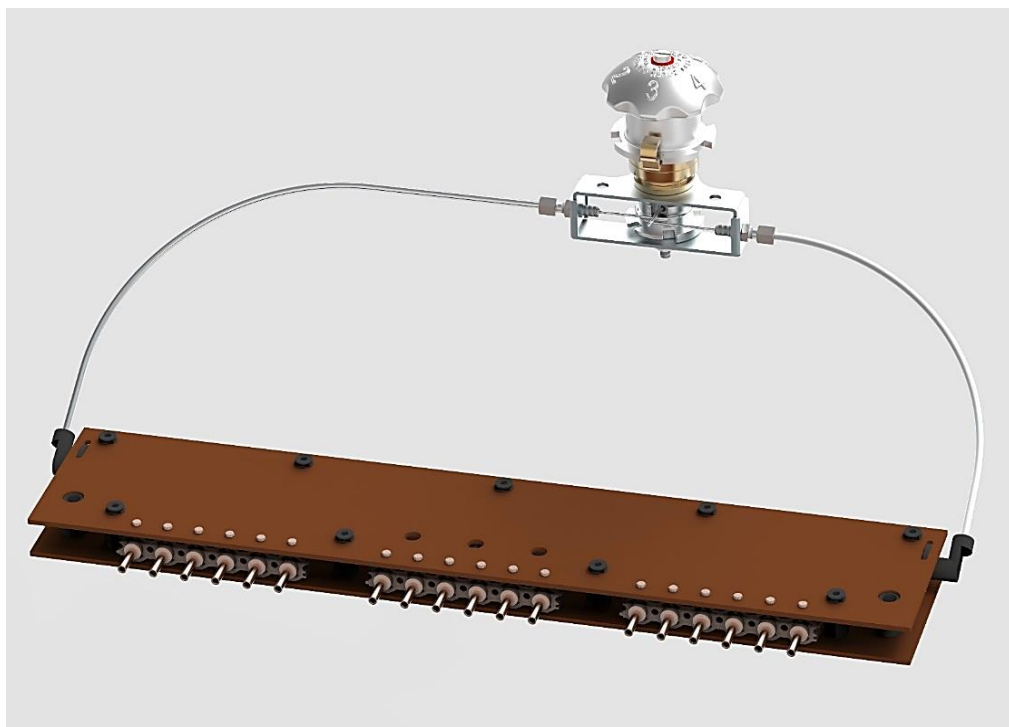


# INSTALLATION MANUAL, USE AND MAINTENANCE OF CABLE TYPE TAP CHANGER FROM 099 SERIES



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## 1. GENERAL

### 1.1 Safety instructions

All personnel involved in the installation, commissioning, operation, maintenance or repair of the equipment must:




- be suitably qualified and
- strictly observe these Operating Instructions.

Improper operation or misuse can lead to

- a reduction in the efficiency of the equipment
- damage to the equipment and property of the user
- serious or fatal injury.

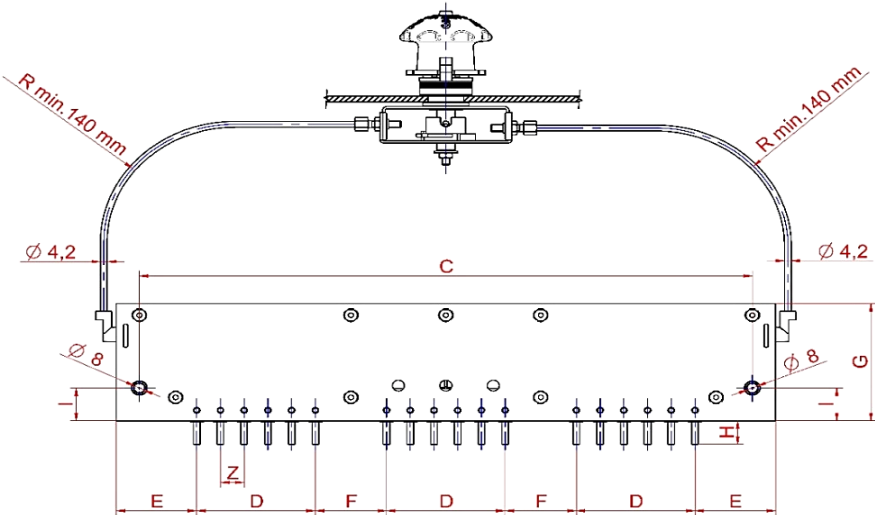
Safety instructions in this manual are presented in three different forms to emphasize important information.

### 1.2 Safety notes on the equipment operation

|   |   |
|---|---|
|    | <p><b>WARNING</b></p> <p>This information indicates particular danger to life and health. Disregarding such a warning can lead to serious or fatal injury.</p>        |
|   | <p><b>CAUTION</b></p> <p>This information indicates particular danger to the equipment or other property of the user. Serious or fatal injury cannot be excluded.</p> |
|  | <p><b>NOTE</b></p> <p>These notes give important information on a certain subject.</p>  |

## 2. DESIGN

### 2.1 Drawing



### 2.2 Generality



This is a de-energized tap changer. It means all switching operations must be performed after disconnecting transformer by the electrical net opening the sectionalizing switches, both HV and LV side, so transformer becomes off-circuit.

Main characteristics of this oil immersed tap changer series are:

- Slimness.
- Easy fixing and installation between tank wall and magnetic core clamp or between transformer cover and upper joke of magnetic core.
- Knob on cover separated from tap changer body, positioned on better place of cover, connected to tap changer with two steel cables and steel/plastic sheath.

- Assembling though specific holes by metallic and/or insulating (\*) material.

Standard appliances and devices are performed in the catalogue.

On cable operated tap changers type 099, the electrical part is separated from the mechanical control. The electrical part is composed by two insulated Bakelite plates that contain the fixed contacts; in the middle, there is the moving Bakelite strip carrying the moving contacts that slides parallel to the plates, operated by the steel cables. The cables curvature should not be excessive. The minimum radius must be at least 140 mm.

## 2.3 Drive handle.

The operating device consists of a drum fixed to the operating handle; steel cables wound around it. On drum casing, there are two (or four) setting screws that permit the position adjusting of moving strip and eliminate any transmission clearance. Each position is marked by a specific notch that block the tap changer in the correct position.

To change position it is necessary to lift axially the knob, turn the knob and insert it in the new position. The action of a spring facilitates this last operation.

## 2.4 Technical features

### **NUMBER OF POSITIONS:**

Standard from 3 to 7 positions.

### **VOLTAGES**

Voltage classes 24 kV and 36 kV

### **CURRENTS:**

30 A – 60 A – 150 A – 200 A.

## 3. SHIPMENT

### 3.1 Shipment

The material is shipped with the right and proper packaging suitable for the type of shipping. Inside the box, divided from tap-changers, there is the sheath provided in skeins. Each tap-changer is closed in a plastic bag with the complete kit for drive handle.

## 3.2 Storage

The DETC must be stored in its packaging, in dry place with temperature in the range of -10 °C / +40 °C.

Upon receive the DETC, please check:

- The outer surface of the packaging must be intact.
- That there are no breakages.

In case you detect any damages, please contact C.A.P.T. office informing the DETC serial number.

## 4. USE AND MAINTENANCE

### 4.1 Use



This is a de-energized tap changer. It means all switching operations must be performed after disconnecting transformer by the electrical net opening the sectionalizing switches, both HV and LV side, so transformer becomes off-circuit



Do not operate while the transformer is energized. Such operation may result in failure of the transformer and injury or death to the operator.

- To operate the tap-changer open the sectionalizing switches, both HV and LV side, so transformer becomes de energized
- If installed, remove the padlock (figure 1, 2)
- Lift axially the knob (figure 3), turn the knob (figure 4) and insert it in the new position (figure 5). The action of a spring facilitates this last operation.
- Install the padlock (figure 6).



Figure 1.



Figure 2.



Figure 3.

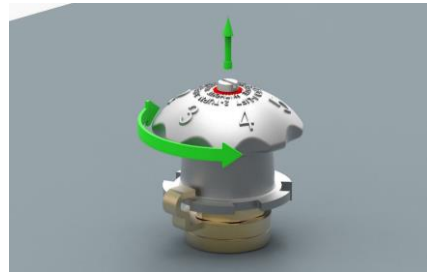


Figure 4.

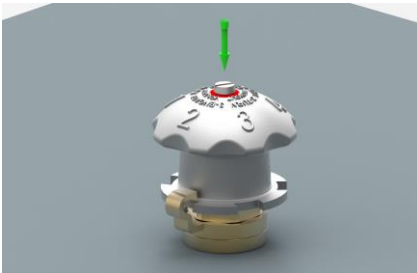


Figure 5.



Figure 6.

## 4.2 Maintenance

During the maintenance of the transformer or at least once a year it is recommended (although not a requirement), especially if the switch remained in the same position, with the transformer de energized, to carry at least 10 operations across the range of taps. Such operation is recommended for a longer life of the switch. In this way, you avoid the formation of a thin film in correspondence of the active part of the fixed and moving contacts, due to oxidation and impurities dispersed in the oil.

It also protects against the formation of "pyrolytic" carbon formation that can occur when the contacts remain on a position for a long time, with a consequent increase of the contact resistance. Before and after this self-cleaning of the contacts, it may be useful to check the efficiency of the switch by means of a resistance measurement ( $m\Omega$ ) of the phases.

## 5. INSTALLATION

### 5.1 Tap-changer

The tap-changer has to be fixed inside the transformer by using the through holes (X).



It is recommended, for models 099-04.100 and 099-45.117 with voltage class 24 kV, using fixing supports or brackets made of insulating material

Information about fixing dimensions and material for finding support are easily available on C.a.p.t catalogue on web site [www.capt.it](http://www.capt.it).

Install the tap-changer in one of the central positions as shown in figure 7. Check the correct position of moving contacts by holes in the fixed bar of tap-changers as shown in figure 8.



Before carrying out any operations lubricate fixed and movable contacts with insulating oil



## 5.2 Preparation of cover or tank wall

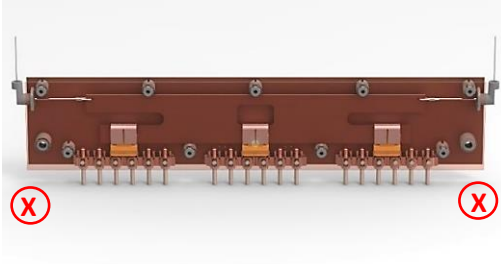


Figure 7.

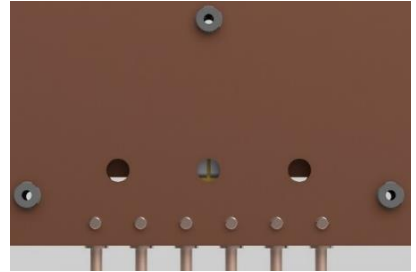
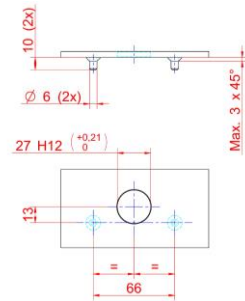


Figure 8.

Prepare inside the cover/tank wall with two pins  $D=6\text{mm}$  and with a hole  $D=27\text{ H12}$  before to mounting the handle mechanism as shown in the figure 9. The pins are required in order to prevent the rotation of handle body (at least one pin is necessary).



Figure 9.



## 5.3 Mounting of the drive handle

Enter the threaded bushing inside the  $D=27\text{ H12}$  hole. Pins should accommodate in the provide hole (see figure 10, 11) as shown in figure.



Figure 10.



Figure 11.

Assemble the accessories you find inside the plastic bag like on Figure 12 or figure 14 in case of aluminum protective cap. The number of washers depends on lid thickness. For instance, for a 2 mm of lid thickness, 7 washers must be used. With a 4 mm lid thickness 5 washers have to be used and so on. The **nut M27x1,5, for fixing the tap-changer** to lid or tank wall must be tightened at 15 Nm.

Insert the knob and operate the drive till reaching the same position of tap-changer. See for instance figures 16 and 17.

After fixing the nut all other accessories can be installed as illustrated on figure 13 or figure 15. The last screw M6x30 must be fixed with a torque value equal to 4,5 Nm.

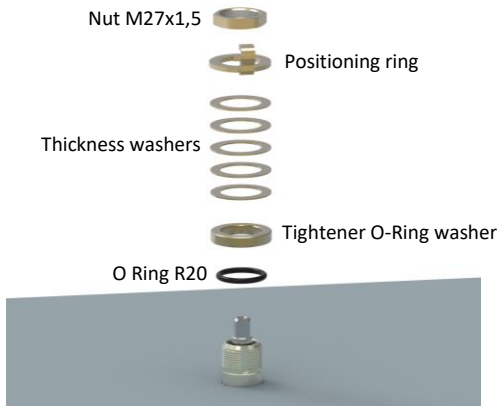


Figure 12.

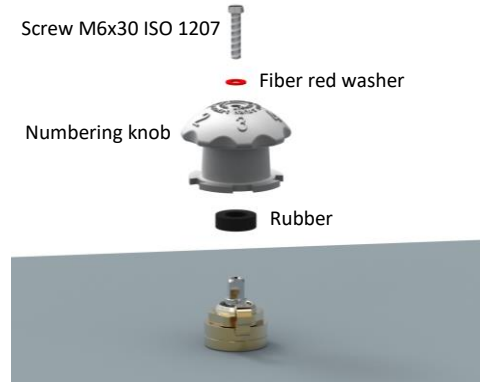


Figure 13.

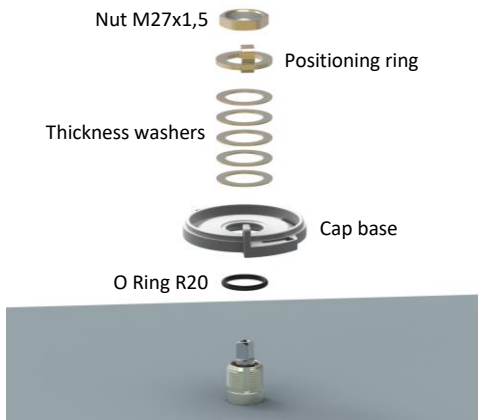


Figure 14.



Figure 15.

## 5.4 Cable mounting and setting



Figure 16.

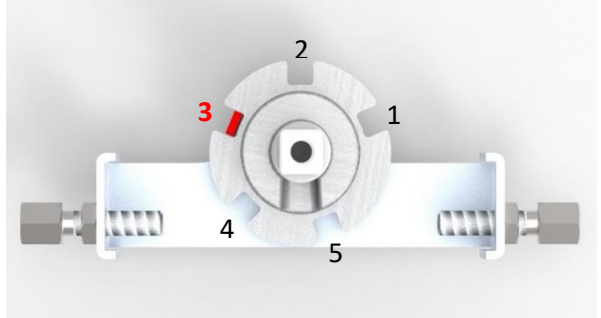


Figure 17.

Cable installation: Tight Screw A and B completely as shown in figure 18.  
Unscrew the threaded bolt C until hole D appears totally free as shown in figure 19.

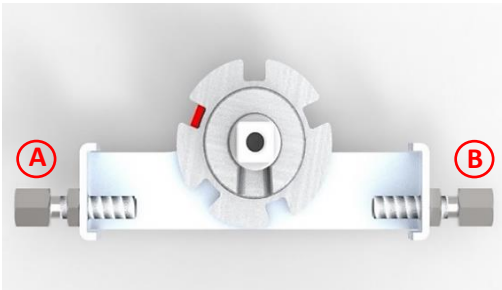


Figure 18.

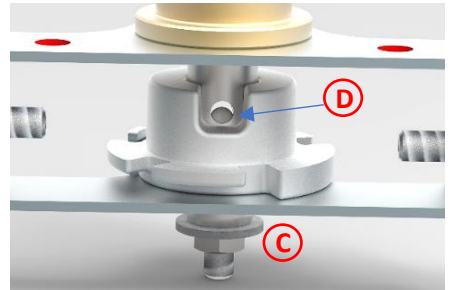


Figure 19.

Sheath (see figure 20) can be provided in two models: one with external diameter 4,5, another one with external diameter 6,5. The first one is a single item composed by an external metal part and an internal PA part. The second option is provided as two separate components: external metal part and internal PA 12 part. This last solution involves the assembling by the customer, as shown on figure 20. Cut and adjust the sheath to the required length and enter the steel cable into it. Cable can exit from the tap changer as shown on figure 21, or as on figure 22. It is highly recommended that the cable does not have curves with lower radius than 140 mm during the stage of installation.



Figure 20.



Figure 21.

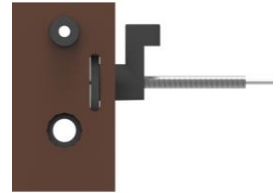


Figure 22.

Insert the first cable inside the tie-rod as show in figure 23 and 24; putting the plastic sheath in place on the tie-rod.

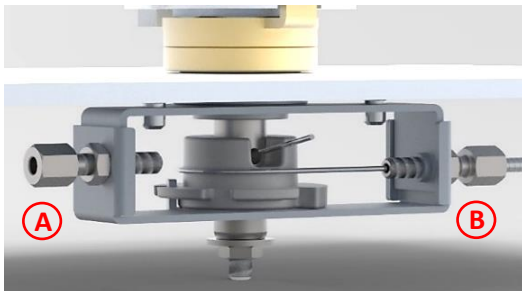


Figure 23.

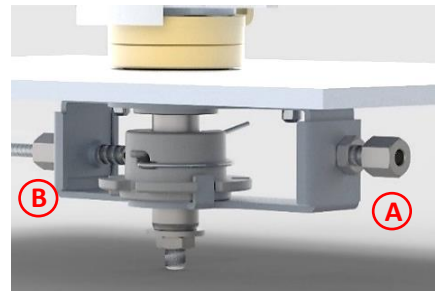


Figure 24.

Insert the second cable inside the tie-rod preventing to overlap the second cable with the one already mounted. Accommodate the sheath in place on the tie-rod as shown in Figure 25 and 26.

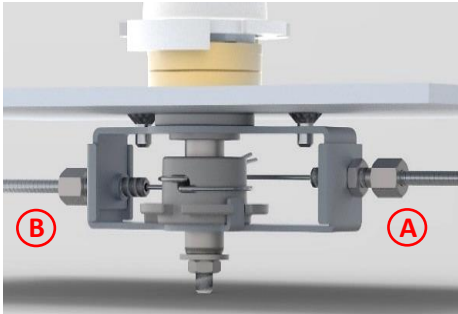


Figure 25.

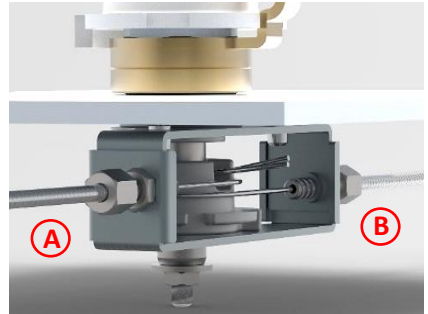


Figure 26.

Pull at the same time the two cables with the maximum force and fix the screw a 5 Nm (C) as shown in Figure 27.

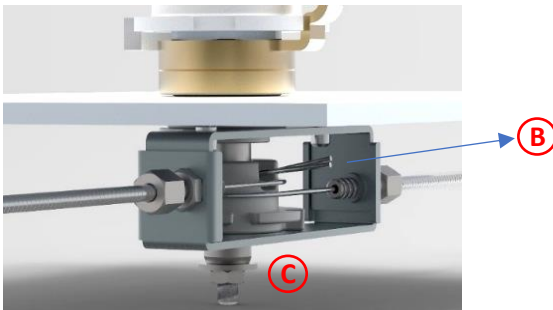


Figure 27.

**Cable adjustment:** Operate three maneuvers till extreme positions in order to check the cables tension. By the tire-rod adjust the cable tension till reach the correct position of moving contacts in each tap-changer position. Check the correct position rotating the knob in both directions. Adjust / cut the exceeding cables from handle mechanism.

## 5.5 Connection of tap winding and tap changer take-off leads

Made of copper with following internal diameters:

| Current | Contacts designation | Contact type          | Internal diameter |
|---------|----------------------|-----------------------|-------------------|
| 30 A    | -                    | Tubular (figure 28)   | 3,1 mm            |
| 60 A    | -                    | Tubular (figure 28)   | 5,1 mm            |
| 150 A   | C                    | Threaded (figure 31)  | M8                |
|         | S                    | Tubular (figure 29)   | 8,1 mm            |
|         | R                    | Removable (figure 30) | 8,1 mm            |
|         | R3                   | Removable (figure 30) | 10 mm             |
| 200 A   | C                    | Threaded (figure 31)  | M10               |
|         | S3                   | Tubular (figure 29)   | 10 mm             |
|         | S                    | Tubular (figure 29)   | 11,5 mm           |
|         | R                    | Removable (figure 30) | 11,5 mm           |

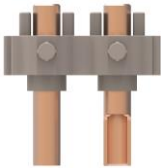


Figure 28.



Figure 29.



Figure 30.

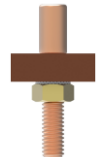
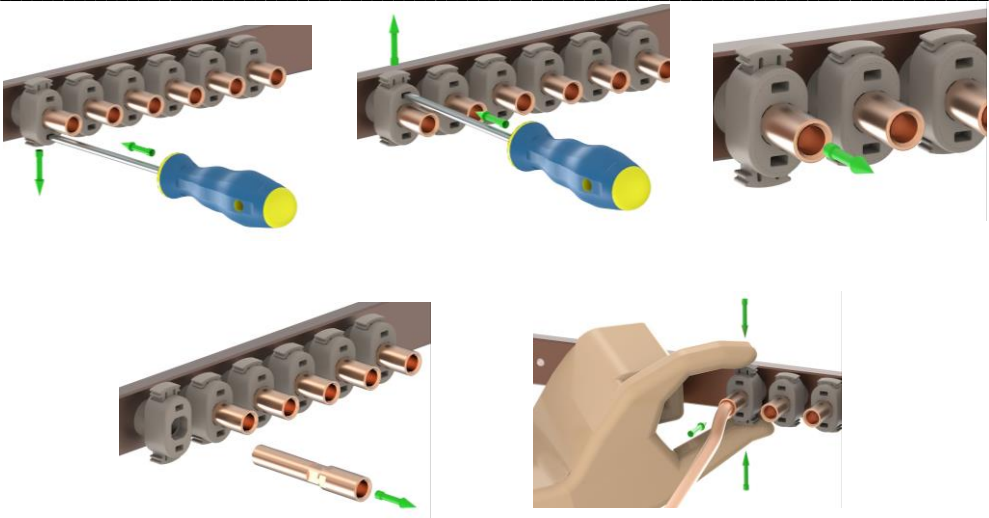


Figure 31.

For fixed contacts tubular type (see figures 28, 29, 30) the cables connection can be executed by crimping “compression” process, or by tinplating. In case of tinplating, the maximum attention is recommended in order to avoid any damage on the adjacent insulating parts. For fixed threaded contacts (see figure 31) the connection has to be executed with cable lug and the fixing is executed by fixing the nuts provided as accessories.

Tightening torque for threaded fixed contacts for 150 A is 10 Nm.

Tightening torque for threaded contacts for 200 A is 15 Nm.



Sequence to undo the fixed contact from the ferrule in PA66.



In case of removable fixed contacts, it is perfectly normal to have a slight joint tolerance between fixed deck, nylon ferrule and contact – it does not compromise the tap changer functioning.



C.A.P.T. highly recommends using flexible cables to execute connections on the tap changer. Furthermore, the cables must not weight in any way on the tap changer.

## 6. DRYING PROCEDURE

### 6.1 Drying procedure

Different drying treatment can be processed by customer: oven, in a vacuum autoclave, vapor-phase or other. In this process the tap changer is normally included too. The maximum temperature suggested by C.A.P.T. for our tap changers is 100°C-120°C for 24-36 hours.



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## 7. WHEN CONTACTING C.A.P.T.

In the following cases please contact C.A.P.T.

- For temperature condition higher/lower than suggested.
- For hard environment conditions, with possibility of snow or sand storming, or in potential seismic area.