15 kV class fused loadbreak elbow connector

General

Eaton's Cooper Power™ series 15 kV Class fused loadbreak elbow connector combines a fully-shielded and insulated plug-in termination with full-range current-limiting fuse protection. The fused loadbreak elbow connector provides a convenient and cost effective means to adding fused protection to underground distribution systems, for connecting underground cables to transformers, switching cabinets and junctions equipped with IEEE Std 386™-2006 standard 200 A, 15 kV Class loadbreak bushings. Designed as a switching device, it is tested at the maximum fuse rating in accordance to the procedures of IEEE Std 386™ standard - latest revision.

Fused loadbreak elbow connectors are molded using high quality peroxide-cured insulating and semi-conducting EPDM rubber. Standard features include a copper probe adapter, coppertop connector, copper loadbreak probe with an ablative arc-follower tip and stainless steel reinforced pulling-eye. The capacitive test points are made of corrosion resistant plastic and are used for voltage detection.

Cable ranges are designed to accept a wide range of cable conductor and insulation sizes and accommodate cable manufactured to either AEIC or ICEA standards.

The coppertop compression connector consists of an aluminum crimp barrel inertia-welded to a copper lug and provides a connection to transition from the cable to the current-limiting fuse. The aluminum barrel makes the connector easy to crimp and the copper lug ensures a reliable, tight, cool operating connection with the current-limiting fuse.

Design tests

To assure a superior level of performance the fused loadbreak elbow connector has been tested according to applicable sections of the following ANSI® and IEEE® standards:

- IEEE Std C37.40™ standard Service Conditions and Definitions for High-Voltage Fuses
- IEEE Std C37.41™ standard Design Tests for High-Voltage Fuses
- IEEE Std 386™-2006 standard for Separable Insulated Connector Systems
- ANSI® C37.47 Standard Specifications for Distribution Fuse Disconnecting Switches and Current-Limiting Fuses

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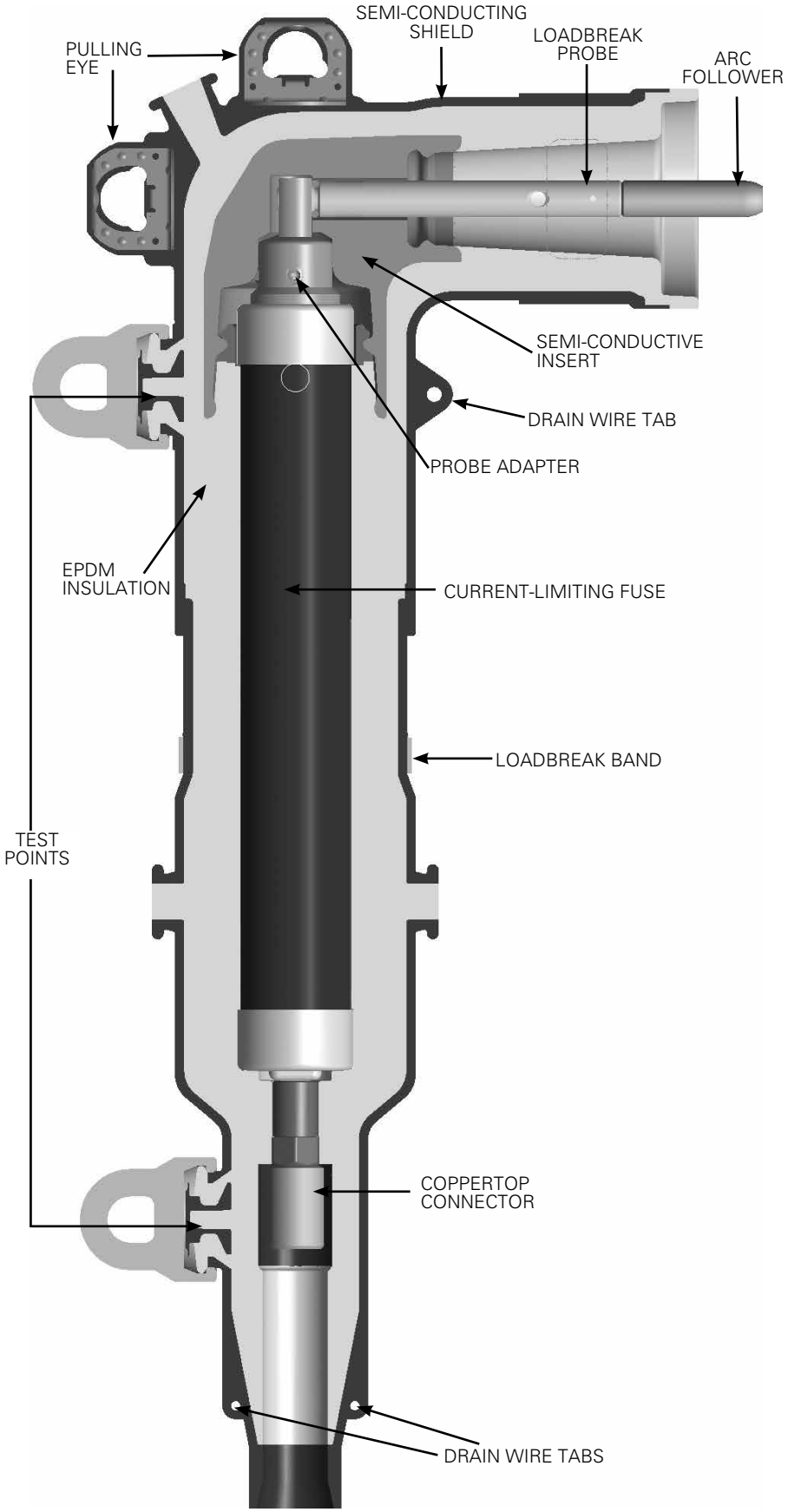
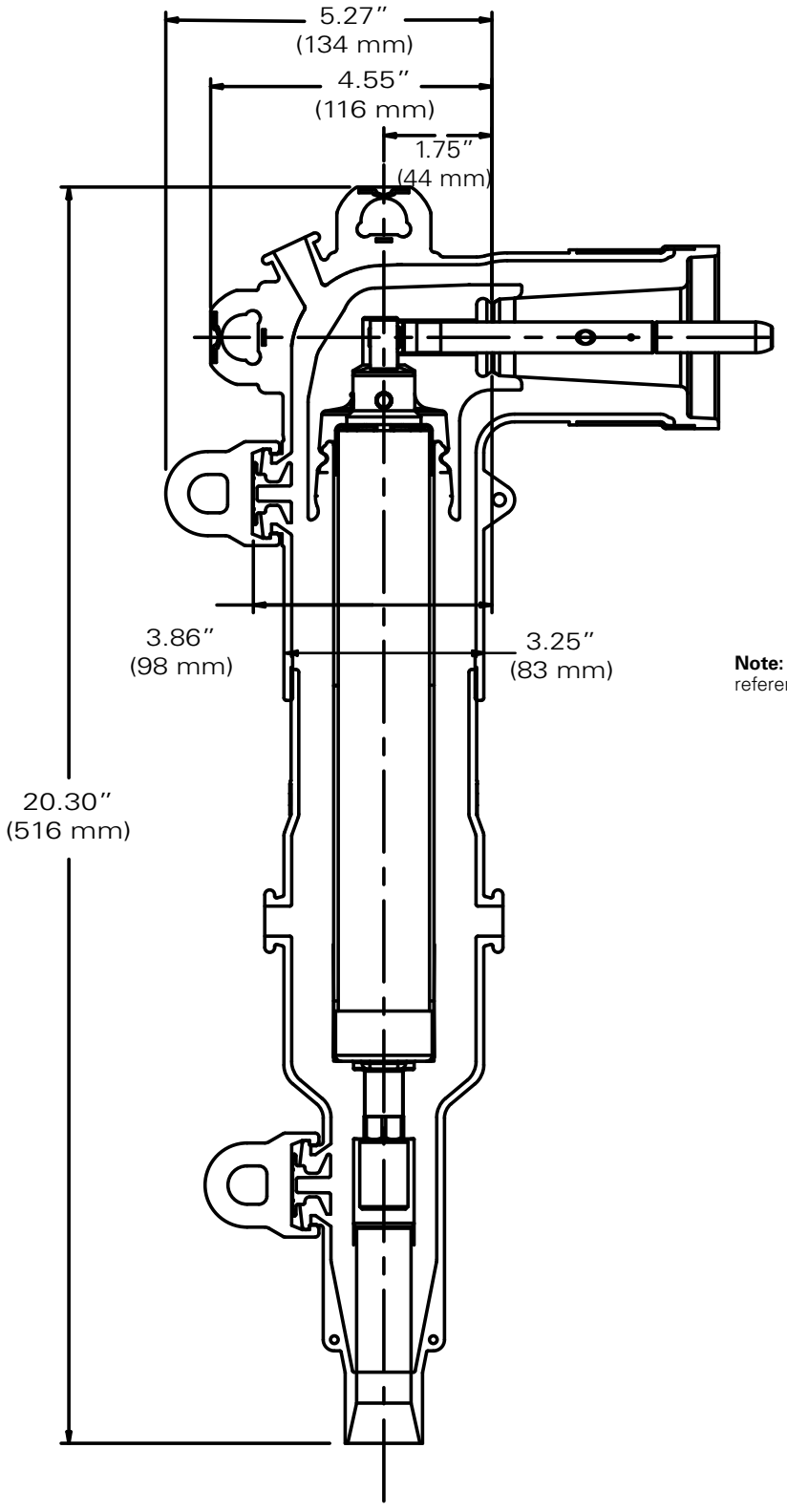


Figure 1. 15 kV Class fused loadbreak Elbow connector cutaway illustrates design features.



Note: Dimensions given are for reference only.

Figure 2. 15 kV Class fused loadbreak elbow connector profile and stacking dimensions shown.

Installation

Cable stripping and scoring tools available from various tool manufacturers are recommended for use when installing fused loadbreak elbows. After preparing the cable, the cable housing is pushed onto the cable. The current-limiting fuse is threaded into the coppertop connector using the supplied hex wrench. The probe adapter and elbow housing are installed and loadbreak probe threaded into the probe adapter. Use a clampstick to perform loadmake and loadbreak operations. Refer to installation instructions, MN650014EN.

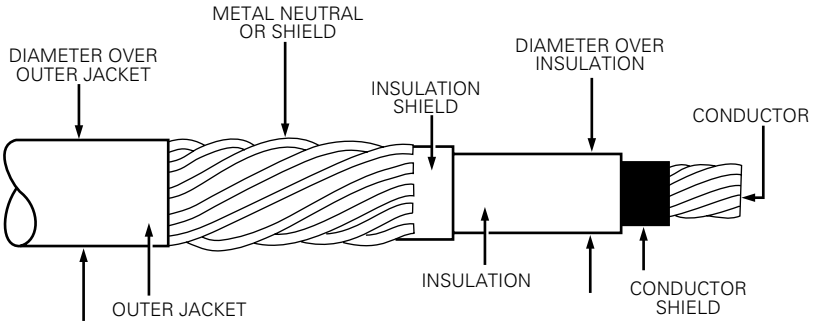


Figure 3. Illustration showing typical construction of medium voltage underground cable.

Production tests

Tests conducted in accordance with IEEE Std 386™-2006 standard:

- AC 60 Hz 1 Minute Withstand
  - 34 kV
- Minimum Corona Voltage Level
  - 11 kV
- Test Point Voltage Test

Tests conducted in accordance with Eaton requirements:

- Physical Inspection
- Periodic Dissection
- Periodic Fluoroscopic Analysis

Table 1. Voltage Ratings and Characteristics

Description	kV
Standard Voltage Class	15
Maximum Rating Phase-to-Phase	8.3
Maximum Rating Phase-to-Ground	8.3
AC 60 Hz 1 Minute Withstand	34
DC 15 Minute Withstand	53
BIL and Full Wave Crest	95
Minimum Corona Voltage Level	11

Voltage ratings and characteristics are in accordance with IEEE Standard 386™-2006 standard.

Table 2. Current Ratings and Characteristics

Description	Amperes
Continuous	Fuse rating
Switching	10 operations at fuse current rating at 8.3 kV
Fault Closure	10,000 A rms symmetrical at 8.3 kV after 10 switching operations

Ordering information

The fused loadbreak elbow connector, elbow/cable housing kits are packaged in individual corrugated cardboard cartons. Each kit contains:

- Fused Elbow, Cable Housing
- Fused Elbow, Elbow Housing
- Coppertop Compression Connector
- Loadbreak Probe
- Probe Adapter and Set Screws
- Probe Installation Tool
- 1/8" Hex Wrench
- Silicone Lubricant
- Installation Instruction Sheet

Note: Current-limiting fuses sold separately. See Tables 6 and 7 for fuse recommendations and Table 5 for electrical ratings and catalog number information.

To order a 15 kV Class fused loadbreak elbow connector kit follow the easy steps below.

STEP 1: Determine the cable's diameter over the electrical insulation as shown in Figure 3 (including tolerances) from cable manufacturer. Then identify a cable range from Table 3 that brackets the minimum and maximum insulation diameters. Select the CABLE RANGE CODE from the far right column.

STEP 2: Identify the conductor size and type in Table 4 and select the CONDUCTOR CODE from the far right column.

For an elbow kit without a compression connector, use "**00**" for the conductor code.

STEP 3: For a Fused Loadbreak Elbow and Cable Housing kit order:

LFEP215TFEC | **CABLE RANGE CODE** | **CONDUCTOR CODE** | **AT**

Table 3. Cable Range for Loadbreak Elbow

Inches	Millimeters	Cable Range Code
0.610" - 0.820"	15.5 - 20.8	A
0.740" - 0.980"	18.8 - 24.9	B
0.910" - 1.180"	23.1 - 29.9	C

EXAMPLE: Select a fused elbow probe and conductor housing kit for 1/0 compressed stranded with a minimum insulation diameter of 0.830" (21.0 mm) and a maximum diameter of 0.890" (22.6 mm).

STEP 1: From Table 3, identify the cable range 0.740"—0.980" (18.8 mm - 24.9 mm) and select the "B" CABLE RANGE CODE.

STEP 2: The conductor size is a 1/0 and the type is compressed.

From Table 4, under the column "Class B Stranded or Compressed" identify 1/0 and select the "06" conductor code.

STEP 3: Order catalog number.

LFEP215TFECB06AT

Table 4. Conductor Size and Type

Class B Stranded or Compressed		Compact or Solid		CONDUCTOR CODE
AWG	mm^2	AWG	mm^2	
No Connector				**00**
		#2	35	**03**
#2	35	#1	–	**04**
#1	–	1/0	50	**05**
1/0	50	2/0	70	**06**
2/0	70	3/0	–	**07**
3/0	–	4/0	95	**08**
4/0	95	250	120	**09**
250*	120	–	–	**10**

* Compressed stranding only.

Note: Coppertop compression connector may be used on both aluminum and copper cable conductors.

Table 5. Fused Loadbreak Elbow Connector Fuse Electrical Ratings and Catalog Numbers

Nominal System Voltage Class - kV	Nominal Fuse Voltage Rating kV	Nominal Fuse Current rating in Amperes	Fuse Catalog Number	Maximum Continuous Current			Minimum Melt I^2t (A^2s)	Maximum Total I^2t (A^2s)
				25°C	40°C	65°C		
		6	FEF083A006	8.9	8.5	8.0	710	3,800
		8	FEF083A008	12.1	11.7	10.9	1,000	5,425
		10	FEF083A010	15.0	14.4	13.5	1,200	5,825
		12	FEF083A012	16.6	16.0	15.0	1,200	5,825
15.5	8.3	18	FEF083A018	21.9	21.1	19.7	1,500	8,000
		20	FEF083A020	25.5	24.6	23.0	2,425	12,000
		25	FEF083A025	34.5	33.2	31.1	4,500	20,500
		30	FEF083A030	40.1	38.7	36.2	6,000	26,200
		40	FEF083A040	45.5	43.8	41.0	9,700	39,750

200 A shorting bar (solid link)

The 200 A fused loadbreak elbow connector shorting bar is used for temporary restoration of service when a standard fuse is not available and can also be used during fault locating and grounding.

Catalog FESBA Kit contains:

(1) Shorting Bar (solid Link)

(1) 3/16" re-usable hex wrench

(1) 1/8" re-usable hex wrench

(25) Adapter set screws

(5) Wire probe wrenches

(1) Bleeder strap

(1) Re-usable caution tag with clasp

(1) Hard plastic carrying case

(1) Installation Instruction Sheet Conductor Size and Type

Figure 4. Shorting bar kit, catalog FESBA

Table 6. Recommended Fuse Ratings for Single- and Three-Phase Applications

Nominal Fuse Rated Voltage - 8.3 kV											Nominal Fused Rated Voltage - 15.5 kV							
Transformer Single-Phase Voltage Rating (kV) - Phase-to-Ground																		
	2.4 kV		4.16 kV		4.8 kV		6.93 - 7.2 kV		7.62 & 7.97 kV		12 & 12.47 kV		13.2 kV		13.8 kV		14.4 kV	
1ø kVA	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
10	–	6	–	6*	–	–	–	6*	–	6*	–	6*	–	6*	–	6*	–	6*
15	8	10	–	6	–	6	–	6*	–	6*	–	6*	–	6*	–	6*	–	6*
25	12	20	8	10	–	8	–	6	–	6	–	6*	–	6*	–	6*	–	6*
37.5	20	25	10	18	10	12	–	8	–	8	–	6	–	6*	–	6	–	6*
50	25	40	18	20	12	20	10	12	8	10	–	6	–	6	–	6	–	6
75	40	–	20	30	20	30	12	20	12	18	8	10	8	8	8	10	–	8
100	–	–	30	–	30	40	25	30	18	25	10	18	10	12	10	18	12	10
167	–	–	–	–	–	–	40	–	25	40	18	–	18	–	18	–	20	20
250	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
333	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
500	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

Nominal Fuse Rated Voltage - 8.3 kV													Nominal Fused Rated Voltage - 15.5 kV			
Transformer Three-Phase Voltage Rating (kV) - Phase-to-Phase																
	2.4 kV		4.16 kV		4.8 kV		8.32 kV		12.47 kV		13.2 to 14.4 kV		20.8 kV		22.9 - 24.9 kV	
3ø kVA	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
30	10	12	–	6	–	6	–	6*	–	6*	–	6*	–	6*	–	6*
45	12	20	8	10	–	8	–	6	–	6*	–	6*	–	6*	–	6*
75	20	30	12	20	10	18	–	8	–	6	–	6*	–	6	–	6*
112.5	40	–	20	28	18	25	10	12	–	8	–	8	–	8	6	6
150	–	–	25	40	20	30	12	20	–	12	8	12	8	10	8	8
225	–	–	40	–	40	–	20	25	12	20	12	18	12	12	10	10
300	–	–	–	–	–	–	25	40	18	25	18	25	12	18	18	12
500	–	–	–	–	–	–	40	–	30	40	30	40	18	–	–	–
750	–	–	–	–	–	–	–	–	–	–	40	–	–	–	–	–
1000	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
1500	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–

* Fuse allows more than 300% of the transformer rating.

Notes:

- Fuse selection is based on the continuous current rating of the fuses at 40°C
- Fuses in listed Column A allow between 1.4 and 2 times the rated current of the transformer; those listed in Column B, allow 2-3 times the rated current of the transformer.
- Recommended fuses meet inrush criteria of 12 times transformer full load current for 0.1 second and 25 times full load current for 0.01 second. Fuses also meet cold load pickup criteria of 6 times transformer full load current for 1 second and 3 times full load current of 10 seconds.
- For three-phase applications, recommendations are limited to GRDY-GRDY transformers with no more than 50% delta connected secondary load, along with certain other assumptions. It is common practice to use line-to-ground rated fuses.

Table 7. Recommended Fuse Ratings for Three-Phase Delta Applications

Transformer Three-Phase Voltage Rating (kV) - Phase-to-Phase												
Nominal Fuse Rated Voltage - 8.3 kV									Nominal Fuse Rated Voltage - 15.5 kV			
	2.4 kV		4.16 kV		4.8 kV		8.32 kV		12.47 kV		13.2 to 14.4 kV	
3ø kVA	A	B	A	B	A	B	A	B	A	B	A	B
30	10	12	–	6	–	6	–	6*	–	6*	–	6*
45	12	20	8	10	–	8	–	6	–	6*	–	6*
75	20	30	12	20	10	18	–	8	–	6	–	6*
112.5	40	–	20	28	18	25	10	12	–	8	–	8
150	–	–	25	40	20	30	12	20	–	12	8	12
225	–	–	40	–	40	–	20	25	12	20	12	18
300	–	–	–	–	–	–	25	40	18	20	18	20[1]
500	–	–	–	–	–	–	40	–	–	–	–	–
750	–	–	–	–	–	–	–	–	–	–	–	–
1000	–	–	–	–	–	–	–	–	–	–	–	–
1500	–	–	–	–	–	–	–	–	–	–	–	–

* Fuse allows more than 300% of the transformer rating.

[1] 20 A @ 14.4 kV only.

Notes:

- Fuse selection is based on the continuous current rating of the fuses at 40°C
- Fuses in listed Column A allow between 1.4 and 2 times the rated current of the transformer; those listed in Column B, allow 2-3 times the rated current of the transformer.
- Recommended fuses meet inrush criteria of 12 times transformer full load current for 0.1 second and 25 times full load current for 0.01 second. Fuses also meet cold load pickup criteria of 6 times transformer full load current for 1 second and 3 times full load current of 10 seconds.

Table 8. Replacement Fused Loadbreak Elbow Connector

Conductor Size				
Concentric or Compressed		Compact or Solid		
AWG	mm^2	AWG	mm^2	Catalog Number
		#2	35	FECC2C03T
#2	35	#1	–	FECC2C04T
#1	–	1/0	50	FECC2C05T
1/0	50	2/0	70	FECC2C06T
2/0	70	3/0	–	FECC2C07T
3/0	–	4/0	95	FECC2C08T
4/0	95	–	–	FECC2C09T
250*	120	–	–	FECC2C10T

* Compressed stranding only.

Note: Coppertop compression connector may be used on both aluminum and copper cable conductors.

Table 9. Replacement Parts

Description	Catalog Number
Loadbreak Probe Installation Tool	2602733A01
Probe Kit (includes Probe, Installation Tool, Silicone Lubricant, Installation Instruction Sheet)	PKFE215
Probe Adapter Kit (Includes Adapter, (2) Set Screws and 1/8" Hex Wrench	FEADPT
Fuse Replacement Wrench Kit (includes (2) Set Screws, (Probe Adapter), (1) 1/8" Hex Wrench, (2) 3/16" Hex Wrenches, (2) Probe Installation Tools	FEWKIT
Silicone Grease 0.175 oz tube (5 grams) 5.3 oz tube (150 grams)	 2603393A03 2605670A02M
Test Point Cap	2639992A01

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