

COMPUTER AIDED DESIGN

STANDARDS AND PRACTICES

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Drawing Standards



TITLE: ENGINEERING DRAWING MANAGEMENT – COMPUTER AIDED DESIGN (CAD) STANDARDS AND PRACTICES

DOCUMENT TYPE: STANDARD

This document is not to be considered in isolation, but in relation to its position in the policy suite hierarchy as illustrated under section heading: document hierarchy and questions.

1 ENDORSEMENTS

SIGN OFF	SIGNATURE AND DATE	NAME AND TITLE	OPERATING UNIT
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Approval Details			
Final approval Date:		Effective date:	
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2 PURPOSE

This document outlines the technical requirements that must be followed when preparing CAD based engineering drawings for Synergy. The requirements described in this document apply to drawings produced by both Synergy employees and those produced on behalf of Synergy by consultants or contractors (subsequently referred to as the "contractor").

The application of these technical requirements will ensure a consistent and high standard of presentation for engineering drawings and will ensure compatibility with existing drawings and the Synergy CAD environment.

They are to be applied both in the preparation of new drawings and the revision to existing drawings. No departure from these requirements is permitted without written approval from the Synergy representative or their authorised delegate.

The standard applies to internal Synergy and external contractor draftspersons.

3 DRAWING REQUIREMENTS – MINIMUM REQUIREMENTS FOR SCOPE OF WORKS

3.1 Scope of Works

Contact the Synergy Engineering Drawing Governance Coordinator to review the Scope of Works before it goes out to tender to check for drawing compliance.

3.2 Contract Award Kick of Meetings

Invite the Synergy Engineering Drawing Governance Coordinator to attend all contract award kick of meetings to reiterate Synergy's drafting standards.

3.3 Required CAD file format

- (a) the nominated software for CAD engineering drawings for the below sites is Bentley Systems MicroStation version v8i SELECT series 3 and Bentley Descartes SELECT series 3 raster version editing software.

- Muja Power Station
- Kwinana Power Station
- Pinjar Power Station
- Mungarra Power Station
- Kalgoorlie Power Station
- Kwinana Gas Turbine 1

- (b) other file formats may be accepted after consultation with Synergy and where agreement is provided in writing. In this instance, the minimum delivery is DWG or DXF format.

- (c) the nominated software for CAD engineering drawings for the below sites is AutoCAD:

- Cockburn Power Station
 - Collie Power Station
 - Kwinana Gas Turbines Stage B
 - Albany Wind Farm
 - Alkimos Power Station
 - Bremer Bay Power Station
 - Coral Bay Power Station
 - Denham Power Station
 - Esperance Wind Farm
-

- Grasmere Wind Farm
 - Greenough River Solar Farm
 - Hopetoun Power Station
 - Kalbarri Wind Farm
- (d) all drawings sent for revision must be returned in the same format they were sent. For example, if they were sent in dgn format, they must be returned in dgn format;
- (e) drawings should not be exported or saved as other formats;
- (f) standard Synergy sheets and borders shall be used for all new and revised drawings. Synergy will provide templates/seed files, models and sheets;
- (g) standalone cit and hybrid drawings consisting of a dgn and cit file should be redrafted to vector;
- (h) all drawings new or old must consist of a sheet and a model;
- (i) information to be captured within the design model include the design co-ordinate grid and items linked to a geographical point (i.e. design information, plans etc.);
 - (ii) information to be captured within the sheet model/paperspace include the title block border, notes, legend, key plan, general notations and dimensions;
- (i) CAD files shall be created on the basis that one drawing sheet = one CAD file. Multiple drawings sheets stored in a single CAD file are not acceptable.
- (j) two drawing samples using our workspace must be provided at the commencement of drafting to synergy.drawings@synergy.net.au to ensure our drawing standards will be adhered to and;
- (k) drawings at the “Issued for Construction” and “As Built” stages must be issued to Synergy in native CAD and PDF format with an Excel spreadsheet transmittal including the drawing number, drawing title and revision.
- (l) Microstation and AutoCAD drawings shall use only fonts that are supplied in a standard off-the-shelf installation. The required font for both applications is ISOCP. All text is to be to AS1100.

3.4 Reference files

References files should be merged into the master drawing before transmitting to Synergy.

3.5 Microstation hybrid CAD files

- (a) Hybrid CAD drawing comprising of a vector (.dgn) and a raster (.cit) file, the CAD filenames shall be identical, other than the file extension;
- (b) the bottom left corner of the raster image shall be located on the centre of the vector design plane (i.e. XY=0.0); and

- (c) the cartesian units must match the vector (.dgn) working units (i.e. mm) and be inserted interactively.
- (d) Consideration should be given on a case by case basis whether to convert a hybrid or standalone cit raster image drawing to 100% vector.

3.6 AutoCAD drawing files

AutoCAD drawings must open successfully (without any errors being generated) and display 100% faithfully when opened in a standard off-the-shelf installation of AutoCAD from 2014 or later. This includes no font substitution occurring i.e. only fonts shape files supplied as part of the standard off-the-shelf version of AutoCAD are to be used in the drawing. The file must not contain custom line styles, shapes, proxy objects or other elements that are not included in the standard off-the-shelf version that will prevent the drawing from displaying faithfully.

CTB files should be transmitted with drawings if Synergy templates are for some reason not used.

Drawings should contain View Ports and not Base View.

The Synergy AutoCAD dwt template files should be used as new files and not by clicking 'From Template' in an old drawing in order for Synergy layers to be included in the file.

3.7 Drawing sheet sizes

All new drawings are to be on produced standard ISO series sheets, namely A0, A1, A2, A3 and A4.

The sheet size should be determined by the content of the drawing.

3.8 CAD file transfer

All drawings should be supplied from external sources to the Synergy representative via email to synergy.drawings@synergy.net.au or made available for download from a secure internet site.

3.9 CAD file naming convention

All CAD files shall use a naming convention based on the drawing numbering scheme that is applicable to each site. CAD filenames are structured using leading zeros and dashes. All CAD filenames must use lower-case characters. E.g. For drawing M109-0035-015, the CAD files are named - m109-0035-015.dgn.

Please refer to the following documents:

19671856 Synergy Drawing Numbering Schemes All Sites

For all new drawings produced on behalf of Synergy by contractors, the drawing numbers are issued by the Synergy drafting office.

3.10 CAD file translation

All CAD drawings shall comply with the following requirements:

- (a) files shall be translated to the nominated software (MicroStation V8i Ss 3 .dgn or AutoCAD dwg format) before hand-over to Synergy.
-

3.11 Principles of operation

- (a) all drawings are to be drawn on CAD full size, this means that one metre on the ground is one metre in the system;
- (b) drawings are to be drawn in their correct location e.g. power station grid system or MGA 94 coordinate system, as relevant; and
- (c) drawings are to be plotted out at standard scales to suit standard drawing sheets.

3.12 Conditions of file set up

- (a) working units:

<u>Basic engineering</u>	1mm:1mm:1000 (default)
Layout engineering	1m:1000mm:1000
Cadastral	1m:100cm:100

- (b) global origin (GO):

<u>Basic engineering</u>	GO = 0, 0 at center of design plane
Layout engineering	GO = 0, 0 at center of design plane
Cadastral	GO = 0, 0 at center of design plane

3.13 Finish file conditions

- (c) displays on:

levels used displayed
weight on
grid on

- (d) displays off:

textnode
level symbology
construction lines
enter data fields

- (e) finished files are to be a complete drawing and border.

Multi-line styles and or custom line styles created and used on the drawings that have not been supplied by Synergy are to be dropped prior to delivery to Synergy.

3.14 Ancillary information

New or revised drawings produced on behalf of Synergy by contractors shall use the latest standard Synergy borders. The contractor may add their own logo immediately above the Synergy title block and record relevant contract details.

3.15 Drawing location

The bottom left hand corner of the drawing border shall be located on the centre of the design plane and defined as X,Y = 0,0.

3.16 CAD text fonts

Microstation V8i ss 3 and AutoCAD 2014 drawings shall use only fonts that are supplied in a standard off-the-shelf installation. The required font for both applications is ISOCP. All text is to be to AS1100.

It is also the responsibility of the contractor to guarantee:

- (a) no custom developed line styles; and
- (b) text is to consist of 0 – 9, Aa – Zz. No special characters. English language only to be used.

3.17 Colour table

Synergy's standard colour table std.tbl should be attached and used. Yellow should never be used but 40 in AutoCAD and 177 in Microstation instead. MicroStation colour designations should be used. i.e.

WHITE	C0=0
BLUE	C0=1
GREEN	C0=2
RED	C0=3
VIOLET	C0=5
ORANGE	C0=6
GREY	C0=7

3.18 CAD line weights

Line weights equating to plotted line thickness

WT=0	0.18 mm
WT =1	0.25 mm
WT =2	0.35 mm
WT =3	0.5 mm
WT =5	0.7 mm

WT =7	1.0 mm
WT =11	1.5 mm
WT =15	2.0 mm
WT =19	2.5 mm
WT =23	3.0 mm

When A0 (or larger) drawings are produced, the minimum line weight (plotted line thickness) is to be 0.35mm.

4 DRAFTING STANDARDS AND PRACTICES

4.1 Drawing title format

The drawing title shall be structured as below:

Line 1: description of the asset and its stage. (Text height=5 mm) e.g. **KWINANA POWER STATION**

Line 2: stage or unit e.g. **STAGE C** (Text height=3.5 mm)

Line 3: description of major plant system or item. (Text height=3.5 mm) e.g. **BOILER FEED PUMP 5 SOUTH**

Line 4: description of particular part of the system or plant item. (Text height=3.5 mm). e.g. **LEAK OFF VALVE**

Line 5: (as required) additional description of plant or plant item. (Text height=3.5 mm) e.g. **ORIFICE PLATE FOR FLOW MEASUREMENT**

Subsequent lines: (Text height=3.5 mm).

Line 6: type of drawing or information conveyed. (Text height=3.5 mm). e.g. **GENERAL ARRANGEMENT**

4.2 Contractor logo information

For drawings produced on behalf of Synergy by contractors, their logo and reference numbers shall be placed immediately above the Synergy title block on the right hand side.

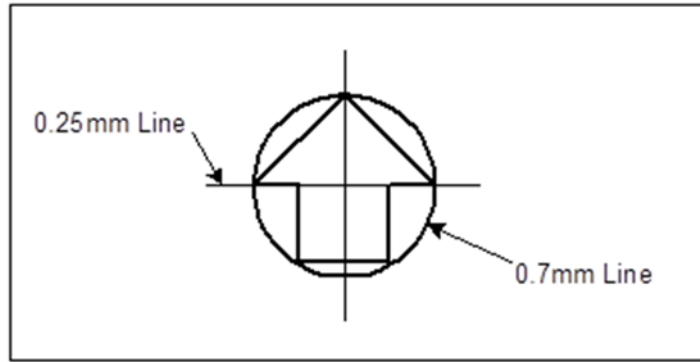
Where a contractor is revising an existing drawing, the reference to the contractor is to be noted in the revision box, as 'revised by contractor name'.

5 DETAILED TECHNICAL REQUIREMENTS

5.1 Orientation of plans

A north point (see figure below) shall be indicated on every location plan, preferably next to the title panel. Wherever possible, all plans for a particular project should be drawn with the same orientation on the drawing sheet. The north point is recommended to face the top of the sheet when viewing the title block.

Standard north point



5.2 Orthographic drawing protection

The preferred method of projection for civil, structural, mechanical and electrical work is the "3rd angle". It shall be used wherever possible. Any variation should be noted and clearly indicated on the views.

5.3 Expression of metric units and symbols

Metric units and symbols shall be expressed in accordance with code AS ISO 1100.

NOTE: symbols for units do not use a period. Plurals are not used.

- (a) use km, not kms; and
- (b) use kg, not kgs.

5.4 Layout of numbers

- (a) general

Commas should not be used as thousand markers.

- (i) 23 456, not 23,456
- (b) decimal sign

Shall be in accordance with AS 1100.

- (c) group of numbers

Numbers of five or more, either side of the decimal symbol, are grouped in three from either side of the decimal symbol with a space between groups.

- (i) 2 345 678
- (ii) 0.870 542
- (iii) 78 045.123 45

Numbers of up to four figures on either side of the decimal marker may be grouped together but preference shall be given to a spacing of three.

- (i) may use 2345.1234, but 2 345.123 4 is preferred
- (d) numbers less than unity

Numbers less than unity must have a zero before the decimal symbol.

- (i) 0.914, not .914

5.5 Scales

- (a) drawing scales

Engineering and architectural drawing scales plus surveying and mapping drawing scales shall use ratios as recommended in AS 1100.101

- (b) single scale on drawings

Where only one scale is used on a drawing sheet, it shall be indicated in the title block.

- (c) multiple scales on drawings

Where more than one scale is used on a drawing sheet, the scale shall clearly be shown adjacent to the view concerned.

Each scale used shall be indicated in the title block.

- (d) different horizontal to vertical scale

Where different scales are used (e.g. road profiles), each scale should be clearly shown.

- (i) horizontal scale 1:500
- (ii) vertical scale 1:100

5.6 Dimensioning

- (a) general

Dimensions should be used on drawings to indicate the distance between planes or surfaces, and should be so placed as to indicate the complete physical detail of the element.

- (b) arrangement of dimensions

Dimensions shall be placed on drawings using the obliqued method or the unidirectional method. Preference shall be given to the obliqued method, where each dimension is inscribed parallel to its dimension line so as to read from the bottom or right hand side of the drawing.

Generally, dimensioning and tolerances will conform to AS 1100.

- (c) not to scale dimensions

Where it is desirable or necessary to indicate that a particular dimension is not to scale, the dimension shall be underlined with a full thick line.

- (d) angular dimensions

Angular dimensions shall be expressed in degrees, or degrees and minutes or in degrees, minutes and seconds;

e.g. 22.5° or $22^\circ 30'$ or $52^\circ 30' 30''$

Where an angle is less than one degree, it shall be preceded by a 0; e.g. 0° 15'

Angles of 90° need not be dimensioned unless required for clarity.

NOTE: In survey drawings, leading zeros are used before minutes and seconds when these figures are less than 10

e.g. 2° 04' 05"

(e) units

In general, only one unit should be used for linear dimensions on a particular drawing in which case the unit symbol may be discarded irrespective of the unit used. In some circumstances it may be necessary to note prominently on the drawing, the unit in which the dimensions are expressed.

(f) accuracy

Attention is drawn to the widespread but erroneous impression that the accuracy to which a quantity is measured or specified is implied either by the number of zeros with which the number ends or the number of decimal places to which the quantity has been expressed. Although various conventions along these lines have been used, the implied accuracy of a number can be derived, if at all, only from the number of significant figures given and in many cases even this implied accuracy may be incorrect. For this reason the accuracy of a measured quantity or the tolerance on a required dimension should be specified in critical cases.

5.7 Datum levels on drawing

(a) levels

Levels record the distance above or below a defined datum either Australian height datum (AHD) or a selected datum for a particular project.

Australian height datum is taken as zero with reference to the mean sea level at Fremantle harbour. Further reference may be made to Public Works department's publication "PWD tidal WA coast" number PWD WA 47574-2.

Levels related to any datum other than standard datum are referred to as reduced levels (RL). Levels shall be expressed on drawing in meters.

(b) datum

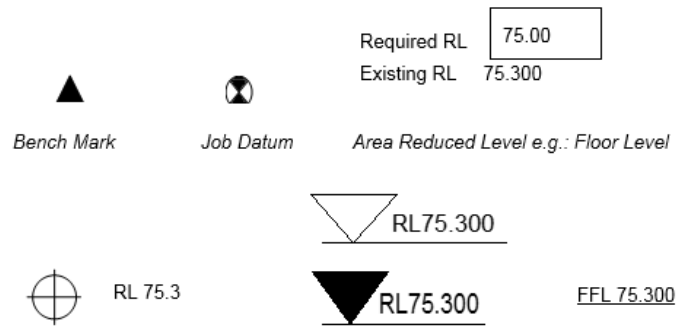
Project datum - a reference datum should be established for each project in order to define the reduced level of the building works. This job datum should be readily located on site and clearly indicated on all drawings.

The datum adopted for a project should ensure that all reduced levels are positive numbers.

(c) expression of levels

Where there is a possibility that levels might be confused with other figures on a drawing, the use of prefixes is recommended, e.g. reduced level or FFL (finished floor level) or FCL (finished ceiling level).

(d) examples



5.8 Co-ordinates

Layout co-ordinates shall always be expressed on drawings in meters to three decimal places and to an accuracy of 0.005m.

- (a) 2700.000 N not 2700N
- (b) 3210.125 E not 3210.123E

5.9 Lettering, numerals, symbols and notes

- (a) general
 - (i) lettering, numerals and symbols shall comply with AS 1100;
 - (ii) lettering should be distinct, uniform and clearly legible in reproductions from the original drawings. Upper case letters shall be used for all titles and sub-titles;
 - (iii) all lettering shall be so orientated that it can read from the bottom of the sheet (title block) or from the right hand side;
 - (iv) upper case lettering shall be preferred on all drawings;
 - (v) lower case lettering shall be used for conventional signs and symbols, e.g. mm; kg; kpa; and
 - (vi) notations made on drawings should be in black on a white back ground or white on a black background.
- (b) notes on drawing
 - (i) general or repeated information should be grouped and preferably located near to and above the title block; and
 - (ii) descriptive notes should be placed as close as practicable to the items to which they refer and in no case shall the lettering obscure any part of the drawing. Instructions on drawings should be positive and written in the imperative.

5.10 Lines

- (a) general

Line work on engineering drawings shall conform to AS 1100.

5.11 Abbreviations and symbols

The use of abbreviations on drawings is NOT recommended.

- (a) in text, notes and table headings in plain language, abbreviations may be used as contained in AS 1100; and
- (b) symbols shall conform to relevant codes and to AS 1100.

6 ELECTRICAL DRAWINGS DETAILS REQUIREMENTS

This section details the standards and practices that are applicable to electrical drawings, in particular circuit diagrams, interconnection & terminal connection diagrams and unit wiring diagrams. AS 4383 describes these and other drawing types used to display or explain electrical functions and connections and to give information for manufacturing, installation and maintenance.

For all drawings, where the manufacturer's symbols are used in preference to those in Australian standards, a legend shall be included with the drawing(s) showing the symbols used and their meaning.

6.1 Circuit (schematic) diagrams

- (a) general arrangement
 - (i) all circuit diagrams shall be drawn using detached representation;
 - (ii) a horizontal ladder layout shall be used. Rungs shall be uniform spaced and coincide with a 1 mm grid, with a preferred minimum vertical spacing between rungs of 10 mm;
 - (iii) all circuit elements and conductors shall be arranged on the sheet in such a manner that provides a minimum of conductor cross-overs;
 - (iv) wherever possible, the power and control circuitry for a particular device should be shown on the same drawing. Preferred line thickness is 0.70 mm for the power circuit and 0.35 mm for the control circuit;
 - (v) duplication of the same device on two or more drawings shall be avoided wherever possible;
 - (vi) the drawing must contain detailed and comprehensive information to the extent that the function and purpose of all parts of the circuit can be clearly understood without the need to refer to other drawings or documents. This will aid in understanding the circuit operation, identifying and locating devices plus identifying other related drawings; and
 - (vii) the drawing numbers and titles of all related drawings must be shown on the drawing. (e.g. connection diagrams, single line diagrams, etc.).
 - (b) information flow

The circuit elements shall be arranged on the sheet out so the flow of information from input to output corresponds to left to right on the drawing sheet.
 - (c) element placement
-

All devices and conductors should be placed on a 1 mm drawing grid. Devices shall be sized to coincide with the 1 mm grid spacing.

(d) line number referencing system

A line number referencing system shall be used for all devices and components

- (i) the line numbers shall coincide with the rung spacing and be drawn on the left side of the drawing. A continuation of the line numbering can be made on the same drawing sheet if required or continue into the second and subsequent sheets of the same drawing;
- (ii) at each coil or device, the line location of all contacts is to be shown. Normally closed contacts shall be indicated with an under-bar (e.g. 17, 29) and spare contacts with the character "S" (e.g. S, S). The line numbers are to be drawn immediately to the right of the coil or device with a minimum text size of 2.5 mm;
- (iii) for coils and devices that have contacts located on another drawing, a description of the function the contact performs, the destination of where it is used plus the relevant drawing number and line number shall be noted adjacent to the contact or group of contacts on the source drawing;
- (iv) at each contact, the line number of the initiating coil or device is to be shown. The line number is to be shown immediately below the contact element with a minimum text size of 2.5 mm;
- (v) for contacts which have their initiating coil or device on another drawing, a description of the function the coil or device, the destination of where it is located plus the relevant drawing number and line number shall be noted adjacent to the contact;
- (vi) for all parts of a circuit that are continued from or to another drawing, a description of the function of that part of the circuit, the destination of where it is continued and the relevant drawing number shall be included; and
- (vii) all power supplies are to be clearly identified. The identification shall include the voltage, AC or DC, a description of where the power is sourced from plus any relevant drawing or document numbers.

(e) terminal numbers

The terminals and terminal numbers for all contacts, coils and devices shall be shown on the drawing. Locate the terminal numbers immediately below the connection point with a minimum text size of 2.5 mm.

(f) wire numbers

All wire numbers shall be shown. The numbers shall be placed immediately above the conductor with a minimum text size of 2.5 mm.

(g) cabling

- (i) all conductors contained in a cable shall be shown using a short dashed line;
 - (ii) show all terminals used for the connection of cables and include the terminal strip designation and the terminal number;
 - (iii) a unique cable terminal symbol should be used to designate terminals at a particular a location. Make the terminal symbol consistent with those already in use for particular designated locations; and
 - (iv) the preference is not to include cable and core numbers on the circuit diagram, but rather to show these on a separate interconnection (termination) diagram.
- (h) item designations and functions
- (i) each device shall have an item designation. Follow AS 3702, with method 1 for block 3;
 - (ii) show the item designation immediately above each element with a minimum text size of 3.5 mm;
 - (iii) the functional description of each coil and device should be shown on the drawing, either adjacent to each coil and device or in a separate table;
 - (iv) show the settings for all timers and other devices that have a setting is applied;
 - (v) include a function diagram and/or notes for devices where their function is not clearly evident from the item designation and description. e.g. Complex timing devices, limit switches;
 - (vi) where a device has connections that perform different functions, each separate function should be noted against the relevant device terminal connection(s);
 - (vii) fuse and circuit breaker ratings shall be shown. For fuses the carrier size and installed fuse size shall be shown. For circuit breakers, the breaker rating and actual settings shall be shown; and
 - (viii) the Ellipse “plant number” shall be included for all devices that are recorded in the Ellipse equipment register.

6.2 Interconnection and terminal connection diagrams and tables

This type of drawing shows the interconnection of all assemblies and devices where a cable is used to interconnect them. It typically shows how the cables are connected at each end and may also be known as a termination diagram.

- (a) method of representation

Diagrammatic representation shall be used. Refer to AS/NZS 4383 for further detail.

- (b) detail required on the drawing
-

- (i) cable numbers, core/pair numbers and wire numbers;
- (ii) for cables where the termination is shown on another drawing, show the description of the cable destination plus the relevant drawing number;
- (iii) designation of all terminal strips and terminal numbers;
- (iv) cable connections to all devices shall be shown, unless the device terminations are shown on another drawing. The devices should be drawn as their circuit symbol or alternatively may be drawn in block form if the connection details are clear;
- (v) show all “double ferruling” where a wire number changes at a terminal point; and
- (vi) the drawing number and title of all related drawings must be shown (e.g. circuit diagrams).

6.3 Unit wiring diagrams and tables

These drawings provide information on the internal electrical connections of a unit or assembly of units. They are also known as wiring diagrams.

- (a) method of representation

Present the information as either a wiring diagram or as a wiring table. Refer to AS/NZS 4383 for further detail.

Typically, reference the appropriate interconnection diagrams and other related diagram for the external connections.

- (b) detail required on the drawing

- (i) all item designations shall be shown and are to be the same as those used on circuit diagram;
- (ii) the item function, make, model and relevant remarks are to be shown either adjacent to the item or in a separate table;
- (iii) wire numbers;
- (iv) terminal numbers;
- (v) for wiring diagrams, the approximate topographical layout of devices should be shown. A separate diagram to show the equipment-layout may be used in the case of a wiring table;
- (vi) for wiring diagrams, the view of each device should indicate the physical terminal layout that would be seen when viewing the device. For a wiring table, this may be shown on the layout drawing; and
- (vii) the drawing number and title of all related drawings must be shown (e.g. Circuit diagrams).

6.4 Drawing mark ups

Mark-ups of drawings are required in order to indicate to a draftsman the changes that are required to the master copy prior to it being re-issued. A consistent approach in drawing mark-up will ensure that the draftsman is presented with a consistent and unambiguous marked up print, thus contributing to accurate and efficient drawing revision.

- (a) general
 - (i) ensure the current revision of the drawing is used for mark-ups;
 - (ii) mark-ups are to be legible and of sufficient size to be easily readable – consider enlarging a section of the drawing if required;
 - (iii) ensure all required detail is shown on the marked-up drawing – incomplete mark-ups will require the draftsman to request additional information, thus delaying the revision process and adding to the cost; and
 - (iv) use a yellow highlight pen to draw attention to small marked-up areas that may be easily missed by the draftsman.
 - (b) additions
 - (i) all additions to the drawing are to be drawn in red pen; and
 - (ii) where there is insufficient space on the drawing to show the additions, attach a sketch(s) showing the additions.
 - (c) deletions
-

- (i) lines and text to be deleted are to be indicated by drawing over them with light blue high-light pen
- (ii) do not use correction fluid (“white out”) to cover lines and text that are to be deleted.
- (d) temporary notes
 - (i) notes required for construction purposes or as instructions to the draftsman are to be drawn in black pen. These are NOT considered to be part of the drawing revision.

Note: an example of a marked up drawing (part) illustrating the requirements described above is attached to this document as [Attachment 1: Example of marked up drawing](#)

6.5 Storage of drawing mark ups

Drafts and marked up drawings that have been circulated must be saved as per the ephemeral documents document in Synergy’s DMS. Please refer to DM document numbers 4352187 Drawing Revision by Synergy and 4366315 Drawing Revision by Contractor.

7 DRAWING REVISIONS

7.1 General

All revisions are to be undertaken using the CAD process.

7.2 Drawing revision reference and cell

Each drawing shall contain a drawing revision block/cell found in the General block/cell library. A new version of the workspace/templates to be issued will contain a drawing revision table built into the title block for recording the revision history. The nature of the revision shall be succinctly and clearly explained in the drawing revision table.

7.3 Drawing revision numbering

- (a) existing issued drawings
 - (ii) for drawings that have been issued on an “as-built” basis and previously revised, either by Synergy or a contractor, the revision sequence should be changed to alpha characters commencing with the letter ‘A’ and not continued with a numeric sequence if used on the most recent issue of the drawing; and
 - (iii) for drawings that have been issued on an “as-built” basis and NOT previously revised, the revision numbering sequence shall use consecutive alpha characters commencing from the letter “A”.
- (b) new drawings
 - (i) before a new drawing is issued for construction to commence or for tendering, it shall be marked 'for review and comment'. The revision numbering sequence shall be consecutive numeric characters

commencing with the number “0”. The drawing shall have “Issued for review and comment” noted in the revision reference and cell;

- (ii) a drawing that is issued for tendering purposes shall be marked 'for tendering only'. The revision numbering sequence shall be consecutive numeric characters commencing with the number “0”. If the drawing was previously issued on a ‘for review and comments’ basis, the revision numbering sequence already in use shall be continued. The drawing shall have “Issued for tendering” noted in the revision reference and cell;
- (iii) when a new drawing is approved and issued for construction to commence, the previous marking 'for review and comment' or “for tendering only” shall be removed and replaced with “approved for construction”. The revision numbering sequence shall be changed to consecutive alpha characters commencing from the letter “A”. The drawing shall have “Issued for construction” noted in the revision reference and cell;
- (iv) following completion of construction, the drawing shall be revised to reflect the final state of the plant. The previous marking “approved for construction” shall be removed from the drawing and the drawing issued using the next available alpha character. The drawing shall have “final as built” noted in the revision reference and cell; and
- (v) revisions carried out after the issue of the “final as built” version of the drawing shall use a revision numbers as described in section a) for existing issued drawings using alpha characters.

7.4 Procedures for revision of CAD drawings

- (c) CAD drawing is revised
 - (i) edit the CAD file to reflect the modifications made to the plant;
 - (ii) issue the CAD drawing as the next revision number, the original drawing number is retained; and
 - (iii) submit drawing for checking and approval.
 - (d) CAD drawing is superseded by a new CAD drawing
 - (i) edit the CAD file by adding the text “SUPERSEDED BY (NEW DRAWING NUMBER)” diagonally across it;
 - (ii) issue the CAD drawing as the next revision number, the original drawing number is retained; and
 - (iii) submit drawing for approval
 - (e) CAD drawing becomes obsolete
-

- (i) edit the CAD file by adding the text “OBSOLETE” diagonally across it;
 - (ii) issue the CAD drawing as the next revision number, the original drawing number is retained; and
 - (iii) submit drawing for approval.
- (f) CAD drawing designated as not maintained
- (i) edit the CAD file by adding the text “NOT MAINTAINED” diagonally across it;
 - (ii) issue the drawing as the next revision number, the original drawing number is retained; and
 - (iii) submit drawing for approval
- (g) CAD drawing becomes decommissioned
- (i) Raise DM ticket Drawings for Revision:
 - (ii) change the drawing Status in DM to Decommissioned;
 - (iii) watermark the drawing in DM for both screen and printing; and
 - (iv) Change the Status and Numbering Scheme to Decommissioned:
 - (v) drawing does not require the next revision number or approval.

7.5 Procedures changing CAD hybrid to CAD vector only drawing

This procedure covers the situation where an existing CAD hybrid drawing (Microstation + Raster) is converted to a CAD vector drawing (Microstation only) by transferring the detail on the raster file onto the CAD vector file (Microstation).

- (a) CAD hybrid drawing is converted to CAD vector drawing
- (i) edit the CAD vector file (Microstation) by redrawing the detail previously on the raster file and to reflect any additional modifications made to the plant;
 - (ii) when the changes to the CAD vector drawing are complete, the raster file must be detached from the CAD vector drawing (using Raster Manager); and
 - (iii) issue the redrawn/revised CAD vector drawing as the next revision number - the original drawing number is retained.

8 DRAWING APPROVAL AND SIGNATURES

- (a) general

Prior to the issue of a new drawing revision, it shall be checked and approved for technical compliance, drafting accuracy and presentation then signed by the persons undertaking these tasks. In the case of drawings that are issued on an “approved for construction” basis, no construction work shall commence until the drawing has been approved for issue. In the case of a drawing produced or revised on behalf of Synergy

by contractors, the final approval for issue of the drawing shall only be given by Synergy representative or their authorised delegate.

Whilst the drawing is pending approval, the status would be set to “pending approval” but the drawing must remain reserved to the draftspersons until approved. The drawing must not be checked in to the Document Management System as a Major version.

(b) title block name required

For the first issue of a drawing, the following checks and approvals plus the corresponding names are required in the title block.

- (i) drawn;
- (ii) checked; and
- (iii) approved.

Drawn

This section will contain the name of the CAD operator and/or design draftsperson responsible for creating the drawing.

Checked

This section will contain the name of the person who completed detail checking of the drawing for technical/dimensional content and accuracy.

Approved

This section will contain the name of the person who approved the first issue of the drawing.

(c) revision block initials required

For the first issue of a drawing, the following checks and approvals plus the corresponding initials are required in the title block.

- (i) drawn;
- (ii) checked; and
- (iii) approved.

Drawn

This section will contain the initials of the CAD operator and/or design draftsperson responsible for revising the drawing.

Checked

This section will contain the name of the person who completed detail checking of the drawing for technical/dimensional content and accuracy.

Approved

This section will contain the initials of the person who approved the issue of the drawing revision.

9 GUIDING PRINCIPLES

9.1 Applicable standards and publications

When undertaking revision to existing drawings that were originally drawn using standards other than those specified in this section, the new standards shall be followed. When approved, exceptions to this can be made if adherence to the current standards would make the drawing difficult to read or confusing. Where the final drawing contains a mixture of different standards, consideration should be given to adding a note(s) to the drawing to clarify the situation.

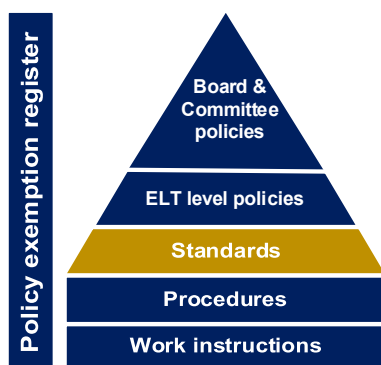
9.2 Australian standards

Unless specifically directed within this document, all drawings shall comply with the requirements of all appropriate Australian standards. Where the standards offer alternatives to drawing layout, content and procedures, and these are not clarified in this document, the exact requirements shall be determined by consulting with the manager Synergy assets or his authorised delegate. These standards include, but are not limited to:

AS ISO 1000	The International System of Units (SI) and its Application
AS 1046	Symbols for Electrotechnical Documents
AS 1100	Technical Drawing
AS 1101	Graphical Symbols for General Engineering
AS 1102	Graphical Symbols for Electrotechnical Documentation
AS/NZS 1376	Conversion Factors
AS/NZS 4382	Preparation of Function Charts for Control Systems
AS/NZS 4383	Preparation of Documents Used in Electrotechnology
AS 3702	Item Designation in Electrotechnology
AS 128.1	Technical Drawings – General principles of presentation – Introduction and index
AS 128.20	Technical Drawings – General principles of presentation – Basic conventions for lines
AS 128.21	Technical Drawings – General principles of presentation – Preparation of lines by CAD systems
AS 128.22	Technical Drawings – General principles of presentation – Preparation of lines by CAD systems
AS 128.23	Technical Drawings – General principles of presentation – Lines on mechanical engineering drawings
AS 128.24	Technical Drawings – General principles of presentation – Lines on mechanical engineering drawings

AS 3643.2	Computer graphics – Initial graphics exchange specification (IGES) for digital exchange of product definition data – Subset of AS 3643.1-Two dimensional drawings architectural, engineering and construction (AEC) industries
HB 20	Graphical symbols for fire protection drawings
HB 3	Electrical and electronic drawing practice for students
HB 7	Engineering drawing handbook
AS 13567.1	Technical product documentation – Organisation and naming of layers for CAD – Overview and principles
AS 13567.2	Technical product documentation – Organisation and naming of layers for CAD – Concepts, format and codes used in construction documentation

10 DOCUMENT HIERARCHY AND QUESTIONS



The policy standard diagram (left) shows where in the document hierarchy this work instruction sits and how it supports all preceding documents in the hierarchy.

Any questions or feedback related to this document should be directed to the document owner in the first instance.

11 RELATED DOCUMENTS/REFERENCES

- | | | |
|-----|--------------|---|
| (a) | DMS# 4342122 | Computer Aided Design (CAD) Standards and Practices |
| (b) | DMS# 4352187 | Drawing Revision by Synergy- Procedures |
| (c) | DMS# 4366315 | Drawing Revision by Contractor |
| (d) | DMS# 6126660 | How do I search for a Drawing FAQ |
| (e) | DMS# 4317428 | Drawing Numbering Scheme - Muja Power Station |
| (f) | DMS# 4318346 | Drawing Numbering Scheme - Kwinana Power Station |
| (g) | DMS# 4275215 | Drawing Numbering Scheme - Collie Power Station |
| (h) | DMS# 4274329 | Drawing Numbering Scheme - Kwinana Gas Turbines |

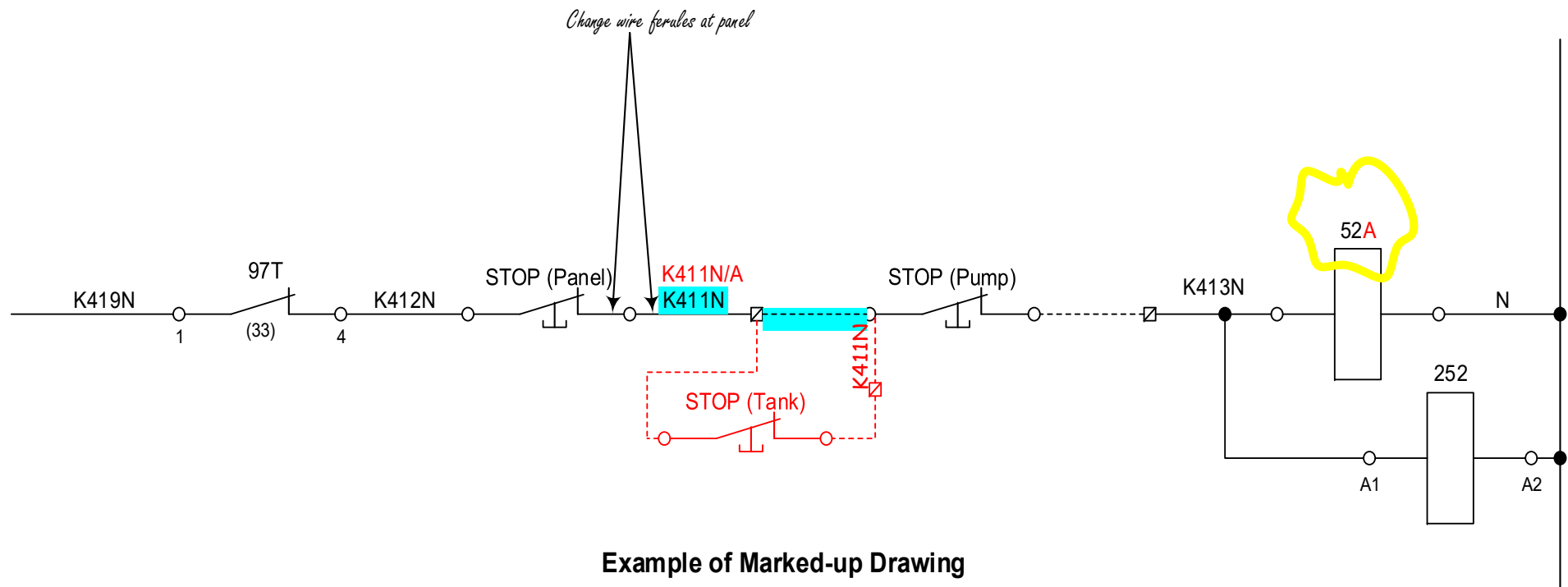
- (i) DMS# 4241397 Drawing Numbering Scheme – Pinjar, Mungarra, Kalgoorlie GT's
- (j) DMS# 5539457 Drawing Numbering Scheme - MPS/KPS PID Diagrams
- (k) DMS# 4405598 Drawing Numbering Scheme - Cockburn Power Station
- (l) DMS# 4447366 Drawing Numbering Scheme – Sustainable Energy Plant

12 CHANGE VARIATION TABLE

VERSION	DATE	AUTHOR	DESCRIPTION OF CHANGE
1	7 December 2017	A V Kondoukas	Reformat, added Synergy drawing samples

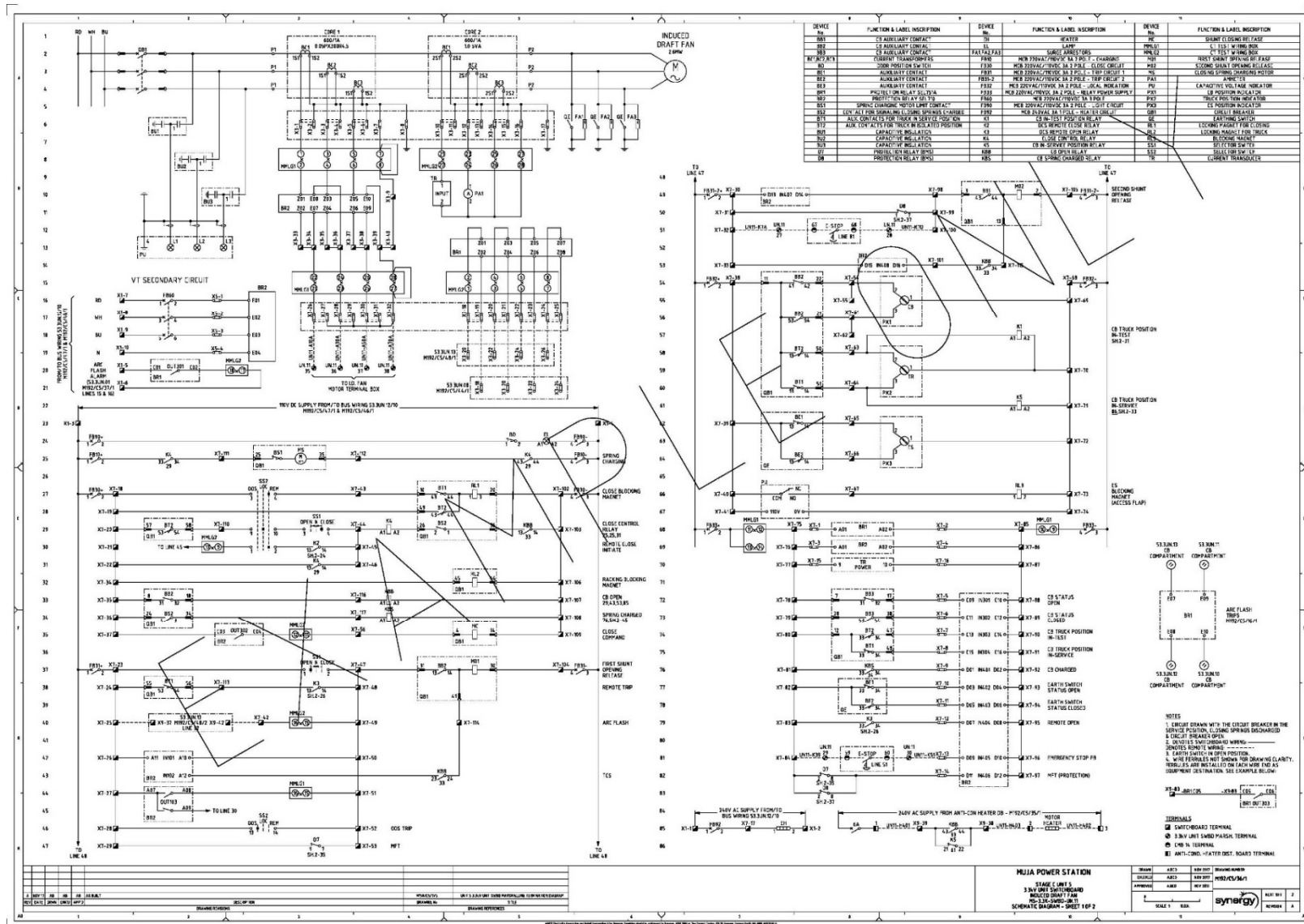
2 SAMPLE DRAWINGS

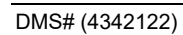
- Attachment 1: Example of marked up drawing
- Attachment 2: Example of Electrical Schematic drawing
- Attachment 3: Example of Mechanical drawing
- Attachment 4: Example of MIRI drawing
- Attachment 5: Example of Single Line Diagram drawing
- Attachment 6: Example of Termination Diagram drawing
- Attachment 7: Example of P&ID drawing



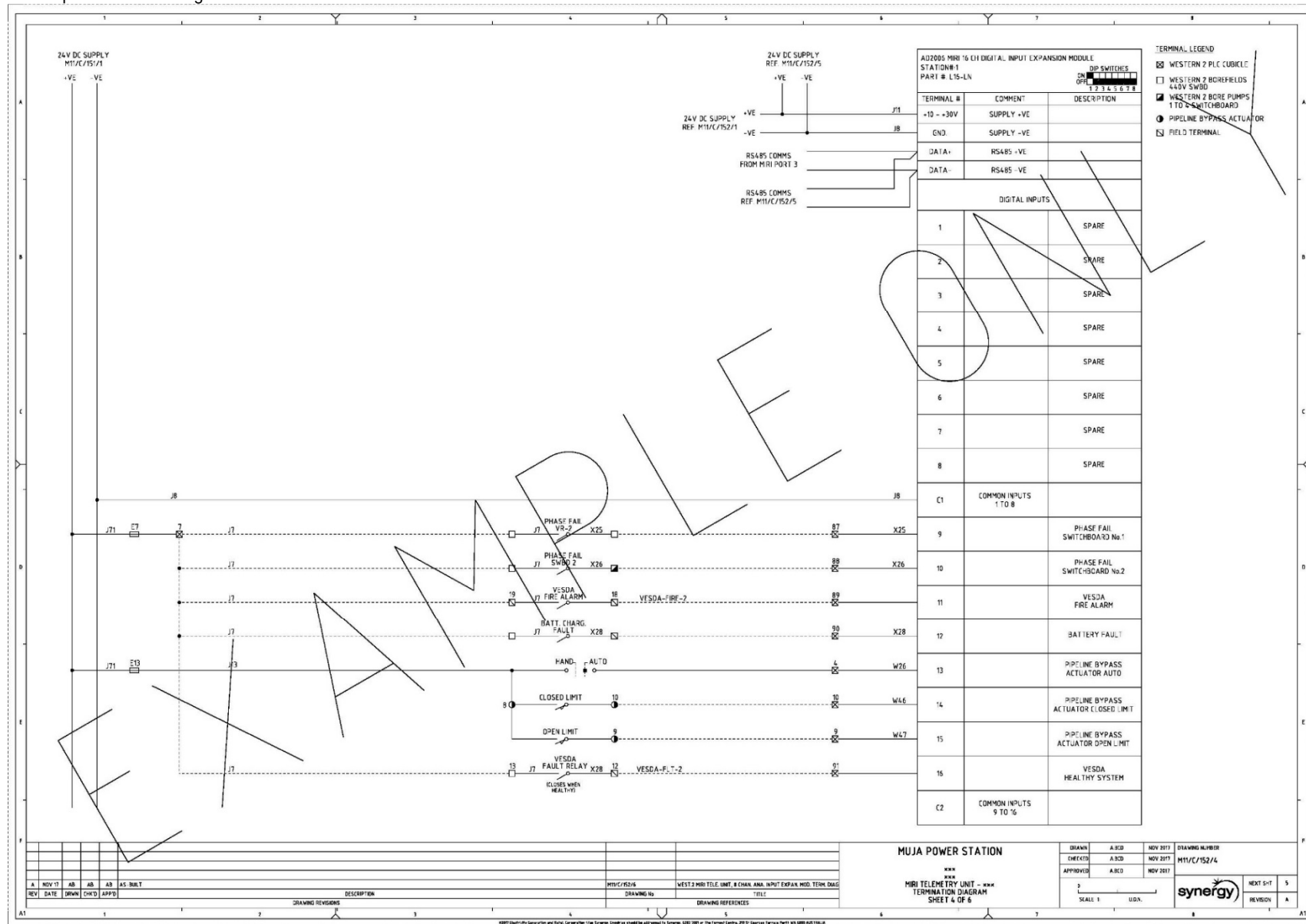
Example of Marked-up Drawing

Attachment 2: Example of Electrical Schematic drawing

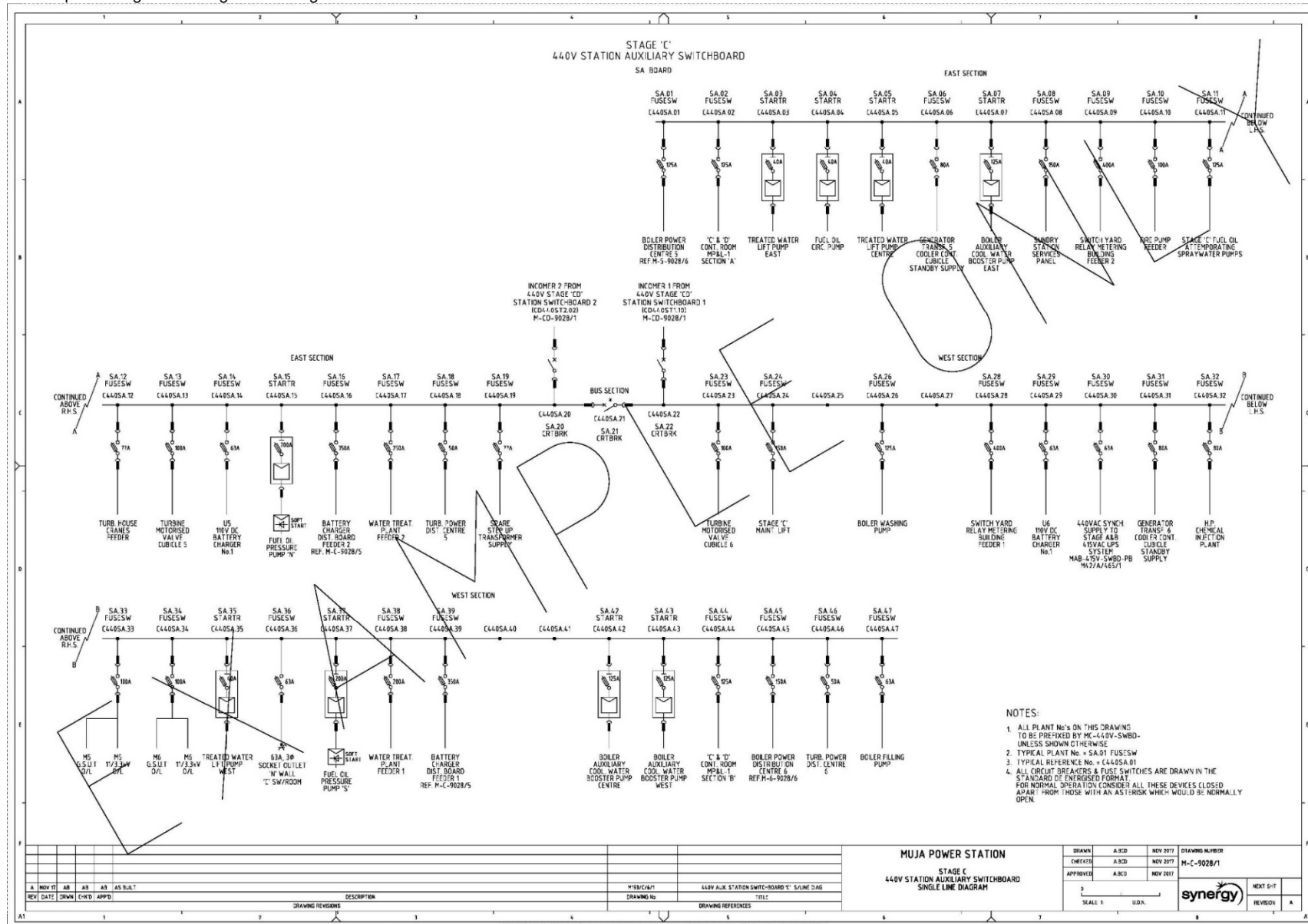




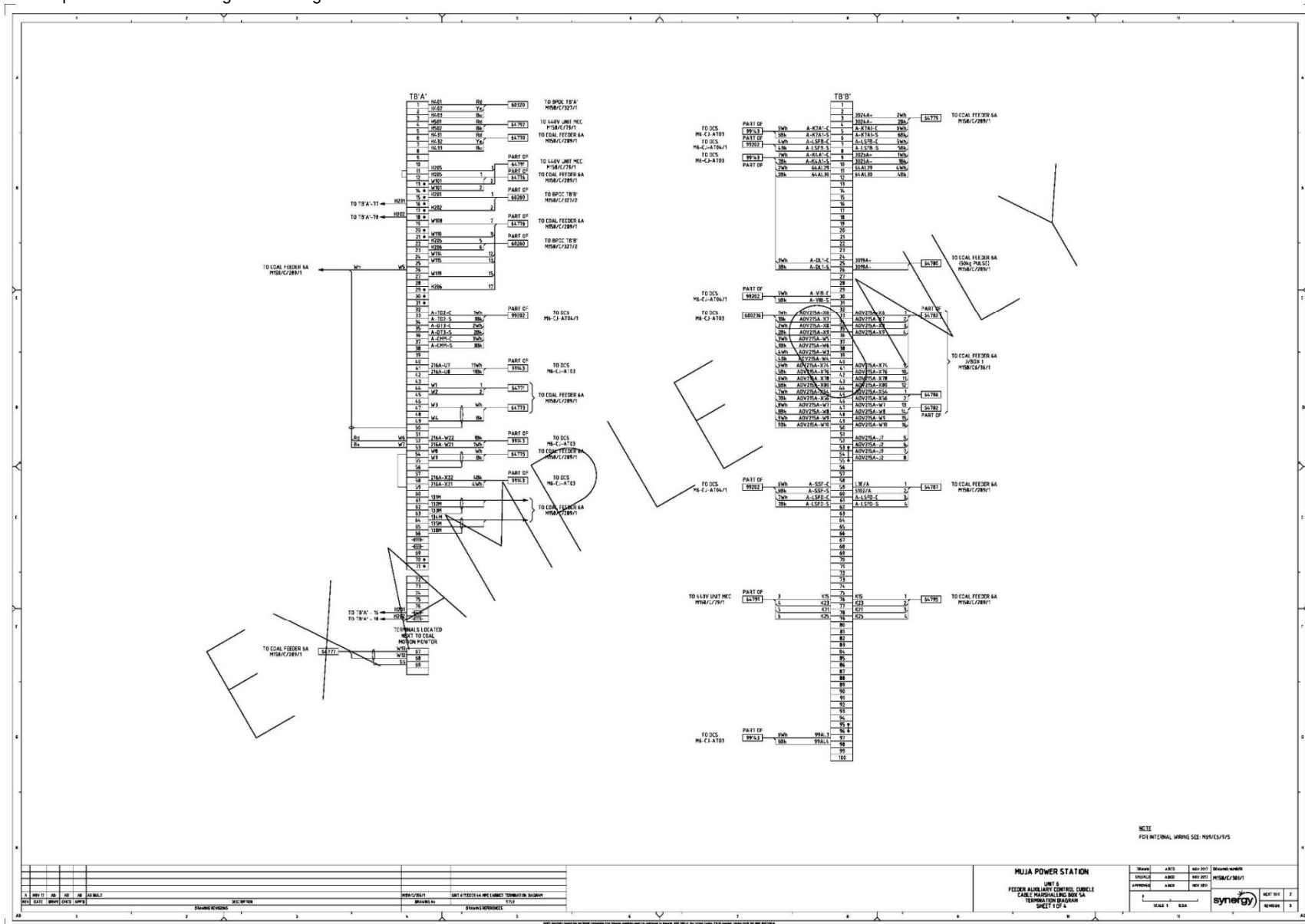
Attachment 2: Example of MIRI drawing



Attachment 2: Example of Single Line Diagram drawing



Attachment 2: Example of Termination Diagram drawing



Attachment 2: Example of P&ID drawing

