

 Eskom	Standard	Technology
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Title: **STANDARD DRAWING
PRACTICE FOR CAD USERS IN
THE POWER PLANT AND
CONTROL PLANT
TECHNOLOGIES ENVIRONMENT
AND FOR ELECTRIFICATION
NETWORKS**

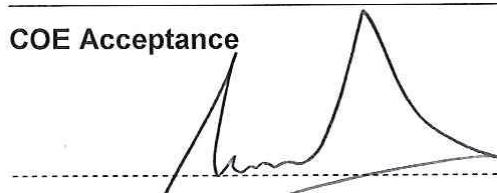
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This document is **STABILISED**. The technical content in this document is not expected to change because the document covers: *(Tick applicable motivation)*

1	A specific plant, project or solution	
2	A mature and stable technical area/technology	x
3	Established and accepted practices.	x

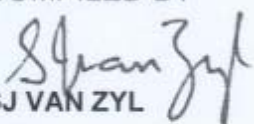
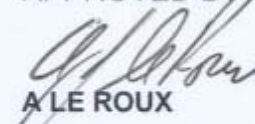
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Foreword

N/A

Revision history

This revision cancels and replaces revision no 0 of standard no. SCSASABI1
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		-	Various changes made to General and Substation layout design.

Authorisation

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

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Introduction

This document sets out the drawing requirements for all Power Plant staff, Control Technologies staff and appointed consultants.

Keywords

CAD users, drawing practice, electrification networks.

Bibliography

BSS 158: Numbering of Lead Wires (obsolete)

Standard specification for the presentation of standard scheme and schematic diagrams (obsolete Eskom document)

1 Scope

This document sets out the methods to be followed to ensure that all draughting staff in Power Plant, Control Technologies, appointed consultants and Electrification Networks work to, and maintain, the same high standard in the preparation and production of CAD drawings.

2 Normative references

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

NRS 002:2000 Second Edition: *Graphical symbols for electrical diagrams* (www.nrs.eskom.co.za)

DISASAAN0: *Distribution Group's standard for the labelling of high voltage equipment.*

SCSASACM0 (DST_34-1171), *Distribution Group's specific representation of operating diagrams in the field, station electric diagrams.*

DISSCABR6 (DSP_34-1612), *Specific requirements for symbols to be used on all schematic representations of diagrams for HV and MV voltage levels.*

DSP_34-963, *Distribution user specification for network operations and operating diagrams.*

DSP_34-254, *Manufacturing specification for Distribution equipment labels.*

DST_34-436, *Distribution standard for feeder operating diagrams.*

DST_34-437, *Distribution standard for station operating diagrams.*

3 Definitions and abbreviations

3.1 Definitions

“AsBuilt” Model: The “AsBuilt” model is the design model of the phase one electrification network design and will also be the “AsBuilt” of the town.

Cordaptix data: Eskom’s customer database.

Designer: The designer is the Engineer or Consultant designing the electrification project.

DGN File: A DGN file is a Microstation file which contains the models, level structure and line style library of the project.

ElecTag.MVBA: A macro for placing the MV pole numbers as tags on the drawing.

Eskom Cell library – (ElecCell.cel): This file contains the electrification symbols.

Eskom Resource file – (ElecLines.rsc): This file contains the MV, LV and cable line styles.

Eskom Seed file – (ElectrificationSeed.dgn): This file contains the Design file settings.

Documentation management system (DMS): An agreed Eskom system (Bentley ProjectWise) to manage all drawings of the Engineering Distribution business, like revision control, workflow, redlining, and Internet accessibility.

Computer-aided design (CAD): Using a preferred Bentley Microstation application to compile detailed design drawings on computer and create and save them on the DMS.

LV lines: Distribution lines of nominal voltage less than 1000V.

“MasterPlan” Model: The “MasterPlan” model is the design model of the phase two electrification network design.

Models: Models are intended to contain the subject of the drawing for example, the town layout, electrification network and plot sheets. There are two types of models, design models and sheet models.

MV lines: Distribution lines of nominal voltage between 1kV and 33kV, including 33kV.

Plot sheet models: Plot sheet models are design models and consist of border sheets, title blocks, construction notes and reference files.

“Redline” Model: A design model created by the designer of additional surveyed topocadastral data not provided on the given “Cadastral” Model.

Tag Set – (MVPOLE): This file defines the tag name, display attributes, data type and default value for each tag in the tag set when numbering poles.

Town “Cadastral” Model: The “Cadastral” Model is the design model of the town layout and topographical information.

Transformer Zones: An area encompassing all erven serviced by a specific transformer.

3.2 Abbreviations

AC: Alternating Current

CAD: Computer-aided design

CO: Colour

CT: Current Transformer

DC: Direct Current

IED: Intelligent Electronic Device (e.g. protection relay, meter etc).

MCB: Miniature Circuit-Breaker

SC: Study Committee

TL: Top Level of Foundation

VT: Voltage Transformer

4 Requirements

4.1 Substation (Power Plant Technologies)

Diagram and data accuracy are the responsibility of every user. Wherever inconsistencies and inaccuracies are identified, the valid information will be captured and forwarded to the responsible person for updating the applicable drawings as required.

4.1.1 Technical requirements

4.1.1.1 General

The preferred drawing software to be used is Microstation V8 or later.

4.1.1.2 Drawing border sheets

Standard sheet borders shall be used:

A0 = 841 mm × 1189 mm

A1 = 594 mm × 841 mm

A2 = 420 mm × 594 mm

A3 = 297 mm × 420 mm

A4 = 210 mm × 297 mm

4.1.1.3 Standard font

FT = 80

[illegible]

4.1.1.5 Title block text notes

When downloaded from the IARC WEB, this document is uncontrolled and the responsibility rests with the user to ensure it is in line with the authorised version on the WEB.

4.1.1.8 Cover Sheet

As per region current operation.

4.1.1.9 Level Indicator

On the each border sheets a level indicator will show what levels have been used to create the specific drawing. If modules are used, the name of the specific module will be indicated here.

4.1.1.10 Scale

Measurements on drawings shall be in millimetres (mm) and drawn 1:1.

The preferred scales are 1:1, 1:2, 1:5, 1:10, 1:20, 1:50, 1:100, 1:150, 1:200 etc.

4.1.1.11 Text

The texts used shall be as follows:

- All notes and dimensioning, the text height (TH) shall be 2,5 mm and the text width (TW) 1,8 mm.
- All subheadings, like scale or title description, the text height shall be 3,5 mm and the text width 2,5 mm.
- All headings / title descriptions, the text height shall be 5 mm and the text width 3,5 mm.
- Master font used shall be Font 80 with a line spacing (LS) of 2,5 mm. All text attributes shall be multiplied by the active scale, for example, for scale 1:100: TH=250, TW=180, LS=250.

4.1.1.12 Line configuration

As per region current operation.

4.1.1.13 File design to views

The final drawing must be saved with "Rotating view angles = 0°"

Set the views on the screens as follows:

- *Window 1:* The drawing to be fitted in this view.

4.1.2 Window 8: Title block

Go to "Workspace/Preferences/GUI options" and select the "Open two application windows".

4.1.3 Drawing sheets**4.1.3.1 Sheet 00 — Master sheet**

This sheet shall be the Master sheet (named as *.**/****-00) with all the information required for the substation.

Draughtspersons can use either modules or levels which ever they prefer as long as it is clearly indicated on the bottom of the sheet in the level indicator 4.1.1.9.

4.1.3.2 Sheet 01 — Station Electric Diagram / Operating Diagram

This sheet (named *.*/*-01). For national standard see SCSASACM0, Distribution Group's specific representation of operating diagrams in the field, station electric diagrams.

4.1.3.3 Sheet 02 — Site Plan

This sheet shall show the location of the substation and its co-ordinates (named *.*/*-02).

Any additional information specific to the Site Plan sheet will be drawn on the Master sheet.

4.1.3.4 Sheet 03 — Level and Drainage Plan

This sheet shall show all levels of the terrace, the positions and schedules of the drainage (named *.*/*-03).

Any additional information specific to the Level and Drainage Plan sheet will be drawn on the Master sheet.

4.1.3.5 Sheet 04 — Earth Grid Layout

This sheet shall indicate the position of the copper rods and straps in relation to the equipment (named *.*/*-04).

Any additional information specific to the Earth Grid Layout sheet will be drawn on the Master sheet at the.

4.1.3.6 Sheet 05 — Foundation Layout

This sheet shall show all the positions of the foundations in the substation (named *.*/*-05).

Any additional information specific to the Foundation Layout sheet will be drawn on the Master sheet.

4.1.3.7 Sheet 06 — Steelwork Layout

This sheet shall show all the equipment steelwork in the substation (named *.*/*-06).

Any additional information specific to the Steelwork Layout sheet will be drawn on the Master sheet.

4.1.3.8 Sheet 07 — General Arrangement Layout

This sheet shall indicate the position of the equipment (named *.*/*-07).

Any additional information specific to the General Arrangement Layout sheet will be drawn on the Master sheet.

4.1.3.9 Sheet 08 — Sections Layout

This sheet shall indicate various sections and clamps to be used for the substation (named *.*/*-08).

Any additional information specific to the Section Layout sheet will be drawn on the Master sheet.

4.1.3.10 Sheets that will follow

Any additional sheets for the same project shall continue with the same numbering system, adding the sheet number to the same drawing number (named *.*/*-**).

4.2 Control Technologies

4.2.1 Borders and title blocks

- a) The drawing border and title block shall be provided on a separate sheet to the actual drawing sheets (i.e. a reference sheet). To facilitate the use of a referenced title block, separate *.dgn files shall be used for each sheet of the drawing set.

The integrity of the reference sheet must be maintained at all times to ensure that any future updates of the drawing are automated. This method saves time when updating drawings as well as saving space on the file server.

Note: Reference sheets for Master Drawings are scheme- and revision specific. For example, the Phase 4 Bus Coupler 1800 scheme (Rev 0) will have the reference file name "title4bc1800r0.dgn" attached to all sheets.

- b) Due to the use of the reference sheets, levels 1, 5 and 63 will no longer be applicable for borders and title blocks. These levels can now be used for scheme specific applications.
- c) The title block shall be as indicated in Figure 2 below.

Master revision number → REVISION 2.1

Master drawing number → D-DT-15401

Sheet index (Sheet 1 only) → SHEET 1 OF 10

Master revision details

REV	SVZ	AUTH	DATE	REVISION TO MASTER
2.1	SVZ	10/03/2009	CHANGES AS PER SHEET 0 - COVER SHEET	SVZ -
2	SVZ	04/04/2008	CHANGES AS PER SHEET 0 - COVER SHEET	SVZ -
1	SVZ	28/08/2007	CHANGES AS PER SHEET 0 - COVER SHEET	SVZ -

LEVELS: 1, 3, 5, 10, 17, 19

Levels to be applied in a specific application

Level indicator (levels actually applied)

MASTER REV "2.1"
FINALISED STAGE
PANEL LAYOUT DIAGRAM

MASTER D-DT-15401

SET NUMBER: 10, SHEET NUMBER: 1, REVISION: 1

PANEL TYPE DESIGNATION: 4RF-1100

Scheme Designation number

MASTER TRACING FILED UNDER D-DT-15401

Figure 2 – Control Plant drawing title block

The title block of Master Drawings shall include the text "Prototype Stage" for draft drawings and "Finalised Stage" for finalised drawings. "Prototype Stage" drawings shall not be used for scheme manufacturing or application drawings.

The scheme designation number (see 4.2.6) shall be printed in the bottom right hand margin of the border. The master tracing number (file name) and revision number shall be printed at the bottom of the right hand border of the sheet, printed vertically. For Master drawings, the revision number shall also be printed in the main window of the title block.

4.2.2 Sheet order

The sheet order as applicable to each scheme is indicated below.

Note: If more than one sheet is required for any of the items below then the required number of sheets shall be allocated. The sequence starts at sheet 0.

Sequence	Description
0	Cover Sheet <ul style="list-style-type: none"> • Level table to indicate level usage • Scheme revisions to reflect design change details, designers name etc. • Terminal table to indicate terminal equipment applicable for scheme specific applications (e.g. Circuit-breaker etc). Drawing reference numbers shall be included
1	Panel Equipment Layout <ul style="list-style-type: none"> • Front and rear view of panel with location, designation, type and manufacturer details of each component. • Terminal plate with orientation & terminal details • Sizes of front, rear and terminal plates shall be indicated in number of U (1 U = 44,45 mm) • Equipment table • Sheet index (see Figure 2)
2	Tripping Logic Diagram <ul style="list-style-type: none"> • Front view of scheme with position of flag indications • Table with designation & description of panels and associated labelling • Basic logic diagram of scheme functionality and operation
3	Schematic Logic Diagram <ul style="list-style-type: none"> • IED programmable logic diagrams (where this feature is not provided graphically in the IED settings software)
4	AC Key Diagram <ul style="list-style-type: none"> • CT specification located at each core. • VT specification located at each core where applicable. • Number of sub-sheets in accordance with scheme design
5	DC Key Diagram <ul style="list-style-type: none"> • Number of sub-sheets in accordance with scheme design
6	Indication DC Key Diagram <ul style="list-style-type: none"> • Number of sub-sheets in accordance with scheme design
7	Spring rewind and indication AC key diagram <ul style="list-style-type: none"> • Spring rewind circuit details • Protection not healthy indication details • Measurements and heater details
8	Supervisory controls DC Key Diagram <ul style="list-style-type: none"> • In accordance with scheme design
9	Protection reference Diagram <ul style="list-style-type: none"> • Diagram of all used and unused terminals of each component employed in the scheme • Number of sub-sheets in accordance with scheme design
10	Panel cabling diagram <ul style="list-style-type: none"> • Terminal plate and details for cabling requirements • Number of sheets in accordance with scheme design
11	Cable block diagram <ul style="list-style-type: none"> • Scheme specific requirements

4.2.3 Standard presentation of Control Plant drawings

The following Microstation design file settings shall be used (Microstation menu: "Settings>Design File"):

Requirements	Description
Grid	GU = 2,5 mm GR = 10 mm Lock = On Display = On
Working Units	Master unit = mm Sub unit = th (100 th = 1 mm) NOTE: Once in Microstation, select: " <i>Settings>design file>working units</i> ", then select the " <i>Advanced</i> " button and make the resolution : 100 per mm.
Levels	Level 10 = On Other levels in accordance with scheme requirements.
Snap Lock	Snap shall be on at all times Key point shall be on at all times Divisor 2 for tentative control
Fence	Inside = On
Font	FT = 80 <div style="border: 1px solid red; padding: 5px; margin-top: 5px;">Note: Font 80 is <u>not included</u> in the default Microstation font library. An updated font library file including Font 80 is available from the DT ProjectWise server (Protection>X Font and Cell). The library file is applied as follows: 1) Search for the default file "font.rsc". It should be found under Program Files>Bentley>Workspace>System>symp. 2) Rename this file (to keep the default version for future reference). 3) Copy the updated "font.rsc" file from DT>Protection ProjectWise into the same folder.</div>
Text	All sheets in the scheme TH = 3 mm (text height) TW = 2,5 mm (text width) Line spacing = 2 mm WT = 1 (weight) LS = 0 (line style)
Line Style	LS = 0 (Solid lines) LS = 2 (Linking lines or loop options) LS = 4 (Relay casing outline)
Weight	WT = 0 (Relay boxes/cases) WT = 1 (Text) WT = 2 (Lines) WT = 5 (Busbars, cable terminal strips and description block) View 1 = Off View 5 = Off View 6 = On View 7 = On View 8 = On
Views	View 1 - Fit full drawing View 5 - Fit full drawing (all levels on) View 6 - Upper left corner View 7 - Revision to master and level blocks View 8 - Title block

4.2.4 Revisions

- a) Control plant Master drawings shall use a decimal-based revision number (e.g. Rev 3.2), where the whole number refers to a major revision number, and the decimal refers to a minor revision. The standard definitions of major and minor revision numbers are as follows:
- Major revision: Any change affecting the safe and/or reliable operation of the scheme, or affecting the manufacturing of the scheme. Major revisions include scheme wiring or component changes or changes to the scheme's programmable logic (where indicated on the drawings). Major revisions to scheme Master drawings shall be communicated to the business by means of a Technical Bulletin/Instruction.
 - Minor revision: Changes to scheme application details (e.g. changes in circuit-breaker or junction box terminal numbers) or changes in the representation of drawings. Minor revisions to Master drawings will be published without a Technical Bulletin being issued. A Technical Bulletin shall, however, be issued if the corrections have been made as a result of an unsafe design or one that could cause unwanted scheme operation.
- b) Revisions to protection scheme application details shall be supported nationally for the duration that a particular scheme remains in production, prior to it being superseded by a new scheme on national contract.
- c) The minor revision number shall be reset to zero once a major revision is published (e.g. a major revision to Rev 2.1 drawings will be published as Rev 3.0).
- d) The same revision numbering convention shall be used as on TESCO documents (see DST 34-4): finalised drawings shall be designated with revision numbers whilst revisions of draft drawings shall be indicated using letters. For example, "Rev 2.1B" indicates that Revision 2.1 is the latest approved drawing, but that a revision is in progress (B indicates that this is the second draft thereof) that will finally be published as Rev 3.0 or Rev 2.2.
- e) All sheets in a drawing set shall share a common revision number. Where a specific sheet is not affected by a revision, it shall use the latest revision number with its revision details indicating "As per previous revision".

4.2.5 Levels**4.2.5.1 Level usage and colours**

- a) Levels shall be used to indicate optional scheme items and to include different application options (e.g. applications using a Kiosk circuit-breaker (on one level), or an indoor circuit-breaker (another level)).
- b) Application information shall be included on all scheme Master drawings. This shall include the interfaces to circuit-breakers, junction boxes, power transformers etc.
- c) The usage of levels in a particular scheme shall be indicated on sheet 0 of the drawing set. Only the levels that are shown on sheet 0 shall be used in the scheme. All items drawn on a particular level shall be coloured as indicated in Table 1.
- d) Unless obvious from the description of levels usage, a scheme utilizing levels shall have a Microsoft Word document explaining the usage of the levels. This document will be saved on the DT ProjectWise server together with the relevant scheme drawings.

Table 1. Standard level usage and colours for Control Plant drawings

Level	Colours	Description	Comment
1	CO = 39	Spare	Scheme related
2	CO = 6	Information blocks – breakers, supplies, etc.	Standard for all scheme types
3	CO = 11	Spare	Scheme related
4	CO = 7	Spare	Scheme related
5	CO = 100	Spare	Scheme related
6	CO = 5	Spare	Scheme related
7	CO = 2	Spare	Scheme related
8	CO = 3	Spare	Scheme related
9	CO = 122	Spare	Scheme related
10	CO = 0	Standard design drawing	Standard for all scheme types
11	CO = 103	Intermediate distribution frame	Standard for all scheme types
12	CO = 41	Spare	Scheme related
13	CO = 60	Spare	Scheme related
14	CO = 102	Spare	Scheme related
15	CO = 10	Spare	Scheme related
16	CO = 4	Spare	Scheme related
17	CO = 36	Standard MV Indoor CB (D-DT-5407)	Scheme related
18	CO = 95	Standard MV Outdoor CB (D-DT-5407)	Scheme related
19	CO = 13	Standard HV Indoor CB (D-DT-5407)	Scheme related
20	CO = 27	Standard HV Outdoor CB (D-DT-5407)	Scheme related
21	CO = 22	Spare	Scheme related
22	CO = 12	Spare	Scheme related
23	CO = 118	Spare	Scheme related
24	CO = 71	Spare	Scheme related
25	CO = 78	Spare	Scheme related
26	CO = 124	Spare	Scheme related
27	CO = 39	Spare	Scheme related
28	CO = 98	Spare	Scheme related
29	CO = 44	Spare	Scheme related
30	CO = 85	Spare	Scheme related
31	CO = 14	Spare	Scheme related

4.2.5.2 Level Indicator

- a) The referenced title block shall include a level indicator, indicating which levels are currently selected (or, for hardcopy drawings, those which were selected at the time of printing). This box is located at the bottom right hand side of the sheet.

LEVELS	1								10				16				22				28	30
--------	---	--	--	--	--	--	--	--	----	--	--	--	----	--	--	--	----	--	--	--	----	----

Figure 3. Standard level indicator

- b) In addition to the level indicator, a window in the drawing title block (see Figure 2) shall indicate, on Level 10, which levels are to be applied in the specific application. This window serves as a means for the Design Engineer to indicate which levels are applicable to the project at hand. This information will be needed should one of the applied levels be unintentionally disabled in the saved version of the drawings.

4.2.6 Protection scheme identification

Protection schemes are to be identified by a 7- or 8-digit code as follows:-

4	FZ	2	5	03
Generation of scheme (see 4.2.6.1)	Scheme group code (see 4.2.6.2)	Manufacturer code (see 4.2.6.3)	Series number (e.g. 5 th scheme in the series)	Major revision number

4.2.6.1 Generation of scheme

Protection scheme generations are identified in accordance with Table 2.

Table 2. Scheme generation indices

Phase	Technology	Approx years
1	Electromechanical	up to 1981
2	Electronic	1982 to 1993
3	Numerical	1993 to 2009
4	Numerical, functionality integrated into IED, adaptive	2004 -

4.2.6.2 Scheme group code

The function of a scheme will be identifiable via the scheme group code of Table 3.

Table 3. Scheme group codes

Code	Description	Code	Description
AC	A.C. board	FZ	Distance protection feeder
AD	A.C./D.C. Modules	FZD	Distance/Diff protection feeder
BC	Bus coupler/section	GD	Differential generators
BP	Busbar protection	LM	Under Frequency Load shedding
BZ	Bus zone	LS	Load shedding
CB	Capacitor bank	MP	Metering panel
CF	Cable Feeder	MS	Metering statistic
CO	Chop-over/Change-over	MT	Metering Tariff
DC	D.C. board	RF	Rural feeder
FC	Phase comparison feeders	SR	Shunt reactor
FD	Differential feeder	TC	Tap-changer
FP	Pilot wire feeder	TM	Power transformer

4.2.6.3 Scheme manufacturer

The scheme manufacturer will be identifiable by a number following the scheme group code:

0 = GENWEST

1 = Alstom

2 = Siemens

3 = ABB

4 = Reyrolle

5 = IST

6 = VAMP SOLUTIONS

7 = Consolidated Power Projects (CONCO)

8 = Woodbeam Technologies

4.2.7 Cable numbers and circuit identification**4.2.7.1 Cable numbers**

Unless superseded by a documented regional standard:

- a) Cables shall be numbered in ranges appropriate to their applicable voltage level and/or function as per Table 4.
- b) Each cable number shall be prefixed by a letter identifying the panel to which it is associated (e.g. Transformer 1 = A, Transformer 2 = B etc).
- c) Wherever possible, cable numbering shall be kept consistent between bays (e.g. x301 is the cable between the Red phase CT and the CT Junction Box on all 132kV bays).

Table 4. Standardised cable number series per voltage level and function

Voltage Level or Function	Cable Number Series
765kV	8000 to 8065
400kV	100 to 165
275kV & 220kV	200 to 265
132kV	300 to 365
88kV, 66kV & 44kV	400 to 465
33kV, 22kV & 11kV	500 to 565
(Bulk) auxiliary power supplies	600 to 690
AC/DC supplies	700 to 790
IDF Cabling	800 to 999
Measurements IDF Cabling	1000 to 1099

4.2.7.2 Circuit identification

Each lead shall have a letter to denote its function (adopted from the obsolete standard BSS 158):

Letter	Description
A	Current transformers for primary protection
B	Current transformers for bus zone protection
C	Current transformers for secondary or back-up protection
D	Current transformers for metering and measurements
E	Reference voltage for instruments, metering and protection
F	Reference voltage for voltage control
G	Reference voltage for synchronizing
H	A.C. supplies and AC/DC supplies for motorized isolators and circuit-breakers
J	Primary DC supplies
K	Protection, closing and tripping circuits
L	Alarms and indication initiated by auxiliary switches and relay contacts excluding those for remote selective control and for general indication equipment
M	Auxiliary and control motor devices, governor motor, rheostat motor, generator AVR control, spring charging motors, transformer cooler motor control, motors for isolator operation
N	Tap-change control including AVC, tap position and progress indication
P	D.C. tripping circuits used solely for busbar protection
R	Interlock circuits and Transfer circuits
S	D.C. Instruments and relays, exciter and field circuits for generators
T	Pilot conductors between panels, independent of the distance between them, for pilot wire protection, for inter tripping or for both
U	Spare cores and connections to spare contacts
W	Supervisory Controls and Analogues, Energy pulsing
X	Supervisory Alarms and indications
Y	Telephones

4.2.8 Standard drawing conventions and practices**4.2.8.1 General**

- a) Drawing symbols shall be taken from the control plant cell library: CCrevN.cel (N = revision number) available on the DT ProjectWise server under the tab "Protection>X Font and Cell" and documented in drawing D-DT-5414. Alternative or additional symbols shall be as per NRS 002.

Note 1: Unless indicated otherwise D-DT-5414 indicates the standard horizontal representation of drawing symbols. For the vertical representation, the cells may be rotated anti-clockwise by 90°. Contacts may be flipped about the vertical axis so as to represent the moving contact as it is applied. Contacts shall under no circumstances be rotated by 180°.

Note 2: The cell library "CCrevN.cel" is used as follows:

- 1) In Microstation, go to menu "Workspace>Configuration", and select the category "Cells". In the righthand window, select "Cell library list", and take note of the Expansion path.
- 2) Copy the file CCrevN.cel from the DT ProjectWise server into the directory noted above (e.g. C:\Program files\Bentley\Workspace\projects\untitled\cell)
- 3) Back in Microstation, go to menu "Element>Cells". In the "File" menu, select the cell library at the bottom of the drop-down box (this should be the file you saved earlier). See Figure 4 below.

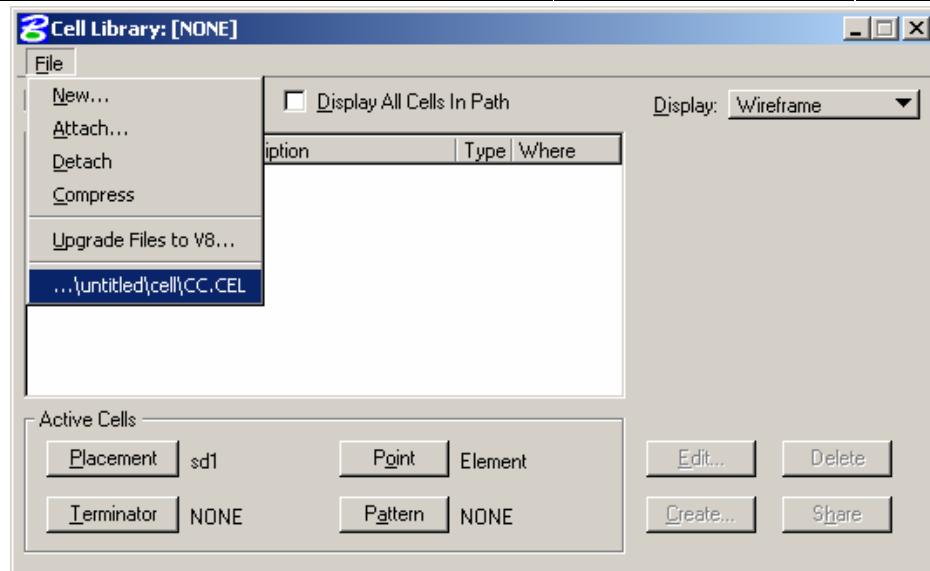


Figure 4. Microstation menu “Elements>Cells” where a Cell library is attached

4) To use the cell library, use the “Cells” toolbar to “Place Active Cell”. The Control Plant cells are designated CC1 to CC275. Alternatively, enable the Key-in window (in the menu “Utilities>Key-in”), and type AC=CCx (Active Cell = CC[number]). Depending on the set-up of the sheet, it may be necessary to set AA=0 (Active Angle = 0 degrees) and AS=1 (Active Scale = 1).

- b) All drawings are to be shown with equipment in the de-energised state, i.e. no AC or DC.
- c) All “breakers” shall be referred to as circuit-breakers, i.e. circuit-breaker open, circuit-breaker closed.
- d) All circuit-breaker contacts are to be shown with the primary contacts in the open position, spring limit switches shown with the springs in the discharged state and air blast/SF6 pressure switches indicating no pressure/gas. The manual spring rewind crank handle shall be shown disengaged from the mechanism.
- e) Latching relays will have their contacts drawn with the “reset” coil having just operated.
- f) All supervisory alarms and controls shall be wired in pairs (1a, 1b etc.) to the appropriate terminals.
- g) Wires terminating at any plant with input from more than one panel/scheme (e.g. VT junction boxes, Bus Zone panels, AC/DC distribution boards) shall be suffixed with a letter representing the panel from which they originate. The same letter shall be used to identify cabling emanating from this panel.
- h) Terminal numbers shall be indicated below the terminal; ferrule numbers above the drawn wire.
- i) Ferrule numbers will change across any device that can interrupt the circuit (e.g. link terminals, fuses, MCBs, relay output contacts etc.). Ferrule numbers do not change across a terminal block, except where a suffix is required on outgoing wires as in (g).
- j) All coils, contacts, etc. belonging to relays, timers etc. shall be drawn in dashed boxes (Line Style 4: short and long strokes), but push buttons, switches, and MCBs will not have boxes. Lines depicting leads shall not be drawn through relay boxes.
- k) The standard page orientation shall be landscape. In the event that the scheme design requires specific sheets being oriented as portrait, the base of the diagram shall be the right-hand edge of the page when viewed in landscape. All writing shall be placed so as to be read in this vertical plane, or the original horizontal plane. The same title block shall be used for landscape or portrait orientations.

4.2.8.2 Cover Sheet

- a) The cover sheet shall include a sheet description and scheme revision details as per the example in Figure 5 below.

SHEET NUMBER	TITLE	REVISION	DATE	DESIGN CHANGE DESCRIPTION
0	COVER SHEET	2.0	04/04/2008	REVISION 2 CHANGES INDICATED.
1	PANEL EQUIPMENT LAYOUT	2.0	04/04/2008	ADDITIONAL RACK MOUNTING HOLES ADDED TO FRONT PANEL TO PREVENT BOWING.
2	SCHEME LOGIC DIAGRAM	2.0	04/04/2008	LABELLING ERRORS CORRECTED: TRIP AND CLOSE LABELS SWAPPED. MCB(AC) RATING CORRECTED TO 10A.
3	AC KEY DIAGRAM	2.0	04/04/2008	AS PER PREVIOUS ISSUE.
4	DC KEY DIAGRAM	2.0	04/04/2008	LEVEL 19: KIOSK CB TERMINALS CORRECTED FROM X1 TO X3 AS PER ALSTOM CB DRAWINGS.
5	DC KEY DIAGRAM	2.0	04/04/2008	LEVEL 19: KIOSK CB TERMINALS CORRECTED FROM X1 TO X3 AS PER ALSTOM CB DRAWINGS.
6	AC SUPPLY KEY & SPRING REWIND DIAGRAM	2.0	04/04/2008	LEVEL 19: KIOSK CB TERMINALS CORRECTED FROM X1 TO X3 AS PER ALSTOM CB DRAWINGS.
7	SUPERVISORY KEY DIAGRAM	2.0	04/04/2008	LEVEL 3: P145 RELAYS R23 & R24 TERMINAL NOS CORRECTED. LEVEL 5: PNH ALARM FERRULE NOS CORRECTED TO X101 & X103, AMP Tx & NOTE 3 ADDED.
8	PROTECTION REFERENCE DIAGRAM	2.0	04/04/2008	AS PER PREVIOUS ISSUE.
9	PANEL CABLING DIAGRAM	2.0	04/04/2008	LEVEL 19: KIOSK CB TERMINALS CORRECTED FROM X1 TO X3 AS PER ALSTOM CB DRAWINGS. LEVEL 5: AMP Tx TERMINALS ADDED TO X3 RAIL.
10	CABLE BLOCK DIAGRAM	2.0	04/04/2008	AS PER PREVIOUS ISSUE.

Figure 5. Typical sheet description and Master revision detail provided on Sheet 0: Cover Sheet

- b) Level application details shall be indicated as in Figure 6.

LEVEL	DESCRIPTION	LEVEL	DESCRIPTION
1		16	
2	STANDARD CIRCUIT BREAKER AS PER D-DT-5407	17	
3	X21 OPTION FOR TWO TERMINAL APPLICATION	18	
4	X21 OPTION FOR THREE TERMINAL APPLICATION	19	
5	APPLICATION ON A SINGLE BUSBAR	20	
6	APPLICATION ON A DOUBLE BUSBAR	21	
7	DIRECTIONAL OPTION FOR BACK-UP PROTECTION	22	
8	SYNCHRONISM CHECK OPTION	23	
9		24	
10	STANDARD DESIGN DRAWING FOR TWO OR THREE TERMINAL FIBRE OPTIC & X21 APPLICATIONS	25	
11	IDF	26	
12	APPLICATION WITHOUT TRANSDUCER	27	
13	TRANSDUCER OPTION	28	
14		29	
15		30	

Figure 6. Typical Level Application detail provided on Sheet 0: Cover Sheet

- c) A table of project specific terminal equipment shall also be provided:

DISTRIBUTION PROJECT APPLICATION EQUIPMENT TERMINALS		
ITEM	DESCRIPTION	DWG No.

Figure 7. List of project-specific terminal equipment provided on Sheet 0: Cover Sheet

4.2.8.3 Panel Equipment layout

- a) The panel equipment layout shall be drawn to scale.
- b) The designation of each protection relay shall be the designation assigned by the manufacturer (e.g. REL 511). The designation of each auxiliary component, MCB, diode etc. shall be as per the device's function (e.g. APT for the Anti-Pump Timer). The suffix T shall be used for tripping relays, and X for auxiliary relays (e.g. APT-X).

4.2.8.4 AC Key Diagrams

- a) Busbars and CTs shall be drawn on the left of the sheet with their corresponding secondary wiring and IEDs shown on the right.
- b) All available CT cores shall be shown whether they are used or not. The class, maximum ratio and ratio used will also be shown.
- c) Secondary AC leads are to be prefixed as per Section 4.2.7.2. Red phase circuits shall be numbered from 10 to 29, White phase from 30 to 49, and Blue phase from 50 to 69 and the residual/star point/neutral from 70 to 89. This applies for both current and voltage circuits.
- d) The scheme wiring is to be numbered so as to permit the following standardised numbering of incoming wires from the substation yard:
 - i) Current circuits: Red: x11; White x31, Blue: x51, Residual: x71, Neutral x80, x81 etc where x is A, B, C or D as per Section 4.2.7.2.
 - ii) Voltage circuits: Red: x11; White x31, Blue: X51, Neutral: x71 where x is E, F or G as per Section 4.2.7.2.
 - iii) Where a scheme has current- and/or voltage inputs from different voltage levels, the inputs from the highest voltage side will be numbered x11, x31 etc. Add 100 to each wire number for each successive lower voltage level (e.g. x111, x131 for the transformer MV CTs and x211, x231 etc. for tertiary CTs).
 - iv) Where a scheme includes inputs from different busbars/bus sections, these shall be numbered x111, x131 and x211, x231 for busbar 1 and 2 inputs etc.
- e) The incoming wires for 230V AC supply circuits shall be numbered H11 (live) and H71 (neutral). Successive wires shall use consecutive numbers.

4.2.8.5 DC Key Diagrams

- a) The positive rail will run vertically along the left hand side and the negative rail will run on the right hand side of the drawing.
- b) The coils of relays, timers or other equipment will be drawn on the right of the diagram with the contacts on the left.
- c) Incoming DC supplies shall be numbered J1 and J2 for the main supply and J3 and J4 for the back-up supply. Ferrule number suffixes shall change to K, L, M, N or P (as appropriate) after the fuse or MCB.

- d) Main tripping lead numbers are to be prefixed with “K” and start with 101 and end with 299. Positive-related leads are numbered with odd numbers, while negative-related leads with even numbers.
- Leads for the Main 2 or back-up tripping circuits are prefixed K and are numbered from 301 to 499. They follow the same pattern as for the Main circuits.
- Prefixes L, M, N or P shall be used in place of “K” as appropriate (see 4.2.7.2).
- e) The ferrules of circuit-breaker fail output wires shall be numbered P7 and P17. For schemes with two circuit-breaker fail outputs (e.g. transformer schemes), these shall use ferrule numbers P7 and P17, and P107 and P117 respectively.

4.2.8.6 Cabling Diagrams

- a) Terminal strips shall be drawn as they are physically arranged.
- b) The cabling diagram shall indicate the destination terminals of each wire leaving the scheme, and in which cable each wire is run. Destination terminals that are to be looped to other terminals shall be suffixed with the star symbol (*), and details of the loops shall be proved in a loop table as per Figure 8.

TERMINAL LOOPS (*)	
CTJB	40-41-42; 43-44-45-46-47-48-E; 52-53-54; 55-56-57-58-59-60-E.
CB MB	X1.17-X1.19; X1.18-X1.20; X1.31-X1.39.

Figure 8. Typical loop table on Cabling Diagrams

4.3 Electrification Networks

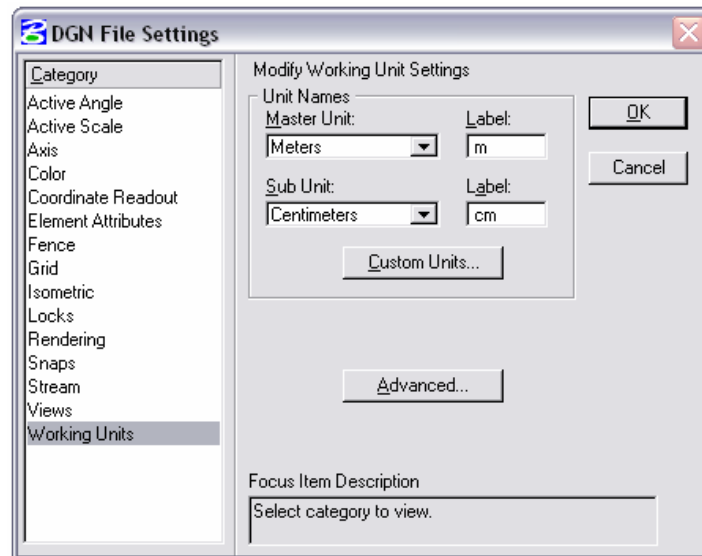
4.3.1 General

Designers undertaking electrification projects are obliged to conform to this standard. Eskom will not accept drawings in CAD and/or raster formats, which have not been specified in this document. The export/import of CAD drawings between various CAD packages is strictly forbidden.

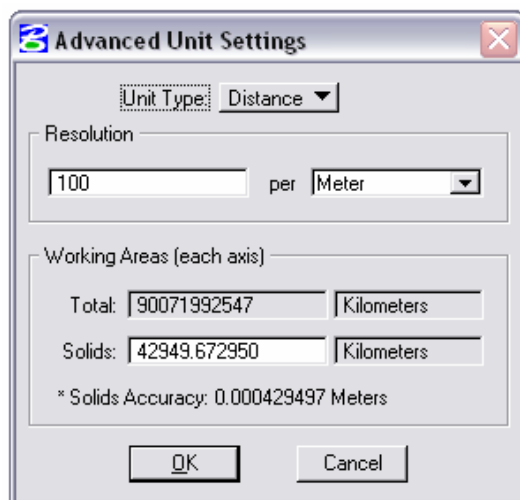
Design applications such as Cart or Power Office are design software that does not conform to this document at this stage. Designs done with this software must be altered to comply with this new standard.

4.3.2 MicroStation design file settings

All drawings will be in 2-D format. The design files settings are set in the ElectrificationSeed.dgn seed file and must not be altered. The electrification seed file must be used when creating a new DGN file. The settings are set as follows:



The design file settings.



The advanced unit settings

Colour Palette:

The default colour palette of MicroStation must be used.

Line Style library:

ElecLines.rsc

Cell library:

ElecCell.cel

Seed file:

ElectrificationSeed.dgn

4.3.3 The Project

The project will consist of two MicroStation Ver 8 or later DGN files. The first DGN file (Main file) will contain all the models for the project which will include the “Cadastral” Layout, “AsBuilt”, “MasterPlan” and MV/LV plotfiles of the “AsBuilt” model. The second DGN file will consist of construction plot sheet models only and are only used for construction purposes.

The DGN file name will consist of the town name (form 10), the abbreviation of the Technical Service Area (obtainable from Maximo) and the LO band. Eskom will provide the correct name for the DGN files as follows:

TOWNNAME-TSA-LO.dgn

This is the main DGN file and contains the following models: - “Cadastral”, “AsBuilt”, “MasterPlan” and MV/LV plotfiles.

e.g. Mataleng-BRKW-25.dgn → Townname is Mataleng, TSA is Barclay West and LO 25.

Eskom will provide the correct name for the Construction DGN files as follows

TOWNNAME-TSA-LO-C1.dgn

This is the construction DGN file and contains only the construction plot sheet models. The “C1” are for first electrification project on the town. For a new extension create a new DGN file with a “C2” extension e.g. Mataleng-BRKW-25-C2.dgn.

All new projects must be created from the standard Eskom Electrification seed file. The Electrification seed file will contain all the basic models (“Cadastral”, “AsBuilt” and “MasterPlan”) and level structure needed for the project. Additional plotsheet models (plotfiles) may be added to the DGN file.

When creating the construction DGN file from the Electrification seed file, the “Cadastral”, “AsBuilt” and “MasterPlan” models must be deleted/renamed in this DGN file. This file must only contain the construction plotsheet models.

4.3.3.1 “Cadastral” Model

The Land Development Department will supply the town layout model which will be named ““Cadastral””. It is geo-referenced and could be either a vector drawing or a combination of vector and orthophoto (raster) format/s as required by the Head of Geographic Mapping.

Both options are such that the designer is able to distinguish between various topographical objects such as erf boundaries, buildings, trees and rivers. Additional information such as the stand numbers, street names and contours are supplied in the “Cadastral” model.

The topocadastral layout or orthophoto may not be modified, moved from the given geographic position or updated by the designer. The designer may not make the town layout (digital or hardcopy) available to any other party.

Should the designer identify additional information and or changes to the topocadastral data, as presented on the given ““Cadastral”” model, these changes need to be surveyed and placed in a separate model with the name “Redline”. The new topocadastral data (surveyed data) must be submitted to Eskom with the project. The format and standard of the survey field book must comply with the Region’s Land Development Department specifications. This information must also be submitted to Eskom Land Development Department.

Stand numbers must be generated for new additions of houses/customers and placed in the Redline model. These numbers must be unique to ensure no duplication of stand numbers or customers in the Cordaptix data. The method and format of numbering stand/erven/houses is described below.

New stand numbers are not to be generated for “proclaimed” towns. If there is more than one customer on a stand, the numbering must be done as below. In Regions where electrical addresses are used, the numbering must be done in accordance with the Regions standards.

The numbering of stands is Region specific and may vary between Regions and the designer must confirm with the region before adding any new stand numbers. The basic rule for the numbering of stands is as follows:

- a) Each stand must have a unique stand number.
- b) More the one customer on the same stand:

The original stand number must be used for the first customer. The other customers on the same stand must be numbered with the stand number and an alphabetic letter behind the stand number, for e.g. 123A, 123B. This example will mean that there are three customers on the same stand (123, 123A and 123B).

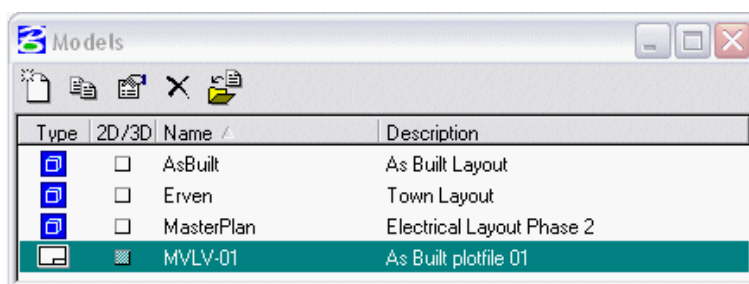
- c) Customers/houses not in a stand boundary:
- d) These customers/houses must be numbered from the last stand number in the town.
- e) Hostels: The general rule for numbering hostels will be as follows:
- Stand number - hostel block number - room number. E.g. 1334B12

4.3.3.2 “AsBuilt” and “MasterPlan” Models

The electrification network for the phase one design (“AsBuilt”) and the phase two design “MasterPlan” must be drawn on separate design models within the project. These two models must be named, “AsBuilt” and “MasterPlan” respectively.

These two models must only contain the electrical networks without construction notes and border sheet information. Any notes and other construction information must be drawn on the construction plotsheet model.

The “Cadastral” model must be referenced to these two models. If a redline model was created it must also be referenced to the AsBuilt model.



Typical model window.

After construction of the electrification networks, the “AsBuilt” model will become the As Built of the town.

4.3.3.3 As-built MV/LV Plot Sheet Models

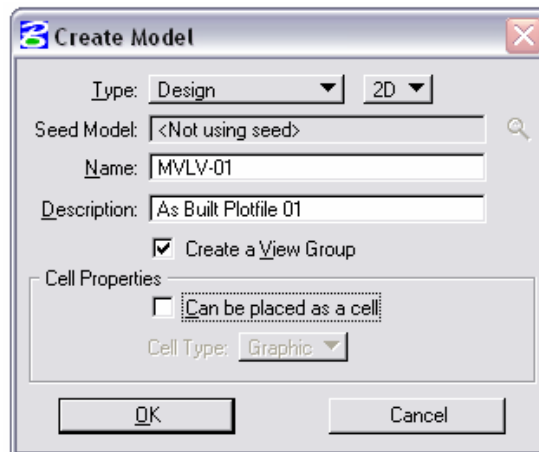
The MV & LV plot sheets are used by Eskom to make plots of the “AsBuilt” of a town. These plotfiles are distribute to various departments, etc.

For new electrification areas the designer must create and approve a new set of MV/LV plot sheet models that must be named and created as follows:

E.g. A town with two (2) MV/LV plot sheet models.

4.3.3.3.1 Method to create a new model

From the type selection choose “Design”. In the name field type in the model name “MVLV-01” and description, “AsBuilt plotfile 01”. Check the create a View Group check box and unchecked the cell properties, can be placed as a cell check box. Repeat the above for the MVLV-02 plot sheet model.

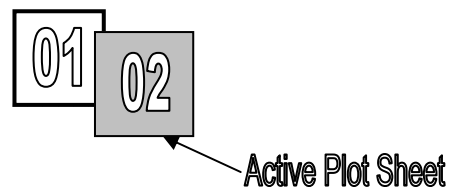


If the design is an extension to an existing town, the designer must create the necessary plot sheet models for the extension to be electrified. If the existing plot sheet models cover this extension, a revision must be added and approved by the designer on these plot sheets in question.

Preferred plot scales for the MV/LV models are 1:1000, 1:1500 and 1:2000. Plot sheets must be created to a scale not exceeding 1:2000.

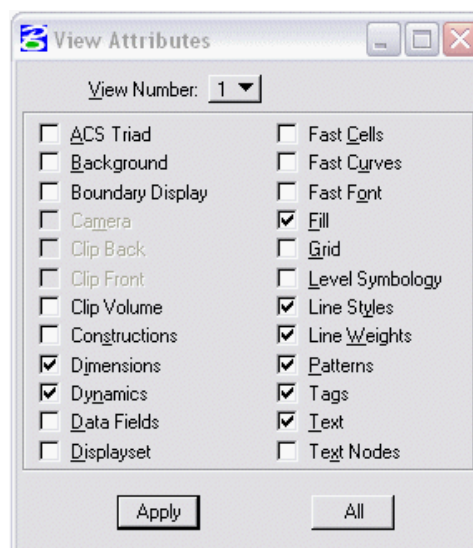
4.3.3.3.2 Plotsheet Index

All MV/LV plot sheet models must have a plot sheet index created below the legend. The active plot sheet must be highlighted in a gray box to indicate the active plot sheet.



A typical plotsheet index.

Plot sheet models view attributes must be set to the view attribute settings below



The MicroStation view attributes for plot sheet models.

4.3.3.4 Construction Plot Files

The Construction plot files are design sheet models created in a **separate DGN file** and are for construction purposes only. These are the initial/final design of the town electrification design. Any notes, descriptions and construction markings must be placed on these models. These plot sheet models must reference the “Cadastral” and “AsBuilt” models of the main DGN file. Construction plotfiles must consist of the following plotsheet models:

Transformer Zones.

MV/LV Layout.

Construction Codes.

Customer Electrical Address (if applicable).

These models must be created and named as follows:

e.g. A town with the name Mataleng with two (2) plotsheet models of the above.

Create a new DGN file (e.g. Mataleng-BRKW-25-C1.dgn). In this DGN file create the plot sheet models for construction. From the type selection choose “Design”. In the name field type in the model name “TrfZone-01” and description e.g. “New Design” or “Construction of extension 5”. Check the create a View Group check box and uncheck the cell properties, can be placed as a cell check box.

The model names and descriptions for the above construction plot sheets must be as follows for a town divided into two plotfiles:

Transformer Zones:

<u>Model Name</u>	<u>Model Description</u>
TrfZone-01	Transformer zone layout 01
TrfZone-02	Transformer zone layout 02

MV/LV Layout:

<u>Model Name</u>	<u>Model Description</u>
MVLV -01	MV/LV layout 01
MVLV -02	MV/LV layout 02

Construction Codes:

<u>Model Name</u>	<u>Model Description</u>
Codes-01	Construction codes 01
Codes-02	Construction codes 02

Customer Electrical Address:

<u>Model Name</u>	<u>Model Description</u>
EleAdd-01	Electrical Address 01
EleAdd-02	Electrical Address 02

The typical contents of these models are described below.

Transformer Zone Plot Sheets:

Transformer zones
MV network with transformers, MV poles and pole numbers

MV & LV Layout Plot Sheets:

MV & LV networks, poles and pole numbers
Street light networks
Transformers
Links and switches
Service connections with phasing.

Construction Pole Code Plot Sheets:

MV & LV networks, poles and pole numbers
 Street light networks
 Transformers
 Links and switches
 Construction pole codes.

Customer electrical address drawings:

Customer electrical addresses
 MV & LV networks, poles and pole numbers
 Transformers
 Links and switches.

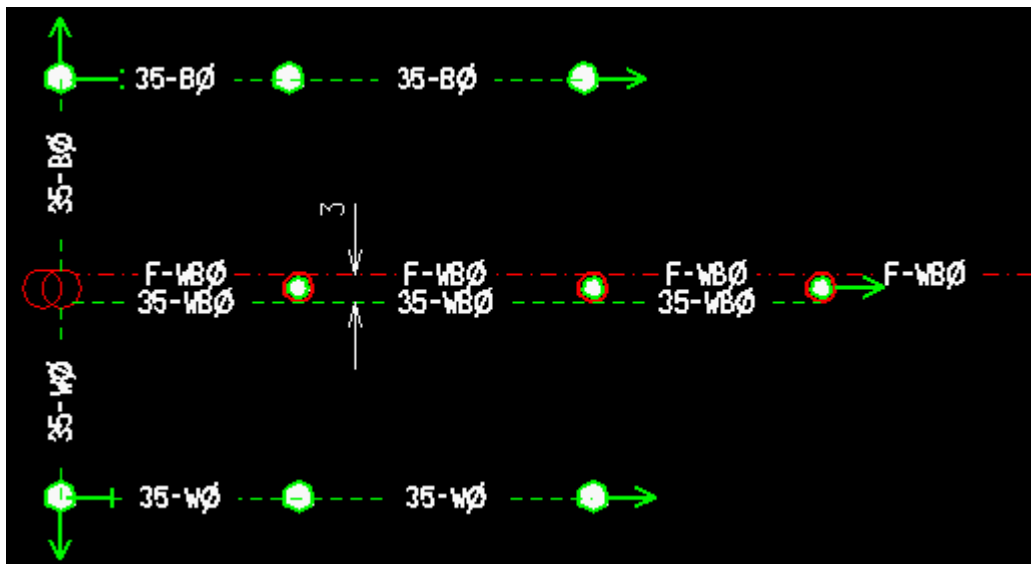
4.3.3.5 Plotfile drawing numbers

Drawing numbers are Region specific and the designer must first confirm with that Region before adding any drawing numbers to plotfiles.

4.3.4 MV and LV lines

All MV and LV lines must comply with the Eskom Electrification Line Style Library (ElecLines.rsc). MV lines must be drawn in colour red and LV lines in colour green. This will distinguish between MV and LV overhead lines. The designer may not modify, delete or add any line styles in the line style library. Any additions to the line style library are to be motivated and forward to Distribution Technology (DT), contact person: Johan Scholtz.

All MV and LV lines must be drawn as line strings (smart lines) and not separate lines from pole to pole. Each segment of the line string must be drawn from pole centre to pole centre. Tee-off lines must start from the centre of the tee-off pole. Where MV and LV lines share the same route and poles, the lines representing them must be drawn the equivalent of 3 meters apart (move parallel 1.5m)



The following MV and LV line attributes must be comply with vector and orthophoto drawings:

Vector drawings:

LV lines - WT = 0; CO = 2
 MV lines - WT = 2; CO = 3

Orthophoto drawings:

LV lines - WT = 2; CO = 2
 MV lines - WT = 4; CO = 3

All MV and LV lines must indicate the phase it is connected to by selecting the correct line style from the "ElecLines.rsc" linestyle library.

MV LINES							
	3 PHASE	DUAL PHASE R&W	DUAL PHASE R&B	DUAL PHASE W&B	SWER PHASE R	SWER PHASE W	SWER PHASE B
FOX	F	70-Rwp	F-Rwp	F-Wbp	F-Rp	F-Wp	F-Bp
GOPHER	G	G-Rwp	G-Rwp	G-Wbp	G-Rp	G-Wp	G-Bp
HARE	H	H-Rwp	H-Rwp	H-Wbp	H-Rp	H-Wp	H-Bp
MINK	M	M-Rwp	M-Rwp	M-Wbp	M-Rp	M-Wp	M-Bp
OAK	O	O-Rwp	O-Rwp	O-Wbp	O-Rp	O-Wp	O-Bp
PANTHER	P	P-Rwp	P-Rwp	P-Wbp	P-Rp	P-Wp	P-Bp
RABBIT	R	R-Rwp	R-Rwp	R-Wbp	R-Rp	R-Wp	R-Bp
SQUIRREL	S	S-Rwp	S-Rwp	S-Wbp	S-Rp	S-Wp	S-Bp
WOLF	W	W-Rwp	W-Rwp	W-Wbp	W-Rp	W-Wp	W-Bp

Typical MV linestyles. MV single phase lines are used for SWER lines

LV LINES							
	3 PHASE	DUAL PHASE R&W	DUAL PHASE R&B	DUAL PHASE W&B	SINGLE PHASE R	SINGLE PHASE W	SINGLE PHASE B
ABC 35	35	35-Rwp	35-Rwp	35-Wbp	35-Rp	35-Wp	35-Bp
ABC 70	70	70-Rwp	70-Rwp	70-Wbp	70-Rp	70-Wp	70-Bp
FOX	F	70-Rwp	F-Rwp	F-Wbp	F-Rp	F-Wp	F-Bp
GOPHER	G	G-Rwp	G-Rwp	G-Wbp	G-Rp	G-Wp	G-Bp
HARE	H	H-Rwp	H-Rwp	H-Wbp	H-Rp	H-Wp	H-Bp
MINK	M	M-Rwp	M-Rwp	M-Wbp	M-Rp	M-Wp	M-Bp
OAK	O	O-Rwp	O-Rwp	O-Wbp	O-Rp	O-Wp	O-Bp
PANTHER	P	P-Rwp	P-Rwp	P-Wbp	P-Rp	P-Wp	P-Bp
RABBIT	R	R-Rwp	R-Rwp	R-Wbp	R-Rp	R-Wp	R-Bp
SQUIRREL	S	S-Rwp	S-Rwp	S-Wbp	S-Rp	S-Wp	S-Bp
WOLF	W	W-Rwp	W-Rwp	W-Wbp	W-Rp	W-Wp	W-Bp

Typical LV linestyles. LV ABC lines will correspond to the number marked on the cables as follows:

1 = R, 2 = W, 3 = B, 4 = Neutral.

The neutral conductor on LV lines is not shown in the linestyle

4.3.5 MV and LV poles

4.3.5.1 General

Poles must be placed in such a way that the MV and LV lines are clearly visible and that no other elements in the drawing interfere or obstruct these lines when plotted

4.3.5.2 Pole numbers

MV poles must be numbered according to Eskom specification. Pole numbers must be placed as close as possible to the pole so that it is clearly legible. Pole numbers take the highest priority of text placed on the drawing.

MV pole numbers must be placed as tag elements and each tag must be attach to its corresponding pole cell. The electrification tag set (MVPOLE) must be used for placing MV pole numbers. This tag set defines the tag name, display attributes, data type and default value for each tag in the tag set and must not be modified. This tag set are made up of the following fields:

Number -: the pole number field
Ptype -: the pole type field
kVA -: the kVA of the transformer.

Number field:

The number field will be used for the pole number and its display attribute will always be set to on

Ptype field:

The Ptype field is a numeric value for the type of structure the pole represents and its display attribute will always be set to off. This numeric value will represent the following:

Zero (0)	:-	Standard pole. Also the default value in the tag set.
One (1)	:-	Transformer pole.
Two (2)	:-	Pole with equipment mounted. Equipment can be links, fuses, metering units etc. This number exclude transformers which have a higher priority with a value of one (1).

kVA field:

If the Ptype field value is set to one for a transformer, the kVA field display attribute must be set to on and the kVA rating of the transformer must be typed into this field, eg. 100KVA.

Only the number field will be displayed on the drawing except when it's a transformer pole. Only then the number and the kVA field display-attributes will be set for displaying.

Eskom will provide a program (ElecTag.mvba) for placing the MV pole numbers as tags on the drawing.



See Annex E for detail description

4.3.6 LV Phasing**4.3.6.1 General**

There are two types of phasing on the LV networks namely, the service connection phasing and the LV line phasing. The phasing of service connections on a three/dual phase network are done by placing the pole box phase cell next to the pole or at each service connection if more than one phase is used from the service connection box. LV line phasing is done by choosing the corresponding line style from the resource file.

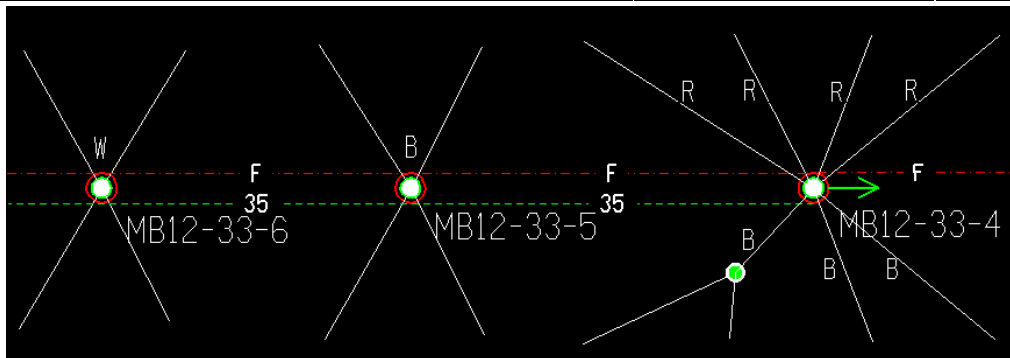
The service connection phase cell need not to be shown on a single phase LV line, as the LV line style indicates the phasing.

4.3.6.2 Service connections

The service connection lines are diagrammatic and indicate which houses or stands are fed from which pole. The service connection must be drawn from the centre of the pole to the stand number or house.

Normally kicker poles are placed at each house but to avoid cluttering of the drawing it is not necessary to indicate all the kicker poles. Kicker poles that need to be shown are poles with splitter boxes. If the drawing permits the placement of all the kicker poles, it may be shown but care must be taken not to clutter the drawing for this will make it difficult to read.

On a dual or three phase system the service connection box phase cell must be used for indicating phasing of service connections.



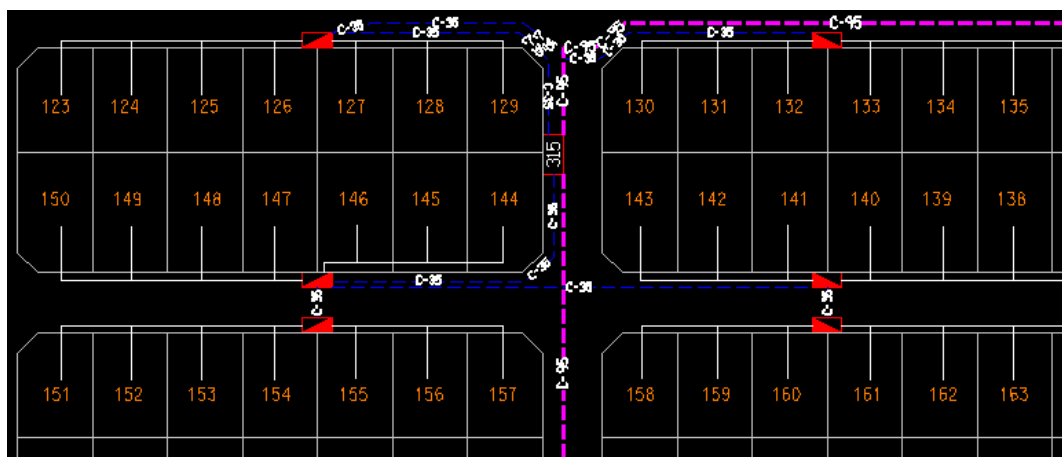
Example for placing service connection phase cell

4.3.6.3 LV Line phasing

The LV line style will indicate the phasing on single and SWER systems. This is done by the the text on the line style indicating either the red, white or blue phases. On an ABC bundle conductor system the bundle cables are marked 1, 2, 3 and 4. This numbers will correspond to red, white, blue and neutral on the LV line style markings.

4.3.7 Cables

Cables must be drawn as line strings (smart lines) with the appropriate line style from the Electrification linestyle resource library. Multiple cables on the same route must be drawn +/- 1m apart so that the text part of the line style is clearly legible. Service connection cables can be drawn from distribution kiosk as follows:



Typical cable network layout.

4.3.8 Transformer Zones

Transformer zones must be drawn as closed shape elements on level 11 and not linestrings. Each transformer zone must have its own shape and transformer zone number. The transformer zone number is also the transformer pole number. The transformer zone number must be placed inside the transformer zone shape and must not touch or overlap the transformer zone shape. The text size of the transformer zone number may vary according to the size of the transformer zone shape, the following norm are suggested:

Standard drawing practice for CAD users in the Power Plant and Control Plant technologies environments and for Electrification Networks

Unique Identifier:	34-195
Type:	DST
Revision:	1
Page:	30 of 38

Text height	:	30
Text width	:	20
Font	:	0 (Standard)
Weight	:	2
Colour	:	7

The Transformer zone (shape) will indicate the boundary of the transformer zone and the area the transformer was designed to electrify. The transformer zone must also include future customers not connected on the initial stage of electrification. This will help Field Services with future infills as for the capacity for which the transformer was designed.

The transformer zone shape must be drawn in such a way that all the stand number text is included in the shape. The transformer zone shape must not overlap any stand number text

Annex A - Impact assessment (Normative)

Impact assessment form to be completed for all documents.

1 Guidelines

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

2 Critical points

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

Comment: Document revision required to include a description of standard drawing conventions and draughting practices for the Control Plant environment.

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

Comment: None.

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

Comment: N/A

2.4 When will new stock be available?

Comment: N/A

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

Comment: N/A

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

Comment: N/A

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

Comment: No comments.

Annex A

(continued)

3 Implementation timeframe

3.1 Time period for implementation of requirements.

Comment: After document has been published.

3.2 Deadline for changeover to new item and personnel to be informed of DX wide change-over.

Comment: N/A

4 Buyers Guide and Power Office

4.1 Does the Buyers Guide or Buyers List need updating?

Comment: N/A

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

Comment: N/A

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

Comment: N/A

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

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

Comment: N/A

5 CAP / LAP Pre-Qualification Process related impacts

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

Comment: N/A

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

Comment: N/A

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

Comment: N/A

Annex A

(continued)

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

Comment: No. Only for the development of new products/Master drawings.

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

Comment: N/A

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

Comment: N/A

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

Comment: No

5.8 Material group(s) affected by specification: (Refer to Pre-Qualification invitation schedule for list of material groups)

Comment: N/A

6 Training or communication**6.1 State the level of training or communication required to implement this document. (E.g. none, communiqués, awareness training, practical / on job, module, etc.)**

Comment: None. Document may be used as training material.

6.2 State designations of personnel that will require training.

Comment: ED Project Engineers, Draughting persons.

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

Comment: A course on Technical Drawing (pertaining to Control Plant) is available through the Eskom Learning Institute (Gert le Roux). Microstation-specific training is also available.

6.4 If applicable, provide details of training that will take place. (E.G. sponsor, costs, trainer, schedule of training, course material availability, training in erection / use of new equipment, maintenance training, etc).

Comment: N/A

6.5 Was Training & Development Section consulted w.r.t training requirements?

Comment: No.

Annex A
(continued)

7 Special tools, equipment, software

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

Comment: None.

7.2 Are there stock numbers available for the new equipment?

Comment: N/A

7.3 What will be the costs of these special tools, equipment, software?

8 Finances

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

Comment: None.

Impact assessment completed by:

Name: Stuart van Zyl (012) 421-4713

Designation: IARC Protection specialist

Annex B - Electrification Legend

(Normative)

LEGEND

SYMBOL	DESCRIPTION
	LV POLE WITH STAY AND STRUT
	LV POLE WITH FLYING STAY
	LV POLE WITH SHORT STAY
	MV POLE WITH STAY AND STRUT
	MV POLE WITH FLYING STAY
	MV POLE WITH SHORT STAY
	TRANSFORMER/MINI SUB
	LV , MV & SHARING POLES
	KICKER POLE (5,7,9m)
	ISOLATOR
	BREAKER
	AUTO RECLOSER
	SECTIONALIZER
	METERING UNIT
	FUSE ISOLATOR
	SURGE ARRESTER
	CABLE JOINT(MV+LV)
	MV CROWS FEET / EARTH SPIKE
	LV CROWS FEET / EARTH SPIKE
	HIGH MAST
	ABC CONDUCTOR 35 & 70
	? - 1 PHASE = R, W, B
	?? - 2 PHASE = RW, RB, WB
	35 & 70 ONLY = 3 PHASE
	MV & LV BARE CONDUCTOR
	F = FOX, G = GOPHER, H = HARE, M = MINK, S = SQUIRREL, W = WOLF, R = RABIT, O = OAK
	PHASES SEE ABC CONDUCTOR
	MV = RED, LV = GREEN
	SERVICE CONNECTIONS 4/10/16mm
	SERV. CONNec. U/G 4/10/16mm
	POLE BOX PHASE CONNECTION
	STREET LIGHT
	STREET LIGHT CABLE
	TELKOM LINE
	TELKOM POLE

Annex C - ELECTRIFICATION LEVELS AND SYMBOLOGY

(Normative)

ELECTRIFICATION LEVELS AND SYMBOLOGY

LEVEL NUMBER	COLOR	LINE STYLE	LINE WEIGHT	DESCRIPTION
2	9	0	0	ERF/STREET BOUNDARIES
3	6	0	0	ERF NUMBERS
4	4	0	2	TOWN EXTENSION BOUNDARIES & NAMES
5	2	0	0	CONTOURS
6	0	0	0	STREET NAMES
7	9	3	0	MAIN ROADS
8	9	0	0	TOWN PERIMETERS
9	9	0	0	BUILDINGS/ERF DETAILS/OBSTACLES
10	1	0	0	LO GRID
*11	7	3	2	TRANSFORMER ZONE
*12		CELL		MINI SUBS / SUBSTATIONS
*13		CELL		TRANSFORMERS
15		CELL		MV EQUIPMENT (ISOL. BRK. M-UNIT)
16		CELL		LV EQUIPMENT
*18	0	0	0 & 2	SERV. CONNECTIONS / HOUSE CABLES
19		CELL		SERV. CONNECTIONS PHASES
20		CELL		LV POLES
21		CELL		MV POLES
22		CELL		MV/LV POLES
24		CELL		HIGHMAST
25	2	ElecLines.rsc		LV LINES
29		ElecLines.rsc		MV LINES
32	0	0	0 & 2	LV POLE No.
33	0	0	0 & 2	MV POLE No.
34		CELL		LV STAY/STRUT
35		CELL		MV STAY/STRUT
40	0	0	0 & 2	EXISTING CONSTRUCTION CODES
41	0	0	0 & 2	EXISTING ELECTRICAL ADDRESSES
42	0	0	0 & 2	NEW CONSTRUCTION CODES
43	0	0	0 & 2	NEW ELECTRICAL ADDRESSES
46		CELL		MV EARTHING
47		CELL		LV EARTHING
50				RESERVED FOR CUSTOMER DATA VERIFICATION
51		CELL		STREET LIGHTS LINES&CABLES/LIGHTS/POLE
52		CELL		TELKOM LINE/POLE
100-119	3	ElecLines.rsc	2	MV CABLES AND CABLE TEXT
120-139		ElecLines.rsc	0	LV CABLES AND CABLE TEXT

* ALL TEXT ON THIS LEVELS TO BE

CO=0, LC=0, WT=0 FOR VECTOR & WT=2 FOR ORTHO PHOTOS 0&2 OR 2&4 IS FOR VECTOR/ORTHO PHOTO

Plotting scales: 1 : 1000, 1 : 1500, 1 : 2000

Annex D - UNDERGROUND CABLES

(Normative)

UNDERGROUND CABLES

CABLE SIZE	LEVEL NUMBER	COLOUR	LINE WEIGHT	LINE STYLE
MV UNKNOWN	100	5	2	ElecLines.rsc
MV 16mm	101	5	2	ElecLines.rsc
MV 25mm	102	5	2	ElecLines.rsc
MV 35mm	103	5	2	ElecLines.rsc
MV 70mm	104	5	2	ElecLines.rsc
MV 95mm	105	5	2	ElecLines.rsc
MV 120mm	106	5	2	ElecLines.rsc
MV 185mm	107	5	2	ElecLines.rsc
MV 240mm	108	5	2	ElecLines.rsc
LV UNKNOWN	120	7	0	ElecLines.rsc
LV 16mm	121	1	0	ElecLines.rsc
LV 25mm	122	1	0	ElecLines.rsc
LV 35mm	122	1	0	ElecLines.rsc
LV 70mm	123	1	0	ElecLines.rsc
LV 95mm	124	1	0	ElecLines.rsc
LV 120mm	125	1	0	ElecLines.rsc

Annex E - Loading ElecTag program

(Normative)

From MicroStation select Utilities -> Macro -> Project Manager

Select Load Project and choose ElecTag.mvba

Double click on ElectrificationTag and select "MVTag" and Run.

Add new tag to pole

This function is used to add a pole number to a MV pole or transformer cell. Type the pole number in the pole number field and select the pole type. The pole type may be one of the following:

- a) Normal MV pole.
- b) Transformer pole.
- c) Equipment pole. (Equipment means isolator, breaker, fuse or metering unit)

Select the pole cell to which the tag must be attached to and place the pole number.

If a transformer was selected type in the kVA of the transformer eg. "100kVA". When pole number is placed the kVA text will be place under the pole number.

The pole number and kVA text may be moved to ensure the text is legible. Moving the pole cell will move the tag text with it.

Copy tag increment

This function will copy MV pole numbers (tags) and increment. Select the pole cell or text to copy increment. Next select the MV pole cell to add the new pole number to. If the pole cell is a transformer cell, a text box will open for the kVA rating of the transformer. Repeat selecting MV pole cell for placing pole numbers.

Copy tag from tee-off pole

This function will copy an existing pole number (tag) and add a "-1" at the end of the number. Select the MV pole cell or text number and the select the first MV pole cell from the tee-off and place then place the MV pole number.

Notes on ElecTag:

- 1) MVTag will use the default text style settings for placing text.
- 2) The pole numbers will be placed on "Level 33".
- 3) For editing any existing pole numbers, use the default MicroStation tag commands.
- 4) Placing a pole number to an existing pole with a tag, will delete the existing tag to that pole