Eskom	Standard	Technology

Title: **SWITCHGEAR TRAINING REQUIREMENTS FROM ORIGINAL EQUIPMENT MANUFACTURERS**

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1. Introduction

With respect to switchgear training, the business does not fully comply with the requirements of the current Eskom Asset Management Strategy. Furthermore, various challenges are experienced with the installation, commissioning, operating, maintenance and failure conditions of switchgear equipment due to the lack of skills. This also impacts on the warranty and entire life cycle stages of switchgear plant.

A standard training approach by all OEMs is required, together with standardized training material.

A standard approach from Switchgear Suppliers and Original Equipment Manufacturers (OEMs) regarding training was not forthcoming. There was therefore a need for a document to standardize on the Eskom requirements for switchgear training from OEMs.

2. Supporting clauses

2.1 Scope

This standard describes the training requirements for Eskom Holdings SOC that shall be adhered to by all OEMs and their respective agents for all life cycle stages of Eskom switchgear equipment.

2.1.1 Purpose

The purpose of this document is to specify the requirements for switchgear training from OEMs.

2.1.2 Applicability

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] High-voltage Switchgear and Controlgear – Part 1: Common Specifications - SANS IEC 62271-1.

[3] Dependability Management Part 3-14: Application Guide – Maintenance and Maintenance Support IEC 60300-3-14.

2.2.2 Informative

None

2.3 Definitions

2.3.1 General

Definition	Description
Agent	This may be a company, corporation, firm, enterprise or institution, or part thereof, whether incorporated or not, public or private, that has its own functions and administration. An agent may also operate/trade (but is not limited to) as a manufacturer, supplier, distributor, consultant, joint venture or contractor.

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Definition	Description
Corrective or Major Maintenance (Intrusive Maintenance and testing)	The execution of intrusive maintenance where intrusive knowledge and skills are required.
Inspection	Visual inspection of the principled features of the switchgear and control gear in service without dismantling (as per 3.1.8 of IEC 62271-1). This may also be referred to as routine inspection/non-intrusive maintenance
Level '1' training	Orientation, functioning and general introduction to the product range. The purpose is to familiarize personnel with the range of products, key design features and the operation thereof.
Level '2' training	Operating of switchgear, routine Inspections (non-intrusive, visual inspection), done to inspect and record the correctness of all components of switchgear and associated components. This includes basic troubleshooting and identification of component failure modes As per SANS IEC 62271-1, Routine Inspection is the visual investigation of the principal features of the switchgear and control gear in service without dismantling.
Level '3' training	Training for Eskom maintenance staff, installers and control technology technicians on all aspects of installation, testing, commissioning, breakdown maintenance and scheduled maintenance of switchgear and associated components. (Also referred to as Periodical Maintenance Tasks (PMT) or Minor Maintenance). As per SANS IEC 62271-1, Minor Maintenance is the execution of low-level or non-specialized scheduled maintenance work in accordance with the manufacturer's maintenance manual and requiring the switchgear and control gear to be taken out of service (i.e. in a down state).
Level '4' training	Training and accreditation on overhauling of switchgear [Also referred to as Major Overhaul Task (MOT) or Major Maintenance]. Level 4 training includes all aspects of Level 1, 2 and 3 training. This Switchgear Maintenance Specialist will then be able to provide training on Levels 1 to 3. As per SANS IEC 62271-1, Major Maintenance (overhaul) is work performed with the objective of repairing or replacing parts which are found to be out of tolerance by inspection, test, examination, or as required by manufacturer's maintenance manual, in order to restore the component and/or the switchgear and control gear to an acceptable condition (within tolerance).
Maintenance	A combination of all technical and administrative actions, including supervision, that are intended to retain an item in, or restore it to, a state in which it can perform a required function [IEC].
Operating	Operating the switchgear as per Operating Regulations for High-voltage Systems.
Operation	Operation of the switchgear itself (i.e. how it works).
Original Equipment Manufacturer (OEM)	For the purposes of this specification, OEM shall include the local representatives of the parent OEM.

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Definition	Description
Overhaul	Work performed with the objective of repairing or replacing parts which are found to be out of tolerance by inspection, test, examination, or as required by the manufacturers' maintenance manual, in order to restore the component and/or the switchgear and control gear to an acceptable condition (within tolerance), (as per 3.1.11 of IEC 62271-1) This may also be referred to as major maintenance or intrusive maintenance, which render the equipment serviceable for an extended period.
Preventative or Minor (non-intrusive Maintenance and testing philosophy)	The execution of low-level work inside the plant and equipment.
Repair	That part of corrective maintenance in which manual actions are performed on an item.
Scheduled Maintenance	Preventative maintenance carried out in accordance with an established time schedule. (As per 3.1.7 of IEC 62271-1). This may also be referred to as minor maintenance or a periodical Maintenance Task (PMT).
Supplier	Entity which is contracted to Eskom.
Switchgear	General term covering switching devices and their combination with associated control, measuring, protective and regulating equipment; also assemblies of such devices and equipment with associated interconnections, accessories, enclosures and supporting structures, intended in principle for use in connection with generation, transmission, distribution and conversion of electric energy.
Switchgear Maintenance Specialist	An accredited Switchgear Maintenance Specialist who receives training and is certified from the OEM to carry out an overhaul to level 4, and is competent to train other staff to level 3.
Training Material	Shall include detailed training manuals as per sample of Eskom training manual, DVDs and drawings.

2.3.2 Disclosure classification

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

2.4 Abbreviations

Abbreviation	Description
CAP	Committee for Accepted Products
CD	Compact Disc
DVD	Digital Video Disc
Dx	Distribution
EAL	Eskom Academy of Learning
EDFS	Electricity Delivery Field Service
IARC	Industry Association Resource Centre
IEC	International Electrotechnical Commission

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Abbreviation	Description
LAP	List of Accepted Products
MOT	Major Overhaul Tasks
n/a	not applicable
OEM	Original Equipment Manufacturer
OU	Operating Unit
PMT	Periodical Maintenance Tasks
QA	Quality Assurance
SC	Study Committee
SCOWT	Steering Committee of Wires & Technology
T&S	Transportation and Storage
TB	Technical Bulletin
TFCC	Technology and Change Control Forum
TSC	Technical Service Centre
TSG	Technical Specialist Group – Switchgear
Tx	Transmission

2.5 Roles and responsibilities

Not applicable

2.6 Process for monitoring

Not applicable

2.7 Related/supporting documents

Not applicable

3. Requirements

3.1 General Training Requirements

a) The supplier and its OEM shall provide OEM accredited instructors to give first-hand training of an international standard on the supplied equipment.

b) For new contracts up to 132 kV, a switchgear unit shall be supplied locally by the OEM within the contractual lead time, for training and quality assurance purposes. However, for switchgear exceeding 132 kV, specialized training is to be conducted at the OEM factory.

c) Switchgear shall not be purchased prior to the training material, for levels 1 to 4, being approved by the combined Eskom Transmission (Tx) and Distribution (Dx) switchgear care groups. (This shall be done in conjunction with the technical approval of the product).

d) The training and training material shall comprise four levels, namely levels 1 to 4, and shall be provided in English. The pre-requisite for the higher-level training shall be the successful completion of the preceding level.

e) Training shall be made available for the life cycle of the switchgear.

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f) Training shall consist of the following:

1) Approximately 30% theoretical training and theoretical examinations thereof.

2) Approximately 70% practical training and the practical examinations thereof.

3.2 Level '4' Training (Switchgear Maintenance Specialist)

3.2.1 Description

Training and accreditation on overhauling of switchgear [Also referred to as Major Overhaul Task (MOT) or Major Maintenance]. Level 4 training shall include all aspects of Level 1, 2 and 3 training. This Switchgear Maintenance Specialist will then be able to provide training on Levels 1 to 3.

3.2.2 Costs

a) All training and training material costs shall form part of the contract. All training costs shall exclude travel and accommodation costs for Eskom trainees.

b) Travel and accommodation expenses for the supplier's trainers are for their own account.

c) The cost of training shall include all theoretical and practical training; and all documentation, DVDs, accreditation and/or certification.

d) The OEM shall indicate the critical training outcomes for the accreditation/certification.

e) Each level of training must be itemised as a separate cost per item per person on the contract.

3.2.3 Location and timing

Note: Level 4 training is a once-off requirement.

3.2.3.1 Training needs

a) The OEM will visit all the operating units once in two years to re-assess accreditation/certified Switchgear Maintenance Specialists;

b) Training to be provided as and when required.

c) A combination of the above (e.g. once-off training for all operating units and grids, and all further training at the Eskom Academy of Learning (EAL)).

3.2.3.2 Additional Level 4 training requirements for Technology Engineers to be accredited/certified as SMEs

a) Design

b) Type tests

c) Quality Assurance (QA)

d) Modifications

The above shall be negotiated and form part of the final contract. This training shall be coordinated by SCOWT.

3.2.4 Content of training programme

a) Name of training programme

Major Maintenance/Corrective Maintenance (Intrusive, servicing of equipment).

b) Purpose

After attending this course, the person/s will be accredited/certified to perform Level 2 and 3 maintenance and conduct training on Levels 2 and 3.

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c) Duration

As per supplier and its OEM recommendations.

d) Location

The supplier and its OEM and/or Eskom to arrange for an agreed training venue. (This must be stated in the contract.)

e) Frequency

To be negotiated as part of the contract. This shall be a once-off training course per Switchgear Maintenance Specialist. Reassessment shall be as per OEM requirement.

f) Course content

To be provided by the OEM and accepted by the combined Tx and Dx Switchgear Care Group.

g) Target group

- Regional Switchgear Maintenance Specialists
- Technical Specialist Group
- Technical Advisers
- Technology Specialists

3.3 Level '3' training

3.3.1 Description

Training for Eskom maintenance staff, installers and control technology technicians on all aspects of installation, testing, commissioning, breakdown maintenance and scheduled maintenance of switchgear and associated components. (Also referred to as Periodical Maintenance Tasks (PMT) or Minor Maintenance).

3.3.2 Costs

a) All training and training material costs shall form part of the contract. All training costs shall exclude travel and accommodation costs for Eskom trainees.

b) The cost of training shall include all theoretical and practical training; and all documentation, DVDs, accreditation and/or certification.

c) Travel and accommodation expenses for the supplier's trainers are for their own account.

d) The OEM shall indicate the critical training outcomes for the accreditation/certification.

e) Each level of training must be itemised as a separate cost per item per person on the contract.

Note: Level 3 training shall have a two-yearly Regional or National training assessment.

3.3.3 Additional courses

The training shall consist of the following additional courses:

3.3.3.1 Erection/installation and commissioning

a) Objective

After attending this course, the person/s will be accredited/certified to install and commission the product/s.

b) Duration

As per supplier and its OEM requirements.

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c) Location

OEM and/or Eskom to arrange for an agreed training venue. (This must be stated in the contract.)

d) Frequency

To be negotiated as part of the contract. This shall be a once-off training course per trainee. Re-assessment shall be as per OEM requirement.

e) Course content

To be provided by the OEM and accepted by the combined Tx and Dx Switchgear Care Group.

f) Target group

- Switchgear Maintenance Specialists
- Technical Specialist Group
- Electricity Delivery Field Service (EDFS) (only Commissioning section)
- Technical Advisers
- Technical Support

3.3.3.2 Erection, commissioning, testing, breakdown maintenance (troubleshooting), minor maintenance (non-intrusive, visual inspection)

a) Objective

After attending this course, the person/s will be accredited/certified to execute breakdown maintenance, minor maintenance and testing (mechanical, electrical and gas analysis or insulation medium analysis).

b) Duration

As per suppliers and its OEM requirements.

c) Location

OEM and/or Eskom to arrange for an agreed training venue.

d) Frequency

To be negotiated as part of the contract. This shall be a once-off training course per trainee. Re-assessment shall be as per OEM requirement.

e) Course content

To be provided by the OEM and accepted by the combined Tx and Dx Switchgear Care Group.

f) Target group

- Switchgear Maintenance Specialists
- Technical Specialist Group
- EDFS (only Commissioning section)
- Technical Advisers
- Technical Support

3.4 Level ‘2’ training

3.4.1 Description

Operating of switchgear, routine Inspections (non-intrusive, visual inspection), done to inspect and record the correctness of all components of switchgear and associated components. This includes basic troubleshooting and identification of component failure modes

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3.4.2 Costs

a) All training and training material costs shall form part of the contract. All training costs shall exclude travel and accommodation costs for Eskom trainees.

b) The cost of training shall include all theoretical and practical training; and all documentation, DVDs, accreditation and/or certification.

c) Travel and accommodation expenses for the OEM's trainers are for their own account.

d) Each level of training must be itemised as a separate cost per item per person on the contract.

3.4.3 Additional course

The training shall consist of the following additional course:

Routine Inspection and Record of substation apparatus such as, but not limited to:

- Counter readings
- Heater
- Gas gauge level
- Oil levels
- Leaks
- Condition of insulators
- Isolator current path alignment
- Corrosion
- Rust
- Report defects

a) Purpose

This training is a general introduction to the product. The purpose is to familiarize personnel with the product, and the inspection and recording of the correctness of all components of the switchgear and associated components.

b) Duration

This shall be one day.

c) Location

A central location in each OU/Grid or at the EAL or relevant Technical Service Centre (TSC) where the switchgear is going to be installed.

d) Frequency

When required.

e) Course content

Training manual, operating manual and DVDs containing all information, as well as a hard copy of presentations for note taking.

f) Target group

- Switchgear Maintenance Specialists
- Technology and Quality
- Field Service Engineers

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- Technical Specialist Group – Switchgear (TSG) maintenance staff
- TSC operating staff
- EDFS
- Network Services Plant and Project Engineers

3.5 Level '1' training

3.5.1 Description

Orientation, functioning and general introduction to the product range. The purpose is to familiarize personnel with the range of products, key design features and the operation thereof.

3.5.2 Costs

a) All training and training material costs shall form part of the contract. All training costs shall exclude travel and accommodation costs for Eskom trainees.

b) The cost of training shall include all theoretical and practical training; and all documentation, DVDs, accreditation and/or certification.

c) Travel and accommodation expenses for the supplier's trainers are for their own account.

d) Each level of training must be itemised as a separate cost per item per person on the contract.

3.5.3 Additional course

The training shall consist of the following additional course:

General Training (Non-accredited Training – Certificate of Attendance)

a) Purpose

This training is a general introduction to the product range. The purpose is to familiarize personnel with the range of products and the operation thereof.

b) Duration

One day.

c) Location

A central location in each OU/Grid or at the EAL or relevant Technical Service Centre (TSC) where the switchgear is going to be installed.

d) Frequency

Once – off on installation of the first equipment in the Dx Region/Tx Grid.

e) Course content

DVD containing all information, as well as a hard copy of presentations for note taking.

f) Target group

- Switchgear Maintenance Specialists
- Technology and Quality
- Field Service Engineers
- TSG maintenance staff
- TSC operating staff
- EDFS

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- Network Services Plant and Project Engineers
- Commercial Services
  - Logistics
  - Warehousing
  - Procurement
- Project Management
  - Clerk of Works
  - Project Coordinators

g) Typical training layout

- General
  - Welcome and introduction (standard) (who's who, safety, time schedule, etc.)
  - Training layout (standard) (contents that will be covered)
  - Company profile (history, location, contact numbers, etc.)
  - National contract/product range (time frame of contract, list of products and SAP numbers, etc.)
  - Specifications (specifications that the product range conforms to)
  - Technical Bulletin (TB) (discuss contents of TB)
  - Ordering schedule (how to order, completion of ordering schedules, lead times, etc.)
- Product specific
  - Product components (overview of the major components of the product/s)
  - Handling, storage and acceptance inspection (e.g. impact recorders, enclosure damage)
  - Site requirements (relay house/plinth, etc.)
  - Installation (high-level overview)
  - Inspection before takeover (after installation inspection)
  - Operating (brief overview)
  - Safety features and precautions (internal arc, general safety issues)
  - Maintenance requirements (brief overview)
- Documentation (list of available documentation)
  - Wiring diagrams
  - Drawings
  - Manuals

4. Authorization

This document has been seen and accepted by:

Name and surname	Designation
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5. Revisions

Date	Rev	Compiler	Remarks
April 2017	1	J Cebekhulu	Document on new template and new doc number.
Jan 2012	0	A Aylward	First issue

6. Development team

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7. Acknowledgements

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