

BBI-A Heat Shrinkable Tubing For Bus Bar

5 – 35 kV

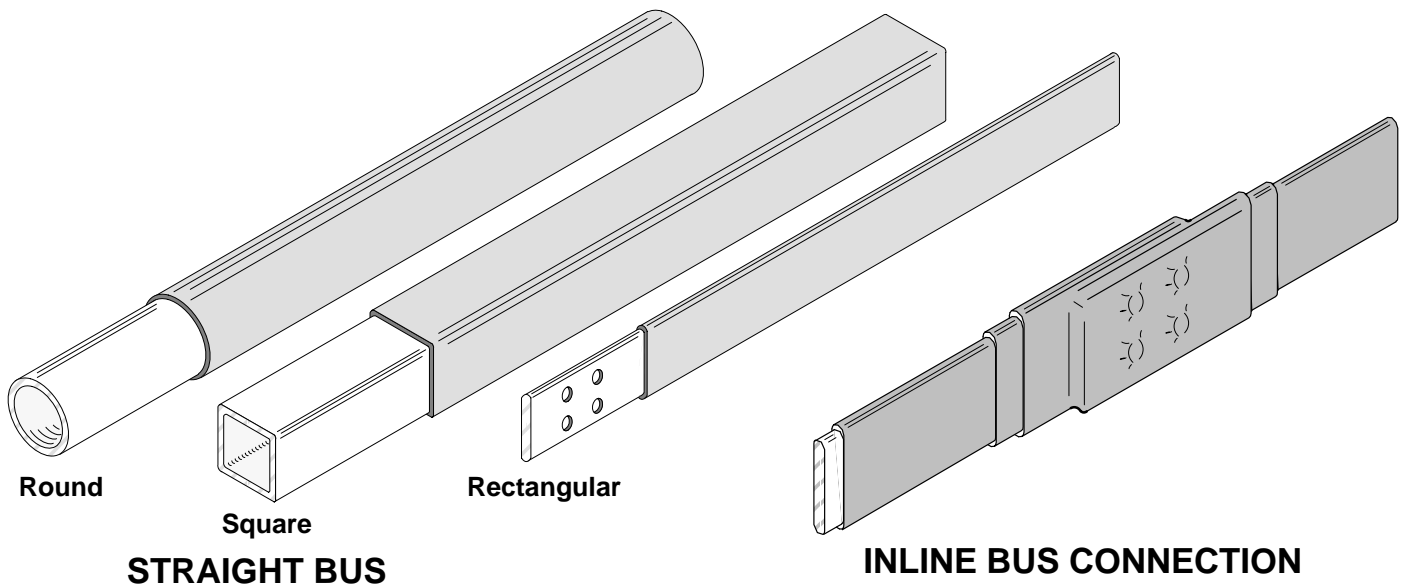
ANSI/IEEE C37.20

5, 8, 15, 25 & 35 kV Classes

Maximum Temperature Rating – 110°C

Material – Polyolefin Based, Heat Shrinkable

Standard Lengths – 20 ft (6,1 m) & 50 ft (15,2 m)



BBI-A Heat Shrinkable Tube

BBI-A Heat Shrinkable Tubing For Bus Bar



BBI-3A	BBI-7A
BBI-4A	BBI-8A
BBI-5A	BBI-9A
BBI-6A	BBI-10A

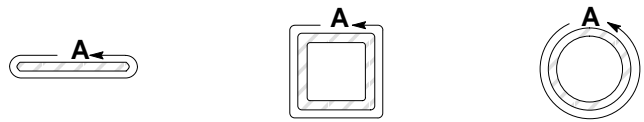
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SCALE: Not to scale

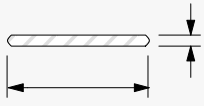
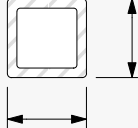

ISSUE DATE: 02/16/93

ISSUE:

A. Selection Charts for Straight Bus Bar
 Standard lengths = 20ft. (6,1m) and 50ft. (15,2m)



5, 8 and 15 kV Bus Bar Size Ranges

Product Number	Bar Circumference (A)			
		Rectangular *	Square *	Round
BBI-3A	3.28 – 5.57 in. (83 – 141 mm)	1 1/2 x 1/4 — 2 1/2 x 1/2 in. (38 x 6 — 64 x 13 mm)	1 x 1 – 1 1/2 x 1 1/2 in. (25 x 25 – 38 x 38 mm)	1 1/8 — 1 3/4 in. (29 — 44 mm)
BBI-4A	5.43 – 8.86 in. (138 – 225 mm)	2 1/2 x 3/8 — 4 x 3/4 in. (64 x 10 — 102 x 19 mm)	2 x 2 in. (51 x 51 mm)	1 3/4 — 2 3/4 in. (44 — 70 mm)
BBI-5A	6.67 – 10.86 in. (169 – 276 mm)	3 x 5/8 — 5 x 3/4 in. (76 x 16 — 127 x 19 mm)	2 x 2 – 2 1/2 x 2 1/2 in. (51 x 51 – 64 x 64 mm)	2 1/8 — 3 3/8 in. (54 — 86 mm)
BBI-6A	7.57 – 12.86 in. (192 – 327 mm)	3 1/2 x 1/2 — 6 x 3/4 in. (89 x 13 — 152 x 19 mm)	2 1/2 x 2 1/2 – 3 x 3 in. (64 x 64 – 76 x 76 mm)	2 1/2 — 4 in. (64 — 102 mm)
BBI-7A	8.28 – 13.00 in. (210 – 330 mm)	4 x 1/4 — 6 x 3/4 in. (102 x 6 — 152 x 19 mm)	2 1/2 x 2 1/2 – 3 x 3 in. (64 x 64 – 76 x 76 mm)	2 3/4 — 4 1/8 in. (70 – 105 mm)
BBI-8A	10.29 – 16.43 in. (261 – 417 mm)	5 x 1/4 — 8 x 3/8 in. (127 x 6 — 203 x 10 mm)	3 x 3 – 4 x 4 in. (76 x 76 – 102 x 102 mm)	3 3/8 — 5 1/8 in. (86 — 130 mm)
BBI-9A	12.29 – 19.23 in. (312 – 488 mm)	6 x 1/4 — 9 x 3/4 in. (152 x 6 — 229 x 19 mm)	3 1/2 x 3 1/2 – 5 x 5 in. (89 x 89 – 127 x 127 mm)	4 — 6 1/8 in. (102 — 156 mm)
BBI-10A	15.43 – 24.14 in. (392 – 613 mm)	8 x 1/4 — 10 x 3/4 in. (203 x 6 — 254 x 19 mm)	5 x 5 – 6 x 6 in. (127 x 127 – 152 x 152 mm)	5 — 7 5/8 in. (127 — 194 mm)

25 kV Bus Bar Size Ranges

BBI-3A	3.28 – 3.56 in. (83 – 90 mm)	1 1/2 x 1/4 — 1 1/2 x 3/8 in. (38 x 6 — 38 x 10 mm)	MEASURE CIRCUMFERENCE	1 1/8 in. (29 mm)
BBI-4A	5.43 – 5.80 in. (138 – 147 mm)	2 1/2 x 3/8 — 2 1/2 x 5/8 in. (64 x 10 — 64 x 16 mm)	MEASURE CIRCUMFERENCE	1 3/4 in. (44 mm)
BBI-5A	6.67 – 7.18 in. (169 – 182 mm)	3 x 5/8 — 3 x 3/4 in. (76 x 16 — 76 x 19 mm)	MEASURE CIRCUMFERENCE	2 1/8 – 2 1/4 in. (54 — 57 mm)
BBI-6A	7.57 – 8.43 in. (192 – 214 mm)	3 1/2 x 1/2 — 4 x 1/4 in. (89 x 13 — 102 x 6 mm)	MEASURE CIRCUMFERENCE	2 1/2 – 2 5/8 in. (64 — 67 mm)
BBI-7A	8.28 – 10.44 in. (210 – 265 mm)	4 x 1/4 — 5 x 3/8 in. (102 x 6 — 127 x 10 mm)	2 1/2 x 2 1/2 in. (64 x 64 mm)	2 3/4 — 3 1/4 in. (70 – 83 mm)
BBI-8A	10.29 – 12.88 in. (261 – 327 mm)	5 x 1/4 — 6 x 3/4 in. (127 x 6 — 152 x 19 mm)	3 x 3 in. (76 x 76 mm)	3 3/8 — 4 in. (86 — 102 mm)
BBI-9A	12.29 – 15.31 in. (312 – 389 mm)	6 x 1/4 — 7 x 3/4 in. (152 x 6 — 178 x 19 mm)	3 1/2 x 3 1/2 – 4 x 4 in. (89 x 89 – 102 x 102 mm)	4 — 4 7/8 in. (102 — 124 mm)
BBI-10A	15.43 – 19.79 in. (392 – 503 mm)	8 x 1/4 — 9 x 3/4 in. (203 x 6 — 229 x 19 mm)	5 x 5 in. (127 x 127 mm)	5 — 6 1/4 in. (127 — 159 mm)

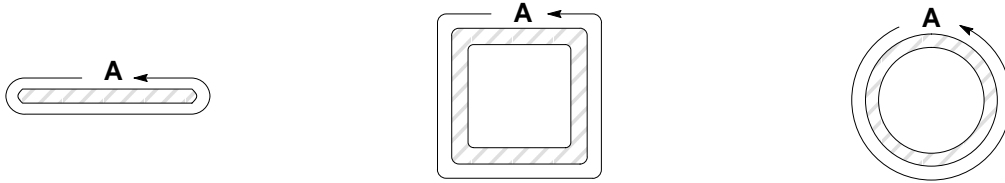
NOTE: * Rectangular and square bar sizes are based on bars having radiused edges and corners.

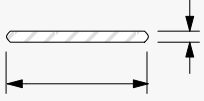
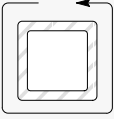

NOTE: BBI-A sizing is based on straight sections of bar. For bolted connections consult bolted connection chart on page 3.

NOTE: Contact your 3M Sales Rep for recommendation on the use of BBI-A on 1/8" thick bus bar.

A. Selection Charts for Straight Bus Bar (Cont.)

Standard lengths = 20ft. (6,1m) and 50ft. (15,2m)



35 kV Bus Bar Size Ranges				
Product Number	Bar Circumference (A)			
		Rectangular *	Square *	Round
BBI-7A	8.28 – 8.86 in. (210 – 225 mm)	4 x 1/4 — 4 x 3/4 in. (102 x 6 — 102 x 19 mm)	MEASURE CIRCUMFERENCE	2 3/4 in. (70 mm)
BBI-8A	10.29 – 10.94 in. (261 – 278 mm)	5 x 1/4 — 5 x 3/4 in. (127 x 6 — 127 x 19 mm)	MEASURE CIRCUMFERENCE	3 3/8 in. (86 mm)
BBI-9A	12.29 – 13.00 in. (312 – 330 mm)	6 x 1/4 — 6 x 3/4 in. (152 x 6 — 152 x 19 mm)	MEASURE CIRCUMFERENCE	4 – 4 1/8 in. (102 – 105 mm)
BBI-10A	15.43 – 16.86 in. (392 – 428 mm)	8 x 1/4 — 8 x 3/4 in. (203 x 6 — 203 x 19 mm)	MEASURE CIRCUMFERENCE	5 – 5 1/4 in. (127 – 133 mm)

NOTE: * Rectangular and square bar sizes are based on bars having radiused edges and corners.

NOTE: BBI-A sizing is based on straight sections of bar. For bolted connections consult bolted connection chart on below.

NOTE: Contact your 3M Sales Rep for recommendation on the use of BBI-A on 1/8" thick bus bar.

B. BBI-A Coverage for Inline Bolted Connections (Rectangular Bus Bar)

NOTE: First select BBI-A size from preceding selection charts for Straight Bus Bar.

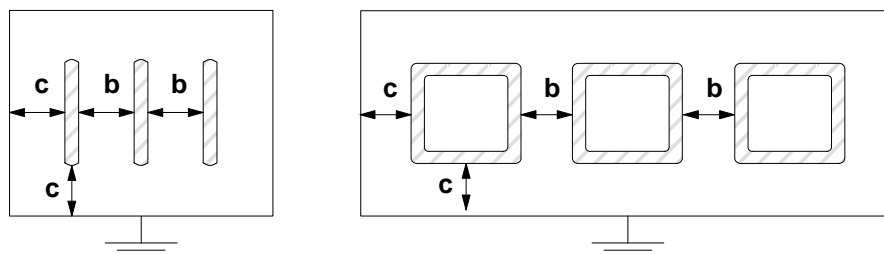
5, 8 & 15 kV: Inline Bolted Connections								
Rectangular Bar Width	BBI-3A	BBI-4A	BBI-5A	BBI-6A	BBI-7A	BBI-8A	BBI-9A	BBI-10A
1.5 in.(38 mm)	1 LAYER							
2.0 in.(51 mm)	2 LAYERS							
2.5 in.(64 mm)		1 LAYER						
3.0 in.(76 mm)		2 LAYERS						
3.5 in.(89 mm)		2 LAYERS	1 LAYER					
4.0 in.(102 mm)		2 LAYERS	2 LAYERS	1 LAYER	1 LAYER			
5.0 in.(127 mm)			2 LAYERS	2 LAYERS	1 LAYER	1 LAYER		
6.0 in.(152 mm)				2 LAYERS	2 LAYERS	1 LAYER	1 LAYER	
7.0 in.(178 mm)						2 LAYERS	1 LAYER	
8.0 in.(203 mm)						2 LAYERS	2 LAYERS	1 LAYER
9.0 in.(229 mm)							2 LAYERS	1 LAYER
10.0 in.(254 mm)								2 LAYERS

25 & 35 kV: Inline Bolted Connections
USE 2 LAYERS OF BBI-A INSULATION FOR ALL 25 & 35 kV INLINE BOLTED CONNECTIONS

C. Typical Dimensions

Product Number	Length	Minimum Expanded Tubing I. D.	Expanded Wall Thickness	Max. Recovered Tubing I. D.	Recovered Wall Thickness
BBI-3A	20 & 50 ft. (6,1 & 15,2 m)	2.38 in. (60 mm)	0.049 in. (1,24 mm)	1.01 in. (26 mm)	0.113 in. (2,87 mm)
BBI-4A	20 & 50 ft. (6,1 & 15,2 m)	4.35 in. (110 mm)	0.043 in. (1,09 mm)	1.67 in. (42 mm)	0.113 in. (2,87 mm)
BBI-5A	20 & 50 ft. (6,1 & 15,2 m)	5.30 in. (135 mm)	0.043 in. (1,09 mm)	2.04 in. (52 mm)	0.114 in. (2,90 mm)
BBI-6A	20 & 50 ft. (6,1 & 15,2 m)	5.90 in. (150 mm)	0.046 in. (1,17 mm)	2.33 in. (59 mm)	0.117 in. (2,97 mm)
BBI-7A	20 & 50 ft. (6,1 & 15,2 m)	6.78 in. (172 mm)	0.048 in. (1,22 mm)	2.55 in. (65 mm)	0.130 in. (3,30 mm)
BBI-8A	20 & 50 ft. (6,1 & 15,2 m)	8.25 in. (210 mm)	0.049 in. (1,24 mm)	3.18 in. (81 mm)	0.128 in. (3,25 mm)
BBI-9A	20 & 50 ft. (6,1 & 15,2 m)	8.83 in. (224 mm)	0.054 in. (1,37 mm)	3.78 in. (96 mm)	0.127 in. (3,23 mm)
BBI-10A	20 & 50 ft. (6,1 & 15,2 m)	10.28 in. (261 mm)	0.059 in. (1,50 mm)	4.53 in. (115 mm)	0.138 in. (3,51 mm)

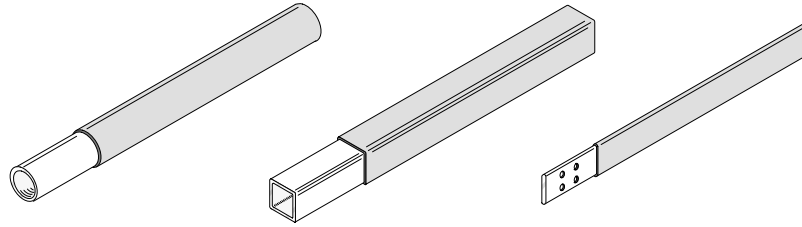
Typical Clearances for Rectangular and Square Bus Bars



Voltage Rating (kV)	BIL (kV)	BBI-A Insulated (Indoor Clearance)		Uninsulated (Indoor Clearance)	
		Dimension b	Dimension c	Dimension b	Dimension c
15 & Below	110	2.7 in. (69 mm)	3.0 in. (76 mm)	7.5 in. (191 mm)	5.0 in. (127 mm)
25	125	3.0 in. (76 mm)	3.5 in. (89 mm)	10.5 in. (267 mm)	7.5 in. (191 mm)
35	150	4.5 in. (114 mm)	5.5 in. (140 mm)	12.5 in. (318 mm)	9.5 in. (241 mm)

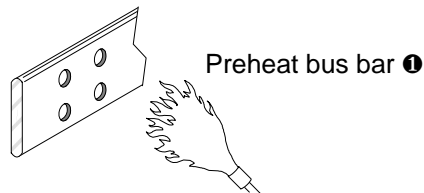
NOTE: b = minimum phase-to-phase dimension
c = minimum phase-to-ground dimension

The table indicates typical minimum clearance dimensions for BBI-A bus bar insulation, as compared to that for uninsulated bus bar. These dimensions are based on 60 Hz withstand, DC withstand (hypot) and BIL tests (Reference: ANSI/IEEE C37.20) and from partial discharge (corona) tests. Testing was performed on 12 ft. (3,7 m) lengths of copper and aluminum bus bar enclosed in a 3 ft. (0,9 m) long duct, with air spacing between the bar and grounded duct.



A. Preparation

1. Clean bus bar using standard practice (e.g. use appropriate cable cleaning solvent).
2. Cut BBI–A Heat Shrinkable Tubing to required length. Use a very sharp knife or a razor knife to ensure a smooth cut with no nicks.
3. Preheating of bus bar is recommended, especially for larger size bars. Preheat to approximately 250 – 300°F (120 – 150°C) ❶. (See figure below)

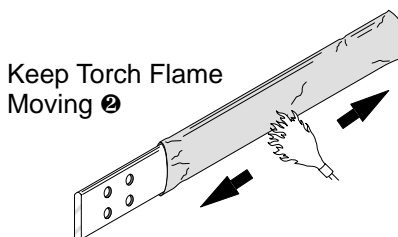


NOTE: Preheating significantly reduces shrink time

4. Slide BBI–A Tubing into position on bus bar.

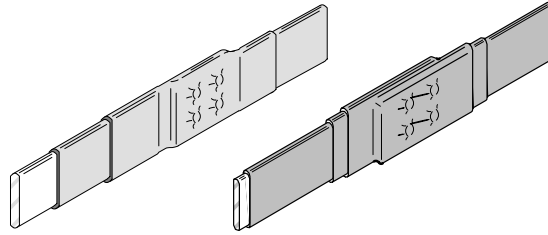
B. Shrink BBI–A Tubing

1. Shrink BBI–A Tubing onto bus bar using standard industry methods (e.g Heat shrink torch, special oven, etc.) ❷. (See figure below)
2. When installing more than one length of BBI–A Tubing on a straight bus bar section, overlap tubing by a minimum of 6 in. (152 mm).



C. Application Tips

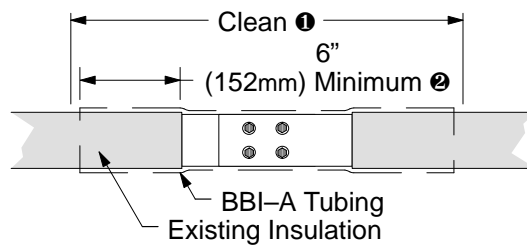
1. **KEEP TORCH FLAME MOVING** to prevent burning of BBI–A Tubing.
2. **For rectangular bars:** Shrink the edges of the BBI–A tubing first. This will achieve a more uniform insulation thickness around the bar.
3. BBI–A Tubing normally shrinks when it reaches approximately 250°F (120°C). **CAUTION:** Burn damage can occur if tubing temperature exceeds approximately 600°F (315°C) for several minutes.
4. **Dimples appearing in BBI–A Tubing during shrinkage are normal,** and are removed with continued even heating.
5. **Heat application should be discontinued immediately after dimples disappear** from BBI–A Tubing, or when tubing has shrunk smoothly onto bus bar.
6. **Use appropriate heat shrink torch which produces a blue and yellow flame.** Application of the yellow portion of flame is recommended for optimum control of the shrink rate.
7. **CAUTION:** Be careful handling insulated bus bar while it is still hot. The heated BBI–A Tubing is soft and susceptible to physical damage.
8. **SAFETY:** Use caution and proper safety procedures when working with open flame and high temperatures. This would include maintaining a well ventilated workplace.



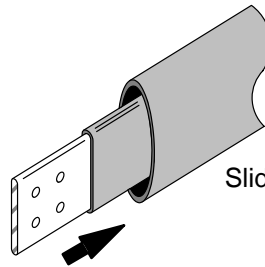
5 – 15 kV (See Additional Instructions on Page 9 for 25 and 35 kV)

A. Preparation for a SINGLE Insulation Layer (15 kV or Less)

1. Consult bolted connection application chart on page 3 to determine if one or two layers of BBI-A are required. If two layers are required go to section B on page 7.
2. Clean bus bar connection, adjacent to exposed bar and existing insulation using standard practice ❶ (e.g. use appropriate cable cleaning solvent).
3. Cut BBI-A tubing to length required to cover bolted connection and at least 6 inches (152 mm) ❷ of existing bus bar insulation. Exercise care to ensure a clean cut. (See figure below)

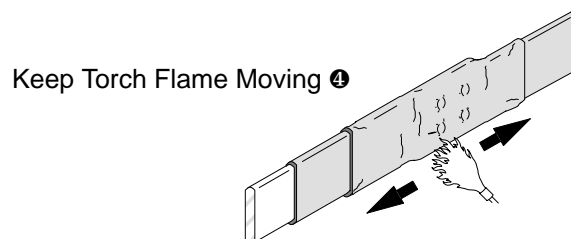


4. Slide BBI-A tubing onto one bus bar. ❸ (See figure below)

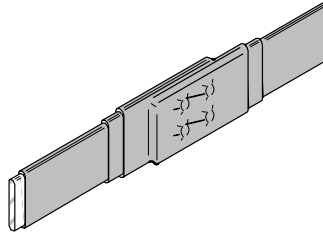


Slide BBI-A Tubing Onto One bus bar ❸.

5. Connect bus bars.
6. Slide BBI-A tubing into required position over bolted connection.
7. Shrink BBI-A Tubing onto bus bar and bolted connection using standard industry methods ❹ (e.g. Heat shrink torch).



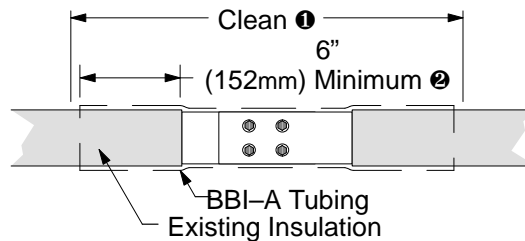
8. Refer to "Application Tips" on page 5.



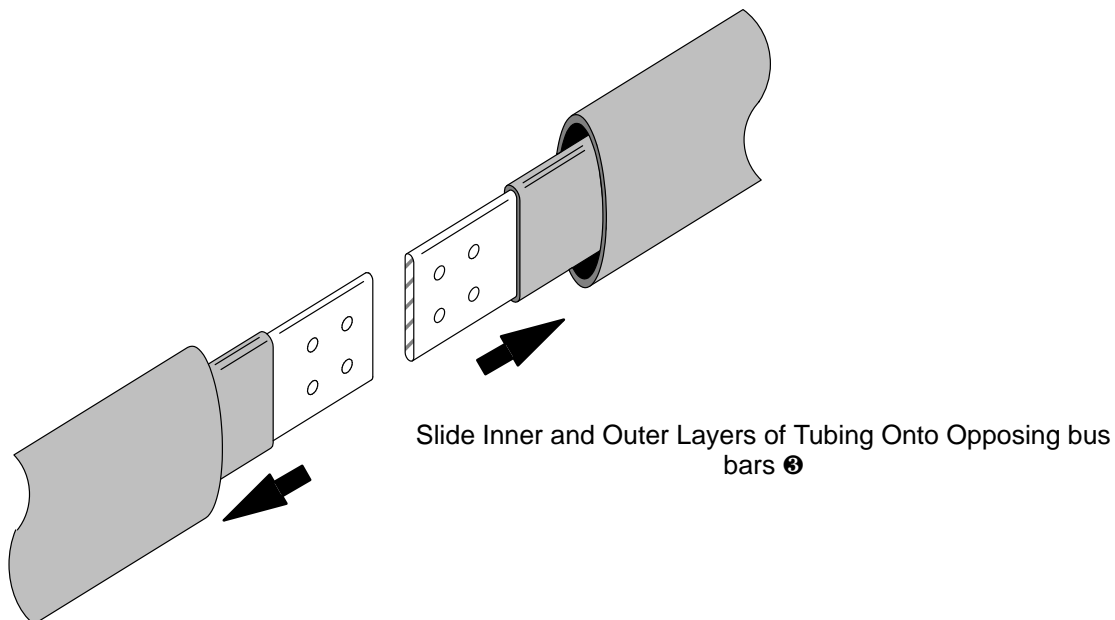
15 – 35 kV

B. Preparation for a DOUBLE Insulation Layer

1. If the application is for 15kV or less, consult the bolted connection application chart on page 3 to determine if one or two layers of BBI-A are required. 25 kV and 35 kV applications will require two layers of BBI-A insulation.
2. See Additional Instructions on Page 9 for 25 and 35 kV.
3. Clean bus bar connection, adjacent to exposed bar and existing insulation using standard practice ❶ (e.g. use appropriate cable cleaning solvent). (See figure below)
4. Cut the inner layer of BBI-A tubing to length required to cover bolted connection and at least 6 inches (152 mm) ❷ of existing bus bar insulation. Exercise care to ensure a clean cut. (See figure below) Cut the outer layer of BBI-A tubing 2 in. (51 mm) shorter than the inner layer.

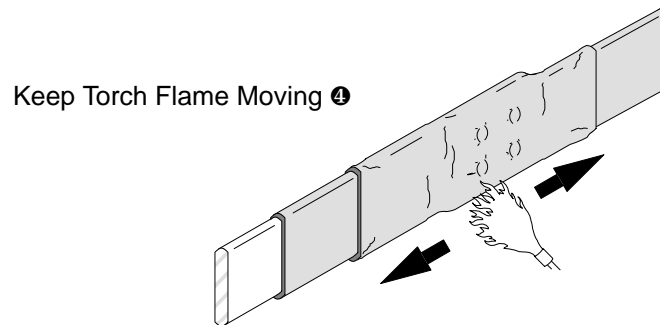


5. Slide inner layer of BBI-A tubing onto one bus bar. Slide the outer layer of BBI-A tubing onto the other bus bar. ❸ (See figure below)



6. Connect bus bars.
7. Slide inner layer of BBI-A tubing into required position over bolted connection.

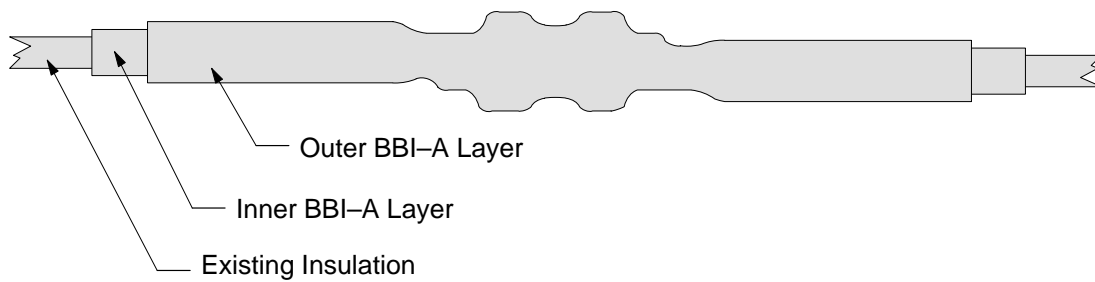
8. Shrink BBI–A Tubing onto bus bar and bolted connection using standard industry methods ④ (e.g Heat shrink torch). (See figure below)



9. Refer to “Application Tips” on page 5.

10. Once the inner layer of BBI–A tubing has completely shrunk, slide the outer layer over the inner layer and center it.

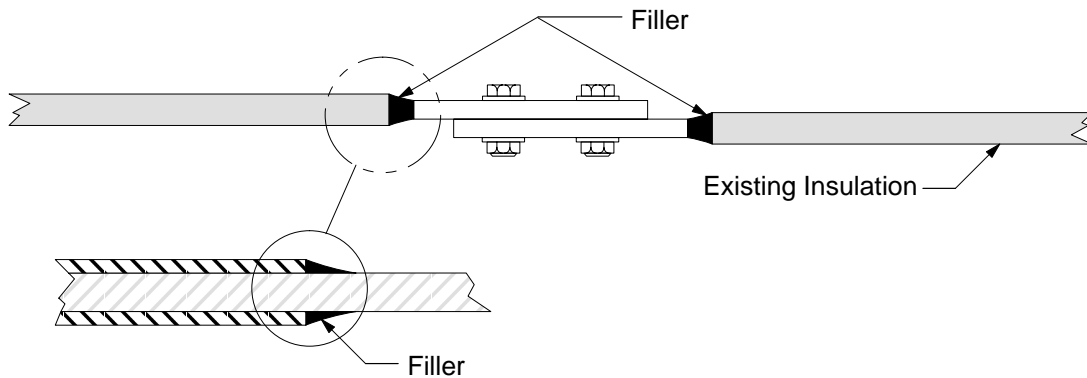
11. Shrink the outer layer of BBI–A tubing. (See figure below)



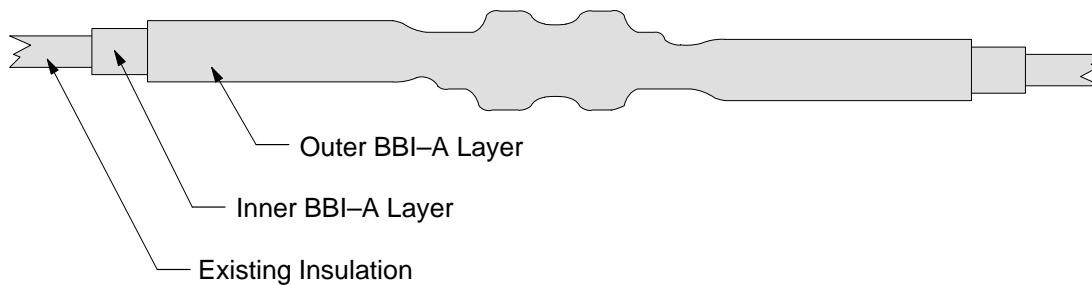
Use Following Instruction Steps in Addition to 5 – 15 kV Instructions

25 & 35 kV:

1. Fill in edges of existing bus bar insulation with an electrical grade mastic, putty or filler (e.g. Scotch™ 2228 Rubber Mastic Tape: cut into strips and fold longitudinally with mastic side facing out. Press filler in against edge of existing insulation to form fillet). (See figure below)



25 & 35 kV Bolted Bus Bar Connection



2. Return to page 7.

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