



Transforming energy into growth

**GUIDE FOR CONNECTION AND INSTALLATION OF  
EQUIPMENT WITH PRECAST ACCESSORIES**

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# GUIDE FOR ACCESSORIES CONECTION AND INSTALLATION FOR PAD TRANSFORMERS, OCCASIONALLY SUBMERSIBLE AND MANEUVERING BOXES

## OBJECTIVE

To establish an adequate procedure for the installation of precast elements (well bushes, inserts, elbows, etc.), on occasionally pad submersible transformers, and maneuvering boxes.

## WARNING

- Read instructions carefully before operating the system.
- All devices must be de-energized during any component installation or uninstallation.
- Do not operate directly with your hands on energized wire.
- Excessive mechanical stress in the assembly of accessories can cause failures in performance.
- Verify product is not damaged and its specification compatibility with other accessories
- Equipment installation and commissioning must be carried out by company qualified personal, with knowledge in safety standards and handling of high voltage equipment.

## WELL BUSH:

It is a bushing with a cavity to couple another component such as an insert bushing. Its purpose is to serve as an interface between the transformer active part and the accessories to connect it to the system. This element is installed in the transformer. Figure 1.

Figure 1. Conventional well bushing and Occasionally submersible well bushing

CONVENTIONAL WELL BUSHING



\*for pad transformers

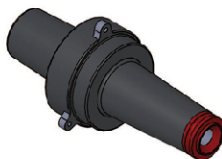
SUBMERSIBLE WELL BUSHING



**INSERT BUSHING:** This connector is installed inside the well bushing and it is coupled with elbow type terminals or with any other accessory meeting ANSI/IEEE 386 standard. It allows a full isolated connection to operate under load. Also, its constructive shape makes it easy to be installed and replaced in the field. Figure 2

Figure 2. Insert Bushing and Integral Bushing

INSERT BUSHING



INTEGRAL BUSHING



Insert bushing installation instructions:

1. Remove the well bushing high voltage protecting cover. The insert bushing must be cleaned, dried and free of contaminants. Evenly apply the silicone lubricant included in the well bushing kit.

NOTE: Make sure all bottom and side cavities are well lubricated. Do not use any other lubricant different to the supplied lubricant.

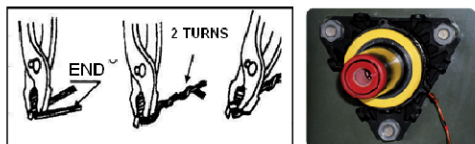
2. Assemble the insert bushing into the well bushing and adjust it clockwise and down to the bottom, applying a final torque of 11,3 to 13,5 N-m. The protecting cover must be removed before tightening the insert bushing. Place the protector back after

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tightening if the connection is not taking place immediately.

3. Insert a No.14 cooper wire into the side eye of the insert body. Grasp eye and wire with pliers and roll the wire two turns. See figure 3. Cut off any excess of wire and connect the other end to the ground terminal.

Figure 3. Connection of cooper wire to insert bushing.



•GROUND

4. If the elbow connector is going to be installed, remove the protector and clean the outer neck with a clean and dry cloth. Evenly apply the lubricant included around the outer surface of the insert bush. Do not use any other lubricant different to the supplied lubricant. If the elbow code connector is not going to be installed, do not remove the protector cover, in order to avoid contamination.

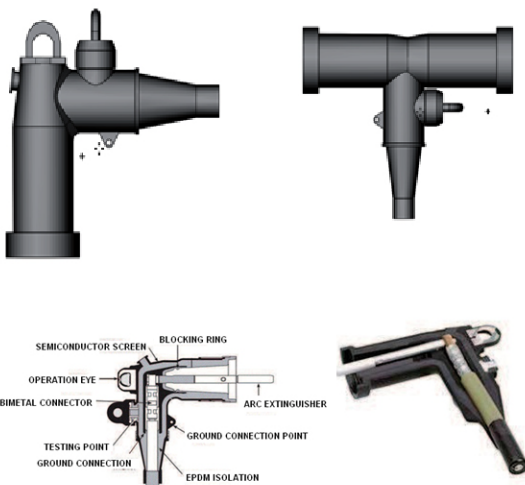
## ELBOW TYPE CONNECTOR:

It is a component that couples with the high tension line dry wire to be further connected to the insulator or transformer bushing. It is so designed that when this coupling takes place, the conductor axes and the bushing must be perpendicular to each other. Fig 4

Figure 4. Conventional elbow type connector (Illustration of its components) and type T\*.

CONVENTIONAL ELBOW

TYPE T ELBOW



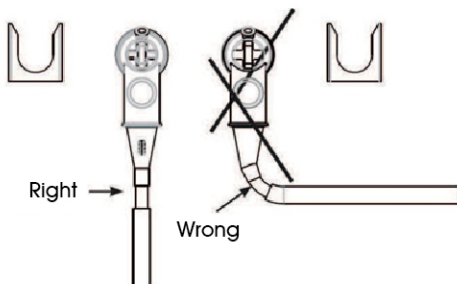
\*Accessory requested by customer.

Installation instructions for conventional elbow type connector:

1. Set wire at final assembly position. Leave a wire gap enough to facilitate insert or removal elbow operations. Cut any wire excess evenly from the center of the hub.

Note: Once the wire is installed, the wire must enter the elbow type connector in a straight line. Avoid any bends of the wire which may induce an elbow bend. See Figure 5.

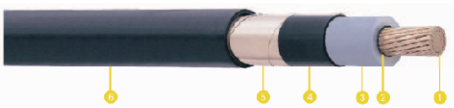
Figure 5. Correct wire placement.



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1. Measure from bottom up a minimum wire length of 292mm. Remove the wire cover (if there is a cover in the wire) to expose off any shielding elements which can be some wires or a copper strip. Unroll the shielding elements. Measure 203 to 216mm up, and then make an even cut to remove the excess of wire. See Figure 7.

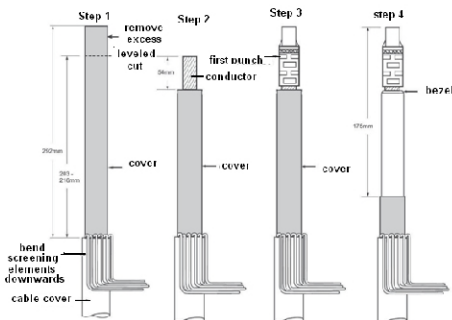
Figure 6. Middle tension conductor illustration.



Note: The middle tension conductors are basically made of::

- 1.Soft copper conductor (or aluminum) cabling.
- 2.Semiconductor reticular polyethylene armoring
- 3.XLPE reticular polyethylene insulation
- 4.Removable semiconductor reticular polyethylene Insulation armoring for installation.
- 5.Copper strip metallic screen for helical application.
- 6.PVC flame retardant jacket, abrasive, heat and humidity resistant.

Figure 7. Dry wire cut illustration.



3.Measure 54 mm downwards from the wire top. Remove coating and insulation to let wire exposed. Be careful not to cut the conductor.

4.Clean the exposed connector using a wire brush. Locate the bimetallic connector in the conductor. Make sure that the threaded hole in the connector is pointing towards the bush.

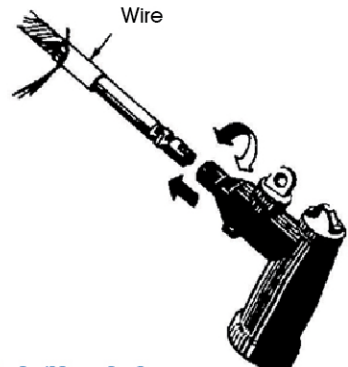
5.Punch the connector using a puncher just under the two metals intersection line and make some punches rotating the connector so punches do not overlap. Do some filing to clean any resulting roughness.

6.Measure from the bimetallic connector top part 175mm and remove the coating having care not to cut or damage the insulation. Bevel insulation approximately 3 mm to facilitate installation of the elbow.

7.Clean the insulation with a lint-free coat saturated with a cleaning solution. Clean the insulation all the way to the coating. Apply a thin layer of lubricant supplied with the insulation elbow. Clean and lubricate the wire entrance into the elbow.

8.Locate elbow in the wire pushing with a rotating motion until the threaded eye of the bimetallic connector gets aligned. Figure 8

Figure 8. Elbow wire insertion.



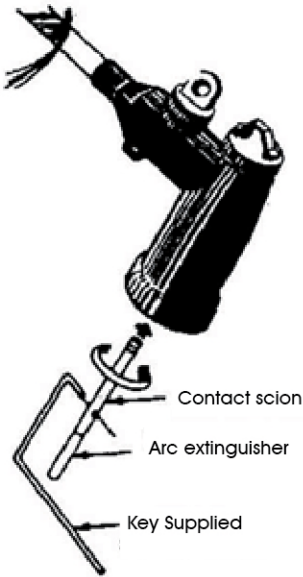
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9. Rotate elbow until the contact rod and the arc extinguisher can be assembled in the punched connector. Thread some turns avoiding any damage to the thread edges. Finish tightening the rod using the key provided until it gets a permanent deformation.

(then discard this tool). Figure 9.

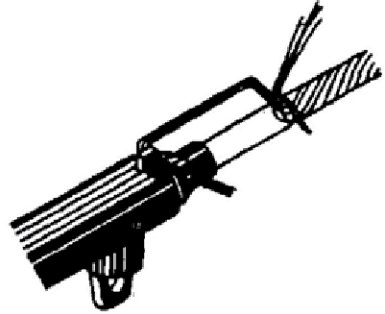
Note: If a different tool is used, make sure not to go beyond 100 in-lb torque. Keep contact rod and arc extinguisher clean at all times.

Figure 9. Rod and connector coupling.



10. Using one or more wire strips (4 gauge), connect all shielding elements to the elbow landing tab close to the wire entrance. The connection must be well adjusted in order to assure a good landing to the elbow screen. Figures 3 & 10.

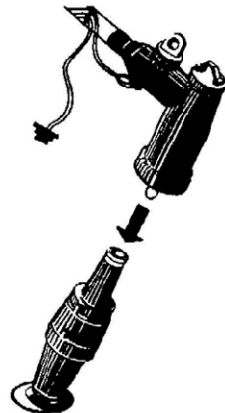
Figure 10. Wire connection.



11. Using a hot work tool with good mechanical rigidity, carefully align elbow with the insert and insert the rod contact between 3 and 6.5 cm. Then push the elbow into the insert to avoid deviating from the insertion axis, Figure 11. The shielding elements (several wires or copper strip) must be grounded and sufficient clearance must be provided for connection or disconnection work.

Note: Visually verify that the insert bushing is being covered, and that the installation allows the elbow to be fully adjusted and that it can be completely removed from the insert bushing

Figure 11. Elbow type connector connection into the insert bushing.





**SHIELD ADAPTOR:** It is used to easily land the conducting jacket of the high tension wire, which are taken to the transformer. Figure 12

Figure 12. Shield adaptor, parking bushing and insulated cap\*



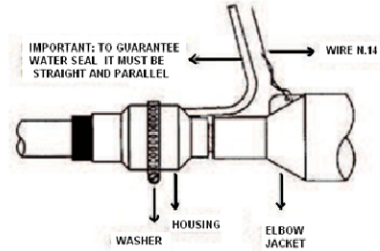
\*Customer requested accessories.

Shield adaptor installation instructions:

1. Cut shielding elements to a length of 25,4mm.
2. Apply lubricant over the wire. Do not use a lubricant different to the one supplied.
3. Place the washer over the shielding adaptor. You must first lubricate the inner part of the housing.
4. Slide the shielding adaptor over the wire in a waving motion.
5. Tight the washer little by little in order to get the corrugated contact (at the inner part of the shield adaptor) to be enough adjusted along with the metallic shield. Between stages, try to rotate the housing of the shield adaptor 3mm backwards, and once you feel that there are counterforces acting on, the washer is just tighten enough.
6. Connect to ground the wire coming out of the shielding adaptor along with the elbow type connector. Figure 13.

Note: The ground conductor of the shielding adaptors must be copper size 6 or 2 AWG

Figure 13. Shielding adaptor connection



**INTEGRAL BUSH:** This element summarizes the elbow bush and the insert. It is used to connect the high tension wire to the transformer primary winding terminals through the elbows. They are designed to operate submerged in oil. This accessory is supplied with the transformer. Figure 2.

Note: To make the connection of the elbow type connector to the integral bush, refer to the installation steps of the elbow type connector.

**INSULATED CAP:** This accessory is designed to electrically and mechanically insulate the integral bush or the insert bush. Figure 12

Note: It is used to electrically insulate the transformer circuit when maintenance or installation work is being carried out.

**PARKING BUSH:** it allows the electrical or mechanical isolation of a high tension conductor coupled to an elbow and temporarily or permanently installing it over itself.

Note: Over this element seats the elbow type

connector when installation or maintenance Works are carried out.

In the following pictures there can be seen the installation of the accessories on the pad type transformers.

Photograph 1. Pad with DPS.



Photograph 2. Pad with Insulated cap and parking bush



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