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Revision history

This is a new document.

Date	Rev.	Compiled by	Clause	Remarks
Feb 2013	0	A J M Kerr		First issue.

Acceptance

This document has been seen and accepted by:

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Introduction

This standard is based on the accumulated knowledge of Field Technicians and Engineers and serves to commit to text much of the discipline of commissioning that has been passed on from person to person. It is intended to ensure as much as possible that the term 'Commissioning' is scoped in more detail and that vital steps in the commissioning process are not omitted. Firming up the expected Scope of Work referred to by the term 'Commissioning' will allow for better management of resources involved in the process, i.e. field technicians/engineers, contractors, settings engineers, application design engineers and suppliers. It will also allow for better quality control and standardization of the work performed by them.

Historically, the commissioning of protection systems was performed by highly experienced Eskom technicians. Most of the knowledge related to the activities required for commissioning was passed on from person to person in a journeyman/apprentice system, which no longer functions as effectively as in the past.

This is in part due to

- loss of the skills base; and
- outsourcing of commissioning activities as existing workload exceeds capacity. The contracting resources are not always familiar with the Eskom commissioning culture and requirements.

This standard is intended to formalize the commissioning requirements, which will assist all internal Eskom resources and contracting resources during commissioning.

Keywords

Commissioning, Pre-commissioning, Contractor, Project Manager, Head of Commissioning, Commissioning Team Leader, Handover, Checklists, Test Results, Documentation, Protection, Intelligent Electronic Device (IED), Relay, Primary Injection, Secondary Injection.

1. Scope

1.1 Purpose

The document is aimed at standardizing the procedure for commissioning and handover of Protection schemes in a substation.

The objective is that:

- a) Tests required for the commissioning of protection systems are specified in enough detail.
- b) Skilled and accredited resources are allocated to perform the tests.
- c) Accountability for performance of the tests rests with the resource allocated.
- d) Documentation is produced that indicates
 - 1) Test results/report.
 - 2) Equipment tested.
 - 3) Person who performed the test.
 - 4) Date on which the tests were performed.

Since the work content involved in the commissioning process is the same regardless of what resource undertakes the work, this document is binding to all categories of resources undertaking the work, namely:

- Internal Eskom resources executing the commissioning work.
- External Eskom resources (i.e. from another division in Eskom) that are employed as a contractor to execute the commissioning work.
- External contractors who are not Eskom employees executing the commissioning work.

The document is broken down into three broad sections:

- Roles, Responsibilities and Accountabilities (4.1) – a description of who does what in the process (at a high level) and who takes overall accountability for the work done in the commissioning process.
- Stages of Commissioning (4.2) – a description (at a high level) of the stages that are undertaken during the commissioning process, and the documentary proof that is required to ensure that the work is completed. This is expanded in full detail in the annexes of this document, where the actual checklists and work procedures are described and documented.
- Process Flow (sequencing) 4.3 – a description of what tasks and documents are necessary in order to progress from one phase to another, and what is required for the next phase to begin. This is described in the format of checkpoints.

Annex B to Annex T contain the relevant forms, certificates, checklists and check sheets. The tick sheet in Annex U should be used by the Eskom Project Coordinator/Consultant or their clerk of works to verify that the appointed commissioning resource (Contractor or Eskom) has completed and handed over the relevant commissioning documents as per 240 54615413 (this standard).

1.2 Applicability

This standard shall apply throughout Eskom Holding Limited, its divisions, subsidiaries and entities wherein Eskom has a controlling interest.

2. References

Parties using this document shall apply the most recent edition of the following documents:

2.1 Normative references

2.1.1 International document(s)

Document number	Document title	Preparer/author	Revision or date of issue
[1] ISO 9001	Quality management systems – requirements	ISO	2000

2.1.2 South African national document(s)

Document number	Document title	Preparer/author	Revision or date of issue
None			

2.1.3 Eskom national document(s)

Document number	Document title	Preparer/author	Revision or date of issue
None			

2.1.4 Eskom divisional document(s)

Document number	Document title	Preparer/author	Revision or date of issue
[2] DISPVAES9	Procedure for testing the ABB power transducer	Eskom	Latest
[3] DPC 34-1032	Distribution test procedure for power transformers	Eskom	Latest
[4] DPC 34-1033	Distribution test procedure for inductive voltage transformers	Eskom	Latest
[5] DPC 34-1034	Distribution test procedure for high voltage disconnectors	Eskom	Latest
[6] DPC 34-1035	Distribution test procedure for inductive current transformers	Eskom	Latest
[7] DPC 34-1036	Procedure for the testing of circuit breakers	Eskom	Latest
[8] DST 34-1245	Distribution standard: Part 2: Earthing section 3: Substation earthing	Eskom	Rev. A
[9] DPC 34-1395	Overcurrent and earth fault relay test procedure	Eskom	Latest
[10] DPC 34-2244	Distribution test procedure for high impedance bus zone protection schemes	Eskom	Latest
[11] DST 34-672	Standard for the application, setting and testing of under-frequency load shedding protection relays	Eskom	Latest

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Document number	Document title	Preparer/author	Revision or date of issue
[12] DST 34-2151	Standard list for protection technician tools & test equipment	Eskom	Latest
[13] OPR 6204	Operating Regulations for High-voltage Systems (ORHVS)	Eskom	Latest
[14] TPC41-53	Power line carriers and associated teleprotection systems; commissioning and major maintenance procedure	Eskom	Latest
[15] TPC41-78	Commissioning of transformers and reactor bays	Eskom	Latest
[16] TPC41-139	Commissioning of current transformers	Eskom	Latest
[17] TPC41-140	Commissioning of transformers and reactors	Eskom	Latest
[18] TPC41-148	Decommissioning and removal of protection panels	Eskom	Latest
[19] TPC41-149	Secondary plant commissioning of bus coupler and bus section	Eskom	Latest
[20] TPC41-166	Commissioning of under frequency load shedding panels	Eskom	Latest
[21] TPC41-177	Secondary plant commissioning of isolators	Eskom	Latest
[22] TPC41-179	Secondary plant commissioning of shunt capacitors	Eskom	Latest
[23] TPC41-180	Secondary plant commissioning of EHV or HV feeder bay	Eskom	Latest
[24] TPC41-192	Secondary plant commissioning of circuit breakers	Eskom	Latest
[25] TPC41-227	Secondary plant commissioning of voltage transformers	Eskom	Latest
[26] TPC41-244	Secondary plant security systems commissioning procedure	Eskom	Latest
[27] TPC41-466	Secondary plant commissioning of low impedance phase three bus zone protection	Eskom	Latest
[28] TPC41-497	Secondary plant commissioning of DC power equipment	Eskom	Latest
[29] TPC41-535	Making a bay safe for commissioning or refurbishment	Eskom	Latest
[30] TPC41-561	Commissioning of metering installations	Eskom	Latest
[31] TPC41-562	Commissioning of measurement installations	Eskom	Latest
[32] TST 41-1064	Standard for the earthing of substation protection equipment	Eskom	Latest

2.2 Informative references

Document number	Document title	Preparer/author	Revision or date of issue
[33] 32-9	Definition of Eskom documents	Eskom Document Centre	Latest
[34] 32-644	Eskom documentation management standard	Eskom Document Centre	Latest

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Document number	Document title	Preparer/author	Revision or date of issue
[35] 474-65	Operating manual of the Steering Committee of Technologies (SCOT)	Vinod Singh	Latest

3. Definitions and abbreviations

3.1 Definitions

Definition	Explanation
Asset Data Capture Sheet	A sheet that is used to capture technical asset data about the Protection Equipment being installed.
Asset Management/ Control Plant Management	The department that is responsible for maintaining Protection asset records. In the Transmission Division, it is the Planning and Performance Department and in the Distribution Division it is the Plant Management Section under the Operations and Maintenance Department in the relevant Operating Unit (OU).
Commissioning	The collection of activities that make up the process of ensuring that Protection Equipment is functioning correctly in order to ensure that the energizing of the portions of the Network that it is designed to protect is done safely.
Commissioning Team Leader	A person, appointed in writing, who supervises the commissioning team. This person is mainly on site, ensures that all activities are completed, and provides regular feedback to the Head of Commissioning.
Commissioning/ Energizing	The process of connecting or reconnecting of plant to the power network and making it live.
Contractor	A person or company that has been hired by Eskom to fulfil a particular task on behalf of Eskom.
Control Plant	Protection, Metering, DC and Telecontrol equipment (also known as Secondary Plant).
Control Plant Cabling	Multi-core, armoured cabling, rated at $U_{AC}/U_{DC} < 1\,000\text{ V}$.
Control Room	The structure that accommodates the Control Plant Equipment and Panels.
Head of Commissioning	A person, appointed in writing, who is accountable for the technical execution of the commissioning process, who ensures that the team has the technical capacity to undertake the commissioning activities, and who ensures that the commissioning team keeps within the time frame allocated in order to deliver the project within agreed time frames.
High Voltage (HV) Yard	The area in the substation where outdoor Power Plant Equipment is housed.
Intermediate Distribution Frame (IDF)	A marshalling frame that is used to connect Telecontrol wiring between the Remote Terminal Unit (RTU) and the control plant cabinets.
Junction Box (JB)	An intermediate interfacing marshalling cabinet, normally located in the substation High Voltage (HV) yard, which connects cables originating from the Power Equipment with cables originating from the Control Room equipment.
Modification Instruction (MI)	An MI, previously issued by Transmission Engineering, and now issued by the Steering Committee of Technologies (SCOT) Study Committee, describes an action to remedy a design error or an undesired technical behaviour. It is compulsory to implement an MI, and to keep a record that the MI has been implemented.

Definition	Explanation
Nonconformance Report (NCR)	A document that is issued against any entity undertaking to supply services or goods to Eskom. They may be internal Eskom resources or external companies. The Nonconformance indicates that the quality of the goods or services is not of an acceptable standard, and that Eskom expects the issue to be rectified, upon which the Nonconformance will be withdrawn.
Panel	This is a steel cabinet used by Eskom to house Control Plant equipment for Protection, Measurements, Metering, DC, Telecontrol and Tele-communication equipment.
Power Plant	This is the equipment that enables the transmission of electrical power from one system to another. It is connected to the Control Plant via electrical cabling and junction boxes. Examples of Power Plant are Power Transformers, Neutral Earthing Compensators/Resistors/Transformers (NECRTs), Circuit-breakers and Isolators
Pre-commissioning	Preparation of plant before the actual energizing of the plant.
Project Manager	The Project Manager is defined as an Eskom Employee within the Capital Programme Department if the project is managed by Eskom; or the Consulting Firm that has been appointed to manage the project on Eskom's behalf if the project management has been outsourced. The Project Manager shall ensure that services are performed within the specified time, quality and budget, that equipment is delivered on time and that all necessary work has been completed before the commissioning can begin.
Relevant Settings Authority	The department that is authorized to calculate and issue settings for Protection Equipment. In Transmission, this is the Settings Department in the System Operator for settings involving Transmission Assets, and the Configuration and Coordination section under the Operations and Maintenance Department in the relevant Operating Unit (OU) for settings involving Distribution assets.
Remote Terminal Unit (RTU)	A device that communicates plant statuses, alarms and controls between the control room and the control centre.
Technical Bulletin (TB)	A TB was previously issued through the TESCO process, and is now issued by a SCOT Study Committee. A TB must be read, understood and actioned if necessary. A TB may describe a particular behaviour, warn staff of this behaviour, and may require action, e.g. a warning label to be affixed to the panel.
Technical Instruction (TI)	A TI was previously issued through the TESCO process, and is now issued by a SCOT Study Committee. A TI describes an action to remedy a design error or an undesired technical behaviour. It is compulsory to implement a TI, and to keep a record that the TI has been implemented.]

3.2 Abbreviations

Abbreviation	Explanation
AC	Alternating Current
CAP	Committee for Accepted Products
CPD	Capital Programme Department
CT	Current Transformer
DC	Direct Current
EDFS	Electricity Delivery Field Services
EDNS	Electricity Delivery Network Services
ERTU	Enhanced Remote Terminal Unit
Fdr	Feeder
FRA	Frequency Response Analysis

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Abbreviation	Explanation
GM	General Manager
HV	High Voltage
ID	Identification
IDF	Intermediate Distribution Frame
IED	Intelligent Electronics Device
imp.	Annex Q and elsewhere?
JB	Junction Box
LAP	List of Accepted Products
MI	Modification Instruction
MV	Medium Voltage
n/a	not applicable
NCC	National Control Centre
NCR	Nonconformance Report
NECRT	Neutral Earthing Compensator/Resistor/Transformer
NER	Neutral Earthing Resistor
ORHVS	Operating Regulations for High Voltage Systems
OU	Operating Unit
PDAC	Protection Data Asset Capture [Form]
PTM&C	Protection, Telecoms, Metering and Control
RTU	Remote Terminal Unit
SCADA	Supervisory Control and Data Acquisition
SCASS	Supervisor Control and Security System
SCOT	Steering Committee of Technologies
SOW	Scope of Work
T&S	Technology and Support
TB	Technical Bulletin
TI	Technical Instruction
VT	Voltage Transformer

4. Commissioning standard for protection equipment

4.1 Roles, responsibilities and accountabilities

Three key roles ensure that the Protection Equipment is properly commissioned:

4.1.1 Project manager

The Project Manager is responsible for ensuring that materials and resources are coordinated such that the project runs according to a time schedule, and that the project is completed to meet the committed date.

The main duties of the Project Manager are:

a) **Compilation of a project plan**

An overall plan shall be compiled that details all activities with timelines using inputs from all stakeholders.

b) **Supervision and coordination of all parties involved**

The Project Manager shall ensure that all parties involved in the project are supervised and coordinated, and that tasks are fulfilled according to Eskom standards, and within the scheduled time. The Project Manager shall ensure that detailed plans are compiled by the resources concerned. The Project Manager shall coordinate and plan regular meetings, and obtain regular feedback and, where slippages occur, take corrective action as appropriate to ensure that the overall project schedule is met.

c) **Arranging of relevant outages**

Once the project plan has been consolidated and agreed on by all stakeholders, the Project Manager will be responsible for arranging all relevant outages.

d) **Communication**

The Project Manager shall confirm, in writing, all outages and changes in programme to the relevant stakeholders.

4.1.2 Head of commissioning

A competent person with advanced protection expertise is to be appointed in writing as the Head of Commissioning. Depending on whether the commissioning task is to be performed by a contractor or by internal Eskom resources, this person could be either an Eskom employee or an external resource. The appointment shall be authorized by either (1) the Protection Line Manager in the case of Eskom internally resourced projects, or (2) the accountable Line Manager if the work is being undertaken by an external contracting company. The Head of Commissioning Appointment Form included in Annex C of this document is to be used for this purpose. It is recommended that the grade of the Head of Commissioning be a G15/P15 or higher.

The Head of Commissioning is to take overall accountability for the execution of the technical work required to commission the Protection Equipment as part of the project being undertaken.

The main duties of the Head of Commissioning are:

a) **Coordination of activities**

The Head of Commissioning is responsible for coordinating the activities of the commissioning team and shall be available to attend meetings and travel to site when necessary.

b) Management of commissioning resources

The Head of Commissioning shall analyse the scope of the project, determine a list of activities and checklists according to the relevant requirements of the Division in which they are operating (i.e. Transmission or Distribution), allocate resources to the activities and manage the resources so that each activity is completed and signed off with the necessary paperwork (i.e. test results) being available for scrutiny.

c) Competency of commissioning resources

The Protection Line Manager is to ensure that the members of the Commissioning Team/s are competent and have the necessary valid written authorization. The Head of Commissioning will allocate resources to perform commissioning on the specific equipment to be commissioned as defined in the Scope of Work (SOW).

d) Provision and calibration of test equipment

The Head of Commissioning shall ensure that the Commissioning Team is provided with the necessary test equipment, and that the equipment has valid calibration certificates.

e) Analysis, validation and compilation of all test results

The Head of Commissioning is responsible for collating all test results produced, while the resources under his/her authority have been busy with their work, and compiling it into a single file or document with the following main objectives:

- 1) To ensure that all tests required have been completed by the commissioning resource.
- 2) To ensure that the test results obtained are consistent with reasonable engineering expectations.
- 3) To ensure that all exceptions are noted.

f) Compilation of a commissioning/energization programme

The Head of Commissioning compiles a commissioning programme (excluding operating instructions) that integrates with the switching steps compiled by the Power Plant Operator that are necessary to energize the protection panel and associated bay. This will ensure that the process is conducted with minimum risks to the network and operating personnel, since the safety of personnel is always the main priority.

g) Sign-off of energization certificate

Once the Head of Commissioning is satisfied that all of the tests are complete, all tests have been passed, and that the results are within expected engineering expectations, and that the commissioning programme is correct, the Head of Commissioning will complete and sign off authority of the Protection Equipment Energization Handover Certificate, as in Annex E.

h) Sign-off of asset handover certificate

Once satisfied that all on-load tests are complete and all documentation has been compiled, the Head of Commissioning will complete a Protection Equipment Asset Handover Certificate, as in Annex F.

4.1.3 Commissioning team leader

A competent person with Protection Expertise is to be appointed in writing by the Head of Commissioning as the Commissioning Team Leader. Depending on whether the commissioning task is to be performed by a contractor or by internal Eskom resources, this person could be either an Eskom employee or an external resource. The Commissioning Team Leader Appointment Form included in Annex D is to be used for this purpose. It is recommended that the Commissioning Team Leader be certified at the intermediate level.

The Commissioning Team Leader shall take accountability for the day-to-day supervision of the activities of the Commissioning Team on site. This work includes task allocation, compilation of test results, ensuring that work is completed according to the necessary checklists, ensuring that drawings are marked up, and attending of site meetings. The Commissioning Team Leader is to liaise closely with the Project Manager to ensure that the overall commissioning schedule is adhered to, and that any risks are quickly identified and communicated to both the Head of Commissioning and the Project Manager.

The main duties of the Commissioning Team Leader are:

a) Site supervision and coordination of commissioning resources

The Commissioning Team Leader is to make sure that the resources allocated complete the work according to the activities and checklists that have been developed for the project. This will involve daily supervision to ensure that the project remains on track, and that the necessary changes and adjustments to activities, timing and sequencing are made in response to site and project variables.

b) Analysis, validation and compilation of all test results

The Commissioning Team Leader is responsible for collating all test results produced while the resources under his/her supervision have been busy with their work, and to sign off each completed activity as complete. The process of signing off does not merely mean that the work has been completed. It means that the work is complete, that the test results indicate that the equipment is performing within expectations and that the tests have been passed.

The purpose of signing off the tests is:

- 1) To ensure that all tests required have been completed by the commissioning resource.
- 2) To ensure that the test results obtained are consistent with reasonable engineering expectations and that the equipment can be classified as having 'passed' the test.

c) Attendance of site meetings

The Commissioning Team Leader shall attend all site meetings and provide regular feedback to both the Project Manager and the Head of Commissioning as to the progress of the commissioning team relative to the overall project timeline.

Any risks shall be identified early so that contingency plans can be put into place in order for the team to remain on track for overall completion of the project.

4.1.4 Consolidation of roles

Depending on the size of the organization performing the commissioning work, it may not be necessary (or desirable) to appoint separate persons in the Head of Commissioning and Commissioning Team Leader roles. In this case, the same individual can fulfil both roles, and appointment forms indicating the same person for both roles will be required.

The reason that the roles have been separated is to cater for larger organizations (such as Eskom), where a number of projects may be overseen by a technical consultant, and it is not possible for such a person to have a strong, permanent, on-site presence.

4.2 Stages of commissioning

The Commissioning Process can be separated into distinct phases, each of which can be broken up into components or stages.

Each phase is discussed briefly, followed by a detailed description.

4.2.1 Pre-commissioning phase

This is the phase of the project where the Power Plant equipment is not yet energized. Tests are performed on both the Control Plant and Power Plant equipment to ensure that it is ready to be energized and connected to Eskom's Power Network as an operational piece of equipment. The following activities are the sub-components of Pre-commissioning:

- a) Panel tests and visual inspection.
- b) Implementation of applicable Technical Instructions (Tis), Technical Bulletins (TBs) and Modification Instructions (MIs).
- c) Secondary tests – comprising tests performed manually, and tests performed automatically by computerized test equipment.
- d) Primary tests.
- e) Normalization of circuits.
- f) Review and submission of documentation.
- g) The completion of the Protection Equipment Energization Handover Certificate in Annex E.

4.2.2 Energization phase (i.e. connect equipment to live power system)

This is the stage of the project where the Power Plant equipment is energized at system voltage and connected to Eskom's power network. After some on-load checks (which can only be performed when the equipment is energized), the equipment is handed over to the Control Centre to operate. The following activities are the sub-components of energization (or putting into commission):

- a) Energization and on-load checks.
- b) Sign-off and handover of assets for operation by completing the Protection Equipment Asset Handover Certificate in Annex F.

Each of the phase categories requires documentation to reflect that the test(s) and checks required have been completed. The documentary evidence shall include:

- The Substation name.
- The Bay name.
- The relevant panel name.
- The checks performed.
- The name of the person who performed the tests or checks.
- The date on which the tests or checks were performed.
- The signature of the person who performed the tests or checks.
- An indication of whether the equipment passed or failed the tests or checks.

All of the tests and checks shall be countersigned and verified by a person who is not the same as the original person who performed the tests. The name of this person and the date when the tests were countersigned are required.

This system of documentation is important to ensure accountability and traceability of crucial steps in the commissioning process, and to ensure that all necessary tasks are completed.

4.2.3 Pre-commissioning phase

4.2.3.1 Pre-commissioning phase – panel tests and visual inspection

The purpose of this group of activities is to check and produce documentary evidence that:

- a) The panel and all contained equipment are visibly intact and mechanically sound.
- b) The panel and contained equipment have not been damaged in transit.
- c) The panel is wired according to the application drawings supplied, and the design version between the equipment and the drawings is the same.
- d) The equipment contained in the panel corresponds in make, model and function to the application drawings provided by either the appointed consultant or the Project Engineering Drawing Office.
- e) The panel and associated equipment are correctly connected to the substation earth according to [8] DST 34-1245 for Distribution Substations, and [32] TST 41-1064 for Transmission Substations.

4.2.3.2 Pre-commissioning phase – implementation of applicable technical instructions, technical bulletins and modification instructions

The purpose of this activity is to ensure that modifications to the protection panel required by approved TIs, TBs and MIs are implemented to the relevant equipment prior to secondary injection. Documentation in the form of the TI/TB/MI reference number, the name of the person who implemented it and the date of implementation is required.

4.2.3.3 Pre-commissioning phase – secondary injection tests

This group of activities comprises:

- a) Applying settings to all relays/Intelligent Electronics Devices (IEDs).
- b) Conducting relay characteristic tests and logic function tests according to settings provided, manufacturer specifications and approved test procedure.
- c) Carrying out end-to-end checks for impedance and current differential schemes.
- d) Carrying out Direct Current (DC) functional checks as per drawing.
- e) Verifying that the measurement transducer outputs are correct
- f) Checking that the supervisory controls, alarms, indications and analogue outputs are correct as initiated (where relevant) from the input source to the control centre; and that the list of data points commissioned corresponds to both the Telecontrol records and protection application drawings.
- g) Ensuring that Test Blocks and shorting strips function correctly.

4.2.3.4 Pre-commissioning phase – primary injection tests

This group of activities comprises the following tests:

- a) Breaker tests and speed checks in compliance with [7] DPC 34-1036 or [24] TPC41-192.
- b) Current Transformer (CT) tests in compliance with [3] DPC 34-1032 or [16] TPC41-139. These include CTs fitted in transformer bushings. The tests are summarized here, but it is to be noted that the preceding documents are the definitive and comprehensive references for the tests and test procedure.
 - Polarity tests.
 - Magnetization curve tests.
 - Ratio tests.
 - Secondary and loop resistance tests.
 - Insulation resistance tests.
 - Tan delta tests on CTs 132 kV and above.
 - Checking of oil levels.
 - Application of specified CT ratio.
- c) Voltage Transformer (VT) tests in compliance with [4] DPC 34-1033 or [25] TPC41-227. The tests are summarized here, but it is to be noted that the preceding documents are the definitive and comprehensive references for the tests and test procedure.
 - Polarity tests.
 - Ratio tests.
 - Insulation resistance tests.
 - Checking of oil levels.
- d) Tan delta tests on all transformer capacitive bushings
- e) Transformer and earthing transformer tests in accordance with [3] DPC 34-1032 or [15] TPC41-78. The test sheets in this standard shall be used for documentation. The tests are summarized here, but it is to be noted that the preceding documents are the definitive and comprehensive references for the tests and test procedure.
 - Vector group tests.
 - Ratio tests.
 - Positive sequence short-circuit impedance tests on all tap positions.
 - Zero sequence impedance tests.
 - Insulation resistance tests.
 - Frequency response tests Frequency Response Analysis (FRA).
 - Winding resistance.
 - Neutral Earthing Resistor (NER) resistance.
 - Calibration and setting of winding and oil temperature gauges and tripping functions (both electromechanical and electronic).

- Calibration and function of Buchholtz and pressure relief devices.
- Tap change and tap change load diverter tests.
- Transformer, Neutral Earthing Compensator/Resistor/Transformer (NECRT), and attached bushings; CT oil level checks.
- Confirmation of fin valves.
- Operation of fans and pumps.
- Confirmation that all Transformer Star Points and NECRT earthing points are earthed according to drawings and transformer insulation requirements.

f) Primary injection tests where applicable according to scheme design including:

- Verification of applied CT ratios.
- Overcurrent and earth fault tests.
- Metering equipment verification tests.
- Differential sensitivity check.
- Differential stability check.
- Restricted earth fault sensitivity check.
- Restricted earth fault stability check.
- Pilot wire sensitivity check.
- Pilot wire stability check.
- Bus zone sensitivity check.
- Bus zone stability checks.
- Negative phase sequence primary test.
- Zero sequence elimination stability check for numerical transformer differential relays.

4.2.3.5 Pre-commissioning – normalization of circuits

During the primary and secondary injection tests, the trip and alarm circuits are usually rendered inoperative by the removal of isolating links, relay trip latches, etc. It is therefore essential that when the primary and secondary injection tests have been completed, the tripping and alarm circuits are checked for correct functioning. Certain settings may have been altered during testing and these have to be normalized. Certain protection functions may have been deactivated in order to test other complementary functions, and these have to be reactivated as per the settings and configuration documentation provided by the relevant settings issuing authority.

4.2.3.6 Pre-commissioning – consolidation and review of test results

The purpose of this group of activities is to consolidate the test results and to ensure that:

- a) All tests originally planned have been completed.
- b) All test results fall within values that correspond with reasonable engineering expectations, and all tests have been passed.
- c) Any defects have been addressed.

- d) The Head of Commissioning is satisfied that the equipment is ready to be made live and arrangements have been made with an authorized person according to the Operating Regulations for High Voltage Systems (ORHVS) [13] OPR 6204 to clear all outstanding work permits.
- e) The necessary documents (such as panel test sheets and energization handover certificates) required by the Control Centre in order for the equipment to be energized, have been completed.

4.2.3.7 Pre-commissioning – compilation of a commissioning programme

The Head of Commissioning shall compile a commissioning programme (i.e. a sequence of steps and procedures) that integrates with the switching steps compiled by the Power Plant Operator that are necessary to energize the protection panel and associated bay. This programme shall be in writing and all of the steps agreed upon with all stakeholders involved in the energization process. This shall be done well in advance of any outage. Since safety is the main priority, this programme shall ensure that all procedures comply with all safety regulations, and are conducted with minimum risks to the network and operating personnel involved.

4.2.4 Energization phase

4.2.4.1 Energization phase – energization and on-load checks

Before the equipment can be energized, the Head of Commissioning shall complete the Protection Equipment Energization Handover Certificate in Annex E. The certificate indicates that Head of Commissioning has reviewed all test results, and is satisfied that it is safe to energize the commissioned equipment, provided that all other safety checks and primary plant tests have been completed.

There are some checks and tests that cannot be performed while the equipment is de-energized. It must be stressed that the equipment cannot be considered to be completely commissioned until on-load checks have been completed and results documented.

The following checks are required:

- a) VT/auxiliary transformer ratio check, and measurement of secondary VT voltages and substation auxiliary voltage.
- b) VT phasing check if applicable – correct phase rotation.
- c) Current measurement checks/on-load confirmation of CT ratios.
- d) Verification of analogue quantities with the Control Centre/cross-check with relay/IED primary figures.
- e) On-load stability checks for differential schemes (i.e. bus zones, current differential feeder schemes and transformer differential schemes).
- f) On-load directional checks for directional overcurrent and impedance relays.
- g) Confirmation checks of on-load operation of tap changers. Recording of measured power factor and transformer loading readings on change control relay(s).

4.2.4.2 Energization phase – sign-off and handover of assets for operation

On successful completion of the on-load checks, the Head of Commissioning shall complete the Protection Equipment Asset Handover Certificate in Annex F. This certificate indicates that the equipment has been fully commissioned, and that the assets are now handed over for operation by the asset owner.

4.2.4.3 Energization phase – final documentation

The purpose of this phase of the process is to ensure that all documentation and test results are compiled and submitted to the relevant department responsible for maintaining asset records/reports. In Distribution, this is the Plant Department, and in Transmission it is the Performance and Planning Department.

The documentation required is the following:

a) **Marked-up drawings**

Three copies of the marked-up drawings are to be issued:

- one copy to the design office for revision;
- one copy to be left in the substation; and
- one copy to be forwarded to the Protection Senior Maintenance Supervisor to be retained until final as-built drawings are issued by the Design Office.

b) **Energization certificate**

An Energization Certificate, signed off by the appointed Head of Commissioning as per 4.1.2g).

c) **Completed checklists**

A hard copy of all the checklists of completed activities, detailed in Annex G to Annex T of this document, is to be forwarded to the Project Manager. Annex G to Annex M are to be used for work undertaken in the Distribution Division, and Annex N to Annex T for work undertaken in the Transmission division.

d) **Commissioning test results**

A hard copy of the Commissioning Test Results, including printouts of the Omicron Relay Characteristic Test Results, hard copies of manual tests, etc. is required to be submitted to the Project Manager. Electronic copies of test results obtained from Computer-aided Test Devices (such as Omicron Test Results) shall be printed and included in the file. Dates, responsible person's name and signatures are required. Supplementary electronic copies of scanned hard copy documents are required, especially electronic copies of the Secondary Injection Test Results.

e) **Proof of applied settings**

All settings applied to all relays shall be retrieved from the relays (downloaded) and hard or electronic copies shall be forwarded to the Settings Issuing Authority for verification against issued settings.

f) **Completed protection data capture sheet and proof of implementation of applicable TIs, TBs and MIs**

A completed Protection Data Asset Capture (PDAC) form is required to be submitted to the Project Manager. This PDAC form contains information about the implementation of applicable TIs, TBs and MIs as well. This is to capture asset information to be used in the plant database. The relevant Technology authority is to be approached to obtain a list of relevant TIs, TBs, and MIs that may be applicable to the equipment concerned. This sheet is included in Annex B.

g) **Asset handover certificate**

An Asset Handover Certificate, signed off by the appointed Head of Commissioning as per 4.1.2h).

Only after all documentation has been received, will the equipment be considered to have been successfully commissioned.

4.3 Process flow (sequencing)

The process for the commissioning and handover of protection schemes at any Eskom site can be broken into two phases: Pre-commissioning and Energizing (commissioning). To ensure that the process runs smoothly and efficiently, the following checkpoints shall be adhered to and the deliverables checked.

4.3.1 Before pre-commissioning begins – checkpoint A

Before the erection of new equipment on site, a meeting shall be arranged by the Project Leader/Project Manager and all departments involved in the Pre commissioning and Energizing process shall be invited.

Before work can commence, the following shall be supplied by the Project Manager to the Commissioning Team:

a) Approved application drawings

The Project Manager shall issue a full set of approved application drawings to the Commissioning Team Leader and shall ensure that no drawings are issued to the cable contractor at this stage.

b) Equipment manuals

Equipment manuals shall be available and handed to the Commissioning Team Leader.

c) Manufacturer test certificates and drawings

Manufacturer's test certificates and manufacturer's drawings shall be handed to the Commissioning Team Leader.

d) Settings and configuration documents

A request shall be made for settings for the protection scheme, Supervisory Control and Data Acquisition (SCADA) database and other equipment. The dates on when the settings will be completed shall be committed to by the various parties. It is preferable that these settings are supplied in electronic format for direct application and verification to the IEDs and other devices.

e) Gantt chart and project time allocations

A project Gantt chart stating the time allowed for all departments involved shall be supplied to all parties. (Plant outage times included.)

f) Tools and equipment

The Project Manager shall ensure that the Quality Assurance department checks that any equipment used by a contractor is in good condition, has a proper valid calibration certificate, and is of a make and type approved by Eskom.

g) General

The Project Manager shall ensure that all parties involved in the project are made aware of the work to be completed before an outage. This will ensure minimum outage times and risk to the system. No outage will be authorized unless the commissioning file has been checked by the Head of Commissioning.

4.3.2 Before pre-commissioning begins – checkpoint B

Checking of drawings: The Head of Commissioning and the Commissioning Team Leader shall confirm the correctness of the drawings before a set of drawings can be handed over to the cable contractor. (The process shall be controlled by the Project Manager.)

4.3.3 Before pre-commissioning begins – checkpoint C

Quality control of cable installation: After the cable contractor has completed the cable and termination work, the Project Manager shall ensure that a representative from the relevant Quality Assurance section checks the cable installation and completes an acceptance document for the work done by the contractor.

4.3.4 After pre-commissioning has been completed – checkpoint D

Clearing of all defects on cable installation: After the Commissioning Team has completed the pre-commissioning task, the Commissioning Team Leader shall complete a list of installation defects and hand this to the Project Manager.

The Project Manager shall ensure that the Cable Installation Contractor is called back to site to repair the defects.

This is an iterative process that will continue until all defects have been corrected.

4.3.5 After pre-commissioning has been completed – checkpoint E

Acceptance document of cable installation: Once checkpoint D has been completed and all defects have been repaired, a representative from the relevant Quality Assurance section shall complete a final acceptance document.

The Project Manager shall ensure that this work takes place well in advance of any energizing date, to prevent the unnecessary cancellation of outages.

4.3.6 Before energizing – checkpoint F

a) Handover meeting

Once all work has been completed, a handover meeting shall be arranged by the Project Manager for the completion and signing of all paperwork involved. No outage will be authorized unless all documentation in the commissioning file has been checked and approved by the Head of Commissioning, to confirm that all work that can be done before the outage and date of energization, has been completed. This meeting shall be held well in advance of any planned date to prevent the unnecessary cancellation of the energizing of the plant, or outages.

Authorized representatives from the various disciplines involved in the Commissioning of the substation (power plant, control plant, secondary, civil, earthing, etc.) shall give the Project Manager written assurance that all components meet the required standards and the plant is ready to be energized.

The Head of Commissioning completes the Protection Equipment Energization Handover Certificate (Annex E) for the panels and equipment that he/she has been responsible for commissioning.

b) Handing over of assets

Prior to the handing over of the Secondary plant assets, the Head of Commissioning shall ensure that the Secondary plant commissioning files are in place.

The Project Manager shall ensure that all parties (Primary and Secondary) have signed all the required documentation before handing over.

4.3.7 Energizing

The Head of Commissioning compiles a commissioning/energizing sequence programme in line with the commissioning guideline, and the HV Plant Representative, in consultation with Head of Commissioning, will check this with the operating programme. This is to ensure that the process is conducted with minimum risks to the network and the safety of personnel is optimum.

The equipment is energized according to the commissioning programme.

4.3.8 On-load tests

The on-load tests are carried out and the results are captured by the Commissioning Team Leader. These results are included in the final documentation stored in the commissioning file.

The commissioning file shall be kept in a safe place and the Head of Commissioning shall ensure an electronic backup is made and kept in a safe database.

4.3.9 Nonconformance

If any party involved in the project fails to comply with this standard and any other relevant Eskom standards and procedures, they shall be held liable and a Nonconformance Report (NCR) shall be issued against them. This may also lead to disciplinary action.

Annex A – Impact assessment

(Normative – for Eskom internal use only)

A.1 Guidelines

- All comments must be completed.
- Motivate why items are not applicable (n/a).
- Indicate actions to be taken, persons or organizations responsible for actions and deadline for action.
- Change control committees to discuss the impact assessment and, if necessary, give feedback to the compiler regarding any omissions or errors.

A.2 Critical points

A.2.1 Importance of this document, e.g. is implementation required due to safety deficiencies, statutory requirements, technology changes, document revisions, improved service quality, improved service performance, optimized costs.

Comment: This document is necessary to improve quality and ensure that there is attention to detail in the commissioning process. This is especially important because of turnover of skills and work being completed by contractors.

A.2.2 If the document to be released impacts on statutory or legal compliance, this needs to be very clearly stated and so highlighted.

Comment: n/a

A.2.3 Impact on stock holding and depletion of existing stock prior to switch over.

Comment: n/a

A.2.4 When will new stock be available?

Comment: n/a

A.2.5 Has the interchangeability of the product or item been verified, i.e. when it fails, is a straight swap possible with a competitor's product?

Comment: n/a

A.2.6 Identify and provide details of other critical (items required for the successful implementation of this document) points to be considered in the implementation of this document.

Comment: n/a

A.2.7 Provide details of any comments made by the Regions regarding the implementation of this document.

Comment: (n/a during commenting phase).

A.3 Implementation time frame

A.3.1 Time period for implementation of requirements.

Comment: Valid for five years.

A.3.2 Deadline for changeover to new item and personnel to be informed of DX wide changeover.

Comment: n/a

A.4 Buyer's guide and power office

A.4.1 Does the Buyer's Guide or Buyer's List need updating?

Comment: No.

A.4.2 What Buyer's Guides or items have been created?

Comment: n/a

A.4.3 List all assembly drawing changes that have been revised in conjunction with this document.

Comment: n/a

A.4.4 If the implementation of this document requires assessment by CAP, provide details under A.5.

A.4.5 Which Power Office packages have been created, modified or removed?

Comment: n/a

A.5 CAP/LAP pre-qualification process-related impacts

A.5.1 Is an ad hoc re-evaluation of all currently accepted suppliers required as a result of implementation of this document?

Comment: No.

A.5.2 If NO, provide motivation for issuing this specification before Acceptance Cycle Expiry date.

Comment: This is not a product-related document.

A.5.3 Are ALL suppliers (currently accepted per LAP) aware of the nature of changes contained in this document?

Comment: n/a

A.5.4 Is implementation of the provisions of this document required during the current supplier qualification period?

Comment: n/a

A.5.5 If Yes to A.5.4, what date has been set for all currently accepted suppliers to comply fully?

Comment: n/a

A.5.6 If Yes to A.5.4, have all currently accepted suppliers been sent a prior formal notification informing them of Eskom's expectations, including the implementation date deadline?

Comment: n/a

A.5.7 Can the changes made, potentially impact upon the purchase price of the material/equipment?

Comment: No.

A.5.8 Material group(s) affected by specification (refer to Pre-qualification invitation schedule for list of material groups).

Comment: No.

A.6 Training or communication

A.6.1 Is training required?

Comment: No.

A.6.2 State the level of training required to implement this document (e.g. awareness training, practical/on job, module).

Comment: n/a

A.6.3 State designations of personnel that will require training.

Comment: n/a

A.6.4 Is the training material available? Identify person responsible for the development of training material.

Comment: n/a

A.6.5 If applicable, provide details of training that will take place (e.g. sponsor, costs, trainer, schedule of training, course material availability, training in erection/use of new equipment, maintenance training).

Comment: n/a

A.6.6 Was Technical Training Section consulted regarding module development process?

Comment: n/a

A.6.7 State communications channels to be used to inform target audience.

Comment: SCOT process.

A.7 Special tools, equipment, software

A.7.1 What special tools, equipment, software, etc. will need to be purchased by the Region to effectively implement?

Comment: Nothing they do not already have.

A.7.2 Are stock numbers available for the new equipment?

Comment: n/a

A.7.3 What will be the cost of these special tools, equipment, software?

Comment: n/a

A.8 Finances

A.8.1 What total costs would the Regions be required to incur in implementing this document? Identify all cost activities associated with implementation, e.g. labour, training, tooling, stock, obsolescence.

Comment: There will not be a cost implication. The document merely formalizes and documents processes that should already be in place. The document will address quality issues due to poor administration, record keeping etc.


Impact assessment completed by:

Name: Angus Kerr

Designation: Chief Engineer


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Annex B – Protection data asset capture form

	Protection Data Asset Capture Form	Unique Identifier	240-54615413 Annex B
		Document Type	Form
		Revision	Draft 0.1
		Effective Date	November 2012
		Group Technology	


Protection Data Asset Capture Form

1. Requirements		
1.1 One Data Asset Capture Form is to be completed per protection scheme commissioned.		
1.2 This form shall be completed in full with valid data.		
1.3 Only fill in IED information for IEDs performing a protection function (i.e. not required for auxiliary relays).		
1.4 If there is only one IED in the scheme, then only complete information for IED 1, etc.		
2. General Information		
Substation Name	Click here to enter text.	
Bay Name	Click here to enter text.	
Panel Type Designation	Click here to enter text.	(e.g. HV Feeder)
Scheme Designation	Click here to enter text.	(e.g. 4FZ3950)
Panel Test Sheet Number	Click here to enter text.	
Date	Click here to enter text.	
3. IED (Relay) Information		
Number of IEDs in Panel	Click here to enter text.	
IED 1:	Manufacturer	Click here to enter text.
	Model Number	Click here to enter text.
	Product Code	Click here to enter text.
	Serial Number	Click here to enter text.
	Firmware Version	Click here to enter text.
	Nominal Current	Click here to enter text.
	Auxiliary Voltage	Click here to enter text.
IED 2:	Manufacturer	Click here to enter text.
	Model Number	Click here to enter text.
	Product Code	Click here to enter text.
	Serial Number	Click here to enter text.
	Firmware Version	Click here to enter text.
	Nominal Current	Click here to enter text.
	Auxiliary Voltage	Click here to enter text.
IED 3:	Manufacturer	Click here to enter text.
	Model Number	Click here to enter text.
	Product Code	Click here to enter text.
	Serial Number	Click here to enter text.
	Firmware Version	Click here to enter text.
	Nominal Current	Click here to enter text.
	Auxiliary Voltage	Click here to enter text.

	Protection Data Asset Capture Form	Unique Identifier	240-54615413 Annex B
		Document Type	Form
		Revision	Draft 0.1
		Effective Date	November 2012
		Group Technology	

IED 4:	Manufacturer	Click here to enter text.		
	Model Number	Click here to enter text.		
	Product Code	Click here to enter text.		
	Serial Number	Click here to enter text.		
	Firmware Version	Click here to enter text.		
	Nominal Current	Click here to enter text.		
	Auxiliary Voltage	Click here to enter text.		
IED 5:	Manufacturer	Click here to enter text.		
	Model Number	Click here to enter text.		
	Product Code	Click here to enter text.		
	Serial Number	Click here to enter text.		
	Firmware Version	Click here to enter text.		
	Nominal Current	Click here to enter text.		
	Auxiliary Voltage	Click here to enter text.		
IED 6:	Manufacturer	Click here to enter text.		
	Model Number	Click here to enter text.		
	Product Code	Click here to enter text.		
	Serial Number	Click here to enter text.		
	Firmware Version	Click here to enter text.		
	Nominal Current	Click here to enter text.		
	Auxiliary Voltage	Click here to enter text.		
4. Modification Instructions, Technical Instructions and Technical Bulletins				
MI, TI or TB Reference No.	Implemented?		By (Name)	Date
	Yes	No		
4.1 Click here to enter text.	<input type="checkbox"/>	<input type="checkbox"/>	Click here to enter text.	Click here to enter text.
4.2 Click here to enter text.	<input type="checkbox"/>	<input type="checkbox"/>	Click here to enter text.	Click here to enter text.
4.3 Click here to enter text.	<input type="checkbox"/>	<input type="checkbox"/>	Click here to enter text.	Click here to enter text.
4.4 Click here to enter text.	<input type="checkbox"/>	<input type="checkbox"/>	Click here to enter text.	Click here to enter text.
4.5 Click here to enter text.	<input type="checkbox"/>	<input type="checkbox"/>	Click here to enter text.	Click here to enter text.
4.6 Click here to enter text.	<input type="checkbox"/>	<input type="checkbox"/>	Click here to enter text.	Click here to enter text.
4.7 Click here to enter text.	<input type="checkbox"/>	<input type="checkbox"/>	Click here to enter text.	Click here to enter text.
4.8 Click here to enter text.	<input type="checkbox"/>	<input type="checkbox"/>	Click here to enter text.	Click here to enter text.


Annex C – Head of commissioning appointment form

	Head of Commissioning Appointment Form	Unique Identifier	240-54615413 Annex C
		Document Type	Form
		Revision	Draft 0.1
		Effective Date	November 2012
		Group Technology	

Head of Commissioning Appointment Form

1. Purpose This document confirms in writing that the following person is hereby appointed as the Head of Commissioning as defined in 412 of this document, and will assume accountabilities and responsibilities as outlined in 412a) to 4.1.2h).			
2. General Information			
Project Name	Click here to enter text.		
Project Number	Click here to enter text.		
Contractor Company	Click here to enter text.		
3. Head of Commissioning Details			
Surname	Click here to enter text.		
First Names	Click here to enter text.		
Unique Number (Eskom) or ID Number (Contractor)	Click here to enter text.		
Signature	Click here to enter text.	Date	Click here to enter text.
Contact Details	Click here to enter text.		
Cellphone Number	Click here to enter text.		
Email Address	Click here to enter text.		
4. Authorization			
Company Representative	Click here to enter text.		
Surname	Click here to enter text.		
First Names	Click here to enter text.		
ID Number	Click here to enter text.		
Signature	Click here to enter text.	Date	Click here to enter text.
Company Stamp			


Annex D – Commissioning team leader appointment form

	Commissioning Team Leader Appointment Form	Unique Identifier	240-54615413 Annex D
		Document Type	Form
		Revision	Draft 0.1
		Effective Date	November 2012
		Group Technology	

Commissioning Team Leader Appointment Form

1. Purpose			
This document confirms in writing that the following person is hereby appointed as the Commissioning Team Leader as defined in 4.1.3 of this document, and will assume accountabilities and responsibilities as outlined in 4.1.3a), 4.1.3b) and 4.1.3c).			
2. General Information			
Project Name	Click here to enter text.		
Project Number	Click here to enter text.		
Contractor Company	Click here to enter text.		
3. Commissioning Team Leader Details			
Surname	Click here to enter text.		
First Names	Click here to enter text.		
Unique Number (Eskom) or ID Number (Contractor)	Click here to enter text.		
Signature	Click here to enter text.	Date	Click here to enter text.
Contact Details	Click here to enter text.		
Cellphone Number	Click here to enter text.		
Email Address	Click here to enter text.		
4. Authorization			
Company Representative	Click here to enter text.		
Surname	Click here to enter text.		
First Names	Click here to enter text.		
ID Number	Click here to enter text.		
Signature	Click here to enter text.	Date	Click here to enter text.
Company Stamp			


Annex E – Protection equipment energization handover certificate

	Protection Equipment Energization Handover Certificate	Unique Identifier	240-54615413 Annex E
		Document Type	Form
		Revision	Draft 0.1
		Effective Date	November 2012
		Group Technology	

Protection Equipment Energization Handover Certificate

1. General Information			
Project Name	Click here to enter text.		
Project Number	Click here to enter text.		
Contractor Company	Click here to enter text.		
Substation Name	Click here to enter text.		
Bay Name	Click here to enter text.		
Panel Type Designation	Click here to enter text.	(e.g. HV Feeder)	
Panel Test Sheet Number	Click here to enter text.		
Scheme Type	Click here to enter text.		
2. Declaration			
I, as the appointed Head of Commissioning, hereby certify that the equipment as above has been fully commissioned, all pre-commissioning tests as required have been completed, and all audited defects have been cleared. The panel is hereby handed over to Eskom for operation, and it is safe to energize the associated bay, provided that all other primary tests have been completed, work permits have been cleared and persons with the necessary ORHVS authorization have deemed it safe. Official post-energization documentation will follow.			
3. Head of Commissioning Details			
Surname	Click here to enter text.		
First Names	Click here to enter text.		
ID Number	Click here to enter text.		
Signature	Click here to enter text.	Date	Click here to enter text.
Company Stamp			


Annex F – Protection equipment asset handover certificate

	Protection Equipment Asset Handover Certificate	Unique Identifier	240-54615413 Annex F
		Document Type	Form
		Revision	Draft 0.1
		Effective Date	November 2012
		Group Technology	

Protection Equipment Asset Handover Certificate

1. General Information			
Project Name	Click here to enter text.		
Project Number	Click here to enter text.		
Contractor Company	Click here to enter text.		
Substation Name	Click here to enter text.		
Bay Name	Click here to enter text.		
Panel Type Designation	Click here to enter text.	(e.g. HV Feeder)	
Panel Test Sheet Number	Click here to enter text.		
Scheme Type	Click here to enter text.		
2. Declaration			
I, as the appointed Head of Commissioning, hereby certify that the equipment as above has been fully commissioned, and that all pre- and post-energization tests as required have been completed. All necessary documentation has been completed, and the panel is hereby handed over to the Eskom asset owner for operation and maintenance.			
3. Head of Commissioning Details			
Surname	Click here to enter text.		
First Names	Click here to enter text.		
ID Number	Click here to enter text.		
Signature	Click here to enter text.	Date	Click here to enter text.
Company Stamp			

Annex G – Distribution transformer commissioning checklist

 Eskom	Distribution Transformer Commissioning Checklist	Unique Identifier	240-54615413 Annex G
		Document Type	Form
		Revision	Draft 0.1
		Effective Date	November 2012
		Group Technology	

Distribution Transformer Commissioning Checklist

Substation									
Bay									
Panel									

Eskom Distribution		Distribution Transformer Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
1. Panel Checks and Quality Inspection									
1.1	Panel and equipment intact and visually sound								
1.2	Panel not damaged								
1.3	Panel wired according to application drawings supplied								
1.4	Scheme version on equipment and drawings correspond								
1.5	Panel equipment corresponds in make, model and function to the application drawings provided								

	Distribution Transformer Commissioning Checklist	Unique Identifier	240-54615413 Annex G
		Document Type	Form
		Revision	Draft 0.1
		Effective Date	November 2012
		Group Technology	

Eskom Distribution		Distribution Transformer Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
1.6	The panel and associated equipment are correctly connected to the substation earth according to TST 41-1064, 'Standard for the Earthing of Substation Protection Equipment'								
1.7	No DC earth fault detected								
1.8	Panel spare cores earthed								
1.9	Lugs crimped correctly								
1.10	Blanking plates fitted and all panel openings closed								
1.11	Wiring /trunking condition								
1.12	Junction boxes								
1.13	Control panels								
1.14	All unused CT cores shorted								
1.15	Panel labelling correct (front)								
1.16	Panel labelling correct (rear – if applicable)								
1.17	DC DB labelling								

	Distribution Transformer Commissioning Checklist	Unique Identifier	240-54615413 Annex G
		Document Type	Form
		Revision	Draft 0.1
		Effective Date	November 2012
		Group Technology	

Eskom Distribution		Distribution Transformer Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
1.18	AC DB labelling								
2. Data Capture and Implementation of Applicable Technical Instructions, Technical Bulletins and Modification Instructions									
2.1	Protection data capture form complete								
2.2	All applicable TIs and TBs implemented (detail on PDC)								
3. Secondary Injection Tests									
3.1	All IED settings correctly applied								
3.2	Overcurrent and earth fault tests in compliance with DPC 34-1395, 'Overcurrent and Earth Fault Relay Test Procedure'; use test sheets in document to capture results								
3.3	Relay characteristic tests and logic functions completed (Omicron results required)								
3.4	DC and functional checks as per drawing								
3.5	Transducer outputs correct								

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		Revision	Draft 0.1
		Effective Date	November 2012
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Eskom Distribution		Distribution Transformer Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
3.6	Telecontrol: Supervisory controls operate correctly. Alarms, indications and analogue outputs are correct to the Control Centre. Proof of detailed list of commissioned alarms, controls and analogue signals required.								
3.7	Test blocks and shorting strips operate correctly								
4. Primary Injection Tests									
4.1	Circuit Breaker Test – HV and MV in compliance with DPC 34-1036, 'Procedure for the Testing of Circuit Breakers'; use test sheets on document for test results								
4.2	Link Tests in compliance with DPC 34-1034, 'Distribution Test Procedure for High Voltage Disconnectors'								

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		Document Type	Form
		Revision	Draft 0.1
		Effective Date	November 2012
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Eskom Distribution		Distribution Transformer Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
4.3	CT tests in compliance with Distribution Standard DPC 34-1035, 'Distribution Test Procedure for Inductive Current Transformers'. These include all HV and MV post type CTs, HV, MV and Neutral bushing type CTs and NEC/R CTs.	Refer to the document for details on tests as well as standard test sheet formats required.							
4.3.1	Polarity Test – all cores								
4.3.2	Magnetization Curve Test – all cores								
4.3.3	Ratio Tests – all cores								
4.3.4	Secondary Loop Tests – all cores (specify circuits)								
4.3.5	Insulation Resistance Tests – all cores								
4.3.6	Tan Delta Tests on 132 kV CTs								
4.3.7	Oil level checks on all CTs								
4.3.8	Application of specified CT ratio (all cores)								

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Eskom Distribution		Distribution Transformer Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
4.4	VT Tests in compliance with Distribution Standard DPC 34-1033, 'Distribution Test Procedure for Inductive Voltage Transformers'	Refer to the document for details on tests as well as standard test sheet formats required.							
4.4.1	VT Polarity Tests – all cores								
4.4.2	VT Ratio Tests – all cores								
4.4.3	VT Insulation Resistance Tests								
4.4.4	VT checking of oil levels								
4.5	Tan Delta Tests on all transformer capacitive bushings								
4.6	Transformer and Earthing Transformer Tests according to Distribution Standard DPC 34-1032, 'Distribution Test Procedure for Power Transformers'	Refer to the document for details on tests as well as standard test sheet formats required.							
4.6.1	Vector Group Tests								
4.6.2	Ratio Tests								
4.6.3	Positive Sequence Impedance Tests on all tap positions								

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Eskom Distribution		Distribution Transformer Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
4.6.4	Zero Sequence Impedance Tests: Transformer HV and MV and NEC/R								
4.6.5	Insulation Resistance Tests								
4.6.6	Frequency Response Test FRA								
4.6.7	Winding resistance								
4.6.8	NER resistance								
4.6.9	Calibration and setting of winding and oil temperature gauges and tripping functions (both electromechanical and electronic). Both POWER Transformer and NEC/R								
4.6.10	Calibration and function of Bucholtz and pressure relief devices on both power transformer and NEC/R								
4.6.11	Tap change and tap change load diverter tests								
4.6.12	Transformer, NECR and attached bushings. CT oil level checks.								

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Eskom Distribution		Distribution Transformer Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
4.6.13	Confirmation of fin valves								
4.6.14	Operation of fans and pumps								
4.6.15	HV star point earthing (solid, via surge arrester, Not earthed) – confirm with settings – record earthing connection type in remarks column.								
4.6.16	MV star point earthing (solid, not earthed, not applicable for delta winding) – confirm with settings – record earthing connection type in remarks column								
4.6.17	NEC/R star point earthing – confirm earth connection solid								
4.7	Primary Injection Tests for protection circuits								
4.7.1	Verification of applied CT ratios								
4.7.2	Differential protection sensitivity check								
4.7.3	Differential stability check								

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Eskom Distribution		Distribution Transformer Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/ Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
4.7.4	Restricted earth fault sensitivity check								
4.7.5	Restricted earth fault stability check								
4.7.6	Zero sequence elimination stability check for differential relays (important for star-delta transformers)								
5. Normalization of Circuits									
5.1	All tripping circuits normalized and proven to trip the circuit breakers. Main and backup.								
5.2	All alarm circuits normalized and proven								
5.3	All IED settings normalized as per documentation provided by EDNS Configuration and Coordination								
5.4	All IED configuration logic and protections function normalized as per documentation provided by EDNS Configuration and Coordination								

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Eskom Distribution		Distribution Transformer Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
5.5	All test blocks have been replaced and all CT circuits are closed.								
6. Consolidation of Test Results									
6.1	All tests that have been planned have been completed								
6.2	All test results obtained are consistent with reasonable engineering expectations								
6.3	All defects have been itemized and addressed according to defect list								
6.4	The transformer bay is ready to be energized.								
6.5	Arrangements have been made with the authorized person in terms of the ORHVS to clear all outstanding work permits								
6.6	Panel Test Sheet has been completed – record Panel Test Sheet number in the Pass/Fail/Remarks column								

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Eskom Distribution		Distribution Transformer Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
6.7	Protection Equipment Energization Handover Certificate has been completed and signed off by Head of Commissioning								
7. On-load Energization Checks									
7.1	VT Voltage Ratio check								
7.2	Auxiliary Voltage check								
7.3	VT Phasing check – correct phase rotation								
7.4	Current Measurement check – on-load confirmation of CT ratios								
7.5	Verification of analogue quantities with Control Centre – Cross-check with values given by IED or panel meters								
7.6	On-load stability check for differential relay. Confirm zero spill current.								
7.7	Directional checks for impedance and directional overcurrent relays								

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Eskom Distribution		Distribution Transformer Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/ Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
7.8	On-load operation of tap changer								
7.9	Record power factor and loading (in primary units) measured by the IED if available. Cross-check with Control Centre.								
8. Final Documentation and Documentation Consolidation									
8.1	Marked-up drawings. Copy in substation, copy to Design Office, copy to area EDFs office.								
8.2	On-load check results, including analogue check results included in commissioning file								
8.3	Commissioning Test Results complete and compiled								
8.4	Proof of applied settings – settings downloaded and forwarded to EDNS Configuration and Coordination								

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Eskom Distribution		Distribution Transformer Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/ Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
8.5	Protection Equipment Asset Handover Certificate has been completed and signed off by Head of Commissioning								


Annex H – Distribution HV feeder commissioning checklist

 Eskom	Distribution HV Feeder Commissioning Checklist	Unique Identifier	240-54615413 Annex H
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Distribution HV Feeder Commissioning Checklist

Substation									
Bay									
Panel									

Eskom Distribution		Distribution HV Feeder Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
1. Panel Checks and Quality Inspection									
1.1	Panel and equipment intact and visually sound								
1.2	Panel not damaged								
1.3	Panel wired according to application drawings supplied								
1.4	Scheme version on equipment and drawings correspond								
1.5	Panel equipment corresponds in make, model and function to the application drawings provided								

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Eskom Distribution		Distribution HV Feeder Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/ Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
1.6	The panel and associated equipment are correctly connected to the substation earth according to TST 41-1064, 'Standard for the Earthing of Substation Protection Equipment'								
1.7	No DC earth fault detected								
1.8	Panel spare cores earthed								
1.9	Lugs crimped correctly								
1.10	Blanking plates fitted and all panel openings closed								
1.11	Wiring /trunking condition								
1.12	Junction boxes								
1.13	Control panels								
1.14	All unused CT cores shorted								
1.15	Panel labelling correct (front)								
1.16	Panel labelling correct (rear – if applicable)								
1.17	DC DB labelling								

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		Revision	Draft 0.1
		Effective Date	November 2012
		Group Technology	

Eskom Distribution		Distribution HV Feeder Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
1.18	AC DB labelling								
2. Data Capture and Implementation of Applicable Technical Instructions, Technical Bulletins and Modification Instructions									
2.1	Protection data capture form complete								
2.2	All applicable TIs and TBs implemented (detail on PDC)								
3. Secondary Injection Tests									
3.1	All IED settings correctly applied								
3.2	Overcurrent and earth fault tests in compliance with DPC 34-1395, 'Overcurrent and Earth Fault Relay Test Procedure'; use test sheets in document to capture results								
3.3	Relay characteristic tests and logic functions completed (Omicron results required)								
3.4	DC and functional checks as per drawing								
3.5	Transducer outputs correct								

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Eskom Distribution		Distribution HV Feeder Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
3.6	Telecontrol: Supervisory controls operate correctly. Alarms, indications and analogue outputs are correct to the Control Centre. Proof of detailed list of commissioned alarms, controls and analogue signals required.								
3.7	Test blocks and shorting strips operate correctly								
4. Primary Injection Tests									
4.1	Circuit Breaker Test – HV and MV in compliance with DPC 34-1036, 'Procedure for the Testing of Circuit Breakers'; use test sheets on document for test results								
4.2	Link Tests in compliance with DPC 34-1034, 'Distribution Test Procedure for High Voltage Disconnectors'								

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Eskom Distribution		Distribution HV Feeder Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
4.3	CT tests in compliance with Distribution Standard DPC 34-1035, 'Distribution Test Procedure for Inductive Current Transformers'.	Refer to the document for details on tests as well as standard test sheet formats required.							
4.3.1	Polarity Test – all cores								
4.3.2	Magnetization Curve Test – all cores								
4.3.3	Ratio Tests – all cores								
4.3.4	Secondary Loop Tests – all cores (specify circuits)								
4.3.5	Insulation Resistance Tests – all cores								
4.3.6	Tan Delta Tests on 132 kV CTs								
4.3.7	Oil level checks on all CTs								
4.3.8	Application of specified CT ratio (all cores)								
4.4	VT Tests in compliance with Distribution Standard DPC 34-1033, 'Distribution Test Procedure for Inductive Voltage Transformers'.	Refer to the document for details on tests as well as standard test sheet formats required.							

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Eskom Distribution		Distribution Transformer Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
4.4	VT Tests in compliance with Distribution Standard DPC 34-1033, 'Distribution Test Procedure for Inductive Voltage Transformers'	Refer to the document for details on tests as well as standard test sheet formats required.							
4.4.1	VT Polarity Tests – all cores								
4.4.2	VT Ratio Tests – all cores								
4.4.3	VT Insulation Resistance Tests								
4.4.4	VT checking of oil levels								
4.5	Tan Delta Tests on all transformer capacitive bushings								
4.6	Transformer and Earthing Transformer Tests according to Distribution Standard DPC 34-1032, 'Distribution Test Procedure for Power Transformers'	Refer to the document for details on tests as well as standard test sheet formats required.							
4.6.1	Vector Group Tests								
4.6.2	Ratio Tests								
4.6.3	Positive Sequence Impedance Tests on all tap positions								

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Eskom Distribution		Distribution HV Feeder Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/ Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
5.3	All IED settings normalized as per documentation provided by EDNS Configuration and Coordination								
5.4	All IED configuration logic and protections function normalized as per documentation provided by EDNS Configuration and Coordination								
5.5	All test blocks have been replaced and all CT circuits are closed.								
6. Consolidation of Test Results									
6.1	All tests that have been planned have been completed								
6.2	All test results obtained are consistent with reasonable engineering expectations								
6.3	All defects have been itemized and addressed according to defect list								
6.4	The transformer bay is ready to be energized.								

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Eskom Distribution		Distribution HV Feeder Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/ Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
6.5	Arrangements have been made with the authorized person in terms of the ORHVS to clear all outstanding work permits								
6.6	Panel Test Sheet has been completed – record Panel Test Sheet number in the Pass/Fail/Remarks column								
6.7	Protection Equipment Energization Handover Certificate has been completed and signed off by Head of Commissioning								
7. On-load Energization Checks									
7.1	New feeders – perform end-to end phasing checks.								
7.2	VT Voltage Ratio check								
7.3	Auxiliary Voltage check								
7.4	VT Phasing check – correct phase rotation								


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Eskom Distribution		Distribution HV Feeder Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
7.5	Current Measurement check – on-load confirmation of CT ratios								
7.6	Verification of analogue quantities with Control Centre – Cross-check with values given by IED or panel meters								
7.7	Directional checks for impedance and directional overcurrent relays								
7.8	Record power factor and loading (in primary units) measured by the IED if available. Cross-check with Control Centre.								
8. Final Documentation and Documentation Consolidation									
8.1	Marked-up drawings. Copy in substation, copy to Design Office, copy to area EDFs office.								
8.2	On-load check results, including analogue check results included in commissioning file								

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Eskom Distribution		Distribution HV Feeder Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/ Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
8.3	Commissioning Test Results complete and compiled								
8.4	Proof of applied settings – settings downloaded and forwarded to EDNS Configuration and Coordination								
8.5	Protection Equipment Asset Handover Certificate has been completed and signed off by Head of Commissioning								


Annex I – Distribution rural feeder/cable feeder/bus section/bus coupler commissioning checklist

 Eskom	Distribution Rural Feeder/Cable Feeder/Bus Section/Bus Coupler Commissioning Checklist	Unique Identifier	240-54615413 Annex I
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Distribution Rural Feeder/Cable Feeder/Bus Section/Bus Coupler Commissioning Checklist

Substation									
Bay									
Panel									


Eskom Distribution		Distribution Rural/Cable Feeder/Bus Section/Coupler Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
1. Panel Checks and Quality Inspection									
1.1	Panel and equipment intact and visually sound								
1.2	Panel not damaged								
1.3	Panel wired according to application drawings supplied								
1.4	Scheme version on equipment and drawings correspond								
1.5	Panel equipment corresponds in make, model and function to the application drawings provided								

	Distribution Rural Feeder/Cable Feeder/Bus Section/Bus Coupler Commissioning Checklist	Unique Identifier	240-54615413 Annex I
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Eskom Distribution		Distribution Rural/Cable Feeder/Bus Section/Coupler Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
1.6	The panel and associated equipment are correctly connected to the substation earth according to TST 41-1064, 'Standard for the Earthing of Substation Protection Equipment'								
1.7	No DC earth fault detected								
1.8	Panel spare cores earthed								
1.9	Lugs crimped correctly								
1.10	Blanking plates fitted and all panel openings closed								
1.11	Wiring /trunking condition								
1.12	Junction boxes								
1.13	Control panels								
1.14	All unused CT cores shorted								
1.15	Panel labelling correct (front)								
1.16	Panel labelling correct (rear – if applicable)								

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Eskom Distribution		Distribution Rural/Cable Feeder/Bus Section/Coupler Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
1.17	DC DB labelling								
1.18	AC DB labelling								
2. Data Capture and Implementation of Applicable Technical Instructions, Technical Bulletins and Modification Instructions									
2.1	Protection data capture form complete								
2.2	All applicable TIs and TBs implemented (detail on PDC)								
3. Secondary Injection Tests									
3.1	All IED settings correctly applied								
3.2	Overcurrent and earth fault tests in compliance with DPC 34-1395, 'Overcurrent and Earth Fault Relay Test Procedure'; use test sheets in document to capture results								
3.3	Relay characteristic tests and logic functions completed (Omicron results required)								

	Distribution Rural Feeder/Cable Feeder/Bus Section/Bus Coupler Commissioning Checklist	Unique Identifier	240-54615413 Annex I
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Eskom Distribution		Distribution Rural/Cable Feeder/Bus Section/Coupler Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
3.4	DC and functional checks as per drawing								
3.5	Transducer outputs correct								
3.6	Telecontrol: Supervisory controls operate correctly. Alarms, indications and analogue outputs are correct to the Control Centre. Proof of detailed list of commissioned alarms, controls and analogue signals required.								
3.7	Test blocks and shorting strips operate correctly								
4. Primary Injection Tests									
4.1	Circuit Breaker Tests in compliance with DPC 34-1036, 'Procedure for the Testing of Circuit Breakers'; use test sheets on document for test results								
4.2	Link Tests in compliance with DPC 34-1034, 'Distribution Test Procedure for High Voltage Disconnectors'								

	Distribution Rural Feeder/Cable Feeder/Bus Section/Bus Coupler Commissioning Checklist	Unique Identifier	240-54615413 Annex I
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Eskom Distribution		Distribution Rural/Cable Feeder/Bus Section/Coupler Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
4.3	CT tests in compliance with Distribution Standard DPC 34-1035, 'Distribution Test Procedure for Inductive Current Transformers'.	Refer to the document for details on tests as well as standard test sheet formats required.							
4.3.1	Polarity Test – all cores								
4.3.2	Magnetization Curve Test – all cores								
4.3.3	Ratio Tests – all cores								
4.3.4	Secondary Loop Tests – all cores (specify circuits)								
4.3.5	Insulation Resistance Tests – all cores								
4.3.6	Tan Delta Tests on 132 kV CTs								
4.3.7	Oil level checks on all CTs								
4.3.8	Application of specified CT ratio (all cores)								
4.4	VT Tests in compliance with Distribution Standard DPC 34-1033, 'Distribution Test Procedure for Inductive Voltage Transformers'.	Refer to the document for details on tests as well as standard test sheet formats required. Note that if the VT tests have already been completed as part of another bay, strike out this section as 'Not Applicable' to avoid duplication.							

	Distribution Rural Feeder/Cable Feeder/Bus Section/Bus Coupler Commissioning Checklist	Unique Identifier	240-54615413 Annex I
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Eskom Distribution		Distribution Rural/Cable Feeder/Bus Section/Coupler Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
4.4.1	VT Polarity Tests – all cores								
4.4.2	VT Ratio Tests – all cores								
4.4.3	VT Insulation Resistance Tests								
4.4.4	VT checking of oil levels								
4.5	Tan Delta Tests on all capacitive bushings								
4.6	Primary Injection Tests for protection circuits								
4.6.1	Verification of applied CT ratios								
5. Normalization of Circuits									
5.1	All tripping circuits normalized and proven to trip the circuit breakers. Main and backup.								
5.2	All alarm circuits normalized and proven								
5.3	All IED settings normalized as per documentation provided by EDNS Configuration and Coordination								

	Distribution Rural Feeder/Cable Feeder/Bus Section/Bus Coupler Commissioning Checklist	Unique Identifier	240-54615413 Annex I
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Eskom Distribution		Distribution Rural/Cable Feeder/Bus Section/Coupler Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
5.4	All IED configuration logic and protections function normalized as per documentation provided by EDNS Configuration and Coordination								
5.5	All test blocks have been replaced and all CT circuits are closed.								
6. Consolidation of Test Results									
6.1	All tests that have been planned have been completed								
6.2	All test results obtained are consistent with reasonable engineering expectations								
6.3	All defects have been itemized and addressed according to defect list								
6.4	The Rural Feeder/Cable Feeder/Bus Coupler or Bus Section bay is ready to be energized.								

	Distribution Rural Feeder/Cable Feeder/Bus Section/Bus Coupler Commissioning Checklist	Unique Identifier	240-54615413 Annex I
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Eskom Distribution		Distribution Rural/Cable Feeder/Bus Section/Coupler Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
6.5	Arrangements have been made with the authorized person in terms of the ORHVS to clear all outstanding work permits								
6.6	Panel Test Sheet has been completed – record Panel Test Sheet number in the Pass/Fail/Remarks column								
6.7	Protection Equipment Energization Handover Certificate has been completed and signed off by Head of Commissioning								
7. On-load Energization Checks									
7.1	VT Voltage Ratio check								
7.2	Auxiliary Voltage check								
7.3	VT Phasing check – correct phase rotation								
7.4	Current Measurement check – on-load confirmation of CT ratios								

	Distribution Rural Feeder/Cable Feeder/Bus Section/Bus Coupler Commissioning Checklist	Unique Identifier	240-54615413 Annex I
		Document Type	Form
		Revision	Draft 0.1
		Effective Date	November 2012
		Group Technology	

Eskom Distribution		Distribution Rural/Cable Feeder/Bus Section/Coupler Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
7.5	Verification of analogue quantities with Control Centre – Cross-check with values given by IED or panel meters								
7.6	Directional checks for impedance and directional overcurrent relays								
7.7	Record power factor and loading (in primary units) measured by the IED if available. Cross-check with Control Centre.								
8. Final Documentation and Documentation Consolidation									
8.1	Marked-up drawings. Copy in substation, copy to Design Office, copy to area EDFs office.								
8.2	On-load check results, including analogue check results included in commissioning file								
8.3	Commissioning Test Results complete and compiled								

	Distribution Rural Feeder/Cable Feeder/Bus Section/Bus Coupler Commissioning Checklist	Unique Identifier	240-54615413 Annex I
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		Revision	Draft 0.1
		Effective Date	November 2012
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Eskom Distribution		Distribution Rural/Cable Feeder/Bus Section/Coupler Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
8.4	Proof of applied settings – settings downloaded and forwarded to EDNS Configuration and Coordination								
8.5	Protection Equipment Asset Handover Certificate has been completed and signed off by Head of Commissioning								

Annex J – Distribution bus-zone commissioning checklist

 Eskom	Distribution Bus-zone Commissioning Checklist	Unique Identifier	240-54615413 Annex J
		Document Type	Form
		Revision	Draft 0.1
		Effective Date	November 2012
		Group Technology	

Distribution Bus-zone Commissioning Checklist

Substation									
Bay									
Panel									

Eskom Distribution		Distribution Bus-zone Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
1. Panel Checks and Quality Inspection									
1.1	Panel and equipment intact and visually sound								
1.2	Panel not damaged								
1.3	Panel wired according to application drawings supplied								
1.4	Scheme version on equipment and drawings correspond								
1.5	Panel equipment corresponds in make, model and function to the application drawings provided								

	Distribution Bus-zone Commissioning Checklist	Unique Identifier	240-54615413 Annex J
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		Revision	Draft 0.1
		Effective Date	November 2012
		Group Technology	

Eskom Distribution		Distribution Bus-zone Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/ Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
1.6	The panel and associated equipment are correctly connected to the substation earth according to TST 41-1064, 'Standard for the Earthing of Substation Protection Equipment'								
1.7	No DC earth fault detected								
1.8	Panel spare cores earthed								
1.9	Lugs crimped correctly								
1.10	Blanking plates fitted and all panel openings closed								
1.11	Wiring /trunking condition								
1.12	Junction boxes								
1.13	Control panels								
1.14	All unused CT cores shorted								
1.15	Panel labelling correct (front)								
1.16	Panel labelling correct (rear – if applicable)								
1.17	DC DB labelling								

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	Distribution Bus-zone Commissioning Checklist	Unique Identifier	240-54615413 Annex J
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Eskom Distribution		Distribution Bus-zone Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
1.18	AC DB labelling								
2. Data Capture and Implementation of Applicable Technical Instructions, Technical Bulletins and Modification Instructions									
2.1	Protection data capture form complete								
2.2	All applicable TIs and TBs implemented (detail on PDC)								
3. Secondary Injection Tests									
NOTE: Use Test Procedures and Test Sheets contained in DPC 34-2244, 'Distribution Test Procedure for High Impedance Bus Zone Protection Schemes'.									
3.1	All IED settings correctly applied								
3.2	Overcurrent and earth fault tests in compliance with DPC 34-1395, 'Overcurrent and Earth Fault Relay Test Procedure'; use test sheets in document to capture results								
3.3	Relay characteristic tests and logic functions completed (Omicron results required)								

	Distribution Bus-zone Commissioning Checklist	Unique Identifier	240-54615413 Annex J
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Eskom Distribution		Distribution Bus-zone Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/ Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
3.4	DC and functional checks as per drawing, including:								
3.4.1	Operation of make-before-break isolator auxiliary contacts – all isolators								
3.4.2	Auxiliary contacts select bay to appropriate zone – all bays, all zones								
3.4.3	All trip repeat relays operate associated breaker – all bays								
3.4.4	Operation of Bus Zone Isolate switch – operation of trip repeat relays does not trip any breakers in 'Isolated' position								
3.4.5	Operation of Bus Zone Isolate switch – all selected trip repeats operate in 'Normal' position								
3.4.6	Operation of Breaker Fail Isolate switch – no trip repeat operation in 'isolated' position								
3.4.7	Operation of Breaker Fail Isolate switch – all selected trip repeat relays operate – all bays								

	Distribution Bus-zone Commissioning Checklist	Unique Identifier	240-54615413 Annex J
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Eskom Distribution		Distribution Bus-zone Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
3.5	Transducer outputs correct								
3.6	Telecontrol: Supervisory controls operate correctly. Alarms, indications and analogue outputs are correct to the Control Centre. Proof of detailed list of commissioned alarms, controls and analogue signals required.								
3.7	Test blocks and shorting strips operate correctly								
3.8	Test block resistance – all bays								
4. Primary Injection Tests									
NOTE: Use Test Procedures and Test Sheets contained in DPC 34-2244, 'Distribution Test Procedure for High Impedance Bus Zone Protection Schemes'.									
4.1	CT Ratio Tests – all bays								
4.2	Link Tests in compliance with DPC 34-1034 'Distribution Test Procedure for High Voltage Disconnectors'								
4.3	Polarity Tests – check at test block								

	Distribution Bus-zone Commissioning Checklist	Unique Identifier	240-54615413 Annex J
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Eskom Distribution		Distribution Bus-zone Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/ Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
4.4	Differential Stability Check – Check zone - all bays to reference bay, all CTs, all phases								
4.5	Differential Stability Check – all zones – all bays to reference bay, all CTs, all phases								
4.6	Differential Sensitivity Check – check zones – all bays, all phases, all CTs								
5. Normalization of Circuits									
5.1	All tripping circuits normalized and proven to trip the circuit breakers. Main and backup.								
5.2	All alarm circuits normalized and proven								
5.3	All IED settings normalized as per documentation provided by EDNS Configuration and Coordination								

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Eskom Distribution		Distribution Bus-zone Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/ Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
5.4	All IED configuration logic and protections function normalized as per documentation provided by EDNS Configuration and Coordination								
5.5	All test blocks have been replaced and all CT circuits are closed.								
5.6	All Trip Repeat Relays have been reset								
5.7	All Master Trip Relays have been reset								
5.8	Breaker Fail Isolate set to 'Isolate' position								
5.9	Bus Zone Isolate Switch set to 'Isolate' position								
6. Consolidation of Test Results									
6.1	All tests that have been planned have been completed								
6.2	All test results obtained are consistent with reasonable engineering expectations								

	Distribution Bus-zone Commissioning Checklist	Unique Identifier	240-54615413 Annex J
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Eskom Distribution		Distribution Bus-zone Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/ Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
6.3	All defects have been itemized and addressed according to defect list								
6.4	The Bus Zone scheme is ready to be energized								
6.5	Arrangements have been made with the authorized person in terms of the ORHVS to clear all outstanding work permits								
6.6	Panel Test Sheet has been completed – record Panel Test Sheet number in the Pass/Fail/Remarks column								
6.7	Protection Equipment Energization Handover Certificate has been completed and signed off by Head of Commissioning								

	Distribution Bus-zone Commissioning Checklist	Unique Identifier	240-54615413 Annex J
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Eskom Distribution		Distribution Bus-zone Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
7. On-load Energization Checks									
7.1	On-load stability check for differential relay. Confirm zero spill current in all zones. Confirm all latching relays are reset.								
7.2	Switch Breaker Fail Isolate Switch to 'Normal' position.								
7.3	Switch Bus Zone Isolate to 'Normal' position.								
8. Final Documentation and Documentation Consolidation									
8.1	Marked-up drawings. Copy in substation, copy to Design Office, copy to area EDFs office.								
8.2	On-load check results, including analogue check results included in commissioning file								
8.3	Commissioning Test Results complete and compiled								

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Eskom Distribution		Distribution Bus-zone Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/ Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
8.4	Proof of applied settings – settings downloaded and forwarded to EDNS Configuration and Coordination								
8.5	Protection Equipment Asset Handover Certificate has been completed and signed off by Head of Commissioning								

Annex K – Distribution arc detection commissioning checklist

 Eskom	Distribution Arc Detection Commissioning Checklist	Unique Identifier	240-54615413 Annex K
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Distribution Arc Detection Commissioning Checklist

Substation									
Bay									
Panel									

Eskom Distribution			Distribution Arc Detection Commissioning Checklist Rev. 0			Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
1. Panel Checks and Quality Inspection									
1.1	Panel and equipment intact and visually sound								
1.2	Panel not damaged								
1.3	Panel wired according to application drawings supplied								
1.4	Scheme version on equipment and drawings correspond								
1.5	Panel equipment corresponds in make, model and function to the application drawings provided								

	Distribution Arc Detection Commissioning Checklist	Unique Identifier	240-54615413 Annex K
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		Effective Date	November 2012
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Eskom Distribution			Distribution Arc Detection Commissioning Checklist Rev. 0			Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
1.6	The panel and associated equipment are correctly connected to the substation earth according to TST 41-1064, 'Standard for the Earthing of Substation Protection Equipment'								
1.7	No DC earth fault detected								
1.8	Panel spare cores earthed								
1.9	Lugs crimped correctly								
1.10	Blanking plates fitted and all panel openings closed								
1.11	Wiring /trunking condition								
1.12	Junction boxes								
1.13	Control panels								
1.14	All unused CT cores shorted								
1.15	Panel labelling correct (front)								
1.16	Panel labelling correct (rear – if applicable)								

	Distribution Arc Detection Commissioning Checklist	Unique Identifier	240-54615413 Annex K
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Eskom Distribution			Distribution Arc Detection Commissioning Checklist Rev. 0			Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
1.17	DC DB labelling								
1.18	AC DB labelling								
2. Data Capture and Implementation of Applicable Technical Instructions, Technical Bulletins and Modification Instructions									
2.1	Protection data capture form complete								
2.2	All applicable TIs and TBs implemented (detail on PDC)								
3. Secondary Injection Tests									
3.1	All IED settings correctly applied								
3.2	Overcurrent and earth fault tests in compliance with DPC 34-1395, 'Overcurrent and Earth Fault Relay Test Procedure'; use test sheets in document to capture results								
3.3	Relay characteristic tests and logic functions completed (Omicron results required)								

	Distribution Arc Detection Commissioning Checklist	Unique Identifier	240-54615413 Annex K
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Eskom Distribution			Distribution Arc Detection Commissioning Checklist Rev. 0			Bay:				
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date	
3.4	DC and functional checks as per drawing									
3.5	Transducer outputs correct									
3.6	Telecontrol: Supervisory controls operate correctly. Alarms, indications and analogue outputs are correct to the Control Centre. Proof of detailed list of commissioned alarms, controls and analogue signals required.									
3.7	Test blocks and shorting strips operate correctly									
4. Primary Injection Tests										
4.1	Ratio Tests – from all Incomer/transformer bays to all master IEDs									
4.2	Secondary Loop Tests – all cores (specify circuits)									

	Distribution Arc Detection Commissioning Checklist	Unique Identifier	240-54615413 Annex K
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Eskom Distribution			Distribution Arc Detection Commissioning Checklist Rev. 0			Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
4.3	If Arc detection is added to a previously commissioned switchboard and unused CT core is used, then perform magnetization curve on the new core.								
5. Normalization of Circuits									
5.1	All tripping circuits normalized and proven to trip the circuit breakers. Main and backup.								
5.2	All alarm circuits normalized and proven								
5.3	All IED settings normalized as per documentation provided by EDNS Configuration and Coordination								
5.4	All IED configuration logic and protections function normalized as per documentation provided by EDNS Configuration and Coordination								

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Eskom Distribution			Distribution Arc Detection Commissioning Checklist Rev. 0			Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
5.5	All test blocks have been replaced and all CT circuits are closed.								
6. Consolidation of Test Results									
6.1	All tests that have been planned have been completed								
6.2	All test results obtained are consistent with reasonable engineering expectations								
6.3	All defects have been itemized and addressed according to defect list								
6.4	The Substation Indoor Switchgear is ready to be energized.								
6.5	Arrangements have been made with the authorized person in terms of the ORHVS to clear all outstanding work permits								
6.6	Panel Test Sheet has been completed – record Panel Test Sheet number in the Pass/Fail/Remarks column								

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Eskom Distribution			Distribution Arc Detection Commissioning Checklist Rev. 0			Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
6.7	Protection Equipment Energization Handover Certificate has been completed and signed off by Head of Commissioning								
7. On-load Energization Checks									
7.1	Current Measurement Check – on-load confirmation of CT ratios								
7.2	Verification of analogue quantities with Control Centre – cross-check with values given by IED or panel meters								
8. Final Documentation and Documentation Consolidation									
8.1	Marked-up drawings. Copy in substation, copy to Design Office, copy to area EDFs office.								
8.2	On-load check results, including analogue check results included in commissioning file								

	Distribution Arc Detection Commissioning Checklist	Unique Identifier	240-54615413 Annex K
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Eskom Distribution			Distribution Arc Detection Commissioning Checklist Rev. 0			Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
8.3	Confirmation that laminated tripping matrix diagram is properly attached to the Arc detection panel								
8.4	P-touch information, e.g. CT ratio, plug setting, time multiplier to be marked on panel – right-hand side of relay								
8.5	Commissioning Test Results complete and compiled								
8.6	Proof of applied settings – settings downloaded and forwarded to EDNS Configuration and Coordination								
8.7	Protection Equipment Asset Handover Certificate has been completed and signed off by Head of Commissioning								


Annex L – Distribution capacitor bank commissioning checklist

 Eskom	Distribution Capacitor Bank Commissioning Checklist	Unique Identifier	240-54615413 Annex L
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Distribution Capacitor Bank Commissioning Checklist

Substation									
Bay									
Panel									

Eskom Distribution		Distribution Capacitor Bank Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
1. Panel Checks and Quality Inspection									
1.1	Panel and equipment intact and visually sound								
1.2	Panel not damaged								
1.3	Panel wired according to application drawings supplied								
1.4	Scheme version on equipment and drawings correspond								
1.5	Panel equipment corresponds in make, model and function to the application drawings provided								

	Distribution Capacitor Bank Commissioning Checklist	Unique Identifier	240-54615413 Annex L
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Eskom Distribution		Distribution Capacitor Bank Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
1.6	The panel and associated equipment are correctly connected to the substation earth according to TST 41-1064, 'Standard for the Earthing of Substation Protection Equipment'								
1.7	No DC earth fault detected								
1.8	Panel spare cores earthed								
1.9	Lugs crimped correctly								
1.10	Blanking plates fitted and all panel openings closed								
1.11	Wiring /trunking condition								
1.12	Junction boxes								
1.13	Control panels								
1.14	All unused CT cores shorted								
1.15	Panel labelling correct (front)								
1.16	Panel labelling correct (rear – if applicable)								
1.17	DC DB labelling								

	Distribution Capacitor Bank Commissioning Checklist	Unique Identifier	240-54615413 Annex L
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		Revision	Draft 0.1
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Eskom Distribution		Distribution Capacitor Bank Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
1.18	AC DB labelling								
2. Data Capture and Implementation of Applicable Technical Instructions, Technical Bulletins and Modification Instructions									
2.1	Protection data capture form complete								
2.2	All applicable TIs and TBs implemented (detail on PDC)								
3. Secondary Injection Tests									
3.1	All IED settings correctly applied								
3.2	Overcurrent and earth fault tests in compliance with DPC 34-1395, 'Overcurrent and Earth Fault Relay Test Procedure'; use test sheets in document to capture results								
3.3	Relay characteristic tests and logic functions completed (Omicron results required)								
3.4	DC and functional checks as per drawing								
3.5	Transducer outputs correct								

	Distribution Capacitor Bank Commissioning Checklist	Unique Identifier	240-54615413 Annex L
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Eskom Distribution		Distribution Capacitor Bank Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
3.6	Telecontrol: Supervisory controls operate correctly. Alarms, indications and analogue outputs are correct to the Control Centre. Proof of detailed list of commissioned alarms, controls and analogue signals required.								
3.7	Test blocks and shorting strips operate correctly								
4. Primary Injection Tests									
4.1	Circuit Breaker Tests in compliance with DPC 34-1036, 'Procedure for the Testing of Circuit Breakers'; use Test Sheets on document for test results								
4.2	Link Tests in compliance with DPC 34-1034, 'Distribution Test Procedure for High Voltage Disconnectors'								

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Eskom Distribution		Distribution Capacitor Bank Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
4.3	CT Tests in compliance with Distribution Standard DPC 34-1035, 'Distribution Test Procedure for Inductive Current Transformers'								
4.3.1	Polarity Test – all cores								
4.3.2	Magnetization Curve Test – all cores								
4.3.3	Ratio Tests – all cores								
4.3.4	Secondary Loop Tests – all cores (specify circuits)								
4.3.5	Insulation Resistance Tests – all cores								
4.3.6	Tan Delta Tests on 132 kV CTs								
4.3.7	Oil Level Checks on all CTs								
4.3.8	Application of specified CT ratio (all cores)								

	Distribution Capacitor Bank Commissioning Checklist	Unique Identifier	240-54615413 Annex L
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Eskom Distribution		Distribution Capacitor Bank Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
4.4	VT Tests in compliance with Distribution Standard DPC 34-1033, 'Distribution Test Procedure for Inductive Voltage Transformers'; this is applicable for indoor switchgear switching station or busbar VTs	Refer to the document for details on tests as well as standard test sheet formats required. Note that if the VT tests have already been completed as part of another bay, strike out this section as 'Nct Applicable' to avoid duplication.							
4.4.1	VT Polarity Tests – all cores								
4.4.2	VT Ratio Tests – all cores								
4.4.3	VT Insulation Resistance Tests								
4.4.4	VT checking of oil levels								
4.5	Tan Delta Tests on all capacitive bushings								
4.6	Record capacitance of each capacitor with serial number								
4.7	Primary Injection Tests for protection circuits								
4.7.1	Verification of applied CT ratios including neutral unbalance CT								

	Distribution Capacitor Bank Commissioning Checklist	Unique Identifier	240-54615413 Annex L
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Eskom Distribution		Distribution Capacitor Bank Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/ Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
5. Normalization of Circuits									
5.1	All tripping circuits normalized and proven to trip the circuit breakers. Main and backup.								
5.2	All alarm circuits normalized and proven								
5.3	All IED settings normalized as per documentation provided by EDNS Configuration and Coordination								
5.4	All IED configuration logic and protections function normalized as per documentation provided by EDNS Configuration and Coordination								
5.5	All test blocks have been replaced and all CT circuits are closed.								

	Distribution Capacitor Bank Commissioning Checklist	Unique Identifier	240-54615413 Annex L
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Eskom Distribution		Distribution Capacitor Bank Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
6. Consolidation of Test Results									
6.1	All tests that have been planned have been completed								
6.2	All test results obtained are consistent with reasonable engineering expectations								
6.3	All defects have been itemized and addressed according to defect list								
6.4	The Capacitor Bank is ready to be energized								
6.5	Arrangements have been made with the authorized person in terms of the ORHVS to clear all outstanding work permits								
6.6	Panel Test Sheet has been completed – record Panel Test Sheet number in the Pass/Fail/Remarks column								
6.7	Protection Equipment Energization Handover Certificate has been completed and signed off by Head of Commissioning								

	Distribution Capacitor Bank Commissioning Checklist	Unique Identifier	240-54615413 Annex L
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Eskom Distribution		Distribution Capacitor Bank Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
7. On-load Energization Checks									
7.1	Neutral spill must be recorded before adjustment and after adjustment								
7.2	Relay adjusted								
7.3	Record imbalance								
7.4	VT voltage ratio check								
7.5	Auxiliary Voltage Check								
7.6	VT Phasing Check – correct phase rotation								
7.7	Current Measurement Check – on-load confirmation of CT ratios								
7.8	Verification of analogue quantities with Control Centre – cross-check with values given by IED or panel meters								
7.9	Directional checks for Impedance and directional overcurrent relays								


	Distribution Capacitor Bank Commissioning Checklist	Unique Identifier	240-54615413 Annex L
		Document Type	Form
		Revision	Draft 0.1
		Effective Date	November 2012
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Eskom Distribution		Distribution Capacitor Bank Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/ Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
7.10	Record power factor and loading (in primary units) measured by the IED if available. Cross-check with Control Centre.								
7.11	Record harmonic readings								
8. Final Documentation and Documentation Consolidation									
8.1	Marked-up drawings. Copy in substation, copy to Design Office, copy to area EDFs office.								
8.2	On-load check results, including analogue check results included in commissioning file								
8.3	Commissioning Test Results complete and compiled								
8.4	Proof of applied settings – settings downloaded and forwarded to EDNS Configuration and Coordination								

	Distribution Capacitor Bank Commissioning Checklist	Unique Identifier	240-54615413 Annex L
		Document Type	Form
		Revision	Draft 0.1
		Effective Date	November 2012
		Group Technology	

Eskom Distribution		Distribution Capacitor Bank Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/ Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
8.5	Protection Equipment Asset Handover Certificate has been completed and signed off by Head of Commissioning								


Annex M – Distribution under-frequency commissioning checklist

 Eskom	Distribution Under-frequency Commissioning Checklist	Unique Identifier	240-54615413 Annex M
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Distribution Under-frequency Commissioning Checklist

Substation									
Bay									
Panel									


Eskom Distribution		Distribution Under-frequency Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/ Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
1. Panel Checks and Quality Inspection									
1.1	Panel and equipment intact and visually sound								
1.2	Panel not damaged								
1.3	Panel wired according to application drawings supplied								
1.4	Scheme version on equipment and drawings correspond								
1.5	Panel equipment corresponds in make, model and function to the application drawings provided								

	Distribution Under-frequency Commissioning Checklist	Unique Identifier	240-54615413 Annex M
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		Revision	Draft 0.1
		Effective Date	November 2012
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Eskom Distribution		Distribution Under-frequency Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/ Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
1.6	The panel and associated equipment are correctly connected to the substation earth according to TST 41-1064, 'Standard for the Earthing of Substation Protection Equipment'								
1.7	No DC earth fault detected								
1.8	Panel spare cores earthed								
1.9	Lugs crimped correctly								
1.10	Blanking plates fitted and all panel openings closed								
1.11	Wiring /trunking condition								
1.12	Junction boxes								
1.13	Control panels								
1.14	All unused CT cores shorted								
1.15	Panel labelling correct (front)								
1.16	Panel labelling correct (rear – if applicable)								

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Eskom Distribution		Distribution Under-frequency Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/ Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
1.17	DC DB labelling								
1.18	AC DB labelling								
2. Data Capture and Implementation of Applicable Technical Instructions, Technical Bulletins and Modification Instructions									
2.1	Protection data capture form complete								
2.2	All applicable TIs and TBs implemented (detail on PDC)								
3. Secondary Injection Tests									
NOTE: Use Test Procedures and Test Sheets contained in DST 34-672, 'Standard for the Application, Setting and Testing of Under-frequency Load Shedding Protection Relays'.									
3.1	All IED settings correctly applied								
3.2	Relay characteristic tests and logic functions completed (Omicron results required)								
3.3	DC and functional checks as per drawing								
3.4	Transducer outputs correct								

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Eskom Distribution		Distribution Under-frequency Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/ Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
3.5	Telecontrol: Supervisory controls operate correctly. Alarms, indications and analogue outputs are correct to the Control Centre. Proof of detailed list of commissioned alarms, controls and analogue signals required.								
3.6	Test blocks and shorting strips operate correctly								
4. Primary Injection Tests									
4.1	CT Tests in compliance with Distribution Standard DPC 34-1035, 'Distribution Test Procedure for Inductive Current Transformers'	Refer to the document for details on tests as well as standard test sheet formats required. If CT circuit has already been tested, or is not used in this application, then strike out the CT test section as 'Not Applicable'.							
4.1.1	Polarity Test – all cores								
4.1.2	Magnetization Curve Test – all cores								
4.1.3	Ratio Tests – all cores								
4.1.4	Secondary Loop Tests – all cores (specify circuits)								

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Eskom Distribution		Distribution Under-frequency Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/ Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
4.1.5	Insulation Resistance Tests – all cores								
4.1.6	Tan Delta Tests on 132 kV CTs								
4.1.7	Oil Level Checks on all CTs								
4.1.8	Application of specified CT ratio (all cores)								
4.2	VT Tests in compliance with Distribution Standard DPC 34-1033, 'Distribution Test Procedure for Inductive Voltage Transformers'; this is applicable for indoor switchgear switching station or busbar VTs	Refer to the document for details on tests as well as standard test sheet formats required. Note that if the VT tests have already been completed as part of another bay, strike out this section as 'Nct Applicable' to avoid duplication.							
4.2.1	VT Polarity Tests – all cores								
4.2.2	VT Ratio Tests – all cores								
4.2.3	VT Insulation Resistance Tests								
4.2.4	VT checking of oil levels								
4.3	Tan Delta Tests on all capacitive bushings								

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Eskom Distribution		Distribution Under-frequency Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/ Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
4.4	Primary Injection Tests for protection circuits	Only do this if the Under-frequency panel is being commissioned as part of a new bay, and if CT circuits are being used for directional power application.							
4.4.1	Verification of applied CT ratios including neutral unbalance CT								
5. Normalization of Circuits									
5.1	All tripping circuits normalized and proven to trip the circuit breakers. Main and backup.								
5.2	All alarm circuits normalized and proven								
5.3	All IED settings normalized as per documentation provided by EDNS Configuration and Coordination								
5.4	All IED configuration logic and protections function normalized as per documentation provided by EDNS Configuration and Coordination								
5.5	All test blocks have been replaced and all CT circuits are closed.								

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Eskom Distribution		Distribution Under-frequency Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/ Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
6. Consolidation of Test Results									
6.1	All tests that have been planned have been completed								
6.2	All test results obtained are consistent with reasonable engineering expectations								
6.3	All defects have been itemized and addressed according to defect list								
6.4	The Under-frequency Panel is ready to be energized.								
6.5	Arrangements have been made with the authorized person in terms of the ORHVS to clear all outstanding work permits								
6.6	Panel Test Sheet has been completed – record Panel Test Sheet number in the Pass/Fail/Remarks column								


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Eskom Distribution		Distribution Under-frequency Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/ Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
6.7	Protection Equipment Energization Handover Certificate has been completed and signed off by Head of Commissioning								
7. On-load Energization Checks									
7.1	VT voltage ratio check								
7.2	Auxiliary Voltage Check								
7.3	VT Phasing Check – correct phase rotation								
7.4	Current Measurement Check – on-load confirmation of CT ratios								
7.5	Verification of analogue quantities with Control Centre – cross-check with values given by IED or panel meters								
7.6	Record power factor and loading (in primary units) measured by the IED if available. Cross-check with Control Centre.								

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Eskom Distribution		Distribution Under-frequency Commissioning Checklist Rev. 0				Bay:			
Item	Description	Check	Pass/Fail/ Remarks	Completed by (Name)	Signature	Date	Checked by (Name)	Signature	Date
8. Final Documentation and Documentation Consolidation									
8.1	Marked-up drawings. Copy in substation, copy to Design Office, copy to area EDFs office.								
8.2	On-load check results, including analogue check results included in commissioning file								
8.3	Commissioning Test Results complete and compiled								
8.4	Proof of applied settings – settings downloaded and forwarded to EDNS Configuration and Coordination								
8.5	Protection Equipment Asset Handover Certificate has been completed and signed off by Head of Commissioning								


Annex N – Transmission secondary plant battery chargers and battery banks check sheet

	Transmission Secondary Plant Battery Chargers and Battery Banks Check Sheet	Unique Identifier	240-54615413 Annex N
		Document Type	Form
		Revision	Draft 0.1
		Effective Date	November 2012
		Group Technology	

Transmission Secondary Plant Battery Chargers and Battery Banks Check Sheet

SUBSTATION		
PLANT		
SCOPE OF WORK		
Items Completed	(Tick if Executed/ Applicable)	Signature
1. Defect Report	<input type="checkbox"/>	
2. As-built drawings (one set on site and one set sent for revision)	<input type="checkbox"/>	
3. Commissioning test results as per Quality Manual (refer to item 14)	<input type="checkbox"/>	
4. ENCOR database updated	<input type="checkbox"/>	
5. Controls and Alarms tested to Control	<input type="checkbox"/>	
6. Complete Functional check done from Panel	<input type="checkbox"/>	
7. No DC earth fault on Substation	<input type="checkbox"/>	
8. Fuse ratings correct	<input type="checkbox"/>	
9. Quality Control		
a) Lugs crimped correctly	<input type="checkbox"/>	
b) Panel holes closed	<input type="checkbox"/>	
c) Wiring condition/trunking	<input type="checkbox"/>	
10. Panel labelling		
a) DC panel	<input type="checkbox"/>	
b) Battery banks	<input type="checkbox"/>	
11. Protection settings implemented	<input type="checkbox"/>	
12. In/out commissioning sheets updated	<input type="checkbox"/>	
13. Updated in/out commissioning sheets handed to Planning and Performance	<input type="checkbox"/>	
Commissioning documentation completed (tick when applicable) http://txweb.eskom.co.za/docManagement/part_b.htm		
✓ Battery Charger Commissioning ✓ Battery Bank Commissioning <input type="checkbox"/> SCASS Document		
Accepted by Secondary Plant Manager or Delegate		
Name	Signature	Date


Annex O – Transmission secondary plant measurements and metering check sheet

	Transmission Secondary Plant Measurements and Metering Check Sheet	Unique Identifier	240-54615413 Annex O
		Document Type	Form
		Revision	Draft 0.1
		Effective Date	November 2012
		Group Technology	

Transmission Secondary Plant Measurements and Metering Check Sheet

SUBSTATION		
PLANT		
SCOPE OF WORK		
Items Completed	(Tick if Executed/ Applicable)	Signature
1. Defect Report	<input type="checkbox"/>	
2. All drawings checked and approved	<input type="checkbox"/>	
3. As-built drawings (one set on site and one set sent for revision)	<input type="checkbox"/>	
4. CT commissioning tests results available	<input type="checkbox"/>	
5. VT commissioning tests results available	<input type="checkbox"/>	
6. Temse database updated.	<input type="checkbox"/>	
7. Analogues tested to Control	<input type="checkbox"/>	
8. Complete Functional check done on Panel	<input type="checkbox"/>	
9. Fuse ratings correct	<input type="checkbox"/>	
10. Panel labelling correct	<input type="checkbox"/>	
11. All transducers calibrated	<input type="checkbox"/>	
12. All meters calibrated	<input type="checkbox"/>	
13. All instruments scaled correctly	<input type="checkbox"/>	
14. CT test blocks do have shorting strips connected	<input type="checkbox"/>	
15. VT test blocks do not have shorting strips connected	<input type="checkbox"/>	
16. All cables tested and connected as per drawing	<input type="checkbox"/>	
17. Quality Control		
a) Spare cores earthed	<input type="checkbox"/>	
b) Lugs crimped correctly	<input type="checkbox"/>	
c) Panel holes closed	<input type="checkbox"/>	
d) Wiring condition/trunking	<input type="checkbox"/>	
e) Junction boxes	<input type="checkbox"/>	
f) All CT circuits closed	<input type="checkbox"/>	
18. Plant walk-down sheets (in/out commissioning sheets) completed	<input type="checkbox"/>	
19. Completed Plant walk-down sheets (in/out commissioning sheets) handed over to Planning and Performance	<input type="checkbox"/>	
Commissioning documentation completed (tick when applicable) http://txweb.eskom.co.za/docManagement/parl_b.htm		
<input type="checkbox"/> Fdr Commissioning	<input type="checkbox"/> CVT Commissioning	<input type="checkbox"/> Current Transformer Commissioning
<input type="checkbox"/> SCASS Document	<input type="checkbox"/> Transformer Commissioning	<input type="checkbox"/> Teleprotection Commissioning
<input checked="" type="checkbox"/> Metering and Measurement	<input type="checkbox"/> Bus Section/Bus Coupler Commissioning	
Accepted by Secondary Plant Manager or Delegate		
Name	Signature	Date


Annex P – Transmission secondary plant SCADA check sheet

	Transmission Secondary Plant SCADA Check Sheet	Unique Identifier	240-54615413 Annex P
		Document Type	Form
		Revision	Draft 0.1
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Transmission Secondary Plant SCADA Check Sheet

SUBSTATION			
PLANT			
SCOPE OF WORK			
COMMISSIONING DATE		NCC PERSONNEL	
SCADA TECHNICIAN			
RTU INFORMATION			
RTU Type	ERTU/BP Address	Baud	Protocol
CONFIGURATION AND DATABASE			
Configuration Rev. No.	Database Rev. No.		Configuration Checksum
Items Completed		(Tick if Executed/ Applicable)	Signature
1. Pre/Commissioning			
a) Pre-commissioning done with alarms simulated from Protection Panel		<input type="checkbox"/>	
b) All analogues successfully tested to National Control		<input type="checkbox"/>	
c) All alarms/indications successfully tested to National Control		<input type="checkbox"/>	
d) All controls successfully tested to National Control		<input type="checkbox"/>	
e) All DC and Charger alarms successfully tested to National Control		<input type="checkbox"/>	
f) DDC verified and tested for correct operation		<input type="checkbox"/>	
2. Quality Checks			
a) Panel labelling correct and satisfactory		<input type="checkbox"/>	
b) All metal parts, sheathing and panel parts earthed		<input type="checkbox"/>	
c) Wiring/cabling neatly and correctly labelled		<input type="checkbox"/>	
d) All crimping work satisfactory		<input type="checkbox"/>	
e) Equipment and auxiliary equipment secure and neat		<input type="checkbox"/>	
f) Supplies drawing correct		<input type="checkbox"/>	
g) Equipment as per specification and fully functional		<input type="checkbox"/>	
h) Indication lamps, switches and equipment displays and functional		<input type="checkbox"/>	
i) Supplied settings and configuration correct		<input type="checkbox"/>	
j) Any modification/correction documented		<input type="checkbox"/>	
k) CT and VT ratio verified		<input type="checkbox"/>	
3. Field Work			
a) All equipment functional tests completed and deviations corrected		<input type="checkbox"/>	
b) Primary equipment tested, verified and checked for correct operation		<input type="checkbox"/>	
c) Test results documented and available		<input type="checkbox"/>	
d) In/out commissioning sheets updated		<input type="checkbox"/>	
e) Updated in/out commissioning sheets handed to Planning and Performance		<input type="checkbox"/>	
Commissioning documentation completed (tick when applicable) http://txweb.eskom.co.za/docManagement/part_b.htm			
✓ SCADA			
Accepted by Secondary Plant Manager or Delegate			
Name	Signature	Date	


Annex Q – Transmission transformer bay check sheet

	Transmission Transformer Bay Check Sheet	Unique Identifier	240-54615413 Annex Q
		Document Type	Form
		Revision	Draft 0.1
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Transmission Transformer Bay Check Sheet

SUBSTATION			
PLANT			
SCOPE OF WORK			
Items Completed	(Tick if Executed/ Applicable)	Signature	
1. Defect Report	<input type="checkbox"/>		
1. As-built drawings (one set on site and one set sent for revision)	<input type="checkbox"/>		
2. Commissioning test results as per Quality Manual (refer to item 16)	<input type="checkbox"/>		
3. ENCOR database updated	<input type="checkbox"/>		
4. Controls and Alarms tested to Control	<input type="checkbox"/>		
5. Complete Functional check done from Panel	<input type="checkbox"/>		
6. Bus zone link selection checked to BZ Panel (correct contacts used). High imp. (Ph1) and medium imp. (Ph2) BZ use 'G' contacts for operating the selection relay on the BZ and low imp. (Ph3 and Ph5) use 'M' contacts	<input type="checkbox"/>		
7. Bus Zone and Breaker fail trips connected in Feeder and Bus Zone panels and checked	<input type="checkbox"/>		
8. No DC earth fault on Substation	<input type="checkbox"/>		
9. Fuse ratings correct	<input type="checkbox"/>		
10. Quality Control			
a) Spare cores earthed	<input type="checkbox"/>		
b) Lugs crimped correctly	<input type="checkbox"/>		
c) Panel holes closed	<input type="checkbox"/>		
d) Wiring condition/trunking	<input type="checkbox"/>		
e) Junction boxes	<input type="checkbox"/>		
f) Control panels	<input type="checkbox"/>		
g) All CT circuits closed	<input type="checkbox"/>		
11. Panel labelling			
a) DC panel	<input type="checkbox"/>		
b) AC panel	<input type="checkbox"/>		
c) Control panel front	<input type="checkbox"/>		
d) Control panel back	<input type="checkbox"/>		
e) Relay panels front	<input type="checkbox"/>		
f) Relay panels back	<input type="checkbox"/>		
12. Protection settings implemented	<input type="checkbox"/>		
13. In/out commissioning sheets updated	<input type="checkbox"/>		
14. Updated in/out commissioning sheets handed to Planning and Performance	<input type="checkbox"/>		
Commissioning documentation completed (tick when applicable) http://txweb.eskom.co.za/docManagement/par_b.htm			
<input checked="" type="checkbox"/> Transformer Bay Commissioning <input type="checkbox"/> Isolator Commissioning <input type="checkbox"/> Current Transformer Commissioning			
<input type="checkbox"/> SCASS Document <input type="checkbox"/> Transformer Commissioning <input type="checkbox"/> Measurement and Metering Document			
<input type="checkbox"/> Breaker Commissioning <input type="checkbox"/> CVT/VT Commissioning Document			
Accepted by Secondary Plant Manager or Delegate			
Name	Signature	Date	


Annex R – Transmission feeder bay check sheet

	Transmission Feeder Bay Check Sheet	Unique Identifier	240-54615413 Annex R
		Document Type	Form
		Revision	Draft 0.1
		Effective Date	November 2012
		Group Technology	

Transmission Feeder Bay Check Sheet

SUBSTATION		
PLANT		
SCOPE OF WORK		
Items Completed	(Tick if Executed/ Applicable)	Signature
1. Defect Report	<input type="checkbox"/>	
2. As-built drawings (one set on site and one set sent for revision)	<input type="checkbox"/>	
3. Commissioning test results as per Quality Manual (refer to item 16)	<input type="checkbox"/>	
4. ENCOR database updated	<input type="checkbox"/>	
5. Controls and Alarms tested to Control	<input type="checkbox"/>	
6. Complete Functional check done from Panel	<input type="checkbox"/>	
7. Bus zone link selection checked to BZ Panel (correct contacts used). High imp. (Ph1) and medium imp. (Ph2) BZ use 'G' contacts for operating the selection relay on the BZ and low imp. (Ph3 and Ph5) use 'M' contacts	<input type="checkbox"/>	
8. Bus Zone and Breaker fail trips connected in Feeder and Bus Zone panels and checked	<input type="checkbox"/>	
9. No DC earth fault on Substation	<input type="checkbox"/>	
10. Fuse ratings correct	<input type="checkbox"/>	
11. Quality Control		
a) Spare cores earthed	<input type="checkbox"/>	
b) Lugs crimped correctly	<input type="checkbox"/>	
c) Panel holes closed	<input type="checkbox"/>	
d) Wiring condition/trunking	<input type="checkbox"/>	
e) Junction boxes	<input type="checkbox"/>	
f) Control panels	<input type="checkbox"/>	
g) All CT circuits closed	<input type="checkbox"/>	
12. Panel labelling		
h) DC panel	<input type="checkbox"/>	
i) AC panel	<input type="checkbox"/>	
j) Control panel front	<input type="checkbox"/>	
k) Control panel back	<input type="checkbox"/>	
l) Relay panels front	<input type="checkbox"/>	
m) Relay panels back	<input type="checkbox"/>	
13. Protection settings implemented	<input type="checkbox"/>	
14. In/out commissioning sheets updated	<input type="checkbox"/>	
15. Updated in/out commissioning sheets handed to Planning and Performance	<input type="checkbox"/>	
Commissioning documentation completed (tick when applicable) http://txweb.eskom.co.za/docManagement/part_b.htm		
<input checked="" type="checkbox"/> Feeder Commissioning <input type="checkbox"/> SCASS Document <input type="checkbox"/> Isolator Commissioning	<input type="checkbox"/> CVT Commissioning Document <input type="checkbox"/> Breaker Commissioning <input type="checkbox"/> Measurement and Metering Document	<input type="checkbox"/> Current Transformer Commissioning <input type="checkbox"/> Teleprotection Document
Accepted by Secondary Plant Manager or Delegate		
Name	Signature	Date


Annex S – Transmission bus coupler/bus section bay check sheet

	Transmission Bus Couple/Bus Section Bay Check Sheet	Unique Identifier	240-54615413 Annex S
		Document Type	Form
		Revision	Draft 0.1
		Effective Date	November 2012
		Group Technology	

Transmission Bus Coupler/Bus Section Bay Check Sheet

SUBSTATION		
PLANT		
SCOPE OF WORK		
Items Completed	(Tick if Executed/ Applicable)	Signature
1. Defect Report	<input type="checkbox"/>	
2. As-built drawings (one set on site and one set sent for revision)	<input type="checkbox"/>	
3. Commissioning test results as per Quality Manual (refer to item 16)	<input type="checkbox"/>	
4. ENCOR database updated	<input type="checkbox"/>	
5. Controls and Alarms tested to Control	<input type="checkbox"/>	
6. Complete Functional check done from Panel	<input type="checkbox"/>	
7. Bus zone link selection checked to BZ Panel (correct contacts used). High imp. (Ph1) and medium imp. (Ph2) BZ use 'G' contacts for operating the selection relay on the BZ and low imp. (Ph3 and Ph5) use 'M' contacts	<input type="checkbox"/>	
8. Bus Zone and Breaker fail trips connected in Feeder and Bus Zone panels and checked	<input type="checkbox"/>	
9. No DC earth fault on Substation	<input type="checkbox"/>	
10. Fuse ratings correct	<input type="checkbox"/>	
11. Quality Control		
a) Spare cores earthed	<input type="checkbox"/>	
b) Lugs crimped correctly	<input type="checkbox"/>	
c) Panel holes closed	<input type="checkbox"/>	
d) Wiring condition/trunking	<input type="checkbox"/>	
e) Junction boxes	<input type="checkbox"/>	
f) Control panels	<input type="checkbox"/>	
g) All CT circuits closed	<input type="checkbox"/>	
12. Panel labelling		
a) DC panel	<input type="checkbox"/>	
b) AC panel	<input type="checkbox"/>	
c) Control panel front	<input type="checkbox"/>	
d) Control panel back	<input type="checkbox"/>	
e) Relay panels front	<input type="checkbox"/>	
f) Relay panels back	<input type="checkbox"/>	
13. Protection settings implemented	<input type="checkbox"/>	
14. In/out commissioning sheets updated	<input type="checkbox"/>	
15. Updated in/out commissioning sheets handed to Planning and Performance	<input type="checkbox"/>	
Commissioning documentation completed (tick when applicable) http://txweb.eskom.co.za/docManagement/part_b.htm		
<input checked="" type="checkbox"/> B/C-B/S Bay Commissioning <input type="checkbox"/> CVT Commissioning Document <input type="checkbox"/> Isolator Commissioning	<input type="checkbox"/> SCASS Document <input type="checkbox"/> Breaker Commissioning	<input type="checkbox"/> Current Transformer Commissioning <input type="checkbox"/> Measurement and Metering Document
Accepted by Secondary Plant Manager or Delegate		
Name	Signature	Date


Annex T – Transmission shunt capacitor bank check sheet

	Transmission Shunt Capacitor Bank Check Sheet	Unique Identifier	240-54615413 Annex T
		Document Type	Form
		Revision	Draft 0.1
		Effective Date	November 2012
		Group Technology	

Transmission Shunt Capacitor Bank Check Sheet

SUBSTATION			
PLANT			
SCOPE OF WORK			
Items Completed	(Tick if Executed/ Applicable)	Signature	
1. Defect Report	<input type="checkbox"/>		
2. As-built drawings (one set on site and one set sent for revision)	<input type="checkbox"/>		
3. Commissioning test results as per Quality Manual (refer to item 16)	<input type="checkbox"/>		
4. ENCOR database updated	<input type="checkbox"/>		
5. Controls and Alarms tested to Control	<input type="checkbox"/>		
6. Complete Functional check done from Panel	<input type="checkbox"/>		
7. Bus zone link selection checked to BZ Panel (correct contacts used). High imp. (Ph1) and medium imp. (Ph2) BZ use 'G' contacts for operating the selection relay on the BZ and low imp. (Ph3 and Ph5) use 'M' contacts	<input type="checkbox"/>		
8. Bus Zone and Breaker fail trips connected in Feeder and Bus Zone panels and checked	<input type="checkbox"/>		
9. No DC earth fault on Substation	<input type="checkbox"/>		
10. Fuse ratings correct	<input type="checkbox"/>		
11. Quality Control			
a) Spare cores earthed	<input type="checkbox"/>		
b) Lugs crimped correctly	<input type="checkbox"/>		
c) Panel holes closed	<input type="checkbox"/>		
d) Wiring condition/trunking	<input type="checkbox"/>		
e) Junction boxes	<input type="checkbox"/>		
f) Control panels	<input type="checkbox"/>		
g) All CT circuits closed	<input type="checkbox"/>		
12. Panel labelling			
a) DC panel	<input type="checkbox"/>		
b) AC panel	<input type="checkbox"/>		
c) Control panel front	<input type="checkbox"/>		
d) Control panel back	<input type="checkbox"/>		
e) Relay panels front	<input type="checkbox"/>		
f) Relay panels back	<input type="checkbox"/>		
13. Protection settings implemented	<input type="checkbox"/>		
14. In/out commissioning sheets updated	<input type="checkbox"/>		
15. Updated in/out commissioning sheets handed to Planning and Performance	<input type="checkbox"/>		
Commissioning documentation completed (tick when applicable) http://txweb.eskom.co.za/docManagement/part_b.htm			
✓ Capacitor Bay Commissioning	<input type="checkbox"/> SCASS Document	<input type="checkbox"/> Current Transformer Commissioning	
<input type="checkbox"/> CVT/VT Commissioning Document	<input type="checkbox"/> Breaker Commissioning	<input type="checkbox"/> Measurement and Metering Document	
<input type="checkbox"/> Isolator Commissioning			
Accepted by Secondary Plant Manager or Delegate			
Name	Signature	Date	

Annex U – Tick sheet for handover per bay for use on Distribution projects

	Tick Sheet for Handover per Bay for use on Distribution Projects	Unique Identifier	240-54615413 Annex U
		Document Type	Form
		Revision	Draft 0.1
		Effective Date	November 2012
		Group Technology	

Tick Sheet for Handover per Bay for use on Distribution Projects

NOTE: This sheet should be used by the Eskom Project Coordinator/Consultant or their clerk of works to verify that the appointed commissioning resource (Contractor or Eskom) has completed and handed over the relevant commissioning documents as per 240-54615413.

SUBSTATION		BAY	
SCHEME TYPE		DATE	
NAME OF COMMISSIONING RESOURCE			

Items Completed	(Tick if Executed/ Applicable)
1. Pre-commissioning	
a) Head of Commissioning Appointment Form (Annex C)	<input type="checkbox"/>
b) Proof of calibration of test equipment	<input type="checkbox"/>
c) Commissioning Team Leader Appointment Form (Annex D)	<input type="checkbox"/>
2. Post-commissioning documents	
a) Marked up drawings (three sets)	<input type="checkbox"/>
1) Copy for Drawing Office	<input type="checkbox"/>
2) Copy for EDFs	<input type="checkbox"/>
3) Copy in Substation	<input type="checkbox"/>
b) Checklists (excluding on-load checks); select applicable annexes. Annex B is compulsory. Per bay commissioned as per 240-54615413.	
1) Protection Data Asset Capture Form (Annex B)	<input type="checkbox"/>
2) Distribution Transformer Commissioning Checklist (Annex G)	<input type="checkbox"/>
3) Distribution HV Feeder Commissioning Checklist (Annex H)	<input type="checkbox"/>
4) Distribution Rural Feeder/Cable Feeder/Bus Section/Bus Coupler Commissioning Checklist (Annex I)	<input type="checkbox"/>
5) Distribution Bus-zone Commissioning Checklist (Annex J)	<input type="checkbox"/>
6) Distribution Arc Detection Commissioning Checklist (Annex K)	<input type="checkbox"/>
7) Distribution Capacitor Bank Commissioning Checklist (Annex L)	<input type="checkbox"/>
8) Distribution Under-frequency Commissioning Checklist (Annex M)	<input type="checkbox"/>
c) Commissioning Test Results (excluding on-load checks)	
1) Proof of applied settings sent to Settings Engineer	<input type="checkbox"/>
2) Proof of applied settings sent to EDFs Protection Senior Supervisor	<input type="checkbox"/>
3) PDAC Form and Proof of Task Instructions and Technical Bulletins complete	<input type="checkbox"/>
4) Test results are on soft copy (Omicron test file)	<input type="checkbox"/>
5) Commission Engineer has done audit per bay (at least two weeks before Energization)	<input type="checkbox"/>
6) Protection Equipment Energization Handover Certificate (Annex E) complete	<input type="checkbox"/>
3. Post-energization	
a) Completed checklists (including on-load checks)	<input type="checkbox"/>
b) Commissioning test results (including on-load checks)	<input type="checkbox"/>
c) Completion of Protection Equipment Asset Handover Certificate (Annex F)	<input type="checkbox"/>