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EQUIPMENT**

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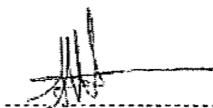
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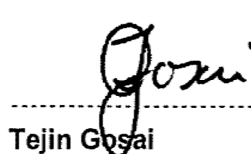
Compiled by



Mulimelwa Tshikosi
Senior Technician PTM&C
Application Design

Date: 18/08/2016

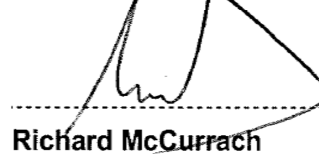
Approved by



Tejin Gosai
Chief Engineer
Telecommunication T&S

Date: 18/08/2016

Authorized by



Richard McCurrach
PTM&C Engineering
Manager

Date: 22/8/2016

Supported by SCOT/SC



Ziyaad Gydien
SCOT/SC Chairperson

Date: 18/08/2016

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1. Introduction

This document covers Eskom's requirements for the installation of any teleprotection and Power Line Carriers (PLC) equipment in a cabinet in the telecommunications or control room located at a substation.

2. Supporting clauses

2.1 Scope

This document sets out a standard for any teleprotection (including PLCs) cabinet, being installed in a telecommunication or control room, associated with the high voltage environment and providing details on the earthing of the cabinet and the glanding of armoured and non-armoured cables.

2.1.1 Purpose

The purpose of the document is to provide a standard which will ensure that all teleprotection (including PLC) cabinets, associated with the harsh high voltage environment, are installed in a correct method that it will safeguard the electronic equipment installed in the cabinet.

2.1.2 Applicability

This document is applicable to the installation of all teleprotection cabinets installed in any telecommunications or control room within Eskom.

This document shall apply throughout Eskom Holdings Limited Divisions.

2.2 Normative/informative references

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

[1] ISO 9001, Quality Management Systems.

2.2.2 Informative

[2] 240-607 25641– Specification for standard 19 inch equipment cabinets.

[3] 0.53/1833 - Standard Equipment Cabinet drawing number

2.3 Definitions

2.3.1 General

Definition	Description
Teleprotection Cabinets	The teleprotection cabinets discussed in this document are used to house the stand-alone teleprotection equipment, Powerline Carriers (PLCs), Fibre Optic Equipment or any other telecommunications or data equipment associated with teleprotection for the station.

2.3.2 Disclosure classification

Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).

2.4 Abbreviations

Abbreviation	Description
AC	Alternating Current
BME	Bandwidth Management Equipment
DC	Direct Current
EA	Engineering Assistant
HDPE	High Density Polyethylene
IDF	Intermediate Distribution frame
LME	Line Matching Equipment
PLC	Power Line Carrier

2.5 Roles and responsibilities

It will be the responsibility of the respective Transmission or Distribution Region/Grid to ensure that this document accompanies any installation requirements of a teleprotection cabinet in a telecommunication or control room at an Eskom substation.

It will also be the responsibility of the contractor or any Eskom staff, employed to install a teleprotection cabinet mentioned in this document, to ensure that the cabinets are installed in accordance with this standard.

2.6 Process for monitoring

Not applicable.

2.7 Related/supporting documents

TST 41-695 - Standard for the installation of telecoms cabinet.

3. Document content

3.1 Drawings

All the relevant documentation will be issued with details of the installation requirements of the cabinet. The following documents and drawings will be issued:

- 1) A Control Room Layout drawing for that station, which shows the position of the cabinet.
- 2) The cabling block diagram of the cabinet, showing the cables associated with the cabinet and their terminations.
- 3) The IDF layout, showing the cable terminations on the IDF.
- 4) The DC circuit breaker positions on the 50 v DC board.

3.2 Pre-installation Check

The following checks must be made prior to installing the cabinet in the station:

- 1) The top and bottom gland plates must be connected to the cabinet earth bar using braided copper, as indicated in the Standard Equipment Cabinet drawing number 0.53/1833.
- 2) The 19" equipment mounting brackets must be installed and both be connected to the top and bottom gland plates using braided copper.

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- 3) The front and back doors must be connected to the top and bottom gland plates using braided copper.
- 4) No scratches or damage must be found on the cabinet. Scratches and severe damage must be reported to the Project Manager.
- 5) A DC circuit breaker rail for mounting circuit breakers must be installed in the cabinet if required.
- 6) A label holder must be fixed to the front and/or the back of the cabinet on the top, preferably above the door.
- 7) Should any of the above not comply, the installer must inform the Project Manager immediately so that the above can be corrected before installation commences.

3.3 Installation Procedure

3.3.1 Installation

- 1) All cabinets will be installed on computer floors in new control rooms and therefore all cables will enter the cabinet from the bottom. The installer must, however, ensure that the floor is strong enough for the cabinet before fixing the cabinet to the floor.
- 2) In the case of a cabinet being installed in an existing Telecommunication or Control room, where there is no computer floor, the cabinet must be bolted to the floor using suitable "Rawl bolts".
- 3) The cabinet must be installed in the position indicated on the Control Room Layout drawing, which will be supplied to the installer. In the case of a discrepancy with the position of the cabinet, the designer must be contacted and the matter resolved.
- 4) A cabinet will be installed over a trench and bolted in an existing Eskom substation. In most cases there will be overhead racking above the cabinet as well. This is to facilitate top and bottom entry of all cables. Where there is no position over a trench, contact the designer for a new position.
- 5) Overhead racking should be installed in existing telecommunications or control rooms where applicable. If there is no overhead racking where the cabinet is to be installed, the following procedure must apply.
 - a) The new section of overhead rack must match the existing overhead racking in the room. The overhead racking must be galvanised.
 - b) The new section must be galvanically connected to the existing rack, using a wide, low impedance joint.
 - c) A flat copper earth bar 50mm x 3mm, must be connected to the existing earth bar and must extend the full length of the new section.

3.3.2 Cabinet Earthing

The cabinet earth must be connected to the top and/or bottom gland plate. The bottom gland plate is connected to the station earth found in the trench below the cabinet. The top gland plate must be connected to the station earth found in the overhead rack. Where feasible both top and bottom gland plates must be connected to the station earth (Figure 1 provides additional detail).The following methods can be used for connecting the telecommunications cabinet to the station earth mat:

- 1) A flat copper bar, 50mm x 3 mm, or 150mm²cross section.
- 2) A 10mm Ø solid round copper conductor. The copper lugs must be brazed to the copper conductor. The crimping method is not acceptable.

3.3.3 Installation of Cables

- 1) All armoured cables can enter the cabinet from the top and the bottom. However all unarmoured cables shall enter the cabinet from the top only. Unarmoured cables that enter the cabinet from the bottom must be installed in HDPE tubing or the cables must run in a dedicated cable tray.

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- 2) All power cables, i.e. 50 V DC, 110 V DC, 220 V DC or 220 V AC cables, shall be installed in trenches. Where there are no trenches, these cables may enter the cabinet from the top.

3.3.4 Glanding of Cables

- 1) All armoured cables must be glanded to the gland plate using an armour gland. There must be a 360° galvanic connection from the screen to the gland plate.
- 2) All un-armoured cables must be fitted with a compression gland. Shrouds must be fitted over the armoured glands.
- 3) Where armoured cables are installed within 30 km from the coast, the shrouds must be filled with grease to protect the armouring from marine corrosion.
- 4) Existing teleprotection cabinet and protection panel must be considered to be live. The installer installing new cables to these cabinets or panels must do so under the supervision of the relevant discipline. If no supervision is available, the cable must be left glanded below the cabinet and the cable end sealed with a heat shrink cap to prevent the ingress of moisture into the cores of the cable.

3.3.5 Terminating of the various cables

- 1) An installer, who is deemed not to have any teleprotection experience and also not accredited by Eskom, may not terminate any cables associated with the teleprotection cabinet.
- 2) The cores of all the cables involved with the installation of a teleprotection cabinet must be lugged with a lug suitable for the connector block being used.
- 3) The lugs must be used where terminations are not done on Kröne tag blocks.
- 4) The installer is required to terminate the following cable types:
 - 10 pair armoured and unarmoured cables at both the teleprotection cabinet and the IDF end.
 - 25 pair armoured and unarmoured cables at both the teleprotection cabinet and the IDF end.
 - 50 V DC, 110 V DC, 220 V DC or 220 V AC power cables at the cabinet and the relevant power supply end.
- 5) The installer is not required to terminate the following cables:
 - 6 Pair X.21 data cable.
 - 12 / 18 Z teleprotection and protection interface cable at the protection panel end.
 - 75 Ω coaxial cable at the cabinet and the LME end.
- 6) Connectors to the above mentioned cables will be fitted and terminated by the commissioning staff.
- 7) The drain wires for cables fitted with them must be earthed at the IDF or at the distant end of the cable.

3.3.6 Sealing of Cable ends

- 1) In cases where the installer is required to gland a cable and fasten it to the gland plate of the Teleprotection cabinet, the unarmoured portion of the cable must be fitted with a heat shrink sealing cap to prevent the ingress of moisture into the cores of the cable.
- 2) In cases where the installer is required to gland a cable and not fasten it to the gland plate of the Teleprotection cabinet, the unarmoured portion of the cable must be fitted with a heat shrink sealing cap to prevent the ingress of moisture into the cores of the cable. Enough slack must be left below the cabinet for which will allow the person terminating the cable to fasten it to the gland plate and the cores can be terminated. See Paragraph 3.3.4.3.

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3.3.7 Chequer Plates

All chequer plates, where applicable, shall be made to fit after the cabinet has been installed, and adequate support provided where needed.

3.3.8 Cabinet Labels

The cabinet must be labelled on the front and/or back, with the relevant feeder details.

3.3.9 Cable Numbers

- 1) All cables must be numbered at both ends.
- 2) Cables installed in the control or telecommunications room can be labelled with non-metal labels.
- 3) Cables installed in the yard which are exposed to ultra violet rays must be numbered with a metal plate and the cable number stamped on it. The plate must be fastened to the cable using metal ties. Plastic cable ties are unacceptable.

3.4 Closure

- 1) The person installing the equipment must ensure that the cabinet is clean inside and is free of all wire cuttings and cable sheaths.
- 2) All drawings must be revised to show the "as built" condition of the equipment in the control or telecommunications room.
- 3) The revised drawings must be returned to the designer and the project leader.
- 4) The designer must ensure that all drawings are properly revised and the revision issued to the appropriate recipients.

4. Authorization

This document has been seen and accepted by:

Name and surname	Designation
Cornelius Naidoo	CoE Design Engineering Manager – PTM&C
Marius v Rensburg	Senior Manager – TX
Paul Grobler	Chief Engineer - TX
Sikelela Mkhabela	Senior Manager - DX
Prudence Madiba	Senior Manager – GX
Alison Maseko	Senior Manager - Eskom Telecommunications

5. Revisions

Date	Rev	Compiler	Remarks
Aug 2016	1	M L Tshikosi	Replaces the TST 41-695, New template and document number

6. Development team

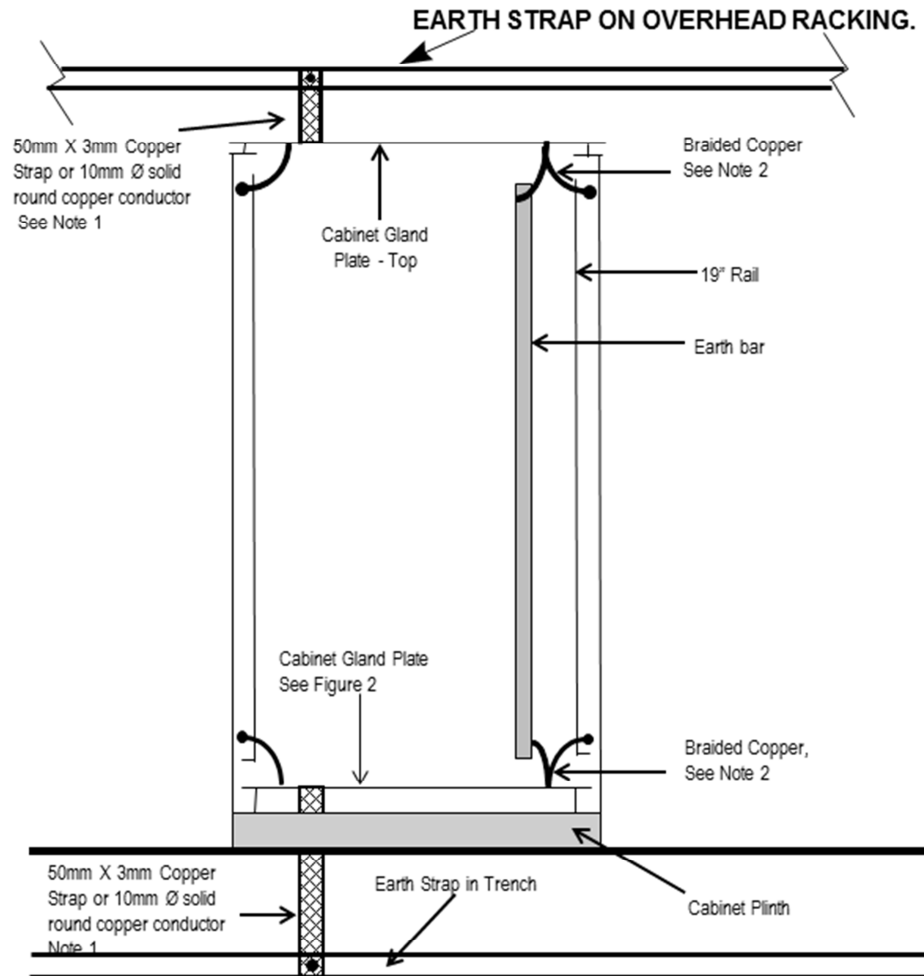
The following people were involved in the development of this document:

- T Gosai
- PT Griffith
- A Pereira

7. Acknowledgements

Not applicable.

Annex A –

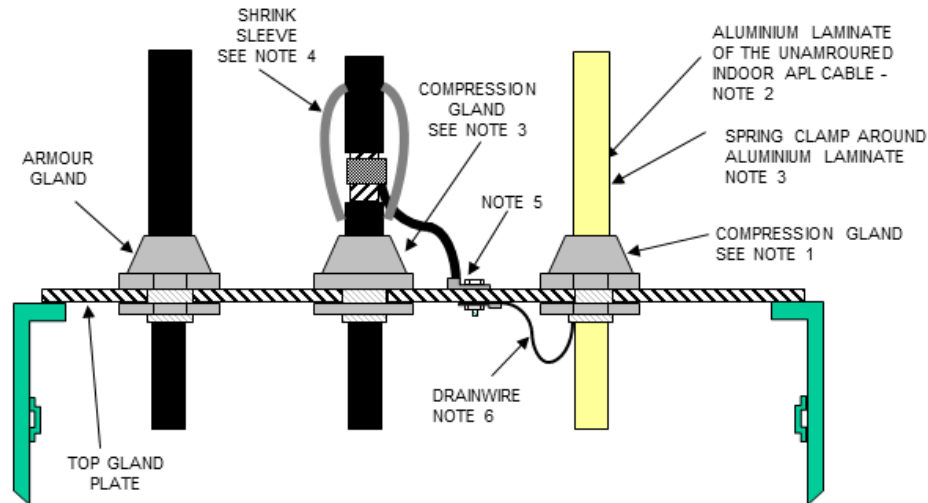


Notes

1. The 50mm X 3mm Copper Strap should be terminated to either the Copper Earth Strap in the trench or overhead rack which ever is applicable.
2. The detail of the cabinet connection to the station earth: **the lugs must be braised to both ends of the 10mm Ø solid round copper conductor., if this option is used** The braided copper must be as short as possible.

Figure A.1: The Earthing of Teleprotection Cabinet to the station earth

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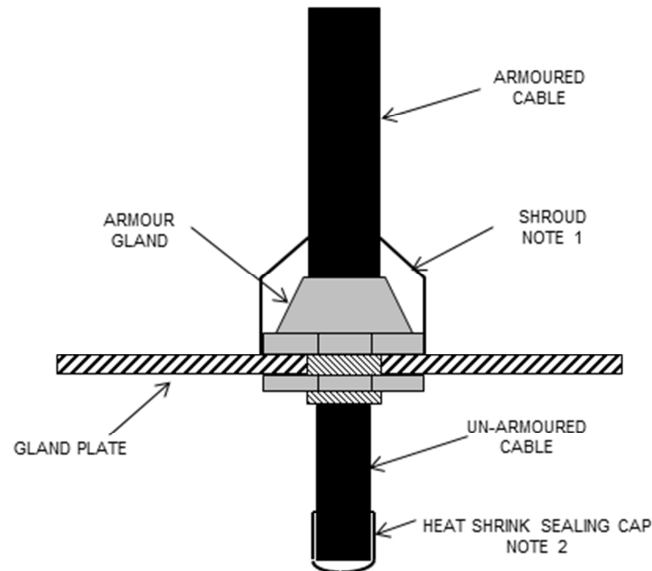


NOTES:

1. Compression gland is installed on the unarmoured indoor cable and on the cabinet gland plate
2. The aluminium laminate of the unarmoured indoor cable is exposed and cleaned so that a spring loaded clamp of the correct size is to be fitted.
3. Where a compression gland is installed on an armoured cable, and earth kit must be installed as described in Note 2.
4. The spring loaded clamp is also fastened to a suitable length of braided copper so that it is galvanically connected at that point and a shrink sleeve covers the exposed Armouring or aluminium laminate and the spring loaded clamp.
5. The braided copper is terminated to the gland plate using a lug and a bolt and nut.
6. If the unarmoured indoor cable does not have an aluminium laminate, the drainwire in the cable is connected to the gland plate as shown.

Figure A.2: The Glanding and Earthing of cables (armoured and unarmoured)

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NOTES:

1. A shroud must be fitted over the armoured gland.
In coastal areas where the installation is done within 30 km from the coast, the shroud must be filled with grease to seal the armouring of the cable from marine corrosion.
2. A heat shrink sealing cap is placed over the end of the un-armoured cable end, where the installer is not required to terminate the cores or pairs of the cable. This is to prevent the ingress of moisture to the cores of the cable.
3. In the case where the installer is required to gland the armoured cable and not fasten it to the gland plate of the cabinet, the installer must seal the cable ends with a heat shrink sealing cap to the un-armoured portion of the cable. This is to prevent the ingress of moisture to the cores of the cable.

Figure A.3: The sealing of the cable ends

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Telecommunication Cabinet Inspection Sheet

To be completed by the Contractor:

Contractor:.....

Installer:.....(Print)

Signed:.....

Date:.....

Pre installation check

1)	Top and bottom gland plates are connected to the cabinet earth bar.	
2)	Earth straps used are braided copper as indicated in Appendix A & B.	
3)	19" mounting brackets are installed in the cabinet and connected to top and bottom gland plates	
4)	The front and back doors are connected to the top and bottom gland plates	
5)	No scratches are found on the cabinet	
6)	A DC circuit breaker mounting rail is installed in the cabinet	
7)	Label holders fixed to the cabinet	

Installation check

1)	Install cabinet as per the Control room layout drawing, attached to Scope of Work.	
2)	Install all cables as indicated in the Scope of Work, correctly.	
3)	Ensure that the cabinet is earthed correctly.	
4)	Gland all cables correctly.	
5)	Boot cable ends correctly.	
6)	Shrouds are fitted over the glands	
7)	Shrouds filled with grease are fitted over the glands close to the coast	
8)	All cables are numbered as per drawings associated with the Scope of Work.	
9)	All drain wires are connected to earth at the IDF and the distant ends of the cable	
10)	Terminate cables correctly. Lugs used where no Krone tag-blocks are present.	
11)	Cables not terminated in a cabinet is sealed properly	
12)	Cabinet is correctly labelled.	
13)	Cabinet cleaned after installation.	
14)	All relevant drawings are marked up and returned to the designer.	