



Transmission Drawing Standard

SAD 0006

Amendment No 2
1 November 2019

Revision History

This standard replaces amendment no 1. This standard has been rewritten due to the new Drawing Management System. All future amendments shall be highlighted in this document with grey colouring.

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For any enquiries relating to the content of this document please contact the Standards Coordinator on 13 10 81.

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1 Documentation Scope

This Standard applies to all drawings that are prepared for the Company's (Endeavour Energy) transmission network for works associated with construction, augmentation and/ or relocation of the Company's assets.

This standard defines requirements that are common for transmission drawings for each transmission design section, including:

- Substation secondary system drawings
- Substation Civil and Mechanical drawings
- Transmission Mains drawings

General requirements for the templates, labels, notes and the general appearance for all company drawings including distribution drawings are defined in SAD 0001.

2 References

External Regulations

ENA National Electricity Network Safety Code (Doc. 01-2008)

External Standards

AS 1100.101 – Standard ISO Sheets and metric scales

AS 1100.- 101 Technical drawing – General principles

AS/NZS 1158 – Lighting for Roads & Public Space

Company Policies and Procedures

Group Board Policy 4.0 – Environment

Company Policy 9.6.1 – Network Connection

Company Policy 9.6.9 – Facilities Access (Shared Infrastructure)

Company Policy 15.3.1 – Information Management

Company Procedure GAM 0036 – Management of Drawing Records

Company Procedure GAM 0104 – Network Asset Information

Network Management Plan December 2013 Review

Company Standards

Mains Design Instruction MDI 0026 – Location of isolation points on the high voltage network

Mains Construction Instruction MCI 0005 – Overhead Construction standards manual

Mains Design Instruction MDI 0031 – Overhead line Design

Company Standards

Mains Design Instruction MDI 0044 – Easement Property tenure

Mains Design Instruction MDI0051 – Underground Transmission Mains Design

Standard Asset Data SAD 0001 – Project drawing standard

Standard Asset Data SAD 0005 – Network Asset Information (NAI) system symbology

Drawing no. 294372 – Drawing specification standard drawing notes

Drawing no. 294854 – Drawing specification standard drawing symbols

Substation Maintenance Instruction SMI 100 – Minimum requirements for maintenance of transmission and zone substation equipment

SMI 101 – Minimum requirements for maintenance of distribution equipment

SMI 124 – Maintenance data entry and defect prioritisation

3 Definitions and Abbreviations

Abbreviation	Meaning
Company	Endeavour Energy
CAD	Computer Aided Design Drafting
DMS	Drawing Management Module of Content Server, an internal application for registering and storing drawings
GIS	Geographical Information System
SLD	Single Line Diagram. A simplified graphical representation of a three-phase power system
DMS	Drawing Management System
CRT	Controlled Revision Tracking
TBI	Title Block Integration
ASP	Accredited Service Providers
DSP	Design Service Providers

Term	Definition
Content Server	The Company's main recordkeeping system that is used to manage both electronic and physical records
Primary Systems	Those part of the Network that transport and distribute electrical power.
Secondary Systems	Control system that control, monitor, and operate the primary systems.

4 General Requirements

4.1 Drawing Management System

All Transmission drawings must be registered and stored within the company's Drawing Management System. The DMS manages drawing version control and drawing approval work flow including maintaining copies of drawing versions and a database of changes made to a drawing.

The management of transmission drawing revision shall be performed via the Controlled Revision Tracking module or CRT dashboard within DMS. The workflow proceeds from draft, to preliminary, to checking, to approval and then to authorisation. Digital signatures are added by the title block integration.

Approved transmission drawings shall be maintained in the vault within content server in an approved directory structure.

4.1.1 Title Block Integration

The Title Block Integration module within DMS interactively populates company compliant title blocks and amendment block with the names of checkers, approvers and authorisation from the DMS work flow. The TBI is triggered on drawing authorisation or approval when the drawings are returned to the vault.

During drawing creation, a standard transmission drawing sheet must be used. The standard transmission drawing sheet has a compliant drawing frame (border), title block and amendment block. At least one compliant drawing sheet is required per drawing. Non-compliant drawing sheets will not trigger TBI and title block information must be manually entered.

4.1.2 Management of legacy drawings

Existing drawing prior to the introduction of DMS will not have a compliant drawing sheet and must be amended for DMS. This shall be managed by either:

- The existing CAD file shall be amended, and a PDF be created. The CAD file and pdf file shall be zipped (as a .zip file) and returned via DMS to the vault. The zip file shall be renamed using the drawing number. For e.g. 385240.zip

or

- The existing drawing shall be amended and drawing frame replaced with a 'compliant' drawing sheet and returned via DMS to the vault.

4.1.3 Drawings provided by external designers

Drawings from external designers such as ASP and DSP shall be registered in DMS. If the external designer does not have access to DMS, then a block of numbers shall be generated and registered in DMS by the company. The list of drawing numbers and compliant drawing sheets shall be provided to the external designer.

External ASP's and DSP's shall also add their respective company logo in an appropriate place on the drawing sheets.

The Mains templates for ASP's and DSP's shall have additional blocks added to each drawing sheet for different purposes, i.e. certification, Indemnity etc.

4.1.4 Drawings for unregulated design

In case if the company is carrying out design drawings as a part of 'Unregulated' work, then the design drawing should bear logo of the respective ASP in addition to the company's logo.

4.2 General Drafting Standards for Transmission Drawings

4.2.1 General Drafting Principles

Transmission drawings produced shall be:

- Clearly convey the intent of the design without ambiguity
- Conform to all relevant Australian and company standards
- Provide adequate information to set out, install and construct the project
- Avoid repetition of the same information
- Use schedules or tables wherever it is necessary
- Refer to standard details where possible.

4.2.2 File format and file name

Transmission Drawings shall be produced in AutoCAD and shall be saved in an AutoCAD 2013 file format.

4.2.3 Drawing titles

Drawings titles shall be no more than four lines. The title structure may vary between drawing types but shall be clear, concise, and consistent with the project details. The structure shall describe the network location, type/ purpose and type of design.

4.2.4 Workspace and viewports

Arrange of viewports are specified in each transmission design section. Viewports shown in paper space, must be 'locked'.

4.2.5 X-references

Substation secondary system designs, and substation civil & mechanical designs do not use X-Refs. Transmission mains designs drawings permit the use of X-refs. X-Refs should be bound to the CAD file.

4.2.6 Paper size

Standard ISO paper sizes of A1, A2, A3, A4 shall be used. Appropriate sizes to be selected to maintain legibility of the details in reduced size format, as far as possible. For example, if A1 size drawing file printed on A3, the details should still be readable.

4.2.7 Layers

Standard drawing layers are specified in each transmission design section.

4.2.8 Scale

Appropriate scales shall be used to provide clarity and uniformity of drawings. Apart from schedules, tables and schematics, all arrangement and detail drafting shall be done in real world co-ordinates with viewports scaled to suit. In paper space, selection of viewport scales shall use standard preferred scales:

1:1 1:2 1:2.5 1:5 1:10 1:20 1:25 1:50 1:100 1:200 1:250 1:500 1:1000 1:1500
1:2000 and 1:2500

Where more than one scale has been used, the words 'AS SHOWN' shall be noted in the title block. The use of bar scales shown on drawings is permitted where required.

The drawing title block will note the size of the actual drawing sheet size for full size hard copy prints.

4.2.9 Line styles and annotations

Standard line styles including line types and annotation are specified in each transmission design section.

4.2.10 Text and fonts

All lettering shall be in upper case. The company uses the font style ISOCP for general text on drawings. For cover sheets True Type fonts such as Arial and Arial Narrow may be used. Refer to each design section for specific text attributes. The selection of font size need to consider for legibility in reduced drawing prints.

4.2.11 Drawing stamps

Drawing stamps shall be applied to drawings in suitable locations to clarify the drawing status. A stamp is required on every sheet of the drawing. Drawings that have been stamped “For Construction” are approved for construction. ASP design drawings will be deemed ‘For Construction’ after Certification.

Standard Drawing Stamps Table

Drawing Stamp	Status	Description
Base Design		Approved “seed” drawing used as starting point for site specific design.
Concept Design		Concept design for internal use by the designer. These drawings are not approved for construction.
Preliminary/ For Information Only		Preliminary design issued for discussion or clarification. These drawings are not approved for construction.
Proposed		Proposed changes during the planning stage.
For Tender		Preliminary design that may be used for quotation and pricing. These drawings are not approved for construction.
Not For Construction		Drawing is not approved for construction
For Construction		Drawing is approved for construction
As Built/ Works As Executed		Drawing has been returned after construction and reflects what was built

4.2.12 Dimensions and Datums

Dimension lines shall be always drawn with even separation from each other for clarity. Baseline dimensions may be used if required. Call-out lines (leaders) shall be used appropriately with its end being either an arrowhead, solid dot or enclosing circle for detail.

Dimensions for substation civil and mechanical and substation secondary design shall be in millimetres. Transmission mains drawings shall be dimensioned in metres (up to two decimal places).

Reduced levels may be shown in either millimetres or metres. Datums for all heights shall be to the Australian Height Datum (AHD). For Northings and Eastings, MGA-56 co-ordinates (Datum GDA 94) shall be used.

Whenever possible, drawings are to be orientated with north pointing to the top of the drawing sheet. The standard Northing block should be used. The North block is to be placed at the top left hand of the plan.

5 Secondary System Drawings

Secondary system drawings detail the requirements of control, monitoring and operation of the primary power network within a substation and includes drawings for the control of primary equipment. Secondary system drawings include drawings for SCADA systems, protection systems, communication systems, metering and auxiliary supply systems.

Secondary system drawings types are:

- Single line drawing
- Control room general arrangement
- Control room light and power
- Control panel general arrangement
- Control panel reference drawing list
- Control panel relay and equipment cut and drill details
- Control panel layouts
- Control panel circuit diagrams
- Control panel connection diagrams
- Manufacturers equipment circuit diagrams
- Manufacturers equipment connection diagrams
- Substation cable schedule
- SCADA system drawings
- Protection system drawings
- Communication system drawings
- Auxiliary supply system drawings

Secondary system drawings shall conform to part 4 of this standard with the following additional requirements.

5.1 Secondary system drawing environment

5.1.1 Workspace and viewports

Only the title block and drawing frame are to be drawn in paper space or the layout tab. To maintain the correct scaling and proportion for circuit diagrams a limit block shall be placed in the model space on the “limits” layer and shall be configured not to plot.

All texts and tables shall be drawn in model space and view ports shall be used to reference the drawing into the file layout tab.

5.1.2 Drawing title

The four-line title block shall typically describe the

1. Substation name or location
2. Equipment or bay identification
3. Drawing function or purpose
4. Drawing type

5.1.3 Paper size

The preferred paper size for a typical substation secondary drawing is A1

5.1.4 Layers

Substation secondary design standard layers are tabled below. The revision and ASP layer are designed to print stamps in red (AutoCAD colour 10). A special layer is required for Accredited Service Providers to place

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the compliance stamps required by customer connections. This layer can be turned off once the drawing is handed over.

Layer Name	CAD Colour	Typical Application
0	Default AutoCAD layer	Do Not Use
Frame	Red	Drawing frame and amendment blocks in paper space
Limits	194 (non-printed)	Used to define electrical dwg limits to suit paper size
Viewport	Non-printed	Viewport in paper space
Pen_025	White, Magenta, Blue, Grey (pen 8)	2.5mm text, Wiring
Pen_035	Yellow, Green	3.5mm text, Symbols
Pen_050	Red	5.0mm text, Outline
Pen_070	Cyan	7.0mm text, Busbar, Cable outline
Dimension	Magenta	Dimension lines
Revision	AutoCAD pen 10 ("Red")	Revision Stamp Block (Red on colour plotter)
ASP	AutoCAD pen 10 ("Red")	Accredited Service Provider compliance stamps

5.1.5 Control Panel Scales

Control Panels shall be drawn in model space at a 1:1 ratio. Any associated text will need to be scaled up to suit the panel size. The preferred scaling range is 1:2, 1:5 and 1:10.

5.1.6 Line styles and dimensions

The standard line styles are centre, dash and hidden. The dimensioning format style is

DIM line colour	By Layer
DIM line weight	By Layer
Baseline spacing	10mm
Extension line colour	By Layer
Extension line weight	By Layer
Extend beyond DIM line	2mm
Offset from origin	2mm

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Arrowheads	Closed filled, 3mm
Text	Yellow, 3.5mm
Text placement	Above, Centred, Aligned with DIM line
Text offset from DIM line	1mm
Overall DIM style scale	1 (As Required)
Measurement scale	1

NOTE: the overall DIM style scale is to be rescaled to suit the panel layout.

5.1.7 Text

Substation secondary design standard text heights are 2.5mm, 3.5mm, 5.0mm and 7.0mm. There is a special 3.0 mm text height that shall be used for wire numbers and symbol identification. The text thickness shall be 10% of the text height.

Secondary Design Text Attributes

Text Height	Text Width	Typical Application	Pen Colour
2.5mm	0.25mm	Symbol terminal numbers, general text	White, Magenta, Blue, Grey (pen 9)
3.0mm	0.25mm	Special text height for symbol identification numbers and wire numbers	White
3.5mm	0.35mm	Symbol headers	Yellow, Green
5.0mm	0.5mm	Subtitle text	Red
7.0mm	0.7mm	Title text	Cyan

5.1.8 Schematic symbols

Electrical schematic symbols are to be drawn in model space at 1:1 ratio using a 5mm grid and a snap of 2.5mm. Symbols are to be aligned vertically to the grid. The schematic circuit is to fit within the limit block of the paper size so that the symbols are not reduced when printed. Standard symbols shall be loaded into the AutoCAD design centre.

NOTE:

A set of standard schematic symbols are also available from the following reference drawings:

514001 Substation Secondary Design Electrical Schematic Symbols

514475 Substation Secondary Design Single Line Diagram Symbols

5.1.9 Drawing Blocks

Panel equipment blocks are to be drawn in model space at 1:1 ratio. Equipment blocks shall be loaded into the AutoCAD design centre.

NOTE:

A set of common equipment panel blocks are also available from the following reference drawings:

514478 Panel Equipment Blocks

514477 SCADA and Communication equipment blocks

5.1.10 Drawing Stamps

A reference set of stamps can be found in drawing 514476

5.1.11 Hazard Icons

Standard hazard icons shall be drawn adjacent to safety and network security hazards. All hazards icons used in the drawing are to be listed in the Safety in Design Statement and Network Security Caution section of the cover sheet, with a short description of the hazard.

NOTE: Refer to drawing 514001 for standard Icons to be used.

5.2 Secondary System drafting principles and drawing sets

Drawings shall be laid out or structured in such a way as to clearly communicate the principle electrical arrangements of an asset. Design ideas or subjects shall be grouped together and laid out in a logical fashion. Cross references shall be minimised.

5.2.1 Secondary system drawing set

Generally, a substation secondary design drawing set, is associated with an asset such as a bay, a panel, equipment, or a scheme. The drawings set shall have a compliant frame inserted in the cover sheet and non-compliant drawing frame in the associated drawing sheets.

A separate drawing sheet is required for information associated with the main function or purpose of the asset, e.g. panel layout and material list, No.1 Protection Schematic diagram etc. The title block information shall be manually updated at drawing creation for the individual drawing sheets.

The set of drawings shall have the same drawing number, same drawing amendment or revision number and the same drawing status stamp on each sheet. Drawing approval is for all sheets in the drawing set.

A drawing set shall typically consist of a cover page, panel layout sheets, schematic diagram sheets and connection diagram sheets.

5.2.1.1 Cover page

The cover page shall have drawing description at the top centre of the drawing and shall include the following drawing information

- a) Design Changes: a short description describing the overall changes to this asset
- b) Drawing Details: List of sheet numbers and their title
- c) Drawing Notes: a short description on drafting issues
- d) Safety in Design Statement: a short description of any atypical hazards associated with the design including its associated Safety Hazard icons.
- e) Network Security Caution: a short description of any network security hazard associated with the design including its associated network security hazard icon.
- f) Design Notes: important information, explanation or settings associated with the design

5.2.1.2 Panel layout sheet

The panel layout sheet is a general arrangement of equipment on the panel and shall including material and label lists. The placement of equipment on the panel shall be dimensioned. Panel steelwork or cut and drill drawings shall generally be a separate drawing

5.2.1.3 Schematic diagram sheet

These drawings show the electrical relationship of the protection and control equipment. The protection and control information are generally dispersed over several sheets.

The AC circuit diagram shall show the relationship between the CT, VT and the protection relays. These shall be titled Protection and Indication circuit diagrams. Arrows shall be drawn above CT windings to show the direction of the current under fault conditions. Polarity dots are to be drawn against the relay windings.

The DC circuit diagram shows the Protection and Control and SCADA circuitry. This may be dispersed onto two different sheets. Either No.1 and No.2 protection circuit diagram or the HV and LV circuit diagram.

Circuit breaker and equipment circuit diagrams are supplied by the manufacture and are often combined with a connection diagram. A company cover sheet shall be added to supplier drawings.

For schematic diagrams, the circuits are to show the circuit logic rather than the physical arrangement. The circuit logic shall flow from top to bottom and left to right across the page. Circuits are to be modularised with a circuit function title. Wire crossings are to be kept to a minimum. Circuits on remote panels are to be enclosed in a dashed line box. The details can be removed if they are duplicated, but a “skeleton” of the circuit is required to show the general circuit principle.

Wiring shall be drawn connected to an element of the device such as a winding, a relay coil, a digital input etc. Wiring shall not be drawn to a disassociated wiring terminal unless it includes a function description. All digital inputs and digital outputs shall include a short text describing its function.

5.2.1.4 Connection diagram sheet

Connection Diagrams shall show the physical termination of control cables to terminal blocks. The drawings shall include the cable number and stranding and its origin. The connection diagrams shall show the wire numbers on both sides of the terminal, core number and wire colour. The connection diagram shall also show any terminal bridging.

A thick line (pen_070 layer) shall be used as the cable trunk and a thin line (pen_2.5 layer) shall be used to draw the individual cores. The cores shall neatly peel off the cable and connect to the terminals.

5.2.2 Management of drawing revision

Amendments to existing drawings are to be managed using DMS which will increment the amendment block revision when the drawing is approved and returned to the vault.

Amendments to a drawing that has been issued for construction shall be known as a work in progress (WIP) amendment. The drawing status shall remain issued for construction (i.e. active) until the last WIP amendment has been built. The drawing status will then become “As Built”.

Identification of drawing changes

A general comment regarding the design change shall be made on the cover page and more detail comments are to be made in the amendment block on those drawing sheets that have a drawing change. If there are no changes on a drawing sheet, then “No Change” is added to the drawing sheet amendment block.

Any changes to an existing drawing will need to be identified by clouding the part of the drawing that has been changed. The clouding should only encompass the new or amended parts of the drawing. The use of clouding may become impractical on schematic diagrams with many wiring changes. In these circumstances the wiring changes may be highlighted by forcing the line and text colour to blue.

5.2.2.1 Drawing changes for concurrent projects

If amendments to an existing drawing is required by different projects, then the changes associated with each project need to be identified. Different coloured clouding and wiring highlights may be used with a text against the change identifying the project number.

If the sequences of the amendments are not related, then each amendment can be added to the WIP drawing. Different coloured clouding and text may be used to identify the changes with an associated revision triangle.

As WAE amendments are returned, new WIP drawings are issued through DMS, with a new drawing amendment revision. If the sequences of the amendments are dependant or mutual exclusive, then the design must be staged. The later amendments shall not be released until the earlier amendments have been constructed and their WAE returned. The co-ordination of the design release shall be negotiated with the project manager.

6 Single Line Diagrams

The SLD has its primary application in power flow studies. Electrical elements such as circuit breakers, transformers, capacitors, bus bars, and conductors are shown using standardized schematic symbols. Instead of representing each of three phases with a separate line or terminal, only one conductor is represented. It is a form of block diagram graphically depicting the paths for power flow between all entities of the system.

Elements on the diagram do not represent the physical size or location of the electrical equipment, but it is convention to organize the diagram with the same left-to-right, top-to-bottom sequence as the switchgear or other apparatus represented and top-to-bottom sequence based on higher to lower voltage.

The SLD is used along with other notational simplifications to define specialised attributes of that part of the network. A secondary advantage to using a SLD is that the simpler diagram leaves more space for non-electrical, such as customer centric or protection-based information to be included.

For requirements on the drawing template and drawing frame size, sheets, title block details, drawing titles and versioning details, please refer to SAD 0001.

6.1 Drawing Environment

6.1.1 Scales

SLD are not to scale

6.1.2 Text

Minimum text size shall be 1.8mm Arial (to allow legibility of drawings reduced in size to A3). Other text sizes and fonts should be selected to provide clarity and reduce congestion.

6.1.3 Symbolology

All symbols used on project drawings shall correspond with those shown on Symbolology Standard SAD 0005 and can be downloaded from the Company's Standards website or as delivered by the Company's GISCAD application.

6.1.4 Basic conventions

- Voltage flow is generally downwards.
- Larger voltage is uppermost to lower voltage on lower level.
- Busbars are in alphabetical order from left to right.
- Circuit breakers are as per field left to right.

- All conductors finish at a change node.

6.1.5 Assets Shown on Single Line Diagrams

The following assets are shown on Single Line Diagrams. Please see SAD 0005 data dictionary for the symbology representing each asset.

- Bond Arc type UGOH
- Buchholz protection
- Bus bar
- Circuit breaker
- Conductor
- Connector node
- Differential protection
- Distance protection
- Earth connection
- Earth fault protection
- Fault indicator
- Frame leakage protection
- Fuse
- Injection cell
- Intertrip arrow
- Line drop compensation
- Low indicator
- Meter
- Motor
- Motor Generator
- Neutral indicator
- Overcurrent protection
- Plug contact
- Pressure relief
- Reactor
- Static frequency unit
- Surge arrestor
- Thermal protection
- Transformer
- Under voltage protection
- Wave trap

7 Civil and Mechanical Drawings

7.1 General Principles

This section defines the drawing and drafting requirements for all building, switchyard and site related drawings, created, and/or modified for use in transmission, zone substations and in switching stations. The types of drawings this section includes, but not limited to the following disciplines:

- Structural engineering
- Civil Engineering
- Architectural
- Hydraulic
- Mechanical Engineering
- Light and Power
- Landscape design

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Civil and Mechanical drawings shall conform to Section 4 of this standard with the following additional requirements.

7.2 Drafting Standards

It is preferred that drawings prepared for the Civil and Mechanical section to have individual drawing numbers created for each drawing. The drawings shall be created and generated as specified in Section 4 of this document.

In cases, where there are external consultants involved in preparing drawings, those drawings can be grouped together under a cover page and uploaded into the DMS. Separate cover page shall be prepared for different disciplines and zipped together prior to uploading into DMS.

7.2.1 Cover Page

The cover page, when required, shall have a description of the project and shall include the following information:

- List of drawing numbers and their title
 - Where external consultants have prepared the drawings, the cover page shall include the external drawing numbers and latest revisions.

The cover page may also include the following:

- Location Plan with north-point
- Clearly indicate the location and drawing discipline

7.2.2 Amendments to drawings

Amendments to existing drawings are to be managed as previously noted in the general drafting requirements.

All changes to an existing drawing will need to be identified by clouding the part of the drawing that has been amended. The clouding should only encompass the new or amended parts of the drawing and/or amended items in the item list. Adjacent to the revision cloud a revision triangle must be shown with the current revision character within the triangle.

Amendments to a drawing that has been issued for construction shall be known as a work in progress (WIP) amendment. The drawing status shall remain issued for construction (i.e. active) until the last WIP amendment has been built. The drawing status will then become “As Built”. As new WIP amendments occur, the old revision clouds will be removed from the drawing and the new ones added.

Company understands ‘As Built’ drawings and ‘Works As Executed’ as the same. At the completion of the project, Works as Executed marked-up drawings are returned to the Civil and Mechanical section and a new amendment will be prepared to update the drawings as required. The revision history for the final amendment on the drawing will state “Works as Executed Issue”

7.2.3 Line Styles

The preferred line styles shall be in accordance with AS 1100.101, AS 1100.301 and AS 1100.501.

7.2.4 Text

The preferred text heights and styles and dimensions shall be in accordance with A1100.101, AS 1100.301 and AS 1100.501.

7.2.5 Symbols

The preferred drawing symbols shall be in accordance with AS 1100.101, AS 1100.201, AS 1100.301 and AS 1100.501.

7.2.6 Drawing Layers

Civil and Mechanical drawing layers Table.

Layer Name	CAD Colour	Typical Application
0	Default AutoCAD layer	Do Not Use
Frame	Red	Drawing frame and amendment blocks in paper space
Defpoints	White (non-plot)	Viewport in paper space
Drawing	As required	General
Details	As required	
Hatch	As required	
Viewport	Non-printed	Viewport in paper space
Pen_18	Grey	0.18mm lines
Pen_25	White	0.25 mm lines
Pen_35	Yellow	0.35 mm lines
Pen_50	Red	0.50 mm lines
Pen_70	Cyan	0.70 mm lines
Text_025	White	2.5mm and 3.0mm text
Text_035	Yellow	3.5mm text
Text_050	Red	5.0mm text
Text_-070	Cyan	7.0mm text
Pen_Colour8	AutoCAD pen colour 8	
Dimension	Yellow, white, Magenta	Dimension text and lines
Stamp_As Built	Red	
Stamp Construction	Red	
Stamp Preliminary	Red	
Stamp Tender	Red	
Revision	AutoCAD pen colour 10	Revision Stamp Block (Red on colour plotter)

8 Transmission Mains Drawings

This section outlines the specific drawing and drafting requirements for Transmission Mains reticulation drawings prepared by in-house or external resources for construction works and to meet company's design certification requirements.

Transmission Mains drawings are usually, a combination of survey data, aerial images, easements, stakeholder boundaries, utilities interaction, geotechnical data, pole/ cable schedules and the planned route in topographical format. Depending upon the type of route, for example O/H or U/G, chainage is shown in the form of O/H line or trenching and under-boring profiles.

All Transmission Mains drawing must have the following minimum requirements.

Requirement	O/H Design	U/G Design	Notes
Continuous Rating	✓	✓	for each section of the feeder
Contingency/ Emergency Rating	✓	✓	for each section of the feeder
Cable / Conductor type/ length	✓	✓	for each section of the feeder
Site Plan and Legend	✓	✓	For all associated works
Locality plan	✓	✓	Including feeder numbers
Aerial Imagery	✓	✓	Use where it adds value to the design
Single line diagram	✓	✓	Existing and Proposed
Circuit diagrams	✓	✓	Indicating phasing and earthing requirements. Circuit diagrams for designs prepared by Endeavour Energy may not be required on the design plan depending on internal design process requirements.
Easement plan	✓	✓	Including overhead conductor blowout
Third-Party Services / Structures	✓	✓	Location and separation from all third-party service / structures etc.
Design Tension	✓		between each set of termination points
Design Temperature	✓		at maximum operating temperature
Circuit Clearances	✓		between two different circuits
Pole Position	✓		GPS co-ordinates to be provided in MGA-56 co-ordinates (Datum GDA 94)
Pole Strength / Height	✓		Populate details in Pole Schedule
Construction Type	✓		For each pole / circuit
Ground Clearance	✓		at the maximum operating temperature

SAD 0006 – Transmission Drawing Standards

Requirement	O/H Design	U/G Design	Notes
Attachment Heights	✓		of all insulators or crossarms
Vibration Damper Requirements	✓		for each span (if needed)
Aerial Marker Ball Requirements	✓		for each span (if needed)
Conductor profile	✓		Indicating clearances for each span
Pole schedule	✓		Structure number, structure type, size and strength, footing diameter and depth, structure co-ordinates, pole top construction, span length, line angle, details of stays, "Y" dimension (joint use)
Stringing chart	✓		Conductor type/ Tensions (kN) 0 – 45 °C / sag / ruling span / strain points / reference temperature for conductor stringing (usually 5 °C) Final creep allowance
Pole earthing details	✓		At each structure
Pole Phasing	✓		Under each pole diagram show the relevant pole numbers as per the Pole Schedule and indicate the direction in which it is being viewed from or to a location.
Details of overhead line design software	✓		The name and version number of overhead line design software used to model and design the overhead line
Cable depth		✓	relative to final ground level
Section Length		✓	for each section of cable
Joint Bay / Link Box / Fibre Pit Details		✓	GPS co-ordinates to be provided in MGA-56 co-ordinates (Datum GDA 94) (location/ separation)
Cable Pulling Tension		✓	for each section of cable (including side wall bearing pressure and pulling tension)
Direction of cable pull		✓	
Bonding arrangement		✓	at each joint / termination
SVL rating		✓	at each link box
Cross sections of cable trench/ underbore		✓	as a minimum at each change of the duct configuration, underbore, road crossings and other services crossings
Underground long section with service crossing		✓	details underground cable depth (existing and proposed finished surface levels / chainage)
Cable termination, connection to previous and/ or subsequent sections		✓	Shown on single line or circuits diagram for entire cable route

8.1 Transmission Mains Drawing Environment

8.1.1 Standard CAD Template

Endeavour Energy Transmission Mains standard template drawing contains standard title blocks, layouts, blocks, layers and line types.

A layout is included for each sheet size available.

8.1.1.1 ASP & DSP Standard Template

The standard template for ASP's and DSP's is automatically attached to the drawing file when a download of an GISCAD extract is performed and MUST not be deleted or replaced by another template.

8.1.2 Drawing number

Drawings with multiple sheets must have one drawing number, and revision to any sheet shall result revising all sheets.

8.1.3 Workspace and Viewports

All drawings are to be drawn in MILLIMETRES in model space at 1:1 ratio except feeder route plans, longitudinal sections, survey details, cadastral maps which are to be drawn in METRES in model space at 1:1 ratio.

Appropriate viewports are required in paper space to set out the drawing details drawn in model space.

8.1.4 Standard Layers

Standard drawing layers are pre-set within the standard template drawing and is available on all GISCAD extracts.

8.1.5 Text

Minimum text size shall be 2.5mm Arial (to allow legibility of drawings reduced in size to A3). Other text sizes and fonts should be selected to provide clarity and reduce congestion.

Generally lower-case text lettering should NOT be used for text in drawings. Text drawn in model space will need to be scaled to suit Viewport scale in paper space.

Mains Design Text Attributes

Text Height	Pen Colour	Typical Application
2.5mm	Grey (pen 8)	Lot numbers and DP numbers
2.5mm	White	Annotations, notes, legends, dimensions, structure numbers, minor feeders
3.5mm	Yellow	Notes, warning titles, legend titles, substation names/ numbers, road names
5.0mm	Red	Main titles, view titles
7.0mm	Cyan	Major titles

8.1.6 Line Types and Weights

The Transmission Mains drafting standard Line types can be selected from Line Type Manager “EE line type library transmission mains”.

For ASP's and DSP's, standard line styles and line weights are set up on the standard template drawing and is available on all GISCAD extracts

8.1.7 Standard Symbols

All symbols used on project drawings shall correspond with those shown on Symbology Standard SAD 0005 and can be downloaded from the Company's Standards website or as delivered by the Company's GISCAD application.

NOTE:

A set of standard symbols are also available from the following reference drawings:

294854 Drawing Specification Standard Drawing Symbols

8.1.8 Importing OLE (object linking and embedding) objects into Drawings

Use of OLE objects, such as Excel spread sheets is permitted. OLE object can be imported into drawing as either an embedded object or linked object.

NOTE:

When OLE objects with text are printed, the text size approximates the text size in the source application.

Nested OLE objects may cause problems. For example, an Excel spreadsheet embedded in a Word document may fail to plot.

9 Authorities and Responsibilities

Manager Asset Standards & Design has the delegated authority and responsibility for approving this instruction for minor changes and making recommendations to General Manager Asset Management for major changes in respect to this instruction.

Substation Design Manager has the authority and responsibility to make sure that the process described within this Standard is followed and endorsing this Standard.

Mains & Civil Design Manager as the authority and responsibility to make sure that the process described within this Standard is followed and endorsing this Standard.

Mains Asset Manager has the authority and responsibility to maintain the transmission drawing process standards updated and disseminated to all stakeholders and users.

Substation Assets Manager has the authority and responsibility to maintain the substation drawing process standards updated and disseminated to all stakeholders and users.

Accredited Service Provider, Level 3 (L3ASP) are responsible to make sure that all information submitted on the reticulation design drawing(s), conforms to the requirements of this Standard and the Customer Connection General Terms and Conditions. The information presented on the plans, derived Annexure 1 - Replacement Kits for Air Break Switches from the designer's site visit, is to be accurately depicted and drawn using the Company's standard symbols and line styles.

Design Services Managers is responsible to make sure all design drawings prepared by the Company's employees conform to this Standard.

Designers have the authority and responsibility to make sure all their design drawings prepared in conformance with this Standard.

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- **SAD 0006 – Transmission Drawing Standards**

Contestable Works Officer/Engineer must make certain, before certification is granted, that the drawing information being received by Endeavour Energy complies with this Standard and all other relevant Company's network Standards and the Connection Policy.

Produced by Asset Standards and Design Branch

W Endeavourenergy.com.au
T 131 081



ABN 11 247 365 823