

Title: **STANDARD FOR THE
LABELLING OF ELECTRICAL
EQUIPMENT WITHIN ESKOM
WIRES NETWORKS**

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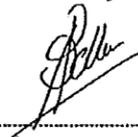


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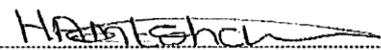


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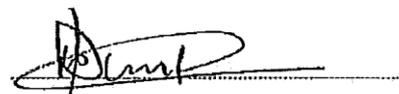


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1. Introduction

This standard is based on and it complies with OHS Act requirements; it was originally prepared / compiled to standardize the labelling of high voltage Equipment within Eskom Wires Networks.

Labelling is a statutory requirement of the Occupational Health and Safety Act (OHS Act) No 85 of 1993. The act states that all controlling apparatus shall be permanently marked so as to identify the system or part of the system it is made up of.

2. Supporting clauses

2.1 Scope

2.1.1 Purpose

The purpose of this document is to standardize labelling of all equipment in Eskom Wires substations, Cable Network and Overhead Lines.

2.1.2 Applicability

This standard applies to all labelling in the Eskom Wires Networks. Retrofitting of labels to meet the requirements of this standard is not mandatory for existing installations but when significant additions / alterations / refurbishment to a substation or line takes place all labelling shall be changed to meet this standard. Where an existing label does not uniquely identify the relevant equipment, or constitutes a possible danger, the label shall be changed immediately.

2.2 Normative/informative references

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

2.2.1 Normative

- [1] Occupational Health and Safety Act and Regulations (OHS Act);
- [2] 240-114967625, Operating Regulations for High Voltage Systems (ORHVS);
- [3] ISO 9001, 2000 Quality Management Systems;
- [4] D-DT-8012, Marker Cable Route Concrete;
- [5] 0.54/404, Electrical equipment enamelled labels details;
- [6] 240-82737065: MV/LV Pole Numbering;
- [7] DDT-5050: MV/LV Line Labelling;
- [8] 0.54/5577, Electrical equipment enamelled labels text layout;
- [9] 240-75660336, The Standard for Design, Manufacturing and Installation of Eskom Wires Business Equipment Labels;
- [10] 240-89556857, Distribution Group's Specific Representation Of Operating Diagrams In The Field – Station Electric Diagrams;
- [11] 240-77297024, Standard For Operating Diagrams For Eskom Transmission Substations;
- [12] 240-56065131, Specification for 11 kV to 33kV Withdrawable Pattern Air-Insulated Indoor Primary Switchgear Standard.
- [13] 240-62629353, Specification For Panel Labelling Standard;
- [14] 240-56362221, Standard For Safety Signs Used In DC Applications; and

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[15] 240-80139037, Statutory Safety Signs In Transmission Sub-Stations And Buildings.

2.2.2 Informative

None

2.3 Definitions

All definitions in the OHS Act 85 and 240-114967625 as well as the following are applicable:

2.3.1 General

| Definition | Description |
|-----------------------------------|---|
| Substation | Means a site on which any transforming, switching or linking apparatus forming part of the power system is situated and on which no active power-generating equipment other than auxiliary generating sets is situated. The term 'substation' includes distribution stations and switching stations. |
| Outdoor Switching stations | Means a site situated outdoors where only switching and linking takes place. No transforming takes place |
| Indoor Switching stations | Means a site situated indoors where only switching and linking takes place. No transforming takes place. |
| Power Equipment | All equipment that are operating or functioning at system voltage above 1000 V i.e. 6.6 kV, 132 kV, 400 kV etc. |
| Auxiliary Equipment | All equipment that are operating or functioning at system voltage below 1000 V |
| Greenfield Substations | Development of a substation on land that had never been used before. The term also relates to creating a substation from the ground up without the need to consider previous work. |
| Auxiliary Transformer | A transformer intended to provide supply to the auxiliary equipment such as main transformer fans, protection and control equipment, building lighting, floodlighting, etc. with 400V |
| Secondary Transformer | A transformer (not an NEC or AUX) that is directly connected to another transformer and is intended to supply the load external to the substation or auxiliary transformers inside the substation. |
| Primary Transformer | Substation main transformers |

2.3.2 Disclosure classification

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

2.4 Abbreviations

All abbreviations in ORHVS and NRS 082, as well as the following, are applicable and a comprehensive list of abbreviations which could be used on labels is detailed in Annexure A:

| Abbreviation | Description |
|--------------|---|
| AUX | Auxiliary |
| BIPM | Business Integration and Performance Management |
| DCB | Disconnecting Circuit Breaker |
| DRG | Drawing |

| Abbreviation | Description |
|--------------|--|
| DX | Distribution |
| HMI | Human Machine Interface |
| LV | Low Voltage |
| OHS Act | Occupational Health and Safety Act |
| ORHVS | Operating Regulations for High Voltage Systems |
| SAP | Systems Applications and Products (software package) |
| SCADA | System Control And Dispatch Application |
| SED | Substation Engineering Department |
| SpM&S | Specialized Maintenance and Support |
| TX | Transmission |

2.5 Roles and responsibilities

- a) The labelling of all electrical equipment in terms of this standard shall be the responsibility of the relevant Managers (HV Plant Managers / O & M Managers) or their delegated appointee.
- b) The maintenance of all electrical network labelling documents and corresponding diagrams and drawings in terms of this standard is the responsibility of Group Technology Division.
- c) The purchase and fitting of all tower labels on lines which are Wires assets, when changes or additions are made, is the responsibility of the Operating Units (OUs).
- d) The designated person or his delegate shall ensure that all labels comply with the requirements in this standard.
- e) The field operator shall ensure that the electrical equipment labels correspond with the operating diagram before commencing with operating.
- f) It is the responsibility of the Project Manager / GMR 2.1 to ensure that the correct labels are erected and corresponds with the operating diagram and control equipment.
- g) Audits need to be conducted by BIPM and SpM&S, to assess the condition and legibility of electrical equipment labels, operating diagrams and control equipment (SCADA, HMI, SAP), in Wires to comply with this standard.

2.6 Process for monitoring

| Document number | Document title |
|-----------------|---|
| 240-45920887 | Process Control Manual (PCM) for Manage Maintenance Base |
| 240-52380420 | Steering Committee of Technologies (SCOT) Standards Development and Change Implementation Procedure |

2.7 Related/supporting documents

This standard supersedes all other application standards pertaining to the equipment labels in Eskom Transmission and Distribution Substations including the following:

| Document number | Document title |
|-----------------|----------------|
|-----------------|----------------|

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| Document number | Document title |
|-----------------|--|
| DST_34-1439 | Standard For The Labelling Of Substations And Networks Labels |
| TST_41-1009 | Standard For The Labelling Of Outdoor High Voltage Equipment Within Eskom Transmission Substations |
| ESKASAAN0 | Standard For The Labelling Of High Voltage Equipment |

3. Requirements

3.1 General

No variations from this standard shall be allowed in any form unless approved by the Eskom Wires Business.

3.1.1 Substation Names and Line Codes Registration

- a) All substations names, lines names and line codes shall be managed according to Wires Business data requirements to avoid duplications.

3.1.2 Basic Labelling Requirements

- a) The basic requirements to follow when labelling the electrical equipment shall be as follows:
- Labelling composition shall be as per the approved abbreviations within the Wires business.
 - Labelling shall provide unique identification of individual electrical equipment within a given substation or network.
 - Labelling of electrical equipment shall not be in conflict with any other label within a given substation or network.
 - In substations where stations have transformers of differing ratios, the transformers with the highest primary voltage, highest secondary voltage and have the lowest voltage ratio in the substation shall be numbered from 1 to 9; and the transformers with the next highest primary and secondary voltages with the next lowest voltage ratio shall be numbered from 11 to 19 etc.

3.1.3 Safety

3.1.3.1 Statutory Requirements

The OHS Act No. 85 of 1993, Electrical Machinery Regulations 7 (4) states: "The user shall mark or label all controlling apparatus permanently so as to identify the system or part of the system on the electrical machinery which it controls, and where such control apparatus is accessible from the front and back these markings shall be on both the front and the back".

3.1.3.2 For statutory safety sign and battery rooms refer to the applicable standards i.e.:

- The Standard for Design, Manufacturing and Installation of Eskom Wires Business Equipment Labels (240-75660336) Annexure A;
- The following references are applicable for statutory safety sign and battery rooms:
 - 240-62629353, Specification For Panel Labelling Standard
 - 240-56362221, Standard For Safety Signs Used In DC Applications
 - 240-80139037, Statutory Safety Signs In Transmission Sub-Stations And Buildings

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3.1.4 Language

The wording on labels shall be in English.

3.1.5 Spare / Unused Panels

Where a panel/bay or any apparatus is permanently taken out of service and not part of the system, all such labels shall be removed.

Spare panel/bay or apparatus shall be labelled as such.

3.1.6 Labelling Abbreviations Usage

- a) All substation and feeder names can be written out in full without abbreviation with the exception of equipment type being referred to e.g. CRAIGHALL 1 TRFR 1 400/275/22kV not CRAIGHALL 1 TRANSFORMER 1 400/275/22kV.
- b) All equipment classes / names shall be abbreviated, examples are found in Annex A e.g. TRFR and not TRANSFORMER.
- c) Abbreviation shall be in uppercase except for "k" in kV and "o" in No. No full stops shall be used.

Note 1: In term of this documents capital letters or uppercase is used or employed to ensure maximum label visibility to the appointed operator, it is safety consideration in ensuring the apparatus is positively identified.

- d) Units such as V, A, kV, VAr etc. must always have a space between value and the unit, e.g. 88 kV.
- e) Where a substation or place has a numeral included in the names, the numeral shall be written out in full, for example, NORTH WEST SEVEN and not NORTH WEST 7.
- f) Abbreviations consisting of a single character that stands alone shall not be used except the abbreviation V for VOLT and T for Tee-off may be used, for example, 400 V.
- g) Voltages below 1000 V shall not be expressed as fractions of kilovolts, for example, 22 kV/400 V and not 22 kV/0.40 kV.
- h) The abbreviation BUS may only be used in conjunction with bus coupler and bus section bays and not when referring to a busbar. Example: 132 kV BUSBAR or 132 kV B/B and not 132 kV BUS

3.2 Substation Labelling

The requirements below shall also apply to all "Greenfield Substations" (new substations) as well as situations where the entire or major sections of the substation are being refurbished.

3.2.1 Labelling Philosophy

The following labelling philosophy shall be applied when deciding the wording and sequence on the label:

Note 1: In the Panel / Bay (i.e. Transformer bay, Feeder bay, Section bay etc) where all or a number of apparatus are grouped or compacted in one or connected in series by the jumper in such a way that the independent / individual maintenance cannot be undertaken or the identification of individual apparatus for the purpose of labelling or operating / naming is not possible or is difficult, such apparatus shall first be identified / named as a group, ie "Isolator, Earth Switch, CT and / or breaker" in the MTGIS, Section Bay consisting of two isolators whether equipped with earth switches or not etc.

- a) Firstly identify the feeder/network name/panel/bay;
- b) Secondly identify the voltage;
- c) Thirdly identify the specific function of the equipment.

Note 2: Panel / Bay (i.e. Transformer bay, Feeder bay, Section bay etc) is all apparatus that constitutes a circuit up to and including the busbar isolating points but excludes the busbars.

Note 3: Do not duplicate the voltage and function on the label.

Note 4: Exceptions: Busbars shall be labelled according to 3.2.3.1. (The voltage must precede the identified busbar, example 132 kV B/B 1).

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3.2.2 Label Types and Colours

3.2.2.1 Substation Operating Labels

- a) All outdoor power equipment operating labels including blockhouse substations and switching stations shall be black lettering on an orange background.
- b) All earth labels shall be white lettering on a black background. Refer to 240-75660336.
- c) All indoor/control plant panel labels shall be black lettering on white background, and
- d) Labelling convention for GIS shall be the same as for HV yards / section “3.2 Substation Labelling” above.

Note 1: Yellow background shall only be used on networks.

3.2.2.2 Auxiliary Labels / Information Labels

- a) All general information labels relating to substation equipment shall have black lettering on a white background.

Example: oil sampling points, Junction box, etc.

3.2.2.3 Warning Labels

- a) All warning labels relating to substation equipment shall have white lettering on a red background.

3.2.2.4 Phase Identification Labels

- a) Phase identification labels shall have a black letter identifying the phase on a label in the phase colour (Red, White, Blue).

3.2.3 Substation Equipment

This includes equipment located within substation yard fencing and enclosures (ie. brick kiosk, transformer, busbar etc.).

3.2.3.1 Busbars

(Including outdoor busbars, busbar floors, indoor SF₆ and metal-clad switchgear installations)

- a) All busbars and sections of busbar shall be labelled at both ends of the busbar.
- b) Where a busbar is split by means of a section isolator/s or breaker/s, the sections of busbar shall be identified as **A, B, C** etc., for example:

132 kV B/B 1A

132 kV B/B 1B

132 kV B/B 1C

Note 1: See annexes B & K for diagrams.

- c) Where there is only one busbar it shall be labelled as **132 kV B/B 1**. Where there is more than one busbars, they shall be labelled as **132 kV B/B 1** and **132 kV B/B 2** or according to their applicable function, for example: **132 kV TRANS B/B 1 (132 kV B/B 2 BYPASS B/B)**, **132 kV TRFR B/B 1** and **132 kV LINE B/B 1**.
- d) Metal-clad switchgear busbar blanking plates/removable panels shall have ‘**DANGER - DO NOT REMOVE**’ in white lettering on red background. The busbar label shall be fixed above or below the blanking plate/removable panel.

3.2.3.2 Phase identification labels

- a) All panels/bays, including busbar sections, shall be fitted with phase identification labels. Phase identification labels shall be located at the ends of the panel/bay.
- b) Additional phasing discs can be installed on all 765 kV Circuit Breakers, Stand-alone three phase Isolators, Earth Switches, all single phase operated isolators, CT’s, VT’s, and SA’s.

- c) Additional phasing discs shall be installed on all Circuit Breakers, Stand-alone three phase Isolators, Earth Switches, all single phase operated isolators installed in the substation employing breaker and half configuration.

3.2.3.3 Transformers

- a) Only transformers performing special duties such as auxiliary transformers (AUX TRFR), earthing transformers (NEC), etc., shall be labelled as such, power transformers shall commonly be termed transformers (TRFR).

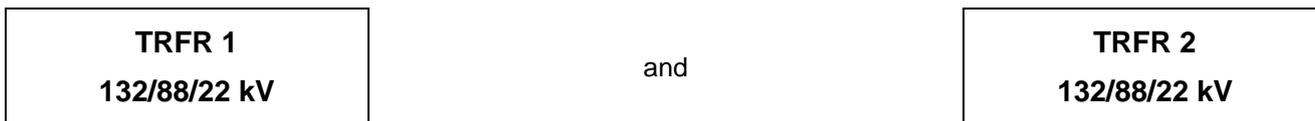
3.2.3.3.1 Primary transformers

All transformers shall be labelled on the primary and secondary sides and, where applicable, the tertiary side.

Note 1: The voltages of tertiary windings are not taken into account when determining transformer numbering.

Note 2: See annex E for diagrams.

- a) In substations where transformers of different ratios are installed the following criteria shall apply in numbering them:
 - The transformers with the highest primary voltage, highest secondary voltage and has the lowest voltage ratio in the substation shall be numbered from 1 to 9;



- The transformers with the next same highest primary and secondary voltages and has the next lowest voltage ratio in the substation shall be numbered from 11 to 19 shall be numbered as follows:



- The next groups of transformers will be labelled 21 to 29, 31 to 39 etc.



Note 3: See annex F for diagrams.

- b) Where two transformers are banked onto a common breaker on either the high voltage or low-voltage side (or both sides) the individual transformers shall have the same number and shall be identified by the addition of A and B, for example:



- c) Where two transformers are banked onto a common breaker on the high-voltage side but have different secondary voltages they shall also be numbered A and B as below, for example:



d) Where only one transformer of a particular ratio exists at a station it shall still be identified by a number, for example:

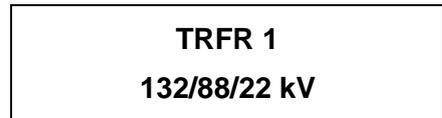


3.2.3.3.2 Secondary transformers

Note 1: See annex T for diagrams.

a) Where a secondary transformer (not an NEC or AUX) is directly connected to another transformer (generally to the tertiary or low voltage winding) the secondary transformer shall bear the name of the transformer to which it is connected followed by the secondary transformer ratio, for example:

Primary transformer



Secondary transformer



3.2.3.3.3 Single-phase units

a) Where single-phase units are installed each unit shall be individually labelled and have phase identification labels.

3.2.3.3.4 Line banks

Note 1: See annexes F and G for diagrams.

a) Transformers connected or linked to a line shall be identified in accordance with the line to which it is connected. (For clarification see Operating High Voltage Systems, 240-114967625), for example:

b) At Craighall, Sandpark and Bryanston are line bank feeders. The transformers at Sandpark and Bryanston shall therefore be labelled:

At Sandpark



and

At Bryanston

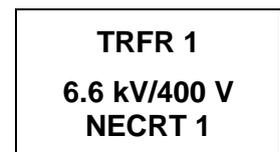


3.2.3.3.5 Earthing transformers (NEC/NER/NECRT)

Note 1: See annex L & BB for NECRT diagrams.

a) Where an earthing transformer is directly connected to another transformer it shall primarily be identified by the designation of the transformer to which it is connected, followed by the voltage level for which the neutral earthing point is being provided and finally also numerically, for example:

for a single unit



for twin units

TRFR 1
6.6 kV NEC 1

TRFR 1
6.6 kV NER 1

TRFR 1
6.6 kV/400 V
NECRT 1

TRFR 1
6.6 kV NEC 2

TRFR 1
6.6 kV NER 2

TRFR 1
6.6 kV/400 V
NECRT 2

- b) Where an earthing transformer also has an auxiliary winding the abbreviation (T) shall be added even if the auxiliary winding is not being used, for example:

TRFR 1
6.6 kV/400 V NECT 1

TRFR 1
6.6 kV/400 V NERT 1

3.2.3.3.6 Auxiliary transformers

- a) Where an auxiliary transformer is directly connected to another transformer, it shall primarily be identified by the designation of the transformer to which it is connected, followed by its own designation and finally also numerically, for example:

for a single unit

TRFR 11
6.6 kV/400 V AUX TRFR 1

for twin units

TRFR 11
6.6 kV/400 V AUX TRFR 1

and

TRFR 11
6.6 kV/400 V AUX TRFR 2

3.2.3.3.7 Voltage transformers / Current transformers

Note 1: See annex C & K for diagrams.

- a) Voltage/current transformers shall be identified by at least one label on the centre phase unit. The identification shall include the panel/bay name to which the VT/CT is connected. for example:

TRFR 1
88 kV CT

CRAIGHALL 1
88 kV CT

88 kV B/B 1A
VT

3.2.3.3.8 Reactors

Note 1: See annexes M, N, O, R, S, U, Y & BB for reactor diagrams.

- a) Reactors shall be numerically identified even if they are singular items of equipment, for example:

RX 1
66 kV

or

RX 1
132 kV

or

RX 1
400 kV

- b) Reactors connected or linked to a line shall be identified by the line to which they are connected or linked, even if the line reactor can be linked as a busbar reactor. In case of reactors where the feeders are not yet connected, the reactor shall be numbered numerically, for example:

WITKOP ONE
132 kV RX 1

TRFR 1
132 kV RX 1

- c) Where substations have reactors of differing voltages, the reactor group having the highest voltage shall be numbered from **1** to **9**; the next highest voltage group from **11** to **19** etc (see 3.2.3.3.1.)

3.2.3.4 Breakers (air break switches/auto trip switches)

- a) All labels shall be fitted so that they are visible from the point of operation. Where single-phase mechanisms are installed each mechanism shall be individually labelled and have phase identification label.

3.2.3.4.1 Transformer breakers

Note 1: See annex C, E, F etc. for diagrams.

- a) Circuit-breaker labels shall be attached at the mechanism box, for example:

TRFR 1
88 kV BKR

TRFR 1
88 kV A/B SW

- b) Where one breaker or air break switch controls the HV side of transformer or double banked transformers, the label shall be, for example:

TRFR 1AB
88 kV BKR

or

TRFR 1AB
88 kV A/B SW

3.2.3.4.2 Feeder breakers/Recloser

- a) Circuit-breaker/recloser labels shall be attached close to the mechanism box so as to positively identify the equipment, for example:

For radial and ring feeders only the destination name shall be used.

KLEVEBANK 1
88 kV BKR

3.2.3.4.3 Bus coupler breakers

Note 1: See annex B & S for diagrams.

- a) Where two parallel bus-bars are coupled by a breaker, the breaker shall be labelled as follows:

B/CPL A
400 kV BKR

- b) Where there is more than one bus coupler, each coupler shall be numbered in alphabetical sequence.

B/CPL A
132 kV BKR

B/CPL B
132 kV BKR

c) A transfer bus coupler shall be labelled as:

**TRANS B/CPL A
275 kV BKR**

3.2.3.4.4 Busbar section breakers

Note 1: The breaker that splits the busbar into sections shall be referred to as a section breaker and not bus section breaker, hence the terminology "SECT BKR" shall not be used on labels.

Note 2: See annexes B, K, R & T for diagrams.

a) Where a busbar is split by a breaker, the breaker shall be labelled numerically first identifying the busbar to which it is linked, for example:

**400 kV B/B 2
SECT BKR 1**

**400 kV B/B 2
SECT BKR 2**

3.2.3.4.5 Tee line breakers

Note 1: See annex J for diagrams.

Note 2: The circuit breaker at Lanseria only controls Lanseria and not Klevebank or Lomond.

a) All substation circuit breakers fed from tee lines shall be identified by the name of both substations or referred to as a local supply breaker.

b) For example the Klevebank/Lomond Two feeder tees off to Lanseria. The label at Lanseria shall therefore be:

**KLEVEBANK/LOMOND 2
88 kV BKR**

c) For example the Plank/Woody feeder tees off to Forest. The label at Woody shall therefore be:

**PLANK 1/FOREST T
66 kV B/B 1 ISOL**

3.2.3.4.6 400 V breakers

a) The 400 V breakers on auxiliary transformers shall be designated, for example:

1 **TRFR 11 AUX TRFR 1
400 V BKR 1**

2 **TRFR 12 AUX TRFR 1
400 V BKR 1** and **TRFR 12 AUX TRFR 1
400 V BKR 2**

3.2.3.4.7 Breaker-and-Half Scheme

Note 1: See annex BB for diagrams.

a) In the breaker-and-half scheme, each voltage level is identified by a unique letter of the alphabet as per Table 3.

- b) Each diameter will be named alphabetically instead of numerically. For example; the first 765 kV diameter will be named **MA** (**M** for the voltage level and **A** to identify it as the first diameter. (A diameter is the connection of two parallel busbars connected together by two or three circuit breakers.)
- c) A typical example of the breaker-and-half scheme is detailed in Annexure BB.

Table 1: Diameter Naming / Voltage Level

| VOLTAGE | DESIGNATED LETTER |
|---------|-------------------|
| 765 kV | M - Magenta |
| 400 kV | G - Green |
| 275 kV | O - Orange |
| 220 kV | T - Tangerine |
| 132 kV | B - Blue |

3.2.3.4.8 MTGIS

Note 1: See annex C for diagrams.

- a) The MTGIS is made of a number of apparatus which operate on their own depending on the associated interlocks. These apparatus are built onto one another in a compact unit and this group shall first be labelled as a unit then all the manually operate able points shall also have their individual functional labels.

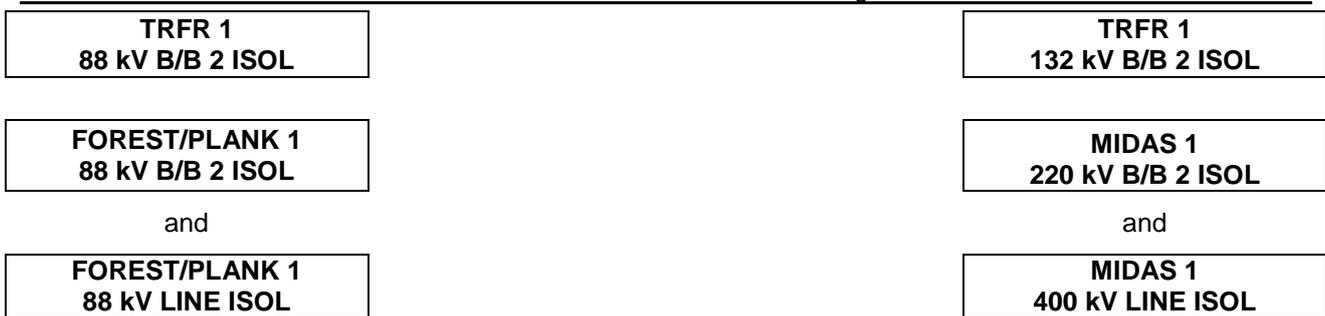
| Mixed Technology Gas Insulated Switchgear | BRYNORTH 88kV MTGIS | LULAMISA 88kV MTGIS |
|---|----------------------|----------------------|
| Earth Switch | 88kV LINE ISOL E/SW | 88kV LINE ISOL E/SW |
| Isolator | 88kV LINE ISOL | 88kV LINE ISOL |
| Current Transformer | 88kV LINE CT | 88kV LINE CT |
| Breaker | 88kV BRK | 88kV BRK |
| Current Transformer | 88kV B/B 1A CT | 88kV B/B 1A CT |
| Isolator | 88kV B/B 1A ISOL | 88kV B/B 1A ISOL |
| Earth Switch | 88kV B/B 1A BRK E/SW | 88kV B/B 1A BRK E/SW |

3.2.3.5 Isolators

- a) All isolators shall be labelled so as to be visible from the point of operation. The labels shall be fitted to support structures only and **NOT** on operating rods.

3.2.3.5.1 Gang operated isolators

- a) All gang operated isolators shall be labelled so as to be visible from the point of operation and all three-pole conventional busbar or line connected isolators shall be labelled as shown in the example below:



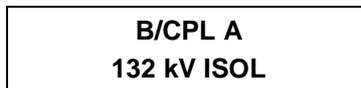
3.2.3.5.2 Pantograph isolators

- a) Where pantograph isolators are fitted each phase shall be individually labelled and have phase identification discs.

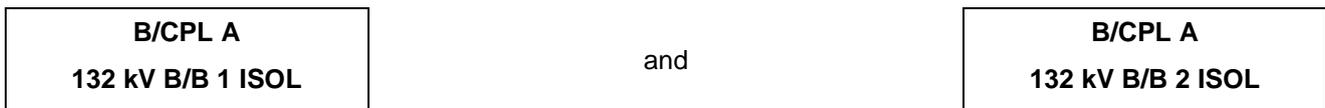
3.2.3.5.3 Bus coupling isolators

Note 1: See annex B & K for diagrams.

- a) Where two parallel bus-bars are coupled by isolators the isolators shall be labelled as:

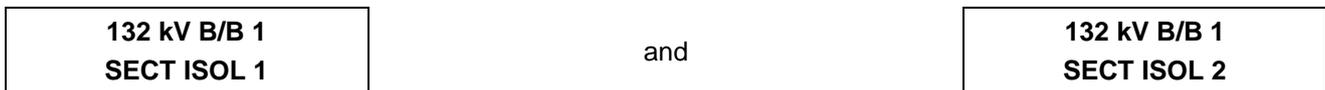


- b) Isolators on either side of a bus coupler breaker shall be labelled according to the bus-bar to which it is linked, for example:

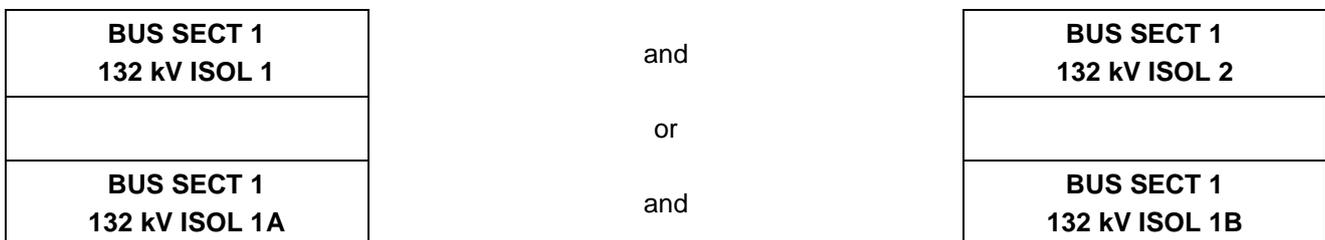


3.2.3.5.4 Section isolators

- a) Where a busbar is split by section isolators, the isolators shall be labelled numerically, for example:

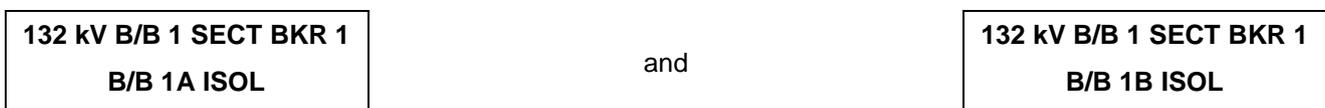


- b) Where a busbar is split by section isolator bays that has two isolators connected in series by a jumper, the isolators shall first be labelled as a unit (group e.g. BUS SEC 1, BUS SEC 2, etc.) and then individual isolators shall be labelled numerically or in accordance with the section of busbar to which individual isolator is linked to in the case that the busbar is split into a number of sections, for example:



Note 1: See annex C for diagrams.

- c) Isolators on either side of a bus section breaker shall be labelled in accordance with the section of busbar to which it is linked, for example:



Note 1: The isolator that splits the busbar into sections shall be referred to as a section isolator and not bus section isolator, hence the terminology "B/SECT ISOL" shall not be used on labels (see Annex C).

3.2.3.6 Earth switches

a) All earth switches shall be labelled in accordance with the standard ruling, for example:



3.2.3.7 Capacitors

Note 1: See annex K & Z for diagrams.

All capacitor bank labels shall be mounted on the entrance gate to the live chamber.

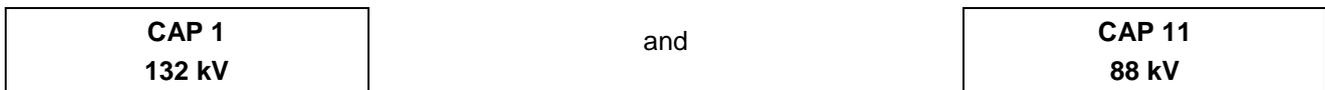
All capacitor banks shall be numbered, for example:



All equipment on a capacitor bank panel/bay shall first identify the capacitor and voltage and then its function, for example:



Where capacitor banks of different voltages are installed the banks with the highest voltage shall be numbered from 1 to 9, the next highest voltage from 11 to 19 etc., for example:

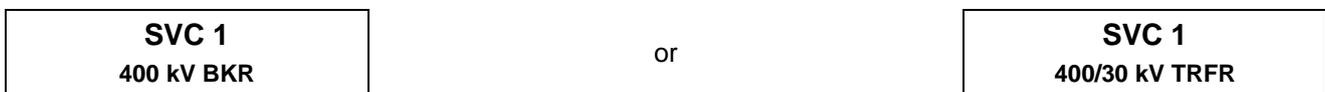
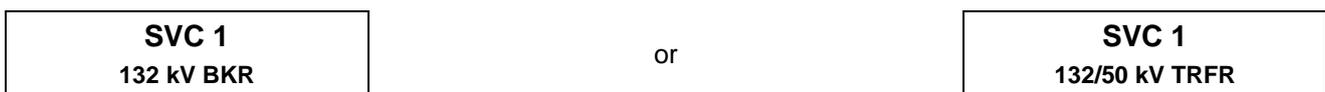


3.2.3.8 Static Var Compensators (SVCs)

Note 1: Single phase SVC units shall be identified by means of phase identification discs.

Note 2: See annex AA for diagrams.

All equipment on a SVC panel/bay shall first identify the SVC and voltage and then its function, for example:

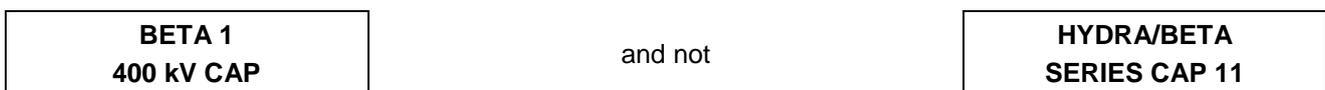


3.2.3.9 Series Capacitors

Note 1: See annex Z for diagrams.

Series capacitor banks located at the substation will be linked to the substation and not the line.

Example:



Series capacitor banks that are located mid-line span will be allocated substation name to which the series cap will be linked.

Example:

| | | |
|--------------------------------------|---------|--|
| KOMSBERG CAP 11 400 kV BYPASS BKR | and not | HYDRA/BETA CAP 11 400 kV BYPASS BKR |
|--------------------------------------|---------|--|

3.2.3.10 Junction boxes

All junction boxes shall be permanently labelled on the operational door (i.e. the door which opens to the control switches). The label shall clearly identify to which panel/bay it is linked, for example:

| | | |
|--------------|---------|------|
| TRFR 1 JB | and not | JB 1 |
|--------------|---------|------|

| | | |
|------------------------|----------|------------------------|
| TRFR 1 132 kV VT JB | and / or | TRFR 1 132 kV CT JB |
|------------------------|----------|------------------------|

All control switches shall clearly identify the equipment that is being controlled.

Note 1: Labels on un-used circuits shall be removed.

3.2.3.11 Control room (protection) panels (including indoor switchgear)

The label shall clearly identify the panel or bay on both the front and back of the panel, for example:

| | | |
|----------------------|----|----------------------|
| MINERVA 1 400 kV FDR | or | TRFR 1 275/132/22 kV |
|----------------------|----|----------------------|

All control switches on the panel shall clearly identify the equipment that is being controlled in terms of this standard and OHS Act.

The labels of switches/pushbuttons on control panels that control HV yard apparatus shall bear the same label inscription as the apparatus that it controls.

3.2.3.12 Fixed earthing ball points

All fixed earthing ball points shall be labelled with a unique numeric or alpha/numeric identification.

3.3 Overhead Labelling

3.3.1 Labelling Philosophy

3.3.1.1 Operating Points Label

The following labelling philosophy shall be applied when deciding the wording and sequence on line labels:

Identify a unique identifier, e.g.: pole number/stand number/installation number/area code/street/unique number as per register;

Note 1: Where two or more isolators are on the same structure each will be uniquely identified.

3.3.1.2 Pole/Structure Numbering

3.3.1.2.1 The philosophy for numbering poles/structure, between power stations:

- a) When a line is between two power station’s HV Yards – the first **two** letters of each power station, shall be used starting with the station having alphabetical precedence.
- b) Identify the sequential pole/structure number and this numbering must start from the power station having alphabetical precedence.

Example: Duvha- Majuba = **DU/MA 1** at Duvha and **DU/MA 10...** at Majuba.

3.3.1.2.2 The philosophy for numbering poles/structure, from power station to substation:

- a) When a line is between a power station and a substation – the first two letters of the power station shall be used followed by the first **three** letters of the substation.

- b) Identify the sequential pole/structure number and this numbering must start from the source power station.

Example: Majuba- Klaarwater = **MA/KLA 1** at Majuba and **MA/KLA 30...** at Klaarwater.

Note 1: Between a power station and a substation where a line forms a connection between a power station and a substation the name of the power station shall appear first.

3.3.1.2.3 The philosophy for numbering poles/structure, from substation to substation:

- a) Firstly identify the number of the line.
- b) Secondly identify the source and destination alphabetically and the first **three** letters of each substation shall be used starting with the substation having alphabetical precedence. In the case where names like “Port Shepstone” and “Port Edward” are substation names in question: _ where the first term of the two terms in the substation names is the same, an exception can be made whereby the first letter in the first term and the first two letters in the second term should be used ie. PSH and PED.
- c) Thirdly identify the sequential pole/structure number and this numbering must start from the source substation;

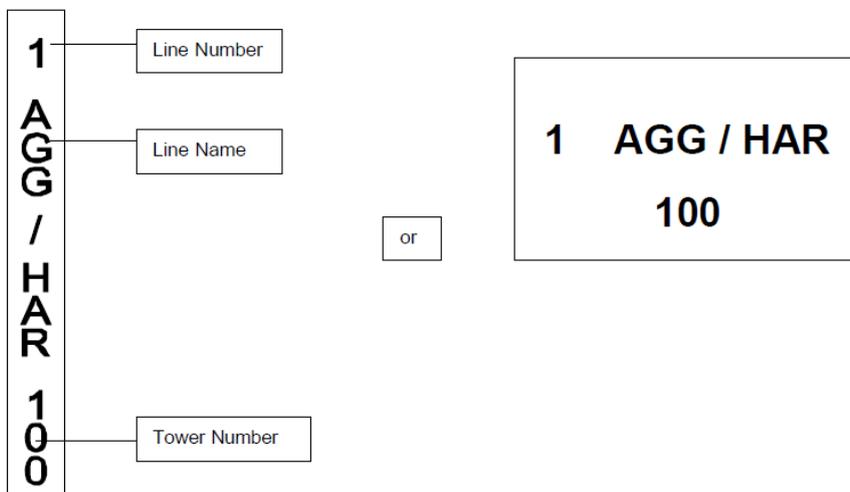
Example: Sol- Zeus = **SOL/ZEU 1** at Sol and **SOL/ZEU 50...** at Zeus.

Note 1: The reason for putting the line number first on the label is to prevent it from being interpreted as part of the pole/structure number, e.g. 2 KLE/LOM 2 and not KLE/LOM 2 2. The label is still interpreted as KLEVELAND/LOMOND line two, tower two.

Note 2: Due to Data Capture System (Smallworld) the length of the number on labels must be restricted to a maximum of 60 characters.

- d) The numbering of lines will be from station to station and not from breaker to breaker. Note this need to be written down(said) although it is the principle already used in the philosophy

Example: If the line name is, **Aggeneis Harib No 1**, at tower 100, the label shall read as follows:



3.3.1.2.4 The philosophy for numbering poles/structure, on networks/feeders:

- a) Identify the source substation and/or feeder/network name;
- b) Identify the sequential pole/structure number and this numbering must start from the source.

3.3.2 Label types and colours

3.3.2.1 Network labels

- a) Labels on HV and MV overhead line operating equipment and cable networks shall be black lettering on a yellow background.

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b) Labels on LV operating equipment shall be black lettering on a white background.

Note 1: Orange background shall only be used in the substations.

3.3.2.2 Line Crossing Labels

a) Line crossing labels shall be a black cross on a reflective background. Refer to 240-75660336.

3.3.3 Overhead Lines Labels

All towers and poles shall be labelled with a unique tower/pole identification number. All terminal towers, tee-off terminal towers and phase transposition shall have phase discs fitted.

Note 1: See annexes P & U for diagrams.

3.3.3.1 HV Tower/Pole Identification Label

- a) On towers, a single label that is visible from ground level as well as from a helicopter during an aerial line inspection shall be mounted at the waist of the tower.
- b) The single pole structure label shall be installed above five meters from the ground.
- c) The designation of a line shall be an abbreviation of the power station names, substation names and network / feeder names. The abbreviations used shall comply with the philosophies in section 3.1.6. above.
- d) All lines between substations shall be numbered numerically, for example, 1,2,3. Where these lines are of differing voltages they shall be numbered as follows, for example:

| | | | |
|---|------------------------------|---|------------|
| 1 | Bloukrans — Tugela is 132 kV | = | 1 BLK/TGA |
| 2 | Bloukrans — Tugela is 88 kV | = | 11 BLK/TGA |
| 3 | Bloukrans — Tugela is 66 kV | = | 21 BLK/TGA |
| 4 | Bloukrans — Tugela is 44 kV | = | 31 BLK/TGA |

Note1: “1” is added in front so as not to have to renumber the first line if a second line is added.

3.3.3.2 Deviations/Additional Structures

If it is necessary to erect additional towers in the feeder after the initial construction and numbering has been completed, such towers shall be given the numbers of adjacent towers (**lower order**), followed by suffix letters, for example, **123A**, if a second structure needs to be added in the same span, then it becomes **123B**.

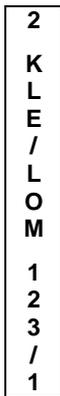
This applies only where no change, or very small changes, in feeder length are involved. Significant changes in line lengths or changes in terminal points shall require the whole feeder to be renumbered.

3.3.3.3 Tee Lines

All tees off main lines shall be numbered in accordance with the main line designation codes. This includes additional structures.

At the take-off T point (**for example, tower 123 or 123A**) the first tower / pole on the tee line shall be numbered **123/1** or **123A/1**, for example:

Klevebank - Lomond No 2 88kV line, a tee off to Lanseria Substation the coding would be either vertical or horizontal and as follows:-



or



Where tees are taken off tees the numbering of structures on the secondary tee shall be designated by the addition of a further stroke number, for example, 123/12/1.

3.3.3.4 Shared Structures And Double Circuit Lines

Where circuits of different voltages share a single structure each circuit shall be labelled individually. The label indicating the circuit with the highest voltage shall be physically located above the label indicating the circuit with the lower voltage.

Double circuit towers shall have two labels so that each line can be identified. The label shall be fixed below and on the same side of the tower as the circuit, which it identifies.

3.3.3.5 Line Crossings

- a) A line crossing label shall be attached to each longitudinal face of the bridge, on the first, second and third poles/towers on all sides of a crossing.
- b) For the purposes of labelling the following shall be considered to be line crossings:
 - where a line physically crosses over another line
 - where two lines converge to run parallel with each other in a single servitude;
 - all tee-off points; loop-in and loop-out and a line deviation more than 60° degrees
 - any situation that could pose a danger to a helicopter doing aerial inspections.

3.3.3.6 Inter-Connector (normally Open Point between Two Feeders)

- All poles / structures shall be uniquely identified in accordance with the philosophy of labelling. (See 3.3.1).
- Only one structure label that is to be decided by project engineer/field services engineer is to be placed on the normally open points. The structure label shall be placed on the pole that has the shorter length.

Note 1: The section indicating normally open on the label shall be a separate label to facilitate the moving of the normally open point (change of the operating point status).

Note 2: Only one label shall identify the pole/structure.

3.3.4 MV Operating and Equipment Labelling

- a) Equipment labels are separate from the pole identification label and must be fitted as near as possible to the equipment it is identifying and must be visible from the point of operating.
- b) A general description of equipment would have to be used in conjunction with a unique pole number or alternatively a unique no. or code can be used on its own.

3.3.4.1 MV Pole / structure identification Labels

- All poles / structures shall be uniquely identified in accordance with the philosophy of labelling. (See 3.3.1).
- All labels shall be alpha numeric. The alpha digits denote the substation and feeder / network name. The numeric digits denote the pole number.
- Multiple pole structures are to be considered as a single pole and given one pole number only.
- Where LV and MV are on a common pole / structure the MV label is used. However where it can assist in the identification of LV circuits and / or customers a separate LV label can also be affixed.
- Where operating equipment is mounted on a pole / structure the equipment label is in addition to the pole / structure identification.

Note 1: The label layout and label colour shall conform to network philosophy, see 3.3.1. & 3.3.2.

3.3.4.1.1 Pole mounted control equipment

Pole mounted breakers / sectionalisers are to be labelled as:

pole number e.g.

PGF49

or

SB56

Pole mounted voltage regulators are to be labelled as:

pole number e.g.

PGF49/16

or

REG43

3.3.4.1.2 Pole mounted control and isolation configuration

Where control and isolation equipment is mounted together on a single structure the labelling shall be as follows:

The isolator on the feeder (incoming) side of the pole mounted breaker shall be labelled as:

S1

in conjunction with Pole No. label or

S123

The isolator on the load (outgoing) side of the pole mounted breaker shall be labelled as:

S2

in conjunction with Pole No. label or

S124

The isolator that by-passes the pole mounted breaker shall be labelled:

S3

in conjunction with Pole No. label or

S125

3.3.4.1.3 Pole mounted transformer

All pole mounted transformers shall be uniquely identified by the area code and number/pole number, e.g

PGF49

or

UMZR56

If only the pole number is used as the identification of the installation and the MV isolator and the transformer are situated on the same structure then only one label is necessary.

3.3.4.1.4 Isolators

For pull stick isolators and gang operated isolators:

pole number e.g.

PGF49/15

or

S345

For drop out fuse isolators:

pole number e.g.

PGF49/16/13

or

T123L1

3.3.5 LV Operating point labelling

3.3.5.1 LV Pole/structure identification Labels

- a) All LV poles / structures are to be identified in accordance with the MV numbering system.
- b) Where multiple LV feeders are fed from a single source the individual feeders shall be identified by the addition of A or B or C to the end of the pole identification number.

Note 1: All Operating point labels shall be fitted as near as possible to the equipment it is identifying and must be visible from the point of operating.

- c) The LV equipment shall be labelled as follows:

- Isolators

All isolators shall be uniquely labelled.

- Fuses

Fuses shall be uniquely labelled and indicate the current rating.

- Circuit Breakers

Where customers are fed directly via a circuit breaker each circuit breaker (pole top make-off) shall be uniquely labelled A, B, C, etc.

3.4 Cable Underground Systems Labelling

3.4.1 MV Labelling Philosophy

3.4.1.1 Mini-Sub and RMU

- a) All ground level and mini-substations shall be uniquely labelled. so as to identify the feeder name, customer name/stand number and nominal voltage per the example where:
 - 1) In this instance DT Sandton Towers denotes the source substation (Doring) and feeder name (Thorn unique name / stand number / substation number of the mini-sub / RMU).
 - 2) Each door must be labelled with the nominal voltage to be accessed.

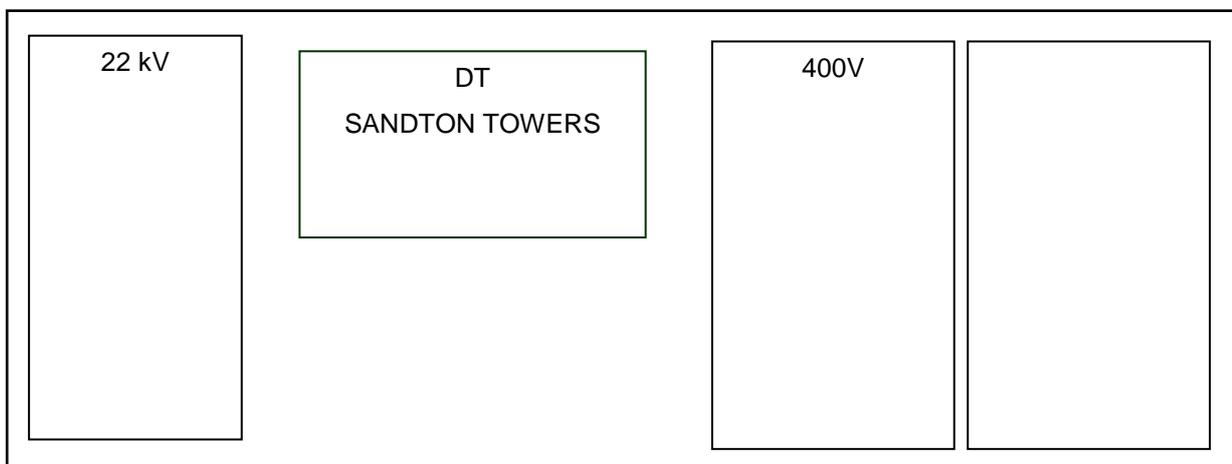
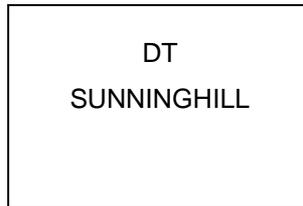


Figure 1: Mini-sub and RMU Labelling

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3.4.1.2 Ring Main Units



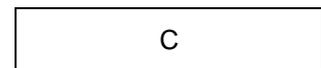
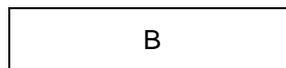
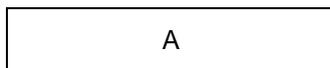
The switching unit of a mini-sub or a stand-alone RMU shall be labelled as follows:



3.4.2 LV Labelling Philosophy

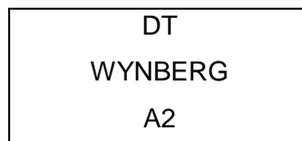
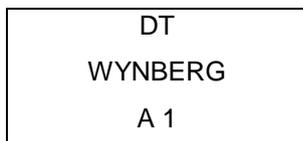
3.4.2.1 Mini Substations

- Each circuit fed from a mini-sub shall be uniquely identified e.g. A, B, C., or L1, L2, L3 or street names.
- Each circuit breaker shall be labelled as follows;



3.4.2.2 Distribution boxes

Distribution Boxes on one circuit shall be labelled sequentially from the mini sub as follows:



Where:

- DT Wynberg denotes the source substation (Doring) and feeder name (Thorn) denotes the unique name / number / code of the mini-sub.
- A1 denotes the first Distribution Box on the A circuit.

3.4.2.3 Circuit Breakers

Where customers are fed directly via a circuit breaker each circuit breaker shall be labelled A or B or C or by stand number; house number; customer name, etc.

Where a single circuit breaker supplies multiple customers each service cable must be labelled at both ends.

Where applicable the legend inside the LV cubicle shall be filled in.

3.4.2.4 Cables terminated onto or from overhead lines

Where there is no operating equipment identifying the cable termination all cables terminations shall be labelled to uniquely identify the address of the equipment or pole connected at the other end of the cable, refer to 240-56030635 & DST_34-1177.

All LV cables shall be labelled at both ends of the cable.

3.4.3 Cable Route Markers

- The cable route marker shall be installed in the ground directly above the power cable.
- Cable route markers (in accordance with D-DT-8012) shall be installed in the ground directly above MV power cables at each road / railway crossing, cable joint, and where there is a change in cable direction, refer to 240-56030635.

Note 1: It is worthwhile to determine GPS coordinates of the cable route, joints, and bends, though this is not required by the standard.

4. Installation

4.1 Position of tower labels on tower / structure / pole

- a) The labels shall be fitted to the frames / brackets using the bolts, nuts and washers as specified on DRG. No. 0.54/404 or the bandit-stripping on pole.
- b) Nuts, bolts and washers shall be supplied by the manufacturer.
- c) Nuts, bolts and metal washers must be hot-dipped galvanised.
- d) The nuts must be turned to firm finger tight and then tightened with a spanner one full turn. (Over-tightening will result in damage to the vitreous enamel coating).
- e) The label frames / brackets will be attached to the existing support steelwork or equipment with the bolts, nuts and washers provided. The nuts must be tightened to normal spanner tightness.
- f) Labels will be positioned in accordance with the Substation Operating Diagram provided.
- g) All line labels shall be positioned on the tower at a height easily viewed from both the ground and air (typically from a helicopter during aerial inspections). This height shall correspond roughly to the lowest conductor height and be near the waist in the case of lattice towers (see annex BB).
- h) When positioning labels, maintenance requirements shall be considered. The label shall be positioned so that maintenance or replacement is possible without interfering with the line operation _ Annex MM shows the basic positions of the tower labels for different tower types.
- i) Only one tower label will be supplied for each tower. The labels shall be positioned so that all odd numbers face the direction of the substation having alphabetical precedence and that all even numbers face the other substation (see annex BB).

4.2 Position of line crossing labels on tower

4.3 Methods of attaching labels onto towers / structures

- a) All labels shall be attached to the tower using three stainless steel banded straps inserted through slots (chain links welded to 10 mm round bars attached onto the frame of the label) in the labels.
- b) The label shall then be attached to a member of the tower in the specified position. The most common size of strap to be used shall be the 12,7 mm ´ 0,7 mm strap.
- c) The contractor shall ensure that all straps used are tightened evenly without damaging or distorting the label. All strap buckles are stainless steel.
- d) All strap buckles shall be stainless steel.
- e) Care shall be taken not to damage or chip the vitreous enamel labels during transport and installation.

5. Related Documents

- a) 240-62629353, Specification for Panel Labelling Standard;
- b) 240-75660336, The Standard for Design, Manufacturing and Installation of Eskom Wires Business Equipment Labels.

6. Forms, Records and Certificates

The manufacturer testing certificate and user’s manual (including the technical specification) shall be included in the package. An example of a certificate is given in annex A.

7. Authorization

This document has been seen and accepted by:

| Name and surname | Designation |
|-------------------|---|
| Amelia Mtshali | Senior Manager Power Delivery Engineering |
| Bheki Ntshangase | Snr Manager Engineering |
| Riaz Vajeth | Snr Manager Engineering |
| Colin Smith | Network Operations SCOT/SC Chairperson |
| Archie Jaykaran | Maintenance SCOT/SC Chairperson |
| Derik Sadler | Middle Manager HV Plant |
| Promise Quluba | Zone Manager |
| Braam Groenewald | Chief Engineer |
| Andre Kotze | Chief Engineer |
| Thinus Du Plessis | Chief Engineer |

8. Revisions

This revision (DST_ 240-120804300) cancels and replaces all revisions of document number DSP_ Eskasaan0 / 41-1009 / 34-1439 / 41-655.

| Date | Rev | Compiler | Remarks |
|----------|-----|-------------|--|
| Oct 2018 | 2 | DM Ntombela | <p>Below are the changes made in this revision:</p> <ul style="list-style-type: none"> a) Added a note in section 3.2.1 Note 1: In the Panel / Bay (i.e. Transformer bay, Feeder bay, Section bay etc) where all or a number of apparatus are grouped or compacted in one or connected in series by the jumper in such a way that the independent / individual maintenance cannot be undertaken or the identification of individual apparatus for the purpose of labelling or operating / naming is not possible or is difficult, such apparatus shall first be identified / named as a group, ie “Isolator, Earth Switch, CT and / or breaker” in the MTGIS, Section Bay consisting of two isolators whether equipped with earth switches or not etc.”; b) Revised Secondary Transformer label; c) Added MTGIS section 3.2.3.4.8 in this document; d) Reviewed section 3.2.3.5.4 Section Isolators; and e) Renumbered the annexures. |

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| Date | Rev | Compiler | Remarks |
|----------|-----|-------------|---|
| Feb 2018 | 1 | DM Ntombela | Rationalized Eskom, Distribution and Transmission documents referenced Eskasaan0 / 41-1009 / 34-1439 / 41-655. New document number |

9. Development team

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

| Name and surname | Designation | Department |
|----------------------|-------------------------------|--------------|
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| J J N Steenkamp | Officer Technical Support | G OU |
| A Haynes | Senior Advisor | TX WP&CS |
| D Sadler | Middle Manager HV Plant | TX WP&CS |
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| L Van Der Westhuizen | Officer Technical Training | TX North |
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| Braam Groenewald | Chief Engineer | PDE_ |
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| Shalen Goonoa | Engineer Prof Electrical | KZNOU |
| Sibongile Maphosa | Chief Engineer Prof Elect | PDE_HV Plant |

10. Acknowledgements

Not applicable.

Annex A – Approved Labelling Abbreviations

(Informative)

Note: The list includes abbreviation in 240-114967625 but they may not all used for labelling and for the purposes of this document and labelling all abbreviation shall be in Caps.

| Abbreviation | Description |
|------------------|---|
| A/B SW | Air Break Switch (WODs, MODs, SODs) |
| A/T SW | Auto trip switch, |
| ARC | Auto Re-close |
| AUX. | Auxiliary |
| B Ø | Blue Phase |
| B/B | Busbar |
| B/CPL | Bus Coupler |
| B/SECT | Bus Section |
| BKR | Breaker |
| BM | Bulk metering unit |
| C/O | Chop over or Change over |
| CAP | Capacitor |
| CMS | Control mode switch |
| CT | Current Transformer |
| CTVT | Current Transformer Voltage Transformer |
| CVT | Capacitor Voltage Transformer |
| E/F | Earth Fault |
| E/SW | Earth Switch |
| FDR | Feeder |
| FUSE ISOL | Fused Isolator |
| GEN | Generator |
| H/O | Hand over |
| HV | High Voltage |
| I/C | In commission |
| I/CTRL | Inter-control Handout |
| ISOL | Isolator |
| JB | Junction Box |
| kV | Kilovolt |
| L/S BKR | Local Supply breaker |
| L/W | Live Work |
| LOAD ISOL | Load Isolator |
| LV | Low Voltage |

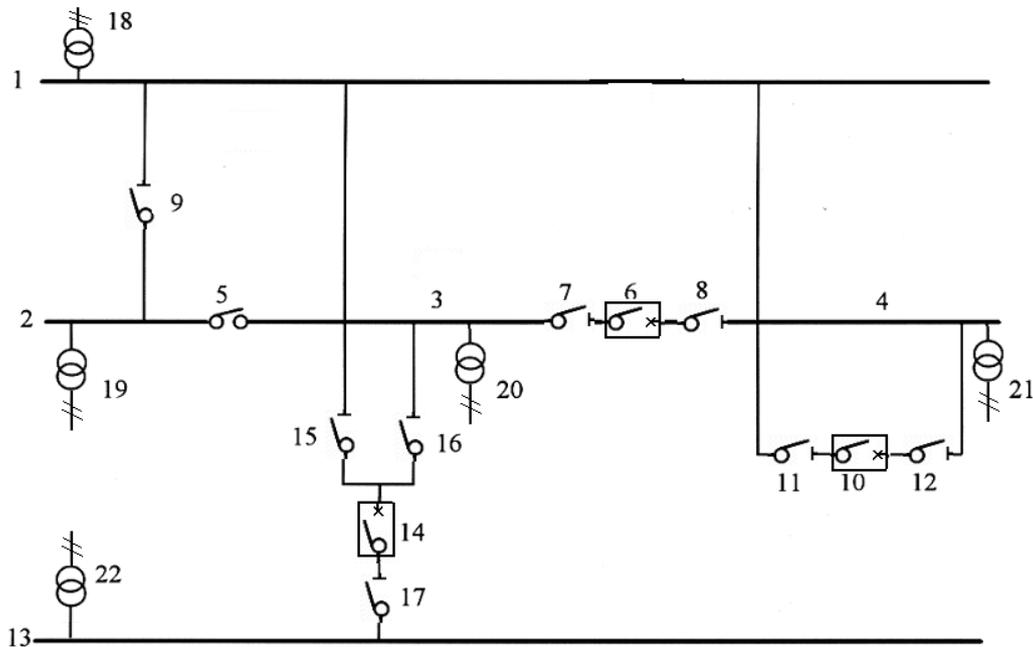
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| Abbreviation | Description |
|----------------|---|
| MTGIS | Mixed Technology Gas Insulated Switchgear |
| M S/S | Mini Substation |
| MV | Medium Voltage |
| N/O | Normally open |
| NEC | Neutral Earthing Compensator |
| NECR | Neutral Earthing Compensator and Resistor |
| NECRT | Neutral Earthing Compensator Resistor and Auxiliary Transformer |
| NECT | Neutral Earthing Compensator and Aux transformer |
| NER | Neutral Earthing Resistor |
| NERT | Neutral Earthing resistor and aux transformer |
| NETW | Network |
| NEUT | Neutral |
| O/C | Over current |
| OOC | Out of commission |
| PTO | Permission to operate |
| PTO&W | Permission to operate and work |
| PTS | Permission to Sectionalise |
| R Ø | Red Phase |
| R/E | Removal Of Earths |
| REG | Regulator |
| ROT | Risk of Trip |
| RX | Reactor |
| S/S | Substation |
| S/T | Safety Test |
| SA | Surge Arrester |
| SE/F | Sensitive earth fault |
| SECL | Sectionaliser |
| SEC | Secondary |
| SECT | Section |
| SOURCE ISOL | Source Isolator |
| SUP | Supervisory |
| SVC | Static Var Compensator |
| SW | Switch |
| SWER | Single Wire Earth Return |
| SWER ISOL TRFR | Single Wire Earth Return Isolating Transformer |

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| Abbreviation | Description |
|---------------------|---------------------|
| T | Tee-off |
| T/C | Tap Changer |
| T/T | Trip Testing |
| TRANS B/B | Transfer Busbar |
| TRFR | Transformer |
| VT | Voltage Transformer |
| VR | Voltage Regulator |
| WØ | White Phase |

Annex B – Busbars and Associated Equipment
(Informative)

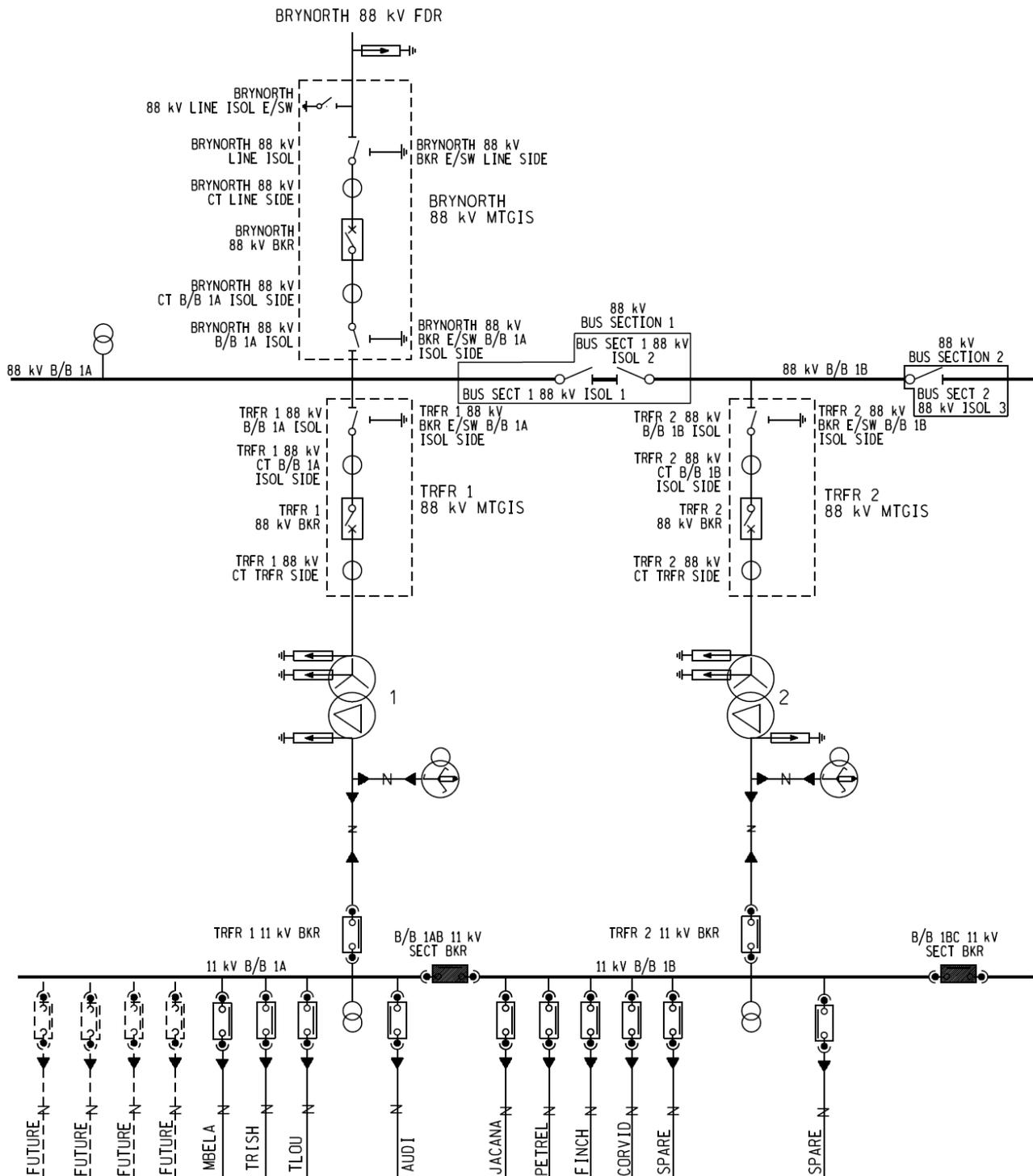


Legend:

| | | | |
|----|--|----|--|
| 1 | 132 kV B/B 1 | 12 | B/CPL B 132 kV B/B 2C ISOL |
| 2 | 132 kV B/B 2A | 13 | 132 kV TRANS B/B 1 |
| 3 | 132 kV B/B 2B | 14 | TRANS B/CPL A 132 kV BKR |
| 4 | 132 kV B/B 2C | 15 | TRANS B/CPL A 132 kV B/B 1 ISOL |
| 5 | 132 kV B/B 2 SECT ISOL 1 | 16 | TRANS B/CPL A 132 kV B/B 2B ISOL |
| 6 | 132 kV B/B 2 SECT BKR 1 | 17 | TRANS B/CPL A 132 kV TRANS B/B 1 ISOL |
| 7 | 132 kV B/B 2 SECT BKR 1 B/B 2B ISOL | 18 | 132 kV B/B 1 VT |
| 8 | 132 kV B/B 2 SECT BKR 1 B/B 2C ISOL | 19 | 132 kV B/B 2A VT |
| 9 | B/CPL A 132 kV ISOL | 20 | 132 kV B/B 2B VT |
| 10 | B/CPL B 132 kV BKR | 21 | 132 kV B/B 2C VT |
| 11 | B/CPL B 132 kV B/B 1 ISOL | 22 | 132 kV TRANS B/B 1 VT |

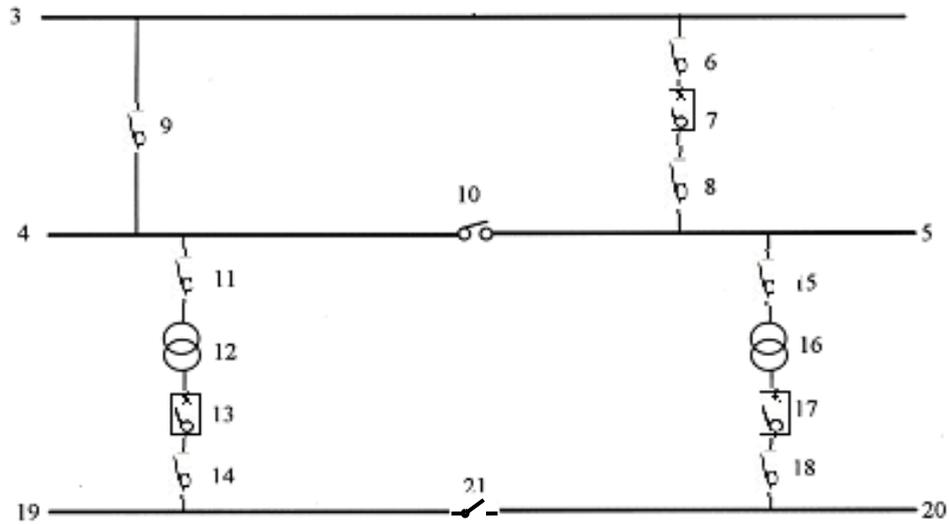
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Annex C – GIS & Section Isolators



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Annex D – Typical Jericho System
(Informative)

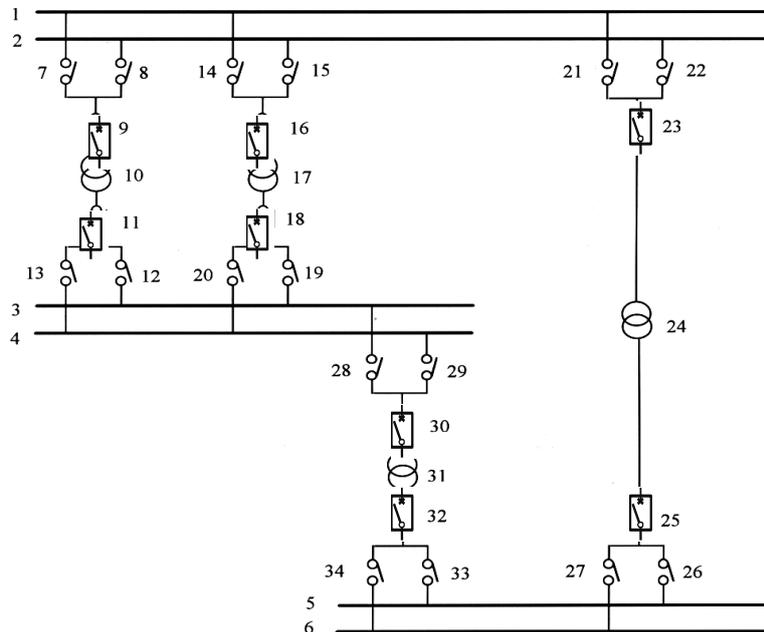


Legend:

| | | | |
|----|----------------------------------|----|-----------------------------|
| 3 | 88 kV LINE B/B | 13 | TRFR 1 11 kV BKR |
| 4 | 88 kV TRFR B/B A | 14 | TRFR 1 11 kV B/B 1A ISOL |
| 5 | 88 kV TRFR B/B B | 15 | TRFR 2 88 kV A/B SW |
| 6 | L/S BKR 88 kV LINE B/B ISOL | 16 | TRFR 2 88/11 kV |
| 7 | 88 kV L/S BKR | 17 | TRFR 2 11 kV BKR |
| 8 | L/S BKR 88 kV TRFR B/B B ISOL | 18 | TRFR 2 11 kV B/B 1B ISOL |
| 9 | L/S BKR 88 kV BYPASS ISOL | 19 | 11 kV B/B 1A |
| 10 | TRFR B/B 88 kV SECT ISOL 1 | 20 | 11 kV B/B 1B |
| 11 | TRFR 1 88 kV A/B SW | 21 | B/B 1 11 kV SECT ISOL 1 |
| 12 | TRFR 1 88/11 kV | | |

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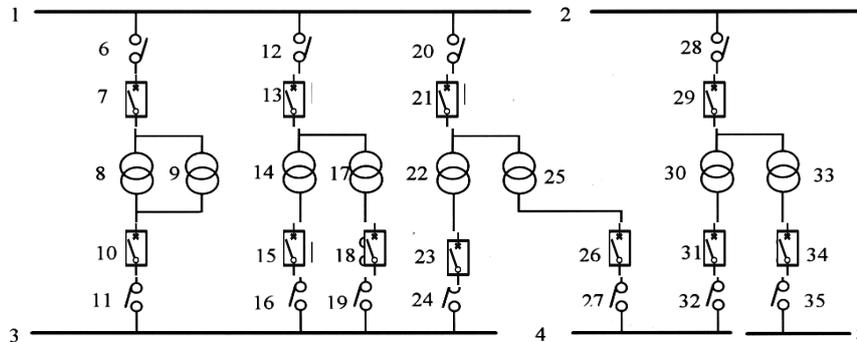
Annex E – Transformers and Associated Equipment
(Normative)



Legend:

| | | | | | |
|----|-----------------------------|----|-----------------------------|----|-----------------------------|
| 1 | 132 kV B/B 1 | 13 | TRFR 1 88 kV B/B 2 ISOL | 24 | TRFR 3 132/44 kV |
| 2 | 132 kV B/B 2 | 14 | TRFR 2 132 kV B/B 1 ISOL | 25 | TRFR 3 44 kV BKR |
| 3 | 88 kV B/B 1 | 15 | TRFR 2 132 kV B/B 2 ISOL | 26 | TRFR 3 44 kV B/B 1 ISOL |
| 4 | 88 kV B/B 2 | 16 | TRFR 2 132 kV BKR | 27 | TRFR 3 44 kV B/B 2 ISOL |
| 5 | 44 kV B/B 1 | 17 | TRFR 2 132/88 kV | 28 | TRFR 11 88 kV B/B 1 ISOL |
| 6 | 44 kV B/B 2 | 18 | TRFR 2 88 kV BKR | 29 | TRFR 11 88 kV B/B 2 ISOL |
| 7 | TRFR 1 132 kV B/B 1 ISOL | 19 | TRFR 2 88 kV B/B 1 ISOL | 30 | TRFR 11 88 kV BKR |
| 8 | TRFR 1 132 kV B/B 2 ISOL | 20 | TRFR 2 88 kV B/B 2 ISOL | 31 | TRFR 11 88/44 kV |
| 9 | TRFR 1 132 kV BKR | 21 | TRFR 3 132 kV B/B 1 ISOL | 32 | TRFR 11 44 kV BKR |
| 10 | TRFR 1 132/88 kV | 22 | TRFR 3 132 kV B/B 2 ISOL | 33 | TRFR 11 44 kV B/B 1 ISOL |
| 11 | TRFR 1 88 kV BKR | 23 | TRFR 3 132 kV BKR | 34 | TRFR 11 44 kV B/B 2 ISOL |
| 12 | TRFR 1 88 kV B/B 1 ISOL | | | | |

Annex F – Transformers and Associated Equipment – Double banked Transformers
(normative)

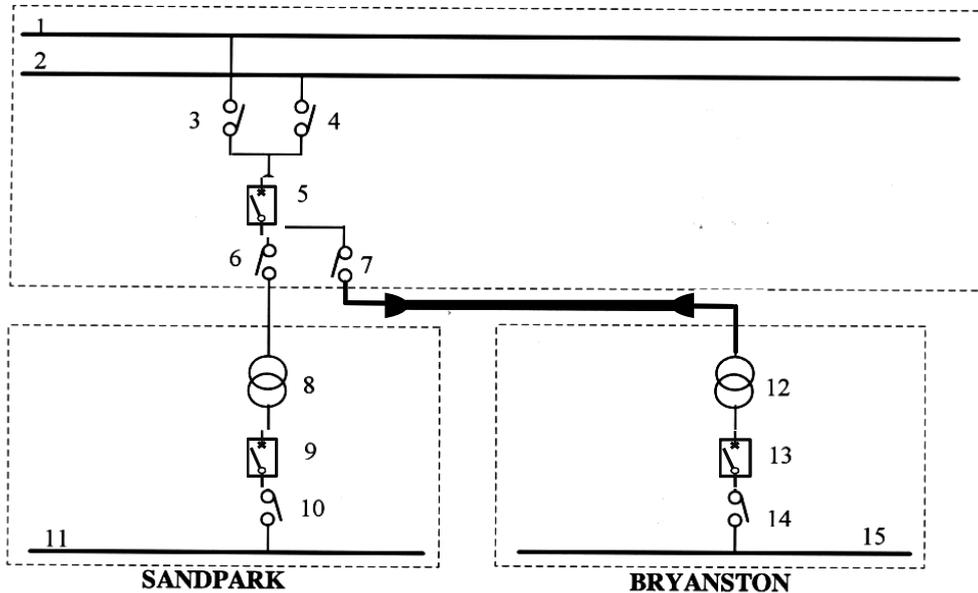


Legend:

| | | | | | |
|----|-------------------------------|----|-------------------------------|----|--------------------------------|
| 1 | 88 kV B/B 1 | 13 | TRFR 2A/B 88 kV BKR | 25 | TRFR 3B 88/11 kV |
| 2 | 44 kV B/B 1 | 14 | TRFR 2A 88/22 kV | 26 | TRFR 3B 11 kV BKR |
| 3 | 22 kV B/B 1 | 15 | TRFR 2A 22 kV BKR | 27 | TRFR 3B 11 kV B/B 1 ISOL |
| 4 | 11 kV B/B 1A | 16 | TRFR 2A 22 kV B/B 1 ISOL | 28 | TRFR 11A/B 44 kV B/B 1 ISOL |
| 5 | 11 kV B/B 1B | 17 | TRFR 2B 88/22 kV | 29 | TRFR 11A/B 44 kV BKR |
| 6 | TRFR 1A/B 88 kV B/B 1 ISOL | 18 | TRFR 2B 22 kV BKR | 30 | TRFR 11A 44/11 kV |
| 7 | TRFR 1A/B 88 kV BKR | 19 | TRFR 2B 22 kV B/B 1 ISOL | 31 | TRFR 11A 11 kV BKR |
| 8 | TRFR 1A 88/22 kV | 20 | TRFR 3A/B 88 kV B/B 1 ISOL | 32 | TRFR 11A 11 kV B/B 1 ISOL |
| 9 | TRFR 1B 88/22 kV | 21 | TRFR 3A/B 88 kV BKR | 33 | TRFR 11B 44/11 kV |
| 10 | TRFR 1A/B 22 kV BKR | 22 | TRFR 3A 88/22 kV | 34 | TRFR 11B 11 kV BKR |
| 11 | TRFR 1A/B 22 kV B/B 1 ISOL | 23 | TRFR 3A 22 kV BKR | 35 | TRFR 11B 11 kV B/B 1 ISOL |
| 12 | TRFR 2A/B 88 kV B/B 1 ISOL | 24 | TRFR 3A 22 kV B/B 1 ISOL | | |

Annex G – Transformers and associated equipment – line banks
(Normative)

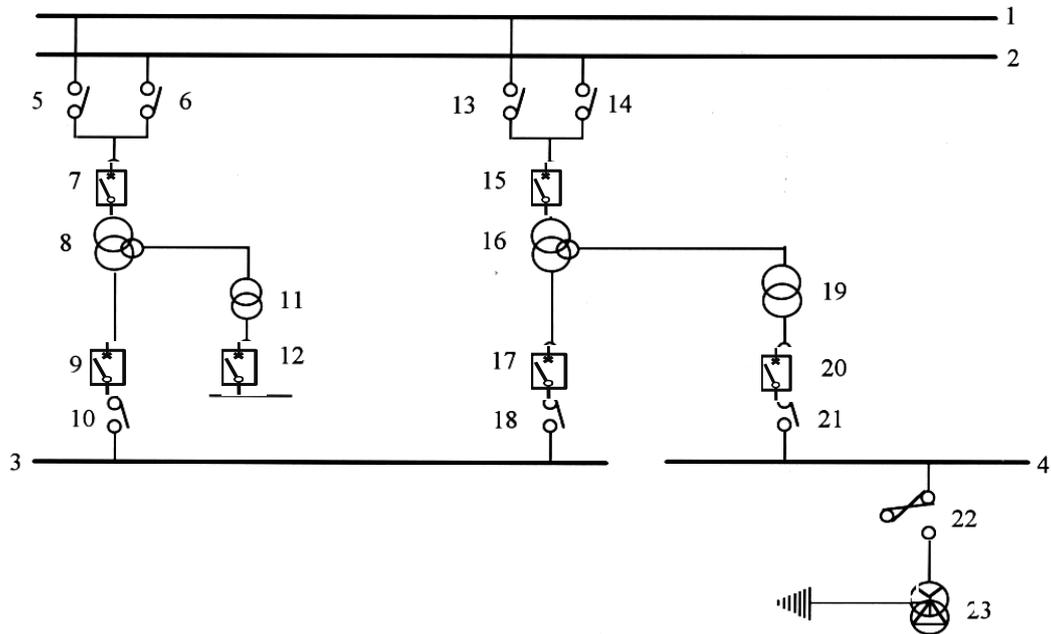
CRAIGHALL



Legend:

| | AT CRAIGHALL | | AT SANDPARK | | AT BRYANSTON |
|---|--|----|--|----|--|
| 1 | 88 kV B/B 1 | 8 | CRAIGHALL 1 TRFR 1 88/44 kV | 12 | CRAIGHALL 1 TRFR 1 88/44 kV |
| 2 | 88 kV B/B 2 | 9 | CRAIGHALL 1 TRFR 1 44 kV BKR | 13 | CRAIGHALL 1 TRFR 1 44 kV BKR |
| 3 | BRYANSTON/SANDPARK 1 88 kV B/B 1 ISOL | 10 | CRAIGHALL 1 TRFR 1 44 kV B/B 1 ISOL | 14 | CRAIGHALL 1 TRFR 1 44 kV B/B 1 ISOL |
| 4 | BRYANSTON/SANDPARK 1 88 kV B/B 2 ISOL | 11 | 44 kV B/B 1 | 15 | 44 kV B/B 1 |
| 5 | BRYANSTON/SANDPARK 1 88 kV BKR | | | | |
| 6 | SANDPARK 1 88 kV LINE ISOL | | | | |
| 7 | BRYANSTON 1 88 kV CABLE ISOL | | | | |

Annex H – Transformers and associated equipment
(Normative)

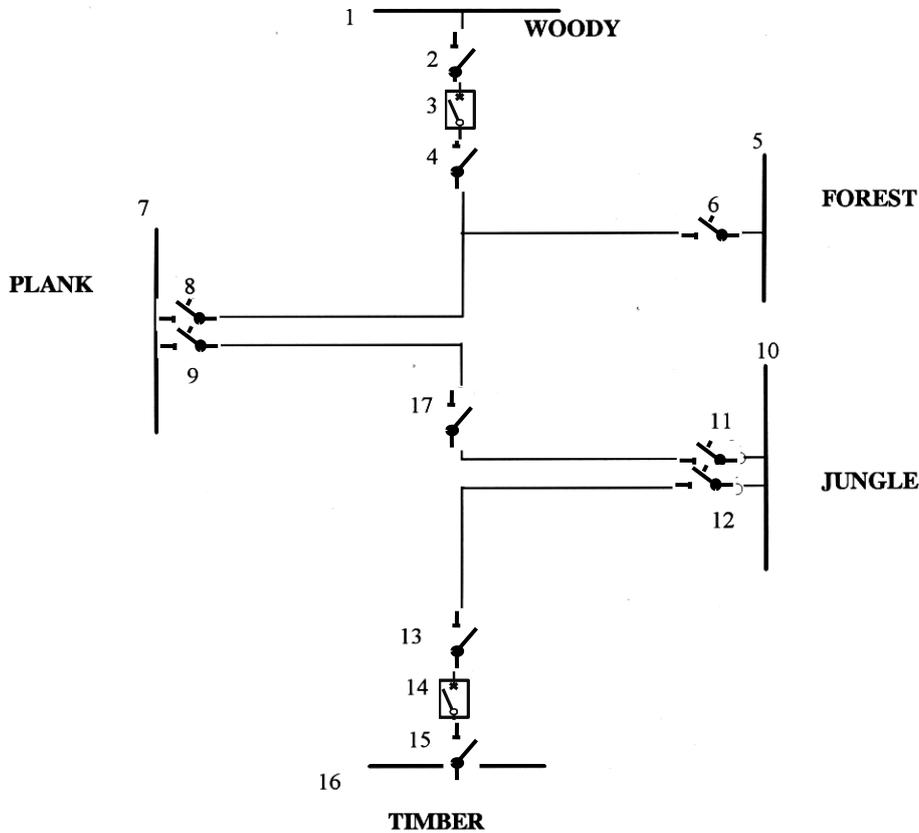


Legend:

| | | | |
|----|----------------------------------|----|-------------------------------------|
| 1 | 132 kV B/B 1 | 13 | TRFR 2 132 kV B/B 1 ISOL |
| 2 | 132 kV B/B 2 | 14 | TRFR 2 132 kV B/B 2 ISOL |
| 3 | 88 kV B/B 1 | 15 | TRFR 2 132 kV BKR |
| 4 | 11 kV B/B 1 | 16 | TRFR 2 132/88/22 kV |
| 5 | TRFR 1 132 kV B/B 1 ISOL | 17 | TRFR 2 88 kV BKR |
| 6 | TRFR 1 132 kV B/B 2 ISOL | 18 | TRFR 2 88 kV B/B 1 ISOL |
| 7 | TRFR 1 132kV BKR | 19 | TRFR 11 22/11 kV |
| 8 | TRFR 1 132/88/22 kV | 20 | TRFR 11 11 kV BKR |
| 9 | TRFR 1 88 kV BKR | 21 | TRFR 11 11 kV B/B 1 ISOL |
| 10 | TRFR 1 88 kV B/B 1 ISOL | 22 | EARTHING TRFR 1 11 kV B/B 1 ISOL |
| 11 | TRFR 1 22 kV/400 V AUX TRFR 1 | 23 | EARTHING TRFR 1 11 kV |
| 12 | TRFR 1 AUX TRFR 1 400 V BKR 1 | | |

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Annex I – Feeders and Associated Equipment
(Normative)

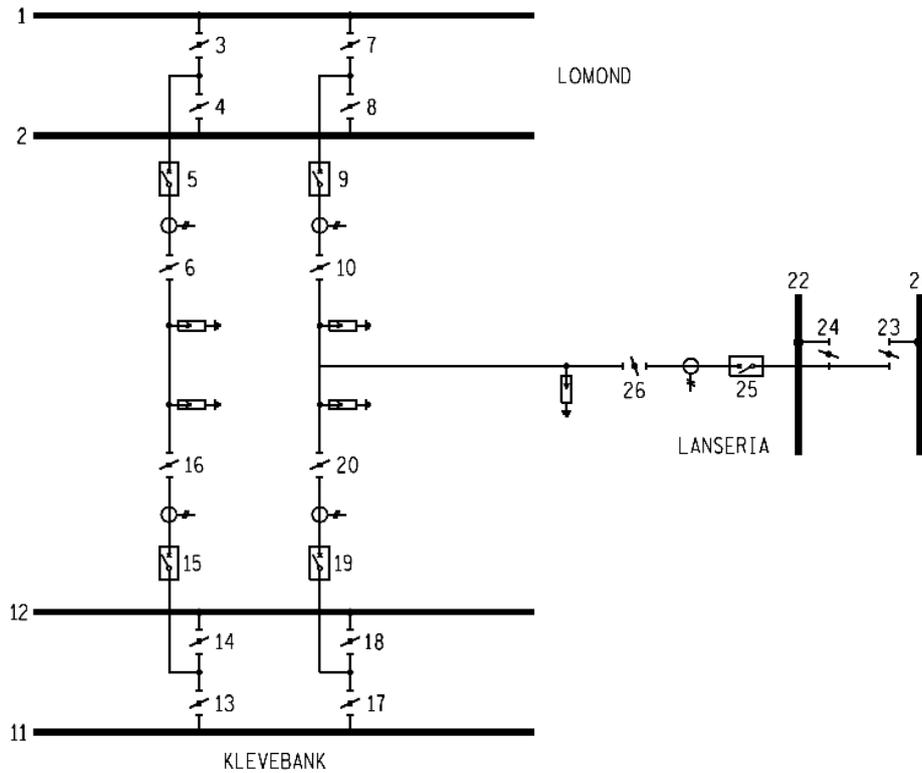


Legend:

| | AT WOODY | | AT JUNGLE |
|---|--------------------------------------|----|--------------------------------|
| 1 | 66 kV B/B 1 | 10 | 66 kV B/B 1 |
| 2 | PLANK 1/FOREST T 66 kV B/B 1 ISOL | 11 | PLANK 1 66 kV A/B SW |
| 3 | PLANK 1/FOREST T 66 kV BKR | 12 | TIMBER 1 66 kV A/B SW |
| 4 | PLANK 1/FOREST T 66 kV LINE ISOL | | AT TIMBER |
| | AT FOREST | 13 | JUNGLE 1 66 kV LINE ISOL |
| 5 | 66 kV B/B 1 | 14 | JUNGLE 1 66kV BKR |
| 6 | WOODY/ PLANK 1 66 kV A/B SW | 15 | JUNGLE 1 66 kV B/B 1 ISOL |
| | AT PLANK | 16 | 66 kV B/B 1 |
| 7 | 66 kV B/B 1 | | PLANK/JUNGLE LINE |
| 8 | WOODY/FOREST T 66 kV A/B SW | 17 | 1 PLA/JUN 53 66kV SECT ISOL |
| 9 | JUNGLE 1 66 kV A/B SW | | |

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Annex J – Feeders and Associated Equipment – Tee Line Feeders
(Normative)

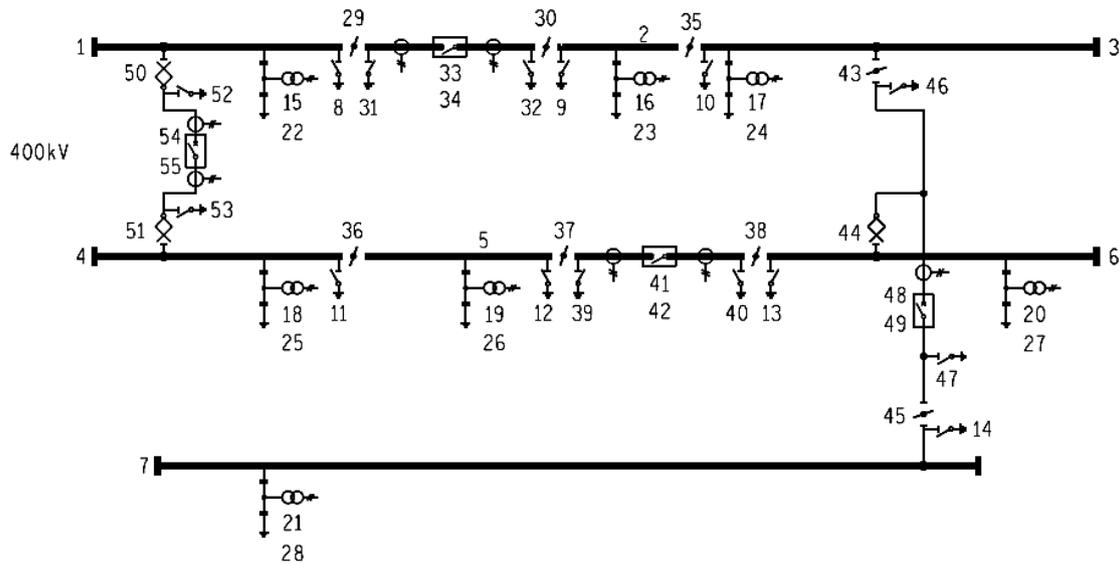


Legend:

| | | | | | |
|---|---|----|--|----|---|
| 1 | 132 kV B/B 1 | 10 | KLEVEBANK 2/LANSERIA TEE 132 kV LINE ISOL | 19 | LOMOND 2/LANSERIA TEE 132 kV BKR |
| 2 | 132 kV B/B 2 | 11 | 132 kV B/B 1 | 20 | LOMOND 2/LANSERIA TEE 132 kV LINE ISOL |
| 3 | KLEVEBANK 1 132 kV B/B 1 ISOL | 12 | 132 kV B/B 2 | 21 | 132 kV B/B 1 |
| 4 | KLEVEBANK 1 132 kV B/B 2 ISOL | 13 | LOMOND 1 132 kV B/B 1 ISOL | 22 | 132 kV B/B 2 |
| 5 | KLEVEBANK 1 132 kV BKR | 14 | LOMOND 1 132 kV B/B 2 ISOL | 23 | KLEVEBANK/LOMOND 2 132 kV B/B 1 ISOL |
| 6 | KLEVEBANK 1 132 kV LINE ISOL | 15 | LOMOND 1 132 kV BKR | 24 | KLEVEBANK/LOMOND 2 132 kV B/B 2 ISOL |
| 7 | KLEVEBANK 2/LANSERIA TEE 132 kV B/B 1 ISOL | 16 | LOMOND 1 132 kV LINE ISOL | 25 | KLEVEBANK/LOMOND 2 132 kV BKR |
| 8 | KLEVEBANK 2/LANSERIA TEE 132 kV B/B 2 ISOL | 17 | LOMOND 2/LANSERIA TEE 132 kV B/B 1 ISOL | 26 | KLEVEBANK/LOMOND 2 132 kV LINE ISOL |
| 9 | KLEVEBANK 2/LANSERIA TEE 132 kV BKR | 18 | LOMOND 2/LANSERIA TEE 132 kV B/B 2 ISOL | | |

NOTE: Phasing discs: CT, VT, SA, Pantograph Isolators; Single ϕ Trfr, Reactor, Isol; also on O/H beam in each bay, either end of Bus Sections & Extreme ends of Busbars

Annex K – Busbars and Associated Equipment



Legend:

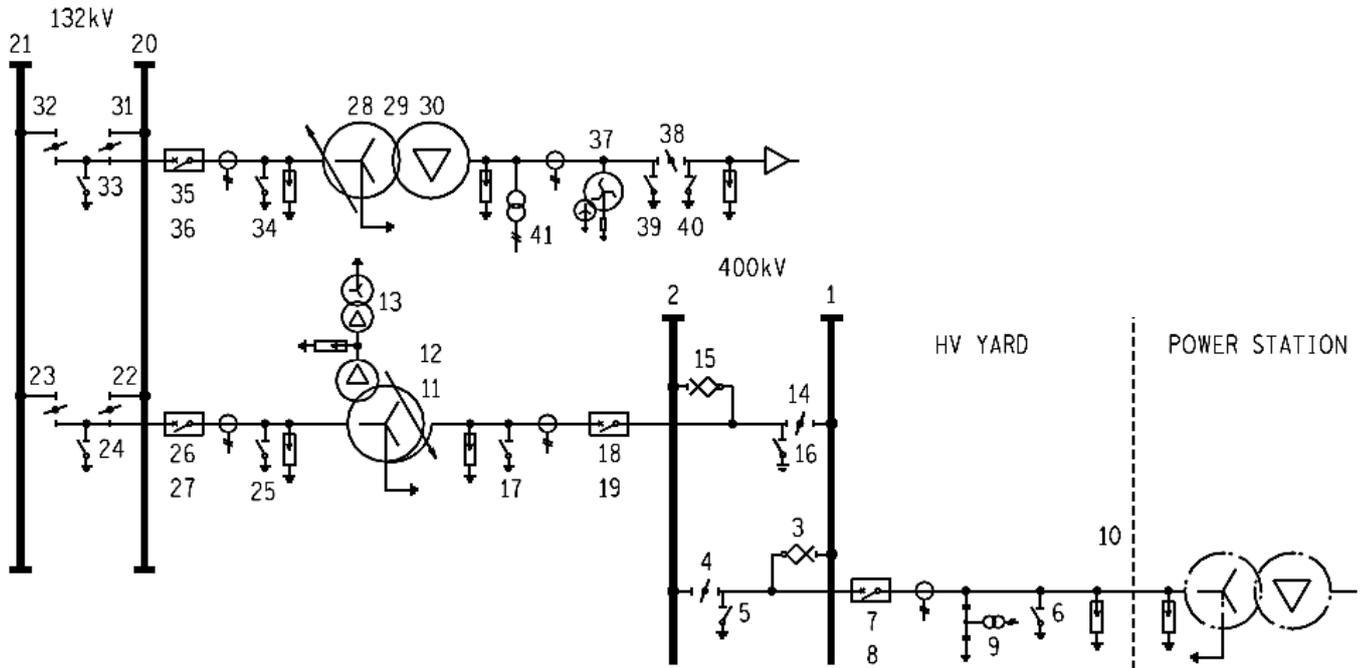
| | | | | | | | |
|----|--|----|------------------------|----|--|----|------------------------------------|
| 1 | 400 kV B/B 1A | 15 | 400 kV B/B 1A VT | 29 | 400 kV B/B 1 SECT BKR B/B 1A ISOL | 43 | 400 kV B/B 1C B/ CPL ISOL |
| 2 | 400 kV B/B 1B | 16 | 400 kV B/B 1B VT | 30 | 400 kV B/B 1 SECT BKR B/B 1B ISOL | 44 | 400 kV B/B 2C B/ CPL ISOL |
| 3 | 400 kV B/B 1C | 17 | 400 kV B/B 1C VT | 31 | 400 kV B/B 1 SECT BKR B/B 1A ISOL E/SW 2 | 45 | 400 kV TRANS B/B B/CPL ISOL |
| 4 | 400 kV B/B 2A | 18 | 400 kV B/B 2A VT | 32 | 400 kV B/B 1 SECT BKR B/B 1B E/SW 1 | 46 | 400 kV B/B 1C B/ CPL ISOL E/SW |
| 5 | 400 kV B/B 2B | 19 | 400 kV B/B 2B VT | 33 | 400 kV B/B 1 SECT BKR | 47 | 400 kV TRANS B/CPL BKR E/SW |
| 6 | 400 kV B/B 2C | 20 | 400 kV B/B 2C VT | 34 | 400 kV B/B 1 SECT BKR JB | 48 | 400 kV TRANS B/B B/CPL BKR |
| 7 | 400 kV TRANS B/B 1 | 21 | 400 kV TRANS B/B 1 VT | 35 | 400 kV B/B 1C B/SECT ISOL | 49 | 400 kV TRANS B/CPL BKR JB |
| 8 | 400 kV B/B 1 SECT BKR B/B 1A ISOL E/SW 1 | 22 | 400 kV B/B 1A VT JB | 36 | 400 kV B/B 2A B/SECT ISOL | 50 | 400 kV B/B 1A B/CPL ISOL |
| 9 | 400 kV B/B 1 SECT BKR B/B 1B E/SW 2 | 23 | 400 kV B/B 1B VT JB | 37 | 400 kV B/B 2 SECT BKR B/B 2B ISOL | 51 | 400 kV B/B 2A B/CPL ISOL |
| 10 | 400 kV B/B 1C B/SECT ISOL E/SW | 24 | 400 kV B/B 1C VT JB | 38 | 400 kV B/B 2 SECT BKR B/B 2C ISOL E/SW | 52 | 400 kV B/CPL A BKR E/SW B/B 1 SIDE |
| 11 | 400 kV B/B 2A B/SECT ISOL E/SW | 25 | 400 kV B/B 2A VT JB | 39 | 400 kV B/B 2 SECT BKR B/B 2B ISOL E/SW 2 | 53 | 400 kV B/B 2A B/CPL ISOL E/SW |
| 12 | 400 kV B/B 2 SECT BKR B/B 2B ISOL E/SW 1 | 26 | 400 kV B/B 2B VT JB | 40 | 400 kV B/B 2 SECT BKR B/B 2C ISOL E/SW 1 | 54 | 400 kV B/CPL BKR |
| 13 | 400 kV B/B 2 SECT BKR B/B 2C ISOL E/SW 2 | 27 | 400 kV B/B 2C VT JB | 41 | 400 kV B/B 2 SECT BKR | 55 | 400 kV B/CPL JB |
| 14 | 400 kV TRANS B/B E/SW | 28 | 400 kV TRANS B/B VT JB | 42 | 400 kV B/B 2 B/SECT JB | | |

NOTE: Phasing discs: CT, VT, SA, Pantograph Isolators; Single ϕ Trfr, Reactor, Isol; also on O/H beam in each bay, either end of Bus Sections & Extreme ends of Busbars

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Annex L – Busbars and Associated Equipment – Power Stations (Station Transformer and Generator Transformer)



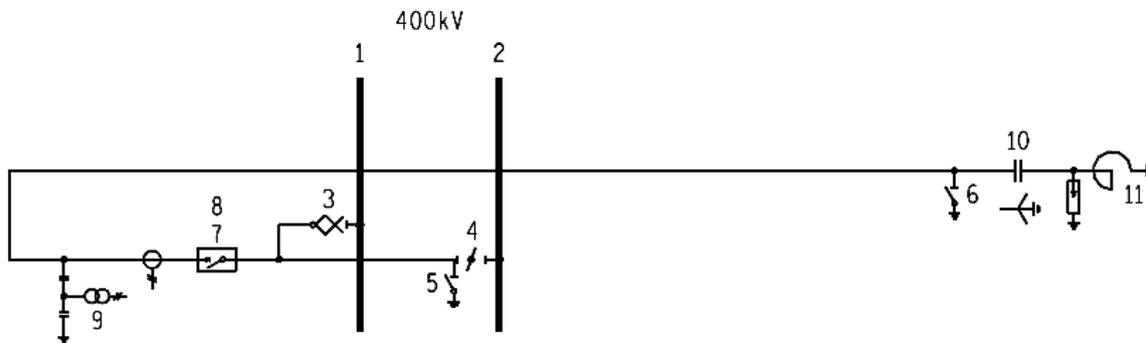
Legend:

| | | | | | | | |
|----|---------------------------------------|----|--|----|--|----|---|
| 1 | 400 kV B/B 1 | 12 | TRFR 1 AUX TRFR 21 DB | 23 | TRFR 1 132 kV B/B 2 ISOL | 34 | STATION TRFR 21 132 kV BKR E/SW TRFR SIDE |
| 2 | 400 kV B/B 2 | 13 | TRFR 1 AUX TRFR 21 22 kV/400 V | 24 | TRFR 1 132 kV BKR E/SW B/B SIDE | 35 | STATION TRFR 21 132 kV BKR |
| 3 | GEN 6 400 kV B/B 1 ISOL | 14 | TRFR 1 400 kV B/B 1 ISOL | 25 | TRFR 1 132 kV BKR E/SW TRFR SIDE | 36 | STATION TRFR 21 132 kV JB |
| 4 | GEN 6 400 kV B/B 2 ISOL | 15 | TRFR 1 400 kV B/B 2 ISOL | 26 | TRFR 1 132 kV BKR | 37 | STATION TRFR 21 11 kV/400 V NECRT 1 |
| 5 | GEN 6 400 kV BKR E/SW B/B SIDE | 16 | TRFR 1 400 kV BKR E/SW B/B SIDE | 27 | TRFR 1 132 kV JB | 38 | STATION TRFR 21 11 kV CABLE ISOL |
| 6 | GEN 6 400 kV BKR E/SW TRFR SIDE | 17 | TRFR 1 400 kV BKR E/SW TRFR SIDE | 28 | STATION TRFR 21 132/11 kV | 39 | STATION TRFR 21 11 kV TRFR E/SW |
| 7 | GEN 6 400 kV BKR | 18 | TRFR 1 400 kV BKR | 29 | STATION TRFR 21 132 kV JB | 40 | STATION TRFR 21 11 kV CABLE E/SW |
| 8 | GEN 6 400 kV JB | 19 | TRFR 1 400 kV BKR JB | 30 | STATION TRFR 21 AUX TRFR 1 DB | 41 | STATION TRFR 21 11 kV VT |
| 9 | GEN 6 400 kV VT | 20 | 132 kV B/B 1 | 31 | STATION TRFR 21 132 kV B/B 1 ISOL | | |
| 10 | GEN 6 INTERFACE JB | 21 | 132 kV B/B 2 | 32 | STATION TRFR 21 132 kV B/B 2 ISOL | | |
| 11 | TRFR 1 400/132/22 kV | 22 | TRFR 1 132 kV B/B 1 ISOL | 33 | STATION TRFR 21 132 kV BKR E/SW B/B SIDE | | |

NOTE: Phasing discs: CT, VT, SA, Pantograph Isolators; Single ϕ Trfr, Reactor, Isol; also on O/H beam in each bay, either end of Bus Sections & Extreme ends of Busbars

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Annex M – Busbars and Associated Equipment – Shunt Capacitors and Reactor

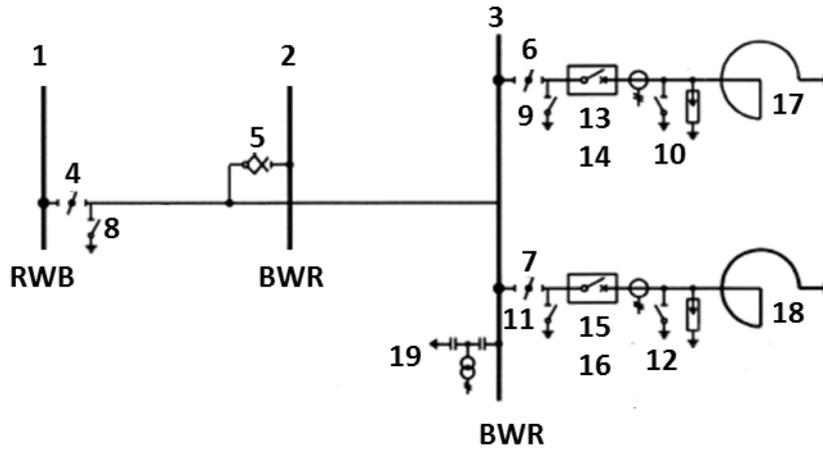


Legend:

| | | | |
|---|-------------------------------|----|---------------------|
| 1 | 400 kV B/B 1 | 7 | CAP 1 400 kV BKR |
| 2 | 400 kV B/B 2 | 8 | CAP 1 400 kV JB |
| 3 | CAP 1 400 kV B/B 1 ISOL | 9 | CAP 1 400 kV VT |
| 4 | CAP 1 400 kV B/B 2 ISOL | 10 | CAP 1 400 kV |
| 5 | CAP 1 400 kV B/B 2 E/SW | 11 | CAP 1 400 kV RX |
| 6 | CAP 1 400 kV BKR E/SW | | |

NOTE: Phasing discs: CT, VT, SA, Pantograph Isolators; Single ϕ Trfr, Reactor, Isol; also on O/H beam in each bay, either end of Bus Sections & Extreme ends of Busbars

Annex N – Busbars and Associated Equipment – Twin Reactors

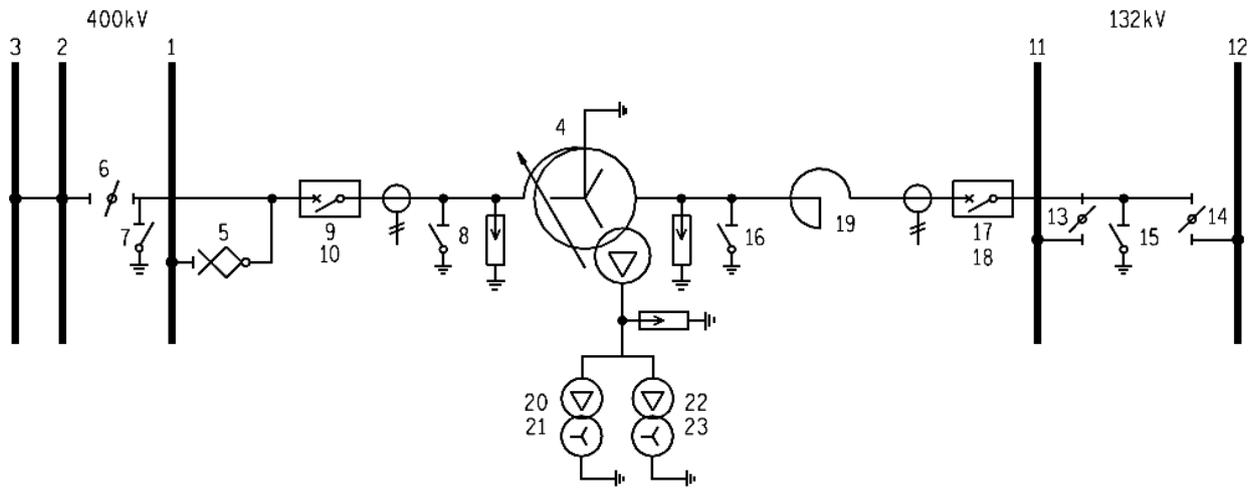


Legend:

| | | | |
|---|-----------------------------|----|-----------------------------|
| 1 | 400 kV B/B 1 | 10 | 400 kV RX 1 BKR E/SW |
| 2 | 400 kV B/B 2 | 11 | 400kV TRANS B/B ISOL 1 E/SW |
| 3 | 400kV TRANS B/B | 12 | 400 kV RX 2 BKR E/SW |
| 4 | 400 kV B/B 1 ISOL | 13 | RX 11 400 kV BKR |
| 5 | 400 kV B/B 2 ISOL | 14 | 400 kV RX 11 JB |
| 6 | 400kV TRANS B/B ISOL 1 | 15 | RX 2 400 kV BKR |
| 7 | 400kV TRANS B/B ISOL 2 | 16 | 400 kV RX 2 JB |
| 8 | 400 kV B/B 1 ISOL E/SW | 17 | 400 kV RX 1 |
| 9 | 400kV TRANS B/B ISOL 1 E/SW | 18 | 400 kV RX 2 |

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Annex O – Transformer Bays with Fault Current Limiting Reactor

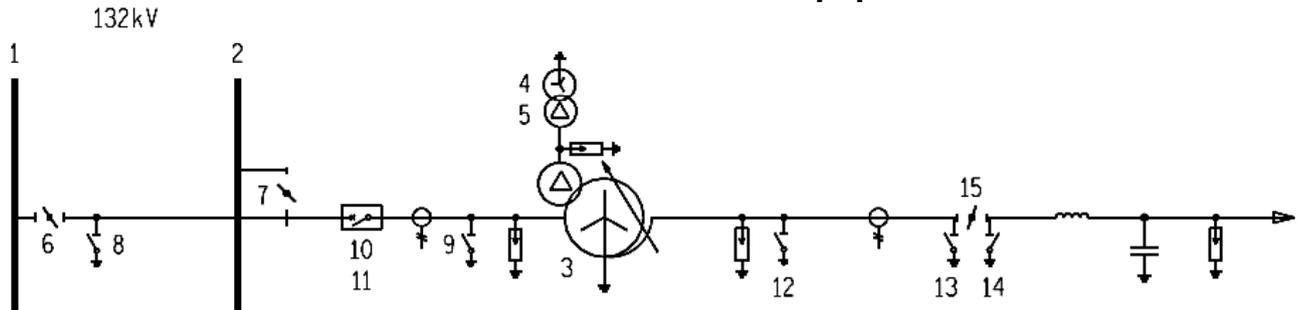


Legend:

| | | | | | |
|---|----------------------------|----|--------------------------------|----|--------------------------------------|
| 1 | 400 kV B/B 1 | 9 | TRFR 1 400 kV BKR | 17 | TRFR 1 132 kV BKR |
| 2 | 400 kV B/B 2 | 10 | TRFR 1 400 kV JB | 18 | TRFR 1 132 kV JB |
| 3 | 400 kV B/B 2 BYPASS B/B | 11 | 132 kV B/B 1 | 19 | TRFR 1 132 kV RX |
| 4 | TRFR 1 400/132/22 kV | 12 | 132 kV B/B 2 | 20 | TRFR 1 AUX TRFR 11 22 kV/400 V |
| 5 | 400 kV B/B 1 ISOL | 13 | 132 kV B/B 1 ISOL | 21 | TRFR 1 AUX TRFR 11 DB |
| 6 | 400 kV B/B 2 ISOL | 14 | 132 kV B/B 2 ISOL | 22 | TRFR 1 AUX TRFR 12 22 kV/400 V |
| 7 | TRFR 1 400 kV ISOL E/SW | 15 | TRFR 1 132 kV BKR ISOL E/SW | 23 | TRFR 1 AUX TRFR 12 DB |
| 8 | TRFR 1 400 kV BKR E/SW | 16 | TRFR 1 132 kV BKR E/SW | | |

NOTE: Phasing discs: CT, VT, SA, Pantograph Isolators; Single ϕ Trfr, Reactor, Isol; also on O/H beam in each bay, either end of Bus Sections & Extreme ends of B/Bs

Annex P – Transformers and Associated Equipment - Line Banks

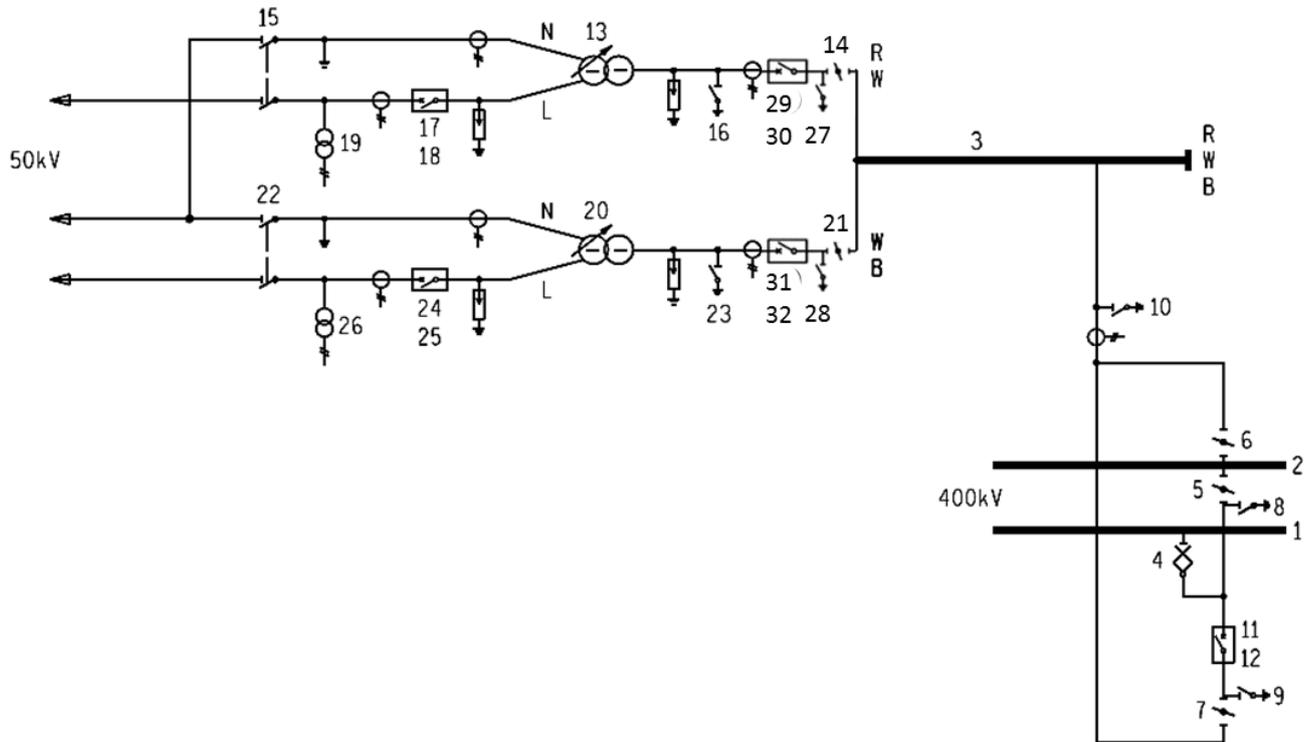


Legend:

| | | | |
|---|---|----|------------------------------------|
| 1 | 132 kV B/B 1 | 9 | HYDRA 1 TRFR 1 132 kV BKR E/SW |
| 2 | 132 kV B/B 2 | 10 | HYDRA 1 132 kV BKR |
| 3 | HYDRA 1 TRFR 1 220/132/22 kV | 11 | HYDRA 1 132 kV BKR JB |
| 4 | HYDRA 1 TRFR 1 22 kV/400 V AUX TRFR 11 | 12 | HYDRA 1 TRFR 1 132 kV E/SW |
| 5 | HYDRA 1 TRFR 1 22 kV/400 V AUX TRFR 11 DB | 13 | HYDRA 1 220 kV LINE ISOL E/SW 1 |
| 6 | HYDRA 1 132 kV B/B 1 ISOL | 14 | HYDRA 1 220 kV LINE ISOL E/SW 2 |
| 7 | HYDRA 1 132 kV B/B 2 ISOL | 15 | 220 kV HYDRA LINE ISOL |
| 8 | HYDRA 1 132 kV B/B 1 ISOL E/SW | | |

NOTE: Phasing discs: CT, VT, SA, Pantograph Isolators; Single ϕ Trfr, Reactor, Isol; also on O/H beam in each bay, either end of Bus Sections & Extreme ends of Busbars

Annex Q – Transformers and Associated Equipment _Single-Phase Traction Supply



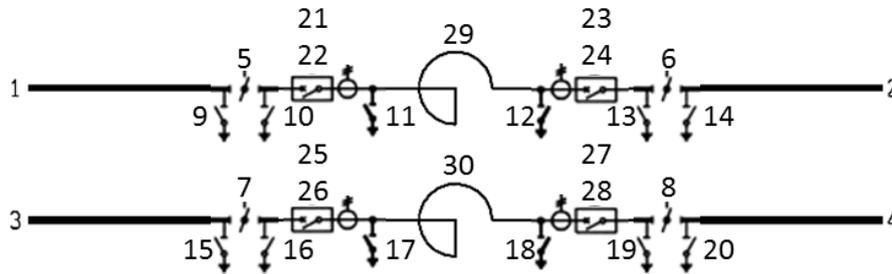
Legend:

| | | | | | |
|----|--|----|--|----|---|
| 1 | 400 kV B/B 1 | 12 | TRACTION FEEDER 400 kV JB | 23 | TRACTION 2 400 kV BKR E/SW TRFR SIDE |
| 2 | 400 kV B/B 2 | 13 | TRACTION 1 TRFR 400/50 kV | 24 | TRACTION 2 50 kV BKR |
| 3 | 400 kV CONNECTOR 1 | 14 | TRACTION 1 400 kV CONNECTOR 1ISOL | 25 | TRACTION 2 50 kV JB |
| 4 | TRACTION FEEDER 400 kV CONNECTOR 1 | 15 | TRACTION 1 50 kV PHASE/NEUTRAL SWITCH | 26 | TRACTION 2 50 kV VT |
| 5 | TRACTION FEEDER 400 kV CONNECTOR 1 | 16 | TRACTION 1 400 kV BKR E/SW TRFR SIDE | 27 | TRACTION 1 400 kV BKR E/SW CONNECTOR SIDE |
| 6 | TRACTION FEEDER 400 kV BYPASS ISOL | 17 | TRACTION 1 50 kV BKR | 28 | TRACTION 2 400 kV BKR E/SW CONNECTOR SIDE |
| 7 | TRACTION FEEDER 400 kV LINE ISOL | 18 | TRACTION 1 50 kV JB | 29 | TRACTION 2 400 kV BKR |
| 8 | TRACTION FEEDER 400 kV BKR E/SW B/B SIDE | 19 | TRACTION 1 50 kV VT | 30 | TRACTION 2 400 kV JB |
| 9 | TRACTION FEEDER 400 kV BKR E/SW CONNECTOR SIDE | 20 | TRACTION 2 TRFR 400/50 kV | 31 | TRACTION 2 400 kV BKR |
| 10 | 400 kV CONNECTOR 1 E/SW | 21 | TRACTION 2 400 kV CONNECTOR 1ISOL | 32 | TRACTION 2 400 kV JB |
| 11 | TRACTION FEEDER 400 kV BKR | 22 | TRACTION 2 50 kV PHASE/NEUTRAL SWITCH | | |

NOTE: Phasing discs: CT, VT, SA, Pantograph Isolators; Single ϕ Trfr, Reactor, Isol; also on O/H beam in each bay, either end of Bus Sections & Extreme ends of Busbars

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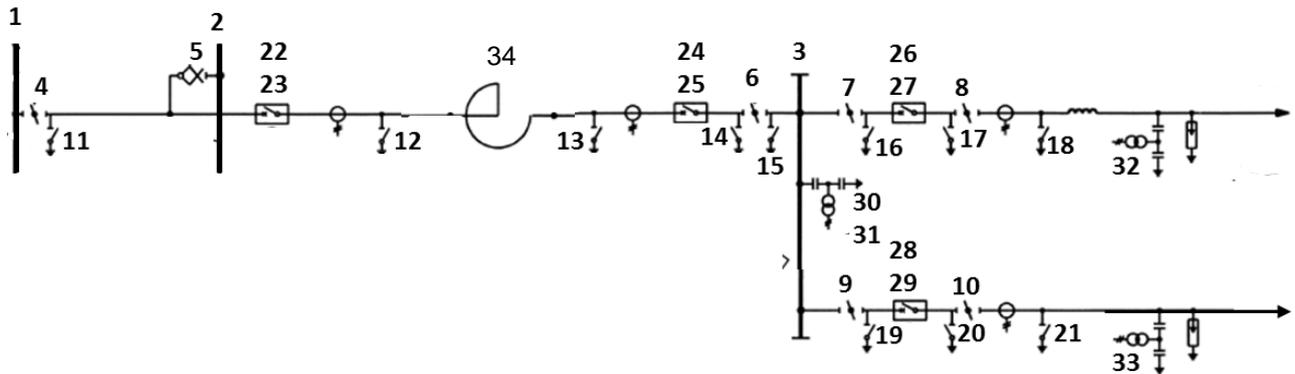
Annex R – Bus Section with Fault Current Limiting Reactor



Legend:

| | | | |
|----|--|----|--|
| 1 | 400 kV B/B 1A | 16 | 400 kV B/B 2 B/SECT 1 BKR 1 E/SW B/B 2A SIDE |
| 2 | 400 kV B/B 1B | 17 | 400 kV B/B 2 B/SECT 1 BKR 1 E/SW RX SIDE |
| 3 | 400 kV B/B 2A | 18 | 400 kV B/B 2 B/SECT 1 BKR 2 E/SW RX SIDE |
| 4 | 400 kV B/B 2B | 19 | 400 kV B/B 2 B/SECT 1 BKR 2 E/SW B/B 2B SIDE |
| 5 | 400 kV B/B 1 B/SECT 1 ISOL B/B 1A SIDE | 20 | 400 kV B/B 2B E/SW |
| 6 | 400 kV B/B 1 B/SECT 1 ISOL B/B 1B SIDE | 21 | 400 kV B/B 1 B/SECT 1 BKR 1 |
| 7 | 400 kV B/B 2 B/SECT 1 ISOL B/B 2A SIDE | 22 | 400 kV B/B 1 B/SECT 1 BKR 1 JB |
| 8 | 400 kV B/B 2 B/SECT 1 ISOL B/B 2B SIDE | 23 | 400 kV B/B 1 B/SECT2 BKR 2 |
| 9 | 400 kV B/B 1A E/SW | 24 | 400 kV B/B 1 B/SECT2 BKR 2 JB |
| 10 | 400 kV B/B 1 B/SECT 1 BKR 1 E/SW B/B 1A SIDE | 25 | 400 kV B/B 2 B/SECT 1 BKR 1 |
| 11 | 400 kV B/B 1 B/SECT 1 BKR 1 E/SW RX SIDE | 26 | 400 kV B/B 2 B/SECT 1 BKR 1 JB |
| 12 | 400 kV B/B 1 B/SECT 1 BKR 2 E/SW RX SIDE | 27 | 400 kV B/B 2 B/SECT2 BKR 2 |
| 13 | 400 kV B/B 1 B/SECT 1 BKR 2 E/SW B/B 1B SIDE | 28 | 400 kV B/B 2 B/SECT2 BKR 2 JB |
| 14 | 400 kV B/B 1B E/SW | 29 | 400 kV B/B 1 RX 1 |
| 15 | 400 kV B/B 2A E/SW | 30 | 400 kV B/B 2 RX 2 |

Annex S – Bus Coupler with Fault Current Limiting Reactor



Legend:

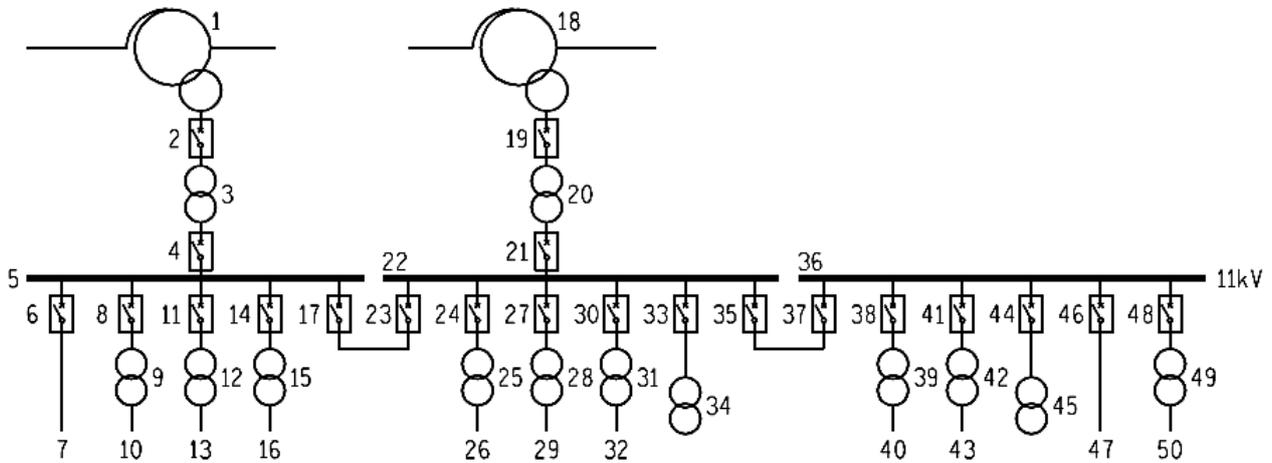
| | | | |
|----|---|--------|--|
| 1 | 400 kV B/B 1 | 18 | MATIMBA 1 400 kV LINE E/SW |
| 2 | 400 kV B/B 2 | 19 | SPITSKOP 3 400 kV BKR E/SW ISOL 3 SIDE |
| 3 | 400kV B/B 3 | 20 | SPITSKOP 3 400 kV BKR E/SW LINE SIDE |
| 4 | 400 kV B/CPL E B/B 1 ISOL | 21 | SPITSKOP 3 400 kV LINE E/SW |
| 5 | 400 kV B/CPL E B/B 2 ISOL | 22 | 400 kV B/CPL E BKR 1 |
| 6 | 400 kV B/CPL E CONNECTOR 1 ISOL | 23 | 400 kV B/CPL E BKR 1 JB |
| 7 | MATIMBA 1 400 kV B/B 3 ISOL | 24 | 400 kV B/CPL E BKR 2 |
| 8 | MATIMBA 1 400 kV LINE ISOL | 25 | 400 kV B/CPL E BKR 2 JB |
| 9 | SPITSKOP 3 400 kV B/B 3 ISOL | 26 | MATIMBA 1 400 kV BKR |
| 10 | SPITSKOP 3 400 kV LINE ISOL | 27 | MATIMBA 1 400 kV JB |
| 11 | B/CPL E 400 kV BKR 1 E/SW B/B 1 SIDE | 28 | SPITSKOP 3 400 kV BKR |
| 12 | B/CPL E 400 kV BKR 1 E/SW RX SIDE | 29 | SPITSKOP 3 400 kV JB |
| 13 | B/CPL E 400 kV BKR 2 E/SW RX SIDE | 30 | 400 kV B/B 3 VT |
| 14 | B/CPL E 400 kV BKR 2 E/SW B/B 3 ISOL SIDE | 31 | 400 kV B/B 3 VT JB |
| 15 | B/CPL E 400 kV B/B 3 ISOL E/SW | 32 | MATIMBA 1 400 kV VT |
| 16 | 400 kV BKR E/SW MATIMBA 1 3 ISOL SIDE | B/B 33 | SPITSKOP 3 400 kV VT |
| 17 | MATIMBA 1 400 kV BKR E/SW LINE SIDE | 34 | B/ COUPLER E 400 kV RX 3 |

NOTE: Phasing discs: CT, VT, SA, Pantograph Isolators; Single ϕ Trfr, Reactor, Isol; also on O/H beam in each bay, either end of Bus Sections & Extreme ends of B/Bs

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Annex T – Transformers and Associated Equipment (Secondary) – 765/400 kV Station Auxiliary Transformers

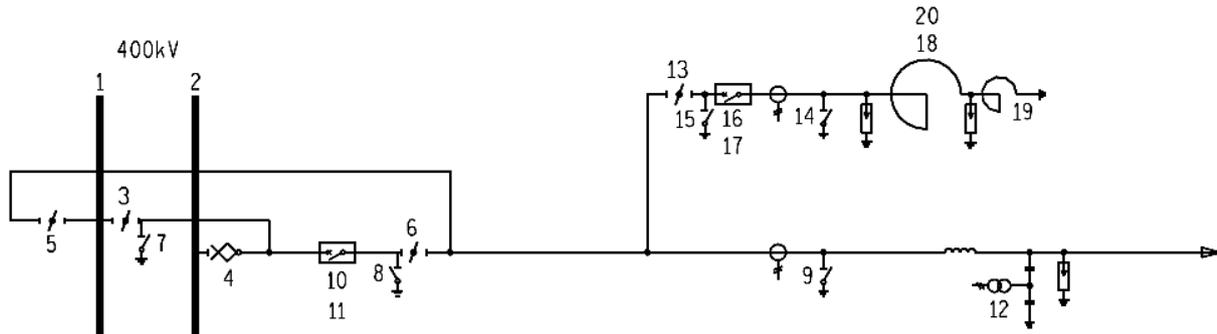


Legend:

| | | | | | | | |
|----|--|----|--|----|------------------------------|----|----------------------------|
| 1 | TRFR 1 765/400/33 kV | 14 | AUX TRFR 23 11 kV BKR | 26 | UNIT 1 400 V DB | 38 | AUX TRFR 27 11 kV BKR |
| 2 | TRFR 1 SECONDARY TRFR 11 33 kV BKR | 15 | AUX TRFR 23 11 kV/400 V | 27 | AUX TRFR 25 11 kV BKR | 39 | AUX TRFR 27 11 kV/400 V |
| 3 | TRFR 1 SECONDARY TRFR 11 33 kV/11 kV | 16 | CONTROL BLOCK 400 V DB | 28 | AUX TRFR2 11 kV/380 V | 40 | UNIT 2 400 V DB |
| 4 | TRFR 1 SECONDARY TRFR 11 11 kV BKR | 17 | 11 kV B/B 1 B/SECT 1 BKR 1 11 kV BKR | 29 | UNIT 2 400 V DB | 41 | AUX TRFR 28 11 kV BKR |
| 5 | 11 kV B/B 1A | 18 | TRFR 2 765/400/33 kV | 30 | AUX TRFR 26 11 kV BKR | 42 | AUX TRFR 28 11 kV/400 V |
| 6 | UNIT 3 11 kV BKR | 19 | TRFR 2 SECONDARY TRFR 12 33 kV BKR | 31 | AUX TRFR 26 11 kV/400 V | 43 | UNIT 3 400 V DB |
| 7 | UNIT 3 | 20 | TRFR 2 SECONDARY TRFR 12 33 kV/11 kV | 32 | CONTROL BLOCK 400 V DB | 44 | MINISUB 2 11 kV BKR |
| 8 | AUX TRFR 21 11 kV BKR | 21 | TRFR 2 SECONDARY TRFR 12 11 kV BKR | 33 | MINISUB1 11 kV BKR | 45 | MINISUB 2 |
| 9 | AUX TRFR 21 11 kV/400 V | 22 | 11 kV B/B 1B | 34 | MINISUB 1 | 47 | RURAL SUPPLY |
| 10 | UNIT 3 400 V DB | 23 | 11 kV B/B 1 B/SECT 1 BKR 2 | 35 | 11 kV B/B 1 B/SECT3 BKR 3 | 48 | AUX TRFR 29 11 kV BKR |
| 11 | AUX TRFR2 11 kV BKR | 24 | AUX TRFR 24 11 kV BKR | 36 | 11 kV B/B 1C | 49 | AUX TRFR 29 11 kV/400 V |
| 12 | AUX TRFR 22 11 kV/400 V | 25 | AUX TRFR 24 11 kV/400 V | 37 | 11 kV B/B 1 B/SECT3 BKR 3 | 50 | UNIT 1 400 V DB |
| 13 | UNIT 1 400 V DB | | | | | | |

NOTE: Phasing discs: CT, VT, SA, Pantograph Isolators; Single ϕ Trfr, Reactor, Isol; also on O/H beam in each bay, either end of Bus Sections & Extreme ends of B/Bs

Annex U – Feeders and Associated Equipment with Line Reactor



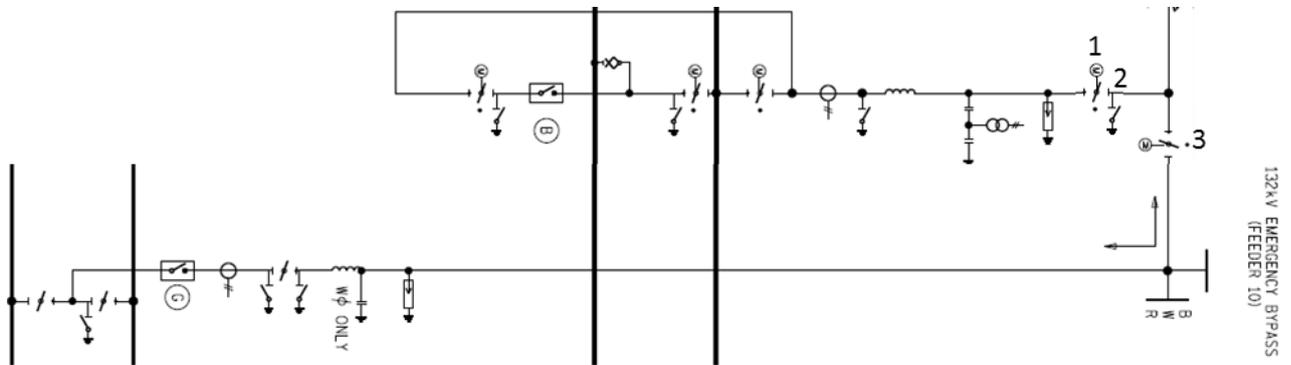
Legend:

| | | | |
|----|--|----|---|
| 1 | 400 kV B/B 2 | 11 | MARANG 1 400 kV JB |
| 2 | 400 kV B/B 1 | 12 | MARANG 1 400 kV VT |
| 3 | MARANG 1 400 kV B/B 2 ISOL | 13 | MARANG 1 400 kV RX ISOL |
| 4 | MARANG 1 400 kV B/B 1 ISOL | 14 | MARANG 1 400 kV RX BKR E/SW RX SIDE |
| 5 | MARANG 1 400 kV BYPASS ISOL | 15 | MARANG 1 400 kV RX BKR E/SW LINE SIDE |
| 6 | MARANG 1 400 kV LINE ISOL | 16 | MARANG 1 400 kV RX BKR |
| 7 | MARANG 1 400 kV BKR E/SW B/B SIDE | 17 | MARANG 1 400 kV RX JB |
| 8 | MARANG 1 400 kV BKR E/SW LINE SIDE | 18 | MARANG 1 400 kV RX |
| 9 | MARANG 1 400 kV LINE E/SW | 19 | MARANG 1 400kV RX NEUTRAL EARTHING RX |
| 10 | MARANG 1 400 kV BKR | 20 | MARANG 1 400kV RX DB |

NOTE: Phasing discs: CT, VT, SA, Pantograph Isolators; Single ϕ Trfr, Reactor, Isol; also on O/H beam in each bay, either end of Bus Sections & Extreme ends of Busbars

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Annex V – Feeder Bays Feeders with Emergency Bypasses at Lower Voltages



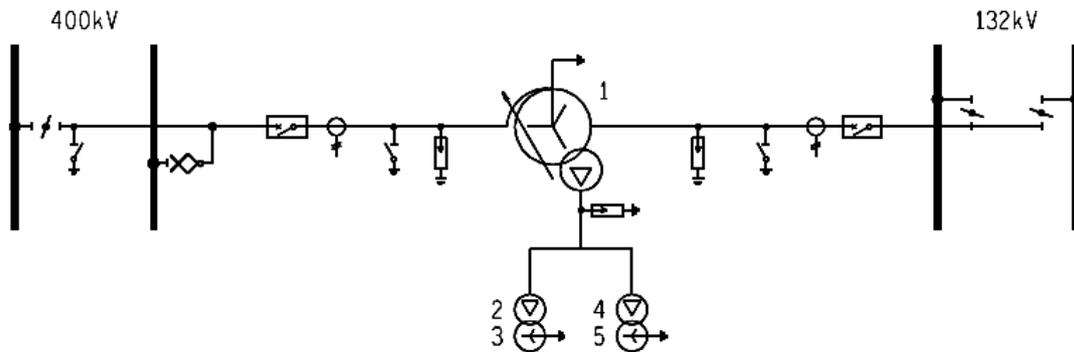
Legend:

| | | | |
|---|--|---|--|
| 1 | SORATA 1 275KV LINE CONNECTING ISOL | 3 | SORATA 1 132KV LINE CONNECTING ISOL |
| 2 | SORATA 1 275/132 kV E/SW LINE SIDE | | |
| Phasing discs: CT, VT, SA, Pantograph ISOLs; Single φ Trfr, Reactor, Isol; also on O/H beam in each bay, either end of Bus Sections & Extreme ends of Busbars | | | |

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Annex W – Transformer Tertiary Bays Auxiliary Transformers



Legend:

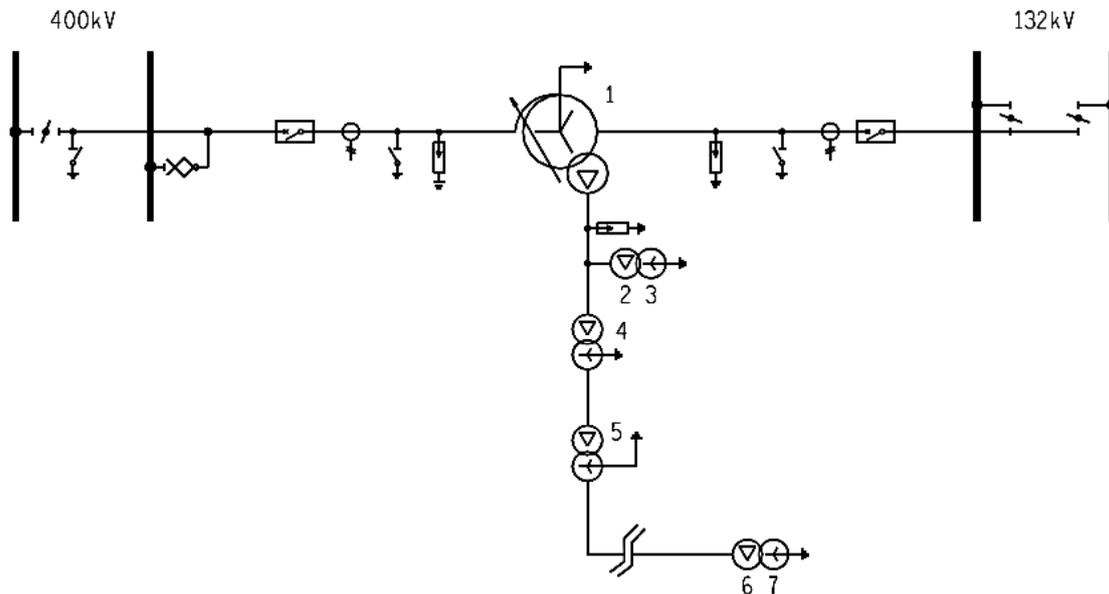
| | | | |
|---|--------------------------------------|---|--------------------------------------|
| 1 | TRFR 1 400/132/22 kV | 4 | TRFR 1 AUX TRFR 12 22 kV/400 V |
| 2 | TRFR 1 AUX TRFR 11 22 kV/400 V | 5 | TRFR 1 AUX TRFR 12 DB |
| 3 | TRFR 1 AUX TRFR 11 DB | | |

NOTE: Phasing discs: CT, VT, SA, Pantograph Isolators; Single ϕ Trfr, Reactor, Isol; also on O/H beam in each bay, either end of Bus Sections & Extreme ends of Busbars

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Annex X – Transformer Tertiary Bays with Step up, Step down and Auxiliary Transformers

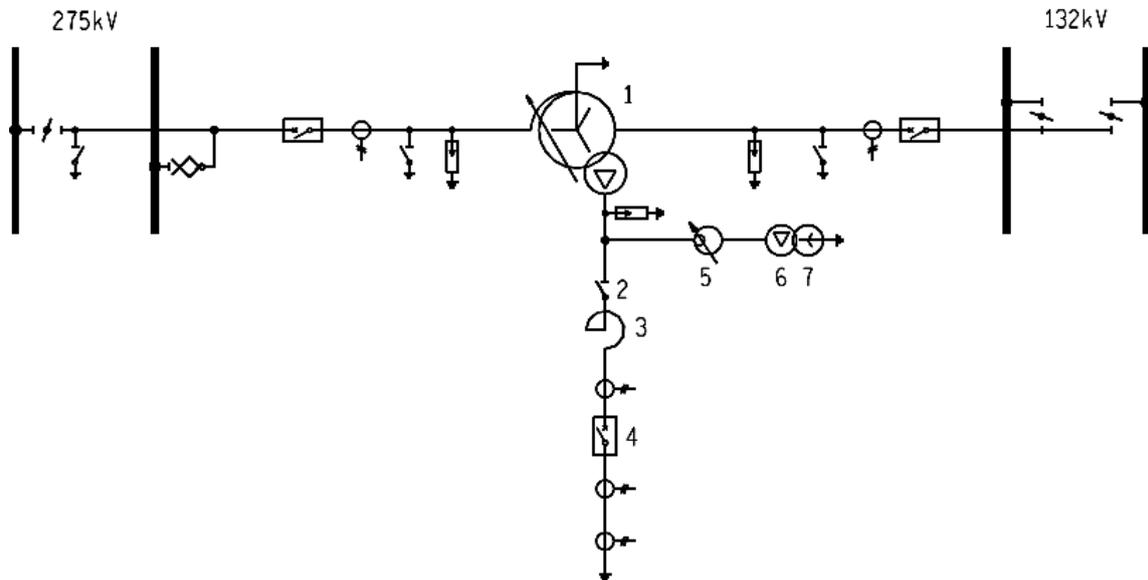


Legend:

| | | | |
|---|--|---|---|
| 1 | TRFR 1 400/132/22 kV | 5 | TRFR 1 SECONDARY TRFR 21 400 V/3,3 kV |
| 2 | TRFR 1 AUX TRFR 11 22 kV/400 V | 6 | TRFR 1 AUX TRFR 31 3,3 kV/400 V |
| 3 | TRFR 1 AUX TRFR 11 DB | 7 | TRFR 31 AUX TRFR 2 DB |
| 4 | TRFR 1 SECONDARY TRFR 12 22 kV/400 V | | |

NOTE: Phasing discs: CT, VT, SA, Pantograph Isolators; Single ϕ Trfr, Reactor, Isol; also on O/H beam in each bay, either end of Bus Sections & Extreme ends of Busbars

Annex Y – Transformer Tertiary Bays with Reactor and Voltage Regulator

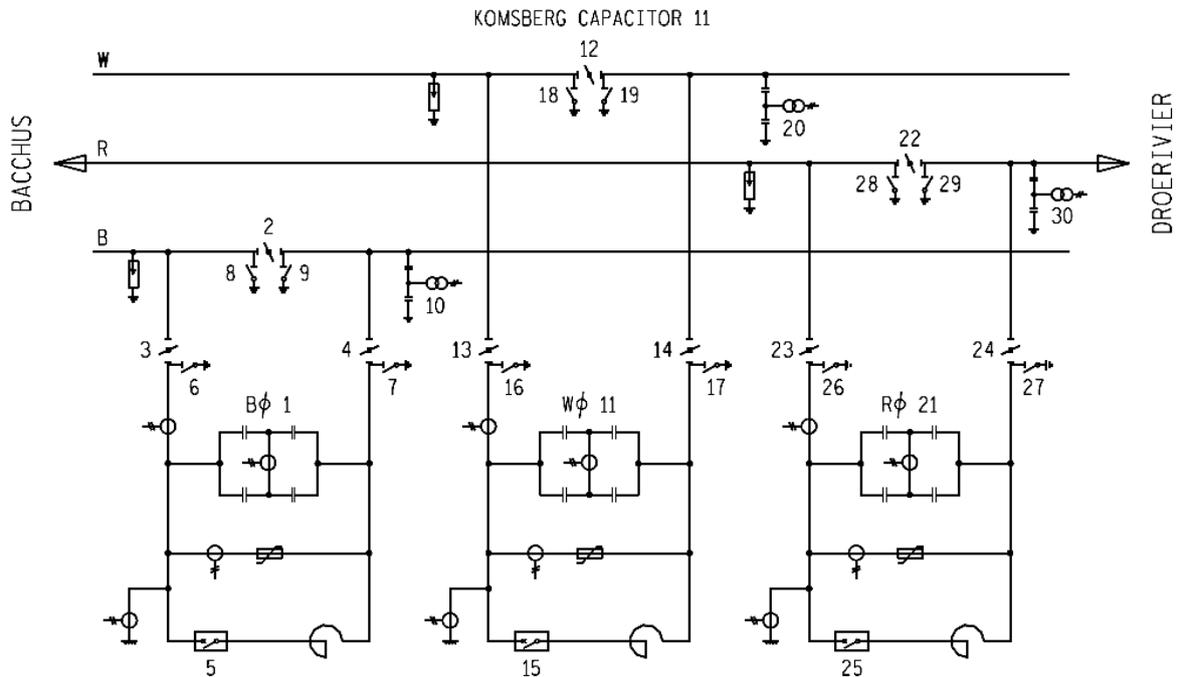


Legend:

| | | | |
|---|-------------------------|---|--------------------------------------|
| 1 | TRFR 1 275/132/11 kV | 5 | TRFR 1 11 kV VOLTAGE REGULATOR |
| 2 | TRFR 1 11 kV RX ISOL | 6 | TRFR 1 AUX TRFR 11 11 kV/400 V |
| 3 | TRFR 1 11 kV RX | 7 | TRFR 1 AUX TRFR 11 DB |
| 4 | TRFR 1 11 kV BKR | | |

NOTE: Phasing discs: CT, VT, SA, Pantograph ISOLs; Single ϕ Trfr, Reactor, Isol; also on O/H beam in each bay, either end of Bus Sections & Extreme ends of Busbars

Annex Z – Series Capacitor Station (Mid Line)

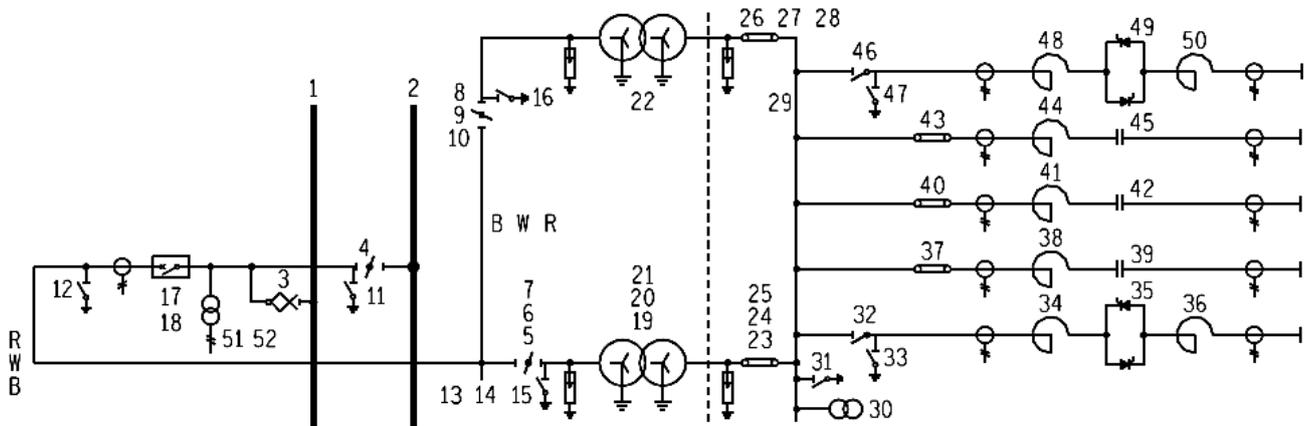


Legend:

| | CAPACITOR BLUE PHASE | | CAPACITOR WHITE PHASE | | CAPACITOR RED PHASE |
|----|---|--------|--|--------|--|
| 1 | KOMSBERG CAP 1 400kV BLUE PHASE | 1 1 | KOMSBERG CAP 1 400kV WHITE PHASE | 2 1 | KOMSBERG CAP 1 400kV RED PHASE |
| 2 | KOMSBERG CAP 1 400 kV BYPASS ISOL Bφ | 1 2 | KOMSBERG CAP 1 400 kV BYPASS ISOL Wφ | 2 2 | KOMSBERG CAP 1 400 kV BYPASS ISOL Rφ |
| 3 | KOMSBERG CAP 1 400 kV LINE ISOL Bφ BACCHUS SIDE | 1 3 | KOMSBERG CAP 1 400 kV LINE ISOL Wφ BACCHUS SIDE | 2 3 | KOMSBERG CAP 1 400 kV LINE ISOL Rφ BACCHUS SIDE |
| 4 | KOMSBERG CAP 1 400 kV LINE ISOL Bφ DROERIVIER SIDE | 1 4 | KOMSBERG CAP 1 400 kV LINE ISOL Wφ DROERIVIER SIDE | 2 4 | KOMSBERG CAP 1 400 kV LINE ISOL Rφ DROERIVIER SIDE |
| 5 | KOMSBERG CAP 1 400 kV BYPASS BKR Bφ | 1 5 | KOMSBERG CAP 1 400 kV BYPASS BKR Wφ | 2 5 | KOMSBERG CAP 1 400 kV BYPASS BKR Rφ |
| 6 | KOMSBERG CAP 1 400 kV CAP BANK E/SW Bφ BACCHUS SIDE | 1 6 | KOMSBERG CAP 1 400 kV CAP BANK E/SW Wφ BACCHUS SIDE | 2 6 | KOMSBERG CAP 1 400 kV CAP BANK E/SW Rφ BACCHUS SIDE |
| 7 | KOMSBERG CAP 11 400 kV CAP BANK E/SW Bφ DROERIVIER SIDE | 1 7 | KOMSBERG CAP 1 400 kV CAP BANK E/SW Wφ DROERIVIER SIDE | 2 7 | KOMSBERG CAP 1 400 kV CAP BANK E/SW Rφ DROERIVIER SIDE |
| 8 | KOMSBERG CAP 1 400 kV LINE E/SW Bφ BACCHUS SIDE | 1 8 | KOMSBERG CAP 1 400 kV LINE E/SW Wφ BACCHUS SIDE | 2 8 | KOMSBERG CAP 1 400 kV LINE E/SW Rφ BACCHUS SIDE |
| 9 | KOMSBERG CAP 1 400 kV LINE E/SW Bφ DROERIVIER SIDE | 1 9 | KOMSBERG CAP 1 400 kV LINE E/SW Wφ DROERIVIER SIDE | 2 9 | KOMSBERG CAP 1 400 kV LINE E/SW Rφ DROERIVIER SIDE |
| 10 | KOMSBERG CAP 1 400 kV VT Bφ | 2 0 | KOMSBERG CAP 1 400 kV VT Wφ | 3 0 | KOMSBERG CAP 1 400 kV VT Rφ |

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Annex AA – Static Var Compensators (SVC)

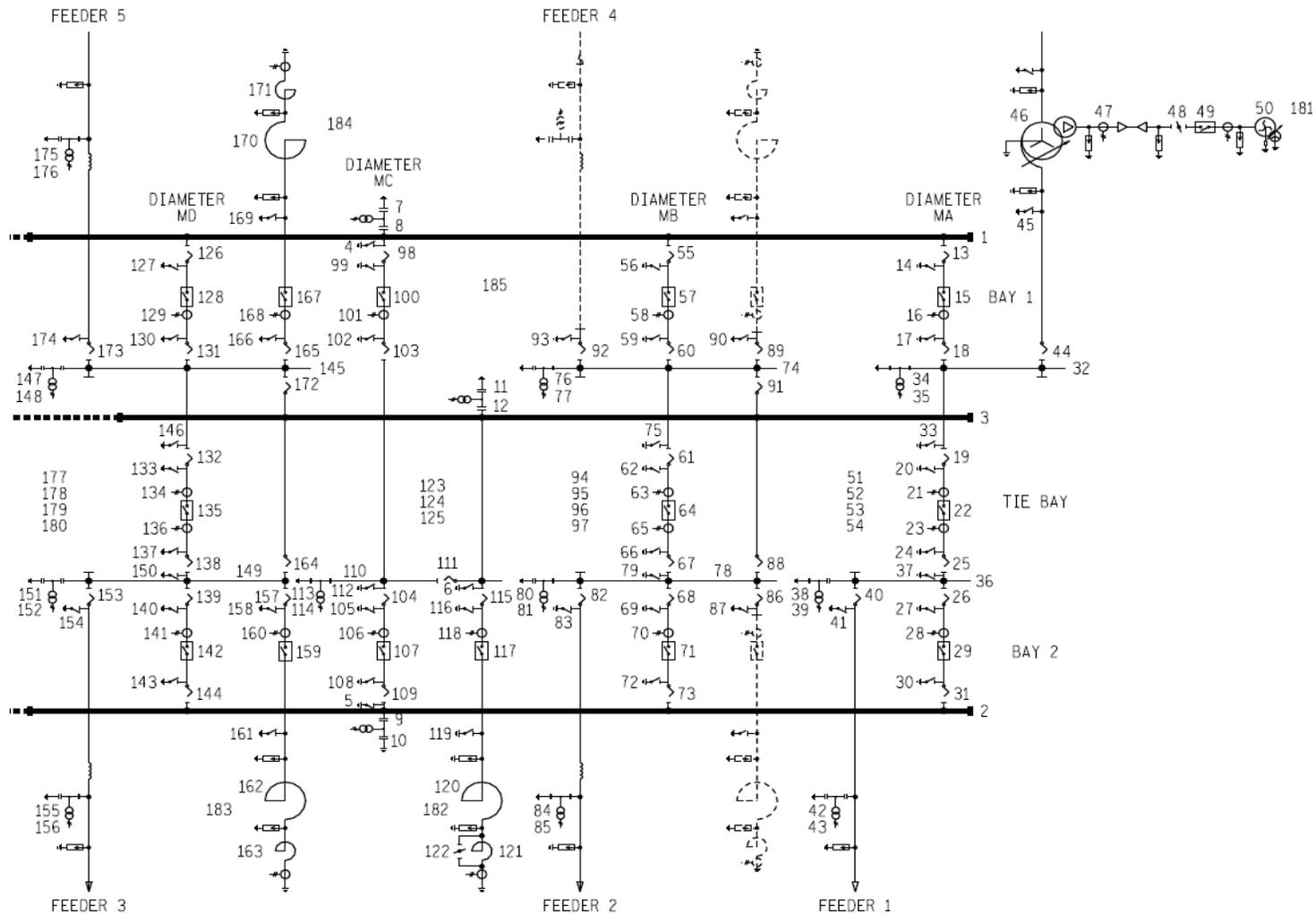


Legend:

| | | | | | | | |
|----|---|----|---------------------------------------|----|--------------------------------------|----|-------------------------------|
| 1 | 400 kV B/B 1 | 14 | SVC 1 TRFR E/SW WHITE PHASE | 27 | SVC 1 STANDBY TRFR 30 kV B/B LINK Wφ | 40 | SVC 1 30 kV FILTER 2 B/B LINK |
| 2 | 400 kV B/B 2 | 15 | SVC 1 TRFR E/SW RED PHASE | 28 | SVC 1 STANDBY TRFR 30 kV B/B LINK Rφ | 41 | SVC 1 30 kV FILTER 2 RX |
| 3 | SVC 1 400 kV B/B 1 ISOL | 16 | SVC 1 400 kV STANDBY TRFR E/SW | 29 | 30 kV SVC 1 B/B | 42 | SVC 1 30 kV FILTER 2 CAP |
| 4 | SVC 1 400 kV B/B 2 ISOL | 17 | SVC 1 400 kV BKR | 30 | SVC 1 AUX TRFR 30 kV/380 V | 43 | SVC 1 30 kV FILTER 3 B/B LINK |
| 5 | SVC 1 400 kV TRFR ISOL BLUE PHASE | 18 | SVC 1 400 kV JB | 31 | SVC 1 30kV B/B E/SW | 44 | SVC 1 30 kV FILTER 3 RX |
| 6 | SVC 1 400 kV TRFR ISOL WHITE PHASE | 19 | SVC 1 TRFR 400/30 kV BLUE PHASE | 32 | SVC 1 30 kV RX 1 B/B ISOL | 45 | SVC 1 30 kV FILTER 3 CAP |
| 7 | SVC 1 400 kV TRFR ISOL RED PHASE | 20 | SVC 1 TRFR 400/30 kV WHITE PHASE | 33 | SVC 1 30 kV RX 1 E/SW | 46 | SVC 1 30 kV RX 2 B/B ISOL |
| 8 | SVC 1 400 kV STANDBY TRFR ISOL BLUE PHASE | 21 | SVC 1 TRFR 400/30 kV RED PHASE | 34 | SVC 1 30 kV RX 1A | 47 | SVC 1 30 kV RX 2 E/SW |
| 9 | SVC 11 400 kV STANDBY TRFR ISOL WHITE PHASE | 22 | SVC 1 STANDBY TRFR 400/30 kV | 35 | SVC 1 30 kV THYRISTOR BANK 1 | 48 | SVC 1 30 kV RX 2A |
| 10 | SVC 11 400 kV STANDBY TRFR ISOL PHASE RED | 23 | SVC 1 TRFR 30 kV B/B LINK | 36 | SVC 1 30 kV RX 1B | 49 | SVC 1 30 kV THYRISTOR BANK 2 |
| 11 | SVC 1 400 kV BKR E/SW B/B SIDE | 24 | SVC 11 TRFR 30 kV B/B LINK | 37 | SVC 1 30 kV FILTER 1 B/B LINK | 50 | SVC 1 30 kV RX 2B |
| 12 | SVC 1 400 kV BKR E/SW SVC SIDE | 25 | SVC 11 TRFR 30 kV B/B LINK | 38 | SVC 1 30 kV FILTER 1 RX | 51 | SVC 1 400 kV VT |
| 13 | SVC 11 TRFR E/SW BLUE PHASE | 26 | SVC 11 STANDBY TRFR 30 kV B/B LINK Bφ | 39 | SVC 1 30 kV FILTER 1 CAP | 52 | SVC 11 400 kV VT JB |

NOTE: Phasing discs: CT, VT, SA, Pantograph Isolators; Single φ Trfr, Reactor, Isol.

Annex BB – 765 kV BKR and a half with Reactor Transfer Busbar



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Legend:

| | BUSBARS | | DIAMETER MA | | FEEDER 1 |
|----|--|----|--|----|--|
| 1 | 765 kV B/B 1 | 22 | DIAMETER MA TIE BAY 765 kV BKR | 41 | BETA 1 765 kV LINE E/SW |
| 2 | 765 kV B/B 2 | 23 | DIAMETER MA TIE BAY 765 kV CT B/B 2 SIDE | 42 | BETA 1 765 kV VT |
| 3 | 765 kV RX TRANSFER B/B | 24 | DIAMETER MA TIE BAY 765 kV BKR EARTH Sw B/B 2 SIDE | 43 | BETA 1 765 kV VT JB |
| 4 | 765 kV B/B 1 E/SW | 25 | DIAMETER MA TIE BAY 765 kV ISOL B/B 2 SIDE | | TRFR 1 |
| 5 | 765 kV B/B 2 E/SW | 26 | DIAMETER MA BAY 2 765 kV ISOL B/B 1 SIDE | 44 | TRFR 1 765 kV ISOL |
| 6 | 765 kV RX TRANSFER B/B E/SW | 27 | DIAMETER MA BAY 2 765 kV BKR E/Sw B/B 1 SIDE | 45 | TRFR 1 765 kV E/SW |
| 7 | 765 kV B/B 1 VT | 28 | DIAMETER MA BAY 2 765 kV CT | 46 | TRFR 1 765/400/33 kV |
| 8 | 765 kV B/B 1 VT JB | 29 | DIAMETER MA BAY 2 765 kV BKR | 47 | TRFR 1 TDB |
| 9 | 765 kV B/B 2 VT | 30 | DIAMETER MA BAY 2 765 kV BKR E/Sw B/B 2 SIDE | 48 | TRFR 1 NECRT 1 33 kV ISOL |
| 10 | 765 kV B/B 2 VT JB | 31 | DIAMETER MA BAY 2 765 kV B/B 2 ISOL 2 | 49 | TRFR 1 NECRT 1 33 kV BKR |
| 11 | 765 kV RX TRANSFER B/B VT | | DIAMETER MA CONNECTOR 1 | 50 | TRFR 1 33 kV/400 V NECRT 1 |
| 12 | 765 kV RX TRANSFER B/B VT JB | 32 | DIAMETER MA 765 kV CONNECTOR 1 | 51 | DMK MA |
| | DIAMETER MA | 33 | DIAMETER MA 765 kV CONNECTOR 1 E/SW | 52 | PLUG BOX MA 701 |
| 13 | DIAMETER MA BAY 1 765 kV B/B 1 ISOL 4 | 34 | DIAMETER MA 765 kV CONNECTOR 1 VT | 53 | PLUG BOX MA 702 |
| 14 | DIAMETER MA BAY 1 765 kV BKR EARTH Sw B/B 1 SIDE | 35 | DIAMETER MA 765 kV CONNECTOR 1 VT JB | 54 | PLUG BOX MA 703 |
| 15 | DIAMETER MA BAY 1 765 kV BKR | | DIAMETER MA CONNECTOR 2 | | DIAMETER MB |
| 16 | DIAMETER MA BAY 1 765 kV CT | 36 | DIAMETER MA 765 kV CONNECTOR 2 | 55 | DIAMETER MB BAY 1 765 kV B/B 1 ISOL |
| 17 | DIAMETER MA BAY 1 765 kV BKR EARTH Sw B/B 2 SIDE | 37 | DIAMETER MA 765 kV CONNECTOR 2 E/SW | 56 | DIAMETER MB BAY 1 765 kV BKR E/Sw B/B 1 SIDE |
| 18 | DIAMETER MA BAY 1 765 kV ISOL B/B 2 SIDE | 38 | DIAMETER MA 765 kV CONNECTOR 2 VT | 57 | DIAMETER MB BAY 1 765 kV BKR |
| 19 | DIAMETER MA TIE BAY 4 765 kV ISOL B/B 1 SIDE | 39 | DIAMETER MA 765 kV CONNECTOR 2 VT JB | 58 | DIAMETER MB BAY 1 765 kV CT |
| 20 | DIAMETER MA TIE BAY 765 kV BKR EARTH Sw B/B 1 SIDE | | FEEDER 1 | 59 | DIAMETER MB BAY 1 765 kV BKR E/Sw B/B 2 SIDE |
| 21 | DIAMETER MA TIE BAY 765 kV CT B/B 1 SIDE | 40 | BETA 1 765 kV LINE ISOL | 60 | DIAMETER MB BAY 1 765 kV ISOL B/B 2 SIDE |

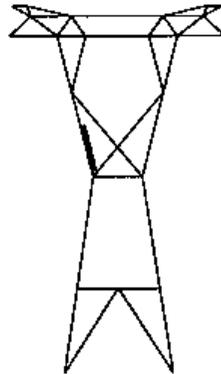
| | DIAMETER MB | | DIAMETER MB CONNECTOR 2 | | FEEDER 4 |
|----|--|----|--|-----|--|
| 61 | DIAMETER MB TIE BAY 765 kV ISOL B/B 1 SIDE | 79 | DIAMETER MB 765 kV CONNECTOR 2 E/SW | 97 | PLUG BOX MB 703 |
| 62 | DIAMETER MB TIE BAY 765 kV BKR E/Sw B/B 1 SIDE | 80 | DIAMETER MB 765 kV CONNECTOR 2 VT | | DIAMETER MC |
| 63 | DIAMETER MB TIE BAY 765 kV CT B/B 1 SIDE | 81 | DIAMETER MB 765 kV CONNECTOR 2 VT JB | 98 | DIAMETER MC BAY 1 765 kV B/B 1 ISOL |
| 64 | DIAMETER MB TIE BAY 765 kV BKR | | FEEDER 2 | 99 | DIAMETER MC BAY 1 765 kV BKR E/Sw B/B 1 SIDE |
| 65 | DIAMETER MB TIE BAY 765 kV CT B/B 2 SIDE | 82 | HYDRA 1 765 kV LINE ISOL | 100 | DIAMETER MC BAY 1 765 kV BKR |
| 66 | DIAMETER MB TIE BAY 765 kV BKR E/Sw B/B 2 SIDE | 83 | HYDRA 1 765 kV LINE E/SW | 101 | DIAMETER MC BAY 1 765 kV CT |
| 67 | DIAMETER MB TIE BAY 765 kV ISOL B/B 2 SIDE | 84 | HYDRA 1 765 kV VT | 102 | DIAMETER MC BAY 1 765 kV BKR E/SW B/B 2 SIDE |
| 68 | DIAMETER MB BAY 2 765 kV ISOL B/B 1 ISOL-SIDE | 85 | HYDRA 1 765 kV VT JB | 103 | DIAMETER MC BAY 1 765 kV ISOL B/B 2 SIDE |
| 69 | DIAMETER MB BAY 2 765 kV BKR E/Sw 2 B/B 1 SIDE | 86 | HYDRA 1 RX 765 kV ISOL | 104 | DIAMETER MC BAY 2 765 kV ISOL B/B 1 SIDE |
| 70 | DIAMETER MB BAY 2 765 kV CT | 87 | HYDRA 1 RX 765 kV BKR E/Sw LINE SIDE | 105 | DIAMETER MC BAY 2 765 kV BKR E/SW 2 B/B 1 SIDE |
| 71 | DIAMETER MB BAY 2 765 kV BKR | 88 | HYDRA 1 765 kV TRANSFER ISOL | 106 | DIAMETER MC BAY 2 765 kV CT |
| 72 | DIAMETER MB BAY 2 765 kV BKR E/Sw B/B 2 SIDE | | FEEDER 4 | 107 | DIAMETER MC BAY 2 765 kV BKR |
| 73 | DIAMETER MB BAY 2 765 kV B/B 2 ISOL | 89 | ZEUS 1 RX 765 kV ISOL | 108 | DIAMETER MC BAY 2 765 kV BKR E/Sw B/B 2 SIDE |
| | DIAMETER MB CONNECTOR 1 | 90 | ZEUS 1 RX 765 kV BKR E/Sw LINE SIDE | 109 | DIAMETER MC BAY 2 765 kV B/B 2 ISOL |
| 74 | DIAMETER MB 765 kV CONNECTOR 1 | 91 | ZEUS 1 765 kV TRANSFER ISOL | | DIAMETER MC CONNECTOR 2 |
| 75 | DIAMETER MB 765 kV CONNECTOR 1 E/SW | 92 | ZEUS 1 765 kV LINE ISOL | 110 | DIAMETER MC 765 kV CONNECTOR 2 |
| 76 | DIAMETER MB 765 kV CONNECTOR 1 VT | 93 | ZEUS 1 765 kV LINE E/SW | 111 | DIAMETER MC B/B RX 1 765 kV CONNECTOR 2 ISOL |
| 77 | DIAMETER MB 765 kV CONNECTOR 1 VT JB | 94 | DMK MB | 112 | DIAMETER MC 765 kV CONNECTOR 2 E/SW |
| | DIAMETER MB CONNECTOR 2 | 95 | PLUG BOX MB 701 | 113 | DIAMETER MC 765 kV CONNECTOR 2 VT |
| 78 | DIAMETER MB 765 kV CONNECTOR 2 | 96 | PLUG BOX MB 702 | 114 | DIAMETER MC 765 kV CONNECTOR 2 VT JB |

| | BUSBAR REACTOR 1 | | DIAMETER MD | | DIAMETER MD CONNECTOR 2 |
|-----|--|-----|--|-----|--|
| 115 | B/B RX 1 765 kV ISOL | 134 | DIAMETER MD TIE BAY 765 kV CT B/B 1 SIDE | 152 | DIAMETER MD 765 kV CONNECTOR 2 VT JB |
| 116 | B/B RX 1 765 kV BKR E/SW TRANSFER B/B SIDE | 135 | DIAMETER MD TIE BAY 765 kV BKR | | FEEDER 3 |
| 117 | B/B RX 1 765 kV BKR | 136 | DIAMETER MD TIE BAY 765 kV CT B/B 2 SIDE | 153 | GAMMA 1 765 kV LINE ISOL |
| 118 | B/B RX 1 765 kV CT | 137 | DIAMETER MD TIE BAY 765 kV BKR E/Sw B/B 2 SIDE | 154 | GAMMA 1 765 kV LINE E/SW |
| 119 | B/B RX 1 765 kV BKR E/SW RX SIDE | 138 | DIAMETER MD TIE BAY 765 kV ISOL B/B 2 SIDE | 155 | GAMMA 1 765 kV VT |
| 120 | B/B RX 1 765 kV | 139 | DIAMETER MD BAY 2 765 kV ISOL B/B 1 SIDE | 156 | GAMMA 1 765 kV VT JB |
| 121 | B/B RX 1 NER | 140 | DIAMETER MD BAY 2 765 kV BKR E/Sw 2 B/B 1 SIDE | 157 | GAMMA 1 RX 765 kV ISOL |
| 122 | B/B RX 1 NER BYPASS ISOL | 141 | DIAMETER MD BAY 2 765 kV CT | 158 | GAMMA 1 RX 765 kV BKR E/Sw LINE SIDE |
| 123 | DMK MC | 142 | DIAMETER MD BAY 2 765 kV BKR | 159 | GAMMA 1 RX 765 kV BKR |
| 124 | PLUG BOX MC 701 | 143 | DIAMETER MD BAY 2 765 kV BKR E/Sw B/B 2 SIDE | 160 | GAMMA 1 RX 765 kV CT |
| 125 | PLUG BOX MC 702 | 144 | DIAMETER MD BAY 2 765 kV B/B 2 ISOL | 161 | GAMMA 1 RX 765 kV BKR E/Sw RX SIDE |
| | DIAMETER MD | | DIAMETER MD CONNECTOR 1 | 162 | GAMMA 1 RX 765 kV |
| 126 | DIAMETER MD BAY 1 765 kV B/B 1 ISOL | 145 | DIAMETER MD 765 kV CONNECTOR 1 | 163 | GAMMA 1 RX NER |
| 127 | DIAMETER MD BAY 1 765 kV BKR E/Sw B/B 1 SIDE | 146 | DIAMETER MD 765 kV CONNECTOR 1 E/SW | 164 | GAMMA 1 RX 765 kV TRANSFER ISOL |
| 128 | DIAMETER MD BAY 1 765 kV BKR | 147 | DIAMETER MD 765 kV CONNECTOR 1 VT | | FEEDER 5 |
| 129 | DIAMETER MD BAY 1 765 kV CT | 148 | DIAMETER MD 765 kV CONNECTOR 1 VT JB | 165 | MERCURY 1 RX 765 kV ISOL |
| 130 | DIAMETER MD BAY 1 765 kV BKR E/Sw B/B 2 SIDE | | DIAMETER MD CONNECTOR 2 | 166 | MERCURY 1 RX 765 kV BKR E/Sw LINE SIDE |
| 131 | DIAMETER MD BAY 1 765 kV ISOL B/B 2 SIDE | 149 | DIAMETER MD 765 kV CONNECTOR 2 | 167 | MERCURY 1 RX 765 kV BKR |
| 132 | DIAMETER MD TIE BAY 765 kV ISOL B/B 1 SIDE | 150 | DIAMETER MD 765 kV CONNECTOR 2 E/SW | 168 | MERCURY 1 RX 765 kV CT |
| 133 | DIAMETER MD TIE BAY 765 kV BKR E/Sw B/B 1 SIDE | 151 | DIAMETER MD 765 kV CONNECTOR 2 VT | 169 | MERCURY 1 RX 765 kV BKR E/Sw RX SIDE |

| | FEEDER 5 | | | | DISTRIBUTION BOARDS |
|-----|--------------------------------------|-----|---------------------------|-----|---|
| 170 | MERCURY 1 RX 765 kV | 176 | MERCURY 1 765 kV VT JB | 181 | TRFR 1 NECRT DISTRIBUTION BOARD |
| 171 | MERCURY 1 RX NER | 177 | DMK MD | 182 | B/B RX 1 DISTRIBUTION BOARD |
| 172 | MERCURY 1 RX 765 kV TRANSFER ISOL | | DISTRIBUTION BOARDS | 183 | GAMMA 1 RX DISTRIBUTION BOARD |
| 173 | MERCURY 1 765 kV LINE ISOL | 178 | PLUG BOX MD 701 | 184 | MERCURY 1 RX DISTRIBUTION BOARD |
| 174 | MERCURY 1 765 kV LINE E/SW | 179 | PLUG BOX MD 702 | 185 | 765 kV YARD STATION DISTRIBUTION BOARD |
| 175 | MERCURY 1 765 kV VT | 180 | PLUG BOX MD 703 | | |

NOTE: Phasing discs: CT, VT, SA, Pantograph Isolators; Single ϕ Trfr, Reactor, Isol; also on O/H beam in each bay, either end of Bus Sections & Extreme ends of Busbars

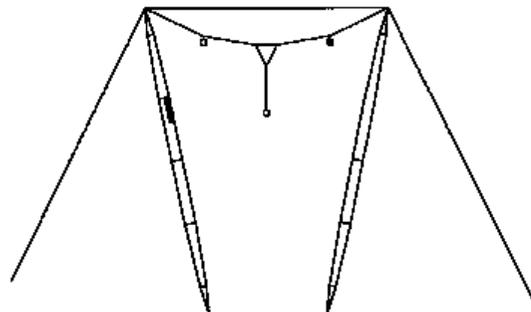
Annex CC – Tower / Structure / Pole Label Position



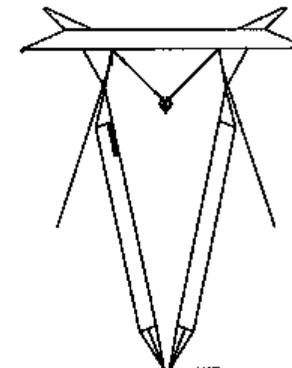
Self Supporting Tower



Double Circuit Tower



Crossrope Tower



Guyed V tower

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