

SUMITOMO RECOMMENDED PROCEDURE**SRP SP-F04-024****INSTALLATION PROCEDURES FOR LIQUID-TIGHT KELLEMS® GRIPS**

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1.0 General

1.1 This procedure describes the standard techniques for installing Liquid-Tight Strain Relief Kellems® Grips to FutureFLEX Air-Blown Fiber (ABF) tube cables.

1.2 Liquid-Tight Kellems Grips provide a very effective means to seal and securely anchor the ends of a tube cable to a Tube Distribution Unit (TDU) entry point. With cable ends firmly held in place, expansions / contractions of the tube cable are allowed to take place in the slack areas installed along the span.

1.3 Kellems Grips also offer several other key advantages.

1.3.1 When properly assembled, a Kellems Grip provides a liquid-tight and dust-tight seal between the tube cable and the TDU entry point. Therefore, Liquid-Tight Kellems Grips are very well suited for use in any application (indoor or outdoor) where the TDU is subject to moisture from hosing, splashing, flooding, and so forth.

1.3.2 SEL's two (2) types (Liquid or Dust-Tight) Kellems Grips provide a compression fit around the tube cable without crushing or crimping the inner tubes.

1.3.3 SEL's Kellems Grips provide strain relief and prevent kinking of the tube cable at its entry point. This feature also aids in protecting the tube cable if the TDU is located in an area susceptible to damage.

Note: *Alternatively, Dust-Tight Strain Relief Kellems Grips are acceptable fittings to secure FutureFLEX ABF tube cables to indoor TDUs only. They are not to be used where the TDU is subject to moisture from hosing, splashing, or flooding. Refer to SRP SP-F04-037 Sumitomo Recommended Procedure FutureFLEX Installation Procedures for Dust-Tight Kellems Grips for additional details.*

Note: *Heat-Shrinkable Cable Entry Seals (CESSs) are also acceptable fittings to secure FutureFLEX ABF tube cables to indoor TDUs only. They do provide a liquid-tight, fume-tight seal between the tube cable and the TDU entry point.*

*However, CESSs are not to be used where **Strain Relief** of the tube cable is required. Refer to SRP SP-F04-038 Sumitomo Recommended Procedure FutureFLEX Installation Procedures for Cable Entry Seals for additional details.*

2.0 Safety Precautions

2.1 The use of safety equipment (safety glasses, safety shoes, cut-resistant Kevlar gloves, etc.) is recommended during this installation procedure.

3.0 Reference Documents

3.1 Sumitomo Recommended Procedure, *FutureFLEX Tube Cable Installation Procedures*, SRP SP-F04-008.

3.2 Sumitomo Recommended Procedure, *FutureFLEX Grounding and Bonding Metallic Tube Cables*, SRP SP-F04-030.

3.3 Sumitomo Recommended Procedure, *FutureFLEX Tube Cable Splicing Procedures*, SRP SP-F04-031.

3.4 Sumitomo Recommended Procedure, *FutureFLEX Tube Cables in Class I – Divisions 1 and 2 Environments*, SRP SP-F04-032.

4.0 Equipment / Tools Required

The following equipment, tools, and materials are required to complete this procedure:

Note: *Liquid-Tight Kellems Grip Kits are available from SEL for the different ABF tube cable types and sizes. Kits are supplied with metal clad Sealing O-Rings and Locknuts.*

4.1 **See TABLE 1** for Liquid-Tight Kellems Grip Kit Part Numbers and Recommended Knockout Hole Sizes.

4.2 Tube Cable Adapter Bushing (DE02TOX) if installing standard 2-tube cables TC02MSOS and TC02TOX; Adapter Bushing (DE04TOD) if installing standard 4-tube cables TC04MSOS and TC04TOD; Adapter Bushing (DE12TOX) if installing standard 12-tube cables and TC12MSOS ; Adapter Bushing (DE24TOX) if installing standard 24-tube cables and TC24MSOS .

TABLE 1
Liquid-Tight Kellems Grips

If Installing Tube Cable P/N		Use Liquid-Tight Grip P/N	Recommended Knockout Hole Size (inches)
TC02TOX	TC02MSOS	DELTKG1 <u>plus</u> order DE02TOX Adapter Bushing separately	1.719 – 1.766
TC04TOD	TC04MSOS	DELTKG1 <u>plus</u> order DE04TOD Adapter Bushing separately	1.719 – 1.766
TC07TOX	TC07MSOS	DELTKG1	1.719 – 1.766
TC12TOX	TC12MSOS	DELTKG5 <u>plus</u> order DE12TOX Adapter Bushing separately	2.453 – 2.500
TC19TOX		DELTKG6	2.453 – 2.500
	TC19MSOS	DELTKG4	2.453 – 2.500
TC24TOX		DELTKG7 <u>plus</u> order DE24TOX Adapter Bushing separately	2.953 – 3.000
TC02TOX-2	TC02MSOS-2	DELTKG2	1.719 – 1.766
TC04TOD-2	TC04MSOS-2	DELTKG3	1.969 – 2.016
TC07TOX-2	TC07MSOS-2	DELTKG5	2.453 – 2.500
TC12TOX-2	TC12MSOS-2	DELTKG6	2.453 – 2.500
TC19TOX-2	TC19MSOS-2	DELTKG7	2.953 – 3.000
TC02MTIO		DELTKG1 <u>plus</u> order DE02TOX Adapter Bushing separately	1.719 – 1.766
TC04MTIO		DELTKG1 <u>plus</u> order DE04TOD Adapter Bushing separately	1.719 – 1.766
TC07MTIO		DELTKG1	1.719 – 1.766
TC12MTIO		DELTKG5 <u>plus</u> order DE12TOX Adapter Bushing separately	2.453 – 2.500
TC19MTIO		DELTKG6	2.453 – 2.500
TC02MTIO-4		DELTKG2	1.719 – 1.766
TC04MTIO-4		DELTKG3	1.969 – 2.016
TC07MTIO-4		DELTKG5	2.453 – 2.500
TC12MTIO-4		DELTKG6 <u>plus</u> order DE12TOX Adapter Bushing separately	2.453 – 2.500
TC19MTIO-4		DELTKG7	2.953 – 3.000

4.3 Tube Cable Adapter Bushing must be ordered separately.

4.4 Aluminum End Caps (if required to seal empty Liquid-Tight Kellems Grips before tube cable is installed)

- DE5KCAP for Kit DELTKG1
- DE6KCAP for Kits DELTKG2, DELTKG3, DELTKG4, DELTKG5, and DELTKG6
- DE7KCAP for Kit DELTKG7

4.5 Tube Cable Cutter (BETL64)

4.6 Utility Knife with Hook Blade

4.7 10-inch (or larger) Adjustable Wrenches

4.8 Strap Wrench or Channel Lock Pliers

4.9 Hammer

4.10 Hole Punch Set for Knockout Holes

4.11 Felt Tip Pen / Marker

4.12 Tape Measure

5.0 Equipment Layout

5.1 See Fig. 1 and Fig. 2 for Liquid-Tight Kellems Grip layout.

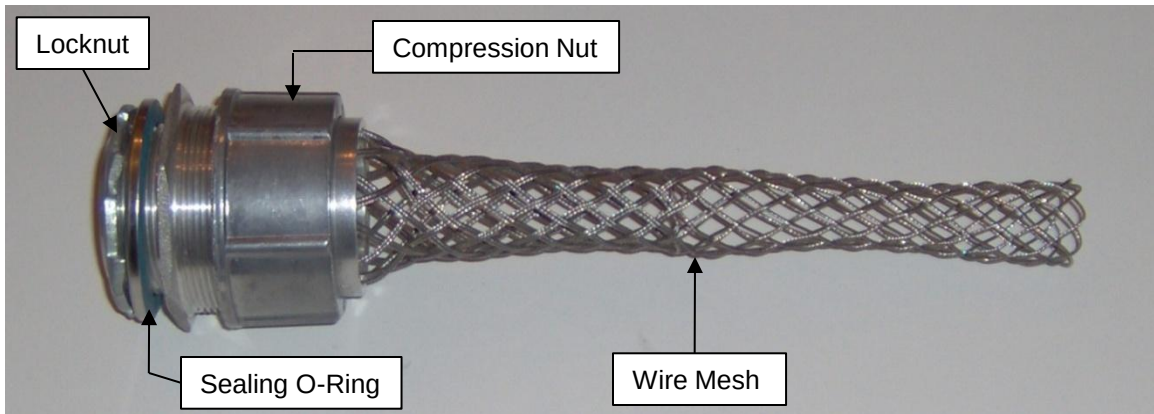


Figure 1
Liquid-Tight Kellems Grip - Assembled

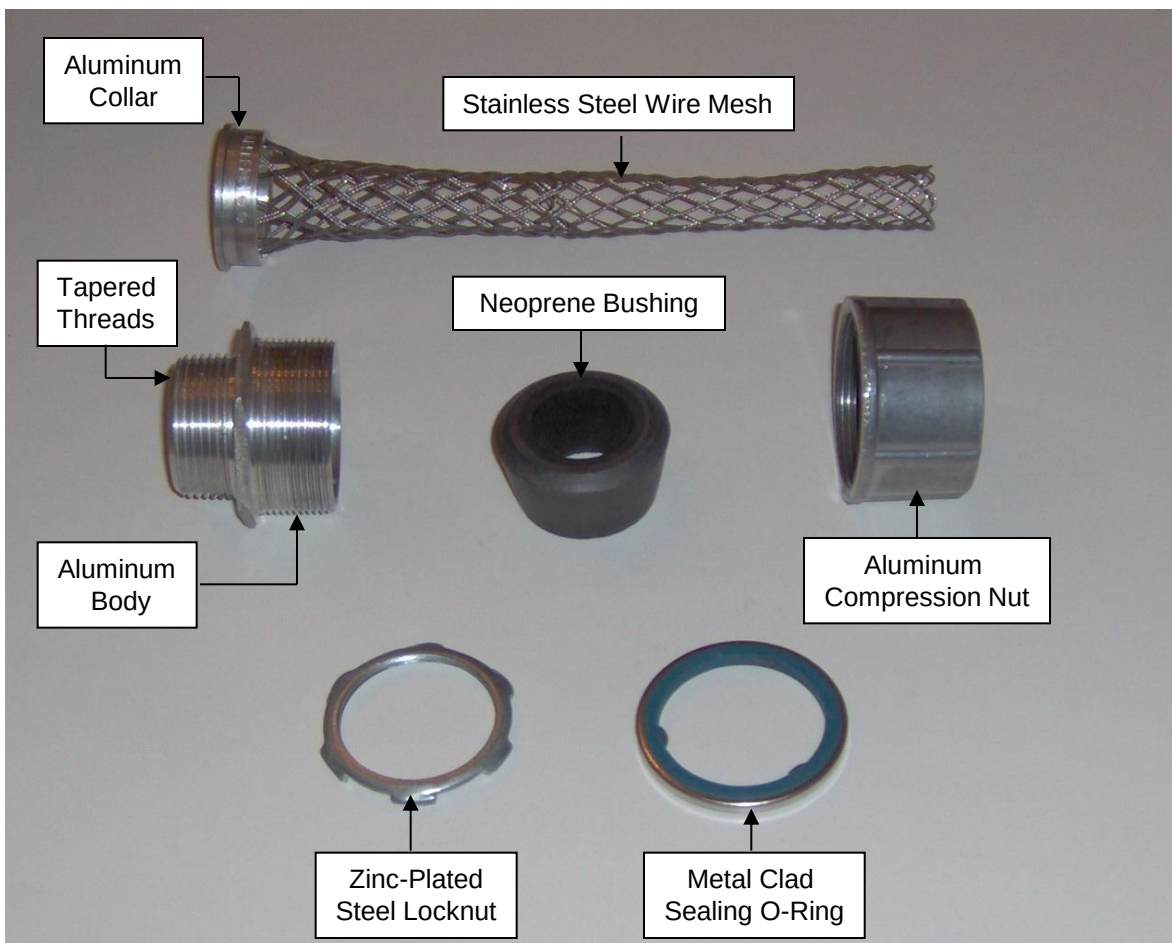


Figure 2
Liquid-Tight Kellems Grip - Straight Male Components

6.0 Preparing the TDU Enclosure

6.1 Refer to TABLE 1 and identify Recommended Knockout Hole Size based on the Liquid-Tight Kellems Grip Kit to be used.

6.2 Prepare TDU enclosure by selecting and marking tube cable entry point locations. To best optimize TDU capacity, it is recommended to stagger tube cable entry locations if possible. See Fig. 3a and Fig. 3b.

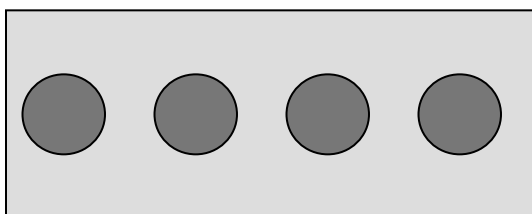


Figure 3a
Inline Tube Cable Entry Locations
Acceptable but Fails to Optimize
TDU Capacity

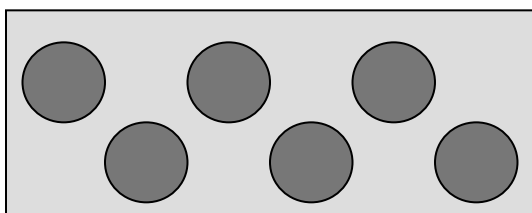


Figure 3b
Staggered Tube Cable Entry Locations
Preferred Method to Optimize
TDU Capacity

6.3 Use appropriate size hole punch and create opening in TDU.

6.4 Install Kellems Grip body into entry point hole.

6.5 Install Sealing O-Ring over tapered threads of body so rubber seal is against inner wall of TDU.

Note: If an airtight seal is required, apply an appropriate sealant (such as RTV Silicone, etc.) between inner wall of TDU and Sealing O-ring.

6.6 Install and hand-tighten Locknut.

6.7 Use appropriate size wrenches and tighten Locknut to firmly secure Kellems Grip body to TDU. See Fig. 4.

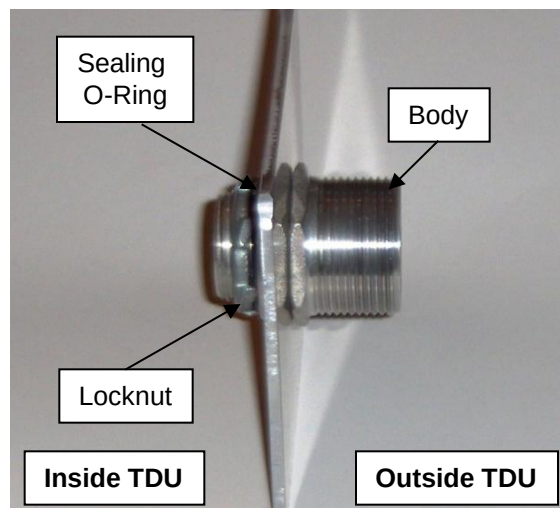


Figure 4
Body Installed in TDU Knockout Hole
O-Ring Installed and Locknut Tighten

7.0 Preparing the Tube Cable

7.1 Slide Kellems Grip compression nut onto end of tube cable.

7.2 Compress wire mesh and slide onto end of tube cable.

7.3 Place tube cable into TDU enclosure and mark jacket in two (2) places. See Fig. 5.

7.3.1 Make first mark about 1" beyond tapered end of Kellems Grip body.

Note: If tube cable is armored, the metallic element must be grounded and bonded. Make first mark about 4" beyond tapered end of Kellems Grip body. See SRP SP-F04-030.

7.3.2 Second mark must be determined on-site. Measure distance required to route individual tubes from the 1" mark to the farthest tube connection point inside TDU and make second mark.

7.4 Remove tube cable from TDU enclosure. Use Tube Cable Cutter (BETL64) to cut tube cable at second mark.

7.5 Use Hook Blade Knife to lightly score tube cable jacket at 1" mark. Pull ripcord and strip jacket away to expose individual tubes.

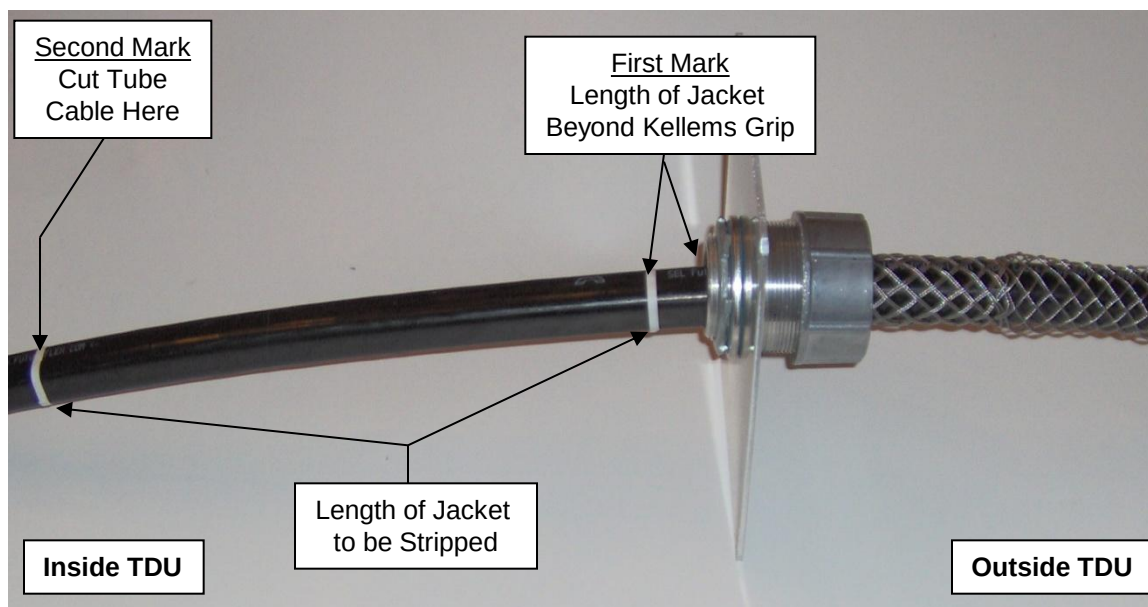


Figure 5
Measuring and Marking Tube Cable

8.0 Completing Liquid-Tight Kellems Grip Assembly

8.1 Slide Kellems Grip neoprene bushing over exposed inner tubes and tube cable jacket.

8.2 Install exposed inner tubes and tube cable through Kellems Grip body and into TDU.

8.3 Continue feeding tube cable through body until about 1" of jacket extends beyond tapered end of Kellems Grip body.

8.4 Slide neoprene bushing, wire mesh, and compression nut forward until they mate with body's threads. **See Fig. 6.**

8.5 Hand-tighten the compression nut onto body; adjust position of wire mesh and neoprene bushing to ensure proper fit.

8.6 Use appropriate size wrenches and tighten compression nut to obtain a liquid-tight, dust-tight seal.

Note: Wrench tightening may cause tube cable to twist within wire mesh. To relieve twisting, compress wire mesh while turning compression nut. Remove all slack from the installed mesh by smoothing it tight to the tube cable jacket.

Note: It is recommended that these components be re-tightened after 24 hours to ensure the seal is maintained.

8.7 If grounding and bonding are required, install shield connector assembly and grounding / bonding strap to the tube cable's metallic jacketing. See SRP SP-F04-030.

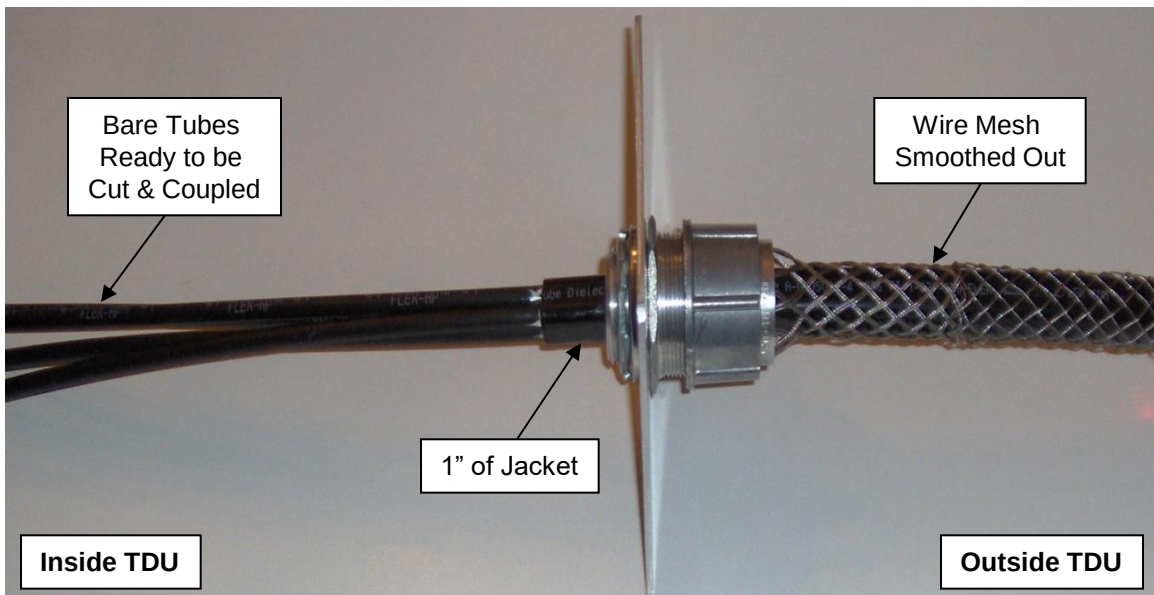


Figure 6
Kellems Grip Installed and Tube Cable Ready for Coupling

9.0 Tube Cable Adapter Bushings

9.1 Use Tube Cable Adapter Bushings (DE02TOX, DE04TOD, DE12TOX, DE24TOX) to install standard 2- and 4, 12, 24 -tube cables into Liquid-Tight Kellems Grips.

9.2 The 2-tube cable has an oblong shape and the 4-tube cable has a square shape, the 12-tube has an triangular type shape and the 24 tube is Elliptical.

The inner openings of these Adapter Bushings are uniquely shaped to accept these tube cables and establish a liquid-tight seal around them.

9.3 Discard any standard bushing the neoprene bushing supplied with the Kellems Grip. Replace with appropriate Adapter Bushing and proceed with normal installation procedures.

See Fig. 7a through Fig. 7d

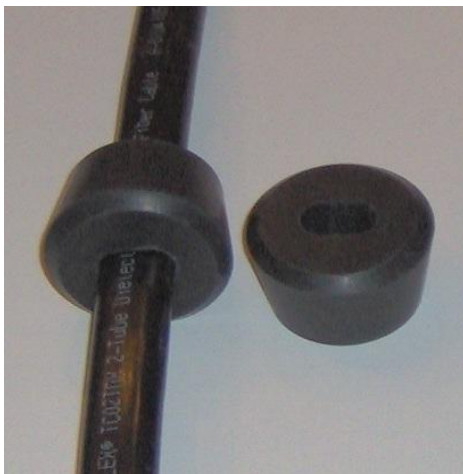


Figure 7a
2-Tube Adapter Bushing



Figure 7b
4-Tube Adapter Bushing



Figure 7c
12-Tube Adapter Bushing



Figure 7d
24-Tube Adapter Bushing

9.4 Adapter Bushings & Kellems Grips

9.5 Reference page 3 of the SRP for Tube cable sizes and the matching Bushings and Kellems Grip part numbers.

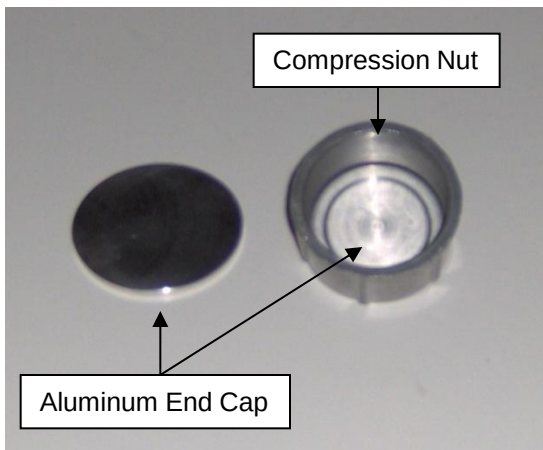


Figure 8
Aluminum End Caps to Seal
Unoccupied Kellems Grips

10.0 Sealing Unoccupied Kellems Grips

10.1 Use Aluminum End Caps (DE5KCAP, DE6KCAP, and DE7KCAP) to seal an empty / unoccupied Liquid-Tight Kellems Grip. End Caps are round metal discs with a diameter that corresponds to the interior size of the Grip's compression nut. **See Fig. 8.**

10.2 Install appropriate size Aluminum End Cap between Kellems Grip compression nut and neoprene bushing.

Note: *If an airtight seal is required, apply an appropriate sealant (such as RTV Silicone, etc.) between End Cap and wire mesh collar.*

10.3 Install and hand-tighten compression nut.

10.4 Use appropriate size wrenches and tighten compression nut to obtain a liquid-tight, dust-tight seal.