



KINGDOM OF CAMBODIA

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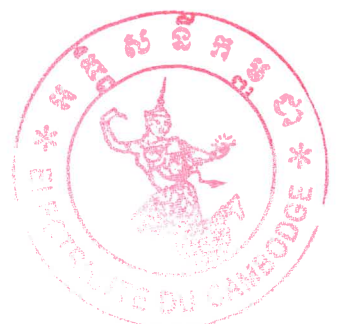
ELECTRICITE DU CAMBODGE

TECHNICAL RULE

EDC-TR-002


LV ABC's IPC, Pre-Insulated Lugs and Joints Installation

May 2023



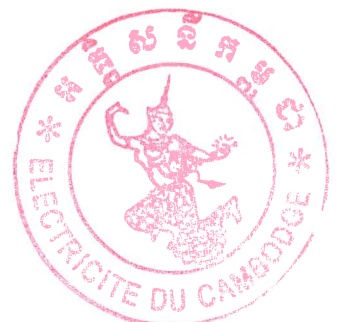


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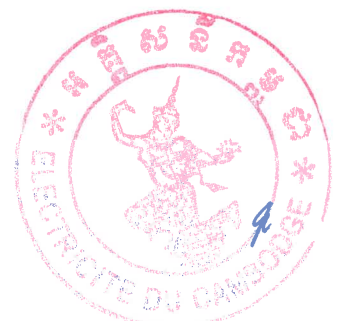


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LV ABC's IPC, Pre-Insulated Lugs and Joints Installation

1 Scope of Application

This document describes the Insulation Piercing Connectors (IPC) and pre insulated lugs and joints installation on Low Voltage Aerial Bundled conductors (LV ABC).

This document clarifies the methods, process and necessary equipment and tools to be used.

2 Safety

IPC and pre insulated lugs and joints can be installed on live line ABC network.

For that purpose, the lineman must wear its working clothes (vest with long sleeves) and the following safety personal protections, equipment or tools.

2.1 Safety personal equipment/protectations:

- Safety shoes
- Helmet
- Safety belt or harness
- Protection glasses
- Composite LV insulating gloves or thin rubber LV insulated gloves associated with leather gloves

3 IPC

IPC used on EDC network are conform to EDC-DTS-LV002- Electrical Accessories for LV ABC standard.

By design, this equipment is fully insulated: no live parts are accessible during installation and lifespan that is defined to be at least 30 years without maintenance.

It is reminded that the total cost for IPC is less than 5% of the total LV ABC network but in case of bad quality connector using or bad installation of good IPC, this equipment could be the origin of about 90% of the faults issued on existing LV ABC network.

This is why it is essential to use IPC from reputed origin but above all install these connectors properly by respecting the rules herein after.

3.1 Safety tools

- Insulated ratchet wrench and right metric size **6 faces sockets**



- Insulated cable cutter



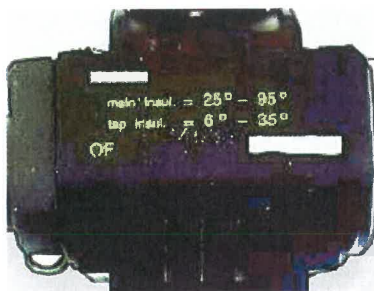
- Insulating sheets with Velcro tape for insulation of potentially live parts; as for example bad quality IPC already installed for which the metallic parts could be live.



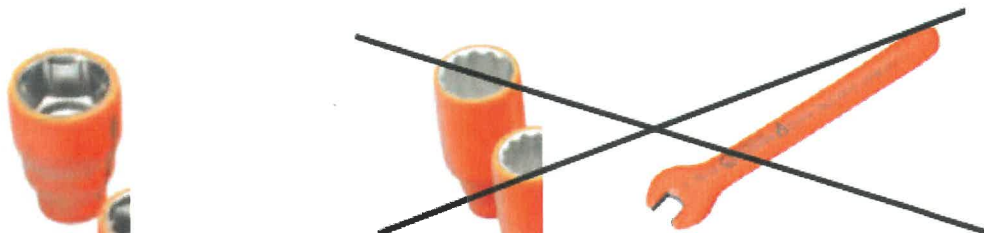
3.2 Installation

3.2.1 Main rules

- As waterproof, an IPC (EDC-DTS-LV002) can be installed in **any position** around the ABC.
- It is **necessary to check the cross section of main and tap ABC and verify the admissible cross sections on the IPC**. As example the tap conductor is 50 mm² and the minimum cross section of tap mentioned on the IPC is 70mm², it is quite sure that the connection will be bad and an issue will occur soon.



- ALWAYS use a **six faces** metric socket for tightening the bolt. Twelve face socket and open end wrench are strictly forbidden. Using such tools will decrease the breaking torque of the shear off head and the IPC will be badly installed and will have issues soon.



- When the tightening head is sheared, **NEVER tight more** the IPC using the second head. This is why the second head is with a different size or shape. The remaining head is used in case of **IPC dismantling only**.

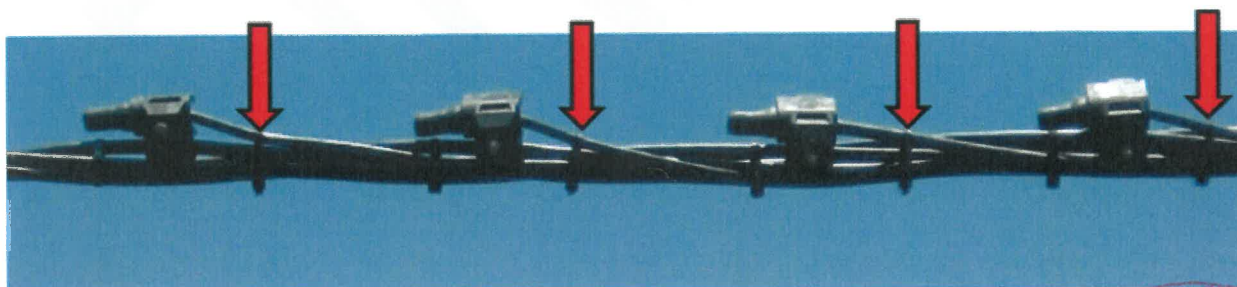


- If the IPC is installed on live ABC network, the load on the tap shall be equal to ZERO Amperes. If there is load on the tap, the piercing and contact teeth could be destroyed during IPC tightening and the connection will be bad and surely destroyed soon.
- As totally waterproof the LV ABC IPC can received indifferently copper or aluminium conductors on main and tap.

3.3 Installation process

- 1) Wear **individual protections** depending the risks (electrical or not). Do not forget to isolate all already installed IPC (because of bad quality) with insulating sheets if LV hot line working.
- 2) Place the tap conductor parallel to the main ABC
- 3) Mark by eye the position where the connector will be placed and install the conductors spacers on the main ABC.
- 4) Cut and insert the tap conductor into the tap-off exit provided and verify the full insertion in the insulating cap which is integral part (or stick to) of the IPC body. Or, in case of attached isolation cap: fully insert the end cap onto then insert the tap conductor inside the IPC tap off part. In both cases it is very important to check if the conductor is fully inserted in the insulating end cap.
- 5) Insert the IPC onto the main conductor between the IPC tightening clamps and make sure of sufficient thrust on the connector towards the cable so as to position it fully,
- 6) Maintain firmly the IPC in place with one hand and tighten the bolts (or screw) up to breaking of the shear off head(s). If the IPC comprise 2 bolts, it is essential to tight a bit one bolt, then the other, tight again the first one and then the other, until both head shear off. Using the right socket is essential.
- 7) Repeat the same operation for other phase and neutral
- 8) Place several polyamide ties to strengthen branch and network cables by avoiding in this way any movement or vibration of the branch, the risk of branch cable break or IPC issue will be avoided

Youtube video of IPC installation link: <https://www.youtube.com/watch?v=mE8c8bQrh5c>



4 Pre-insulated lugs and junction sleeves

Pre-insulated lugs and junction sleeves used on EDC network are conform to EDC-DTS-LV002- Electrical Accessories for LV ABC standard.

By design this equipment is pre-insulated and the hexagonal crimping is done over the insulation.

Junction sleeves are fully insulated and only the connecting palm of lugs is not insulated.

This equipment is specifically designed for using on LV ABC.

The pre-insulated junction are designed to be middle span (under mechanical traction) installed thanks the specific longer sleeve for neutral that can withstand more than the traction of the neutral messenger. They can be installed without mechanical traction also.

Pre-insulated lugs **CANNOT** be installed under mechanical traction.

4.1 Safety tools

- Insulated cable cutter



- Insulating sheets with Velcro tape for insulation of potentially live parts; as for example bad quality IPC already installed for which the metallic parts could be live.



- Insulated knife or specific insulation removing tool



4.2 Installation

4.2.1 Main rules

- Before installation it is **necessary to check the cross section of ABC and verify the cross sections mentioned on the lug or sleeve.**



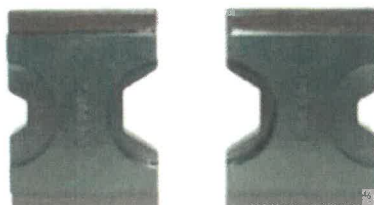
Or by the colour code as follow:

| Cross section (mm ²) | Colour code |
|----------------------------------|-------------|
| 16 | Blue |
| 25 | Orange |
| 35 | Red |
| 50 | Yellow |
| 54.6 Neutral messenger | Black |
| 70 Neutral messenger and phase | White |
| 150 | Violet |

- Before installation, it is necessary to check if the **right hexagonal compression dies** are available:



Dies are of regular hexagonal type.



Dies for 50, 55, 80 kN presses



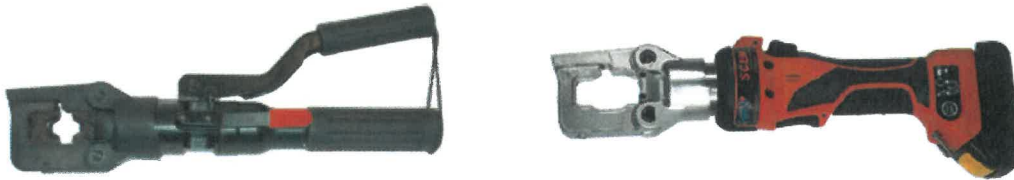
Dies for 120/130 kN press

The necessary dies for crimping all ABC cross section range are: E140, E173 and E215



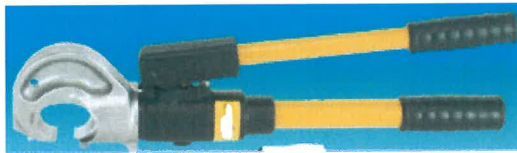
NEVER COMPRESS WITH A WRONG DIE

- The minimum strength of the hydraulic compression tool is 50kN



50 or 55 kN presses

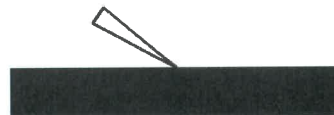
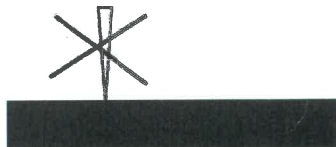
80 or 120/130 kN hydraulic press can be used but they are heavier and more cumbersome.



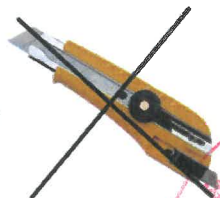
120/130 kN presses

For 120/130 kN press the dies are of 9 mm large instead of 5 for 50, 55, 80 kN presses.

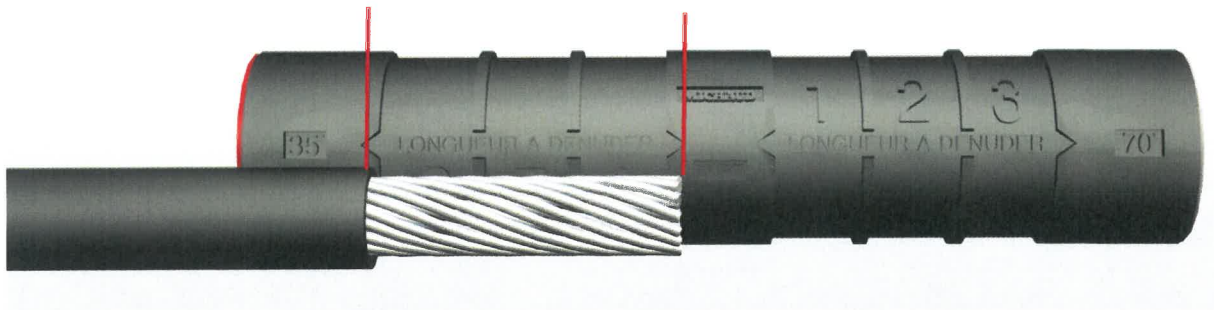
- **Never remove the insulation by perpendicular cut with a knife or cutter.** This hurt the wires that can break latter due to ABC vibrations. It is better to use a specific tool.



Dead work only



- Remove the insulation respecting the length mentioned on the lug or the sleeve.



- Always check the full insertion of the conductor inside the lug or sleeve

4.2.2 Installation process

4.2.2.1 Pre-insulated lugs

- 1) Wear **individual protections** depending the risks (electrical or not). Do not forget to isolate all already installed IPC (because of bad quality) with insulating sheets if LV hot line working.
- 2) Put the lug in its final place, and cut the conductor with right length



- 3) Put the conductor parallel to the lug and mark the length of insulation stripping as mentioned on the lug and then remove the insulation

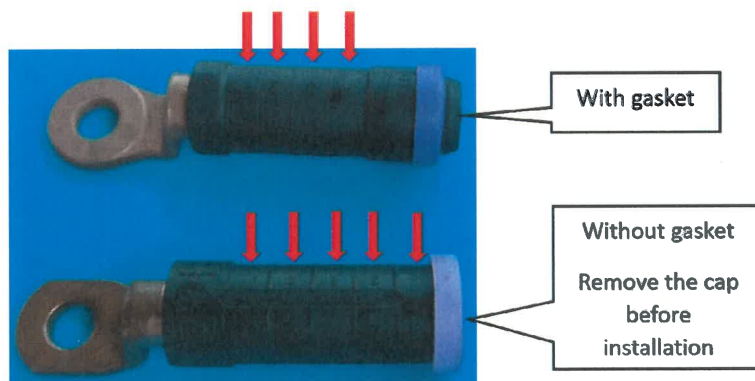


- 4) Eventually brush the bare conductor with thin wires metallic brush under neutral grease.
- 5) Fully insert the conductor inside the lug.
- 6) Turn the lug palm in the right position
- 7) Compress the lug with the right hexagonal die following the crimping sequence mentioned on the lug



- 8) Repeat the same operation for other phase and neutral
- 9) Form the conductors and connect the lugs

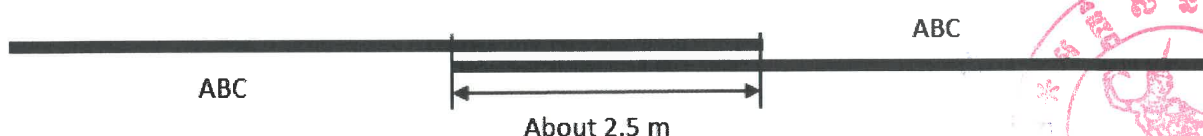
In case of use of lugs of without end gasket type it is necessary to compress one more time the end of lug onto the conductor insulation.



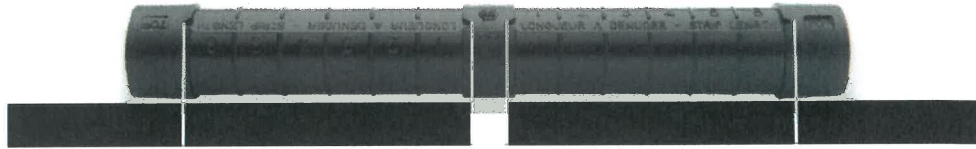
YouTube video link: <https://www.youtube.com/watch?v=hXhMraGAZwk>

4.2.2.2 Pre-insulated junction sleeves

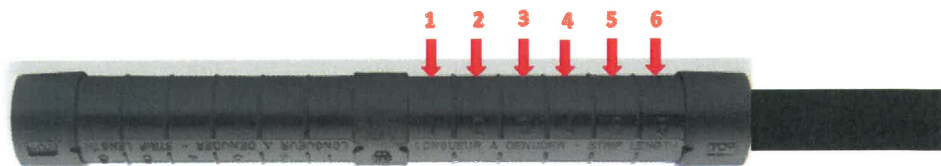
- 1) Wear **individual protections** depending the risks (electrical or not). Do not forget to isolate all already installed IPC (because of bad quality) with insulating sheets if LV hot line working.
- 2) Install the both ends of ABC parallel on a flat surface (soil) and cross them on about 2.5 meters.



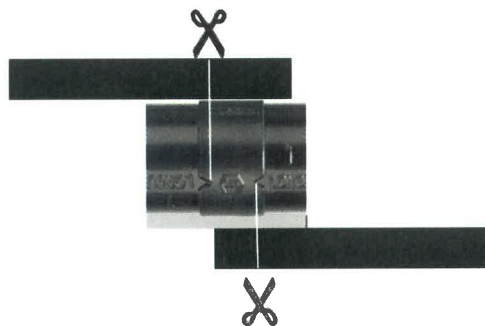
- 3) Approximately in the middle of the 2.5 m ABC crossing length cut the two neutral conductors and **only the neutral**. Avoid to fold the neutral and phases.
- 4) Put the neutral junction sleeve (the longer sleeve) parallel to the two neutral, mark the lengths to strip on both neutrals.



- 5) Remove the insulation
- 6) Eventually brush the bare conductor with thin wires metallic brush under neutral grease
- 7) Fully insert one neutral conductor inside the neutral sleeve
- 8) Compress the lug with the right hexagonal die following the crimping sequence mentioned on the sleeve.

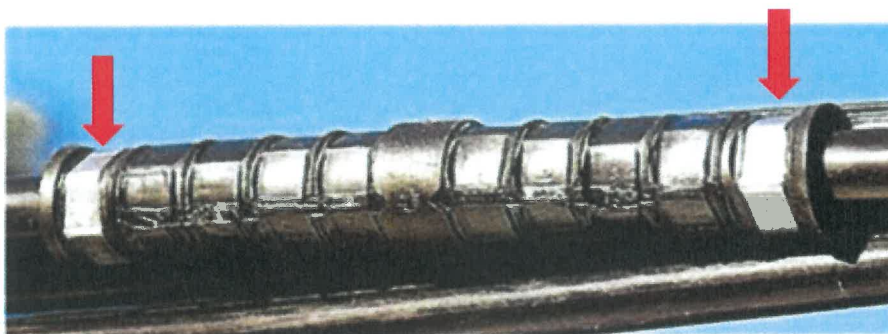


- 9) Fully insert the second neutral conductor inside the neutral sleeve and compress as per above in 8)
- 10) Made a small traction on both ABC in order to made them straight
- 11) Put both phase 1 in place keeping the form of bundled
- 12) Cut both phase 1 according the marking on the sleeve at about 20 cm than the neutral sleeve already installed. Sleeves are distributed along the bundled with about 20cm between each other.



- 13) Fully insert the phase conductors inside the sleeve
- 14) Compress the phase sleeve according points 8 and 9 afore
- 15) Repeat the same operations for the other phases
- 16) Attach all conductors using polyamide ties
- 17) Then the ABC could be strength.

In case the pre-insulated junction sleeves are of no end gasket type, one more compression needs to be done on both end onto the conductor insulation.



Sample of phase pre-insulated junction sleeve without end gaskets after full compression.

