule or nut.	
5	WHAT	Insert tube into swaging die. Verify that tube is bottomed out. DMT line should NOT be visible.		6	WHAT	While holding tube in place within the pre-swaging tool, hand tighten the nut. The nut should turn freely. If the nut does not turn freely, the die (or nut) must be cleaned or replaced.	 **C**
	WHY	If tube is not fully seated, ferrules will be swaged in incorrect location on tube. **S**			WHY	The tube must be held in place to prevent it from backing out during pre-swaging. If the nut does not turn freely the swaging die is likely damage or worn, which could prevent the tube from being swaged properly.	

7	WHAT: Mark the nut and die with a fine-tipped sharpie at the 6 o'clock position. **M** WHY: These black marks are needed to control step 8.		8	WHAT: While holding tube against the die, tighten the nut 1-1/4 turns (to the 9 o'clock position). **C** WHY: Less than 1-1/4 turns can cause a leak.	
9	WHAT: Verify DMT line on tube is fully exposed above nut. If the DMT line is not exposed, turn up to 1/8 turn more and recheck. If line is still not visible, then scrap the tube. **C** WHY: If DMT line is not "high enough", either tube is not seated enough in DMT, OR not swaged far enough (due to hand tightening variation).		10	WHAT: Remove the tube from the swaging die by gently moving tube side to side. If excessive force is needed to remove the tube, the swaging die should be replaced. **M** WHY: Excessive force to remove the tube may indicate that the swaging die is worn, which could cause an under swaged condition.	

Equipment List:

Description	Manufacturer	Manufacturer's Part Number
1/4" Non-Gaugable Pre-Swaging Die	Swagelok	MS-ST-400
3/8" Non-Gaugable Pre-Swaging Die	Swagelok	MS-ST-600
1/2" Non-Gaugable Pre-Swaging Die	Swagelok	MS-ST-810
Ultra-Fine Point Permanent Black Marker	Sharpie	37001
1/4" Depth marking tool	Swagelok	MS-DMT-400
3/8" Depth marking tool	Swagelok	MS-DMT-600
1/2" Depth marking tool	Swagelok	MS-DMT-810
1.75X Ring Light	Any	---
Open-ended wrenches	Any	---
Vise	Any	---
Nylon brush	Any	---
Microfiber Cloth	Any	---

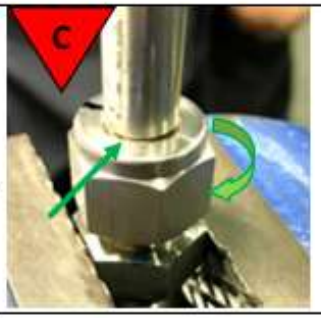
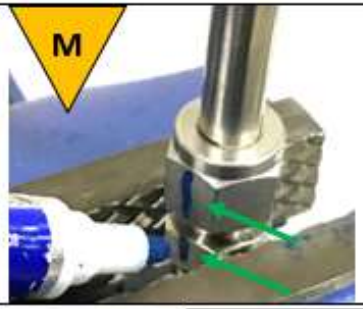
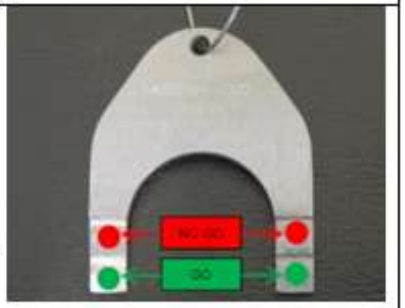
Job Breakdown:

Important Steps	Key Points	Reasons Why
1. Mark tube	1. Tube bottomed out in DMT	Provide reference for swaging and tightening.
2. Install three components	2. Only Swagelok	Mixed parts could leak.
	3. Nut, then back ferrule, then front ferrule	Missing, mis-located and mis-oriented parts could leak.
3. Tube into die	1. Die is clean and smooth	Dirty or worn dies do not work properly.
	2. Tube bottomed out in die	The tube must be fully inserted into the die.
	3. Turn nut to hand tight	Correct starting point.
4. Mark nut and die	1. At 6 o'clock	Provides visual aid to start turning
5. Turn nut	1. 1-1/4 turns	Incorrect turns could cause a leak.
	2. Stop at 9 o'clock	Provides visual aid to finish turning.
	3. DMT line fully showing	Verify swage is complete
6. Remove tube	1. Gently rock tube back and forth	Too much force means the die is worn.

Appendix B. WI.0441 Tightening of tube fittings

Tightening of Tube Fittings
Scope: Tightening of 1/2" Swagelok fittings, port connectors and port adaptors.
Note: "Substitute from WI.0198"

Standard Work Instruction

1	WHAT	Install swaged tube into fitting. Verify that both nut and fitting have same manufacturer markings. C		2	WHAT	Tighten nut (by hand or with wrench) until top of nut is aligned with the bottom of the DMT mark.	
	WHY	Swagelok/Parker fittings and nuts are NOT interchangeable.			WHY	This line shows the nut's correct starting location prior to tightening.	
3	WHAT	Mark across nut and fitting with blue paint pen		4	WHAT	Put a "backing wrench" on the adjacent fitting. **Note:** some products require holding a different component - this will be noted in the product-specific work instructions.	
	WHY	The marks are needed for step 5 and inspection.			WHY	The backing wrench prevents the fitting from rotating. This ensures that the nut is NOT under-tightened.	
5	WHAT	Using the blue marks as a visual reference, turn nut between 1/2 and 5/8 of a turn C	 	6	WHAT	Check gap between nut and fitting with the GO-NOGO gap gage. If the GO section fits AND the NOGO section does not fit, the part is good. If the NO-GO section fits, then tighten the fitting and recheck. If the GO section does not fit, the tube must be removed and scrapped.	 C
	WHY	If the nut is turned less than 1/2 turn, it may pass a leak test, but leak later in the field.			WHY	The gap indicates how tightly the ferrules are seated against the fitting. Too much gap will allow a leak. Not enough gap indicates too much swaging or tightening.	

7	Add torque seal between nut and fitting (only when specifically required by customer).		8	---	---
WHAT			WHAT		
WHY	---		WHY	---	

Equipment List:

Description	Manufacturer	Manufacturer's Part Number
1/4" gap inspection gage	Agility Fuel Solutions	TBD
3/8" gap inspection gage	Agility Fuel Solutions	TBD
1/2" gap inspection gage	Agility Fuel Solutions	TD 400394
Blue paint pen	Dykem	84001
Ultra-fine tip permanent black marker	Sharpie	37001
Yellow torque seal	Dykem	83317
Open-ended wrenches	Any	---
Vise	Any	---

Job Breakdown:

Important Steps	Key Points	Reasons Why
1. Tube into fitting	1. Same manufacturers	Swagelok and Parker fittings are not interchangeable.
	2. Tube bottomed out in fitting	The tube must be fully inserted into the fitting.
	3. DMT line fully showing	Provides correct starting point.
2. Mark parts	1. Across nut and fitting	Provides visual aid to start tightening.
3. Turn nut	2. Use backing wrench	Holds everything in place to prevent leaks.
	3. 1/2 turn	Incorrect turns could cause a leak.
	4. Marks on opposite sides	Provides visual aid to finish tightening.
	5. Verify gap	Verify tightening is complete, but not too much.
4. Torque seal	1. Across nut and fitting	Shows if fitting was loosened.

6. Warranty Information

This procedure is covered under warranty. Standard repair time (SRT) is 6.0 hours. Please refer to Warranty Manual, ENP-067, for warranty reimbursement procedures.

For parts and support, contact Agility Fuel Solutions Customer Care:

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Proprietary Statement

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Revision	Description	Author	Approved By	Date
--	Initial Release	C. Grasso	CCG Team	05/04/2020
A	ADDED: References to FT.0320 tracking and quality inspection document. REVISED: retrofit kit contents. DELETED: non-required p/ns from corresponding install steps.	C. Grasso	CCG Team	05/07/2020
B	REVISED: Section 5.3 Step 1 disassembly sequence	C. Grasso	CCG Team	05/28/2020
C	REVISED: Fitting and clamp tightening sequences.	C.Grasso	CCG Team	06/07/2020