Volume 8
Consultant Drafting Procedures and Standards (For Engineering Drawings)

Renewable Resources
825 NE Multnomah Blvd
(Suite 1500)
Portland, Oregon 97232

DOCUMENT REVISION RECORD

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Consultant Drafting Procedures and Standards

1. General

1.1. Scope

These Procedures outline the control and handling of Renewable Resources drawings. This process must be followed when acquiring drawings for the purpose of design creation. More detailed department specific instructions for file management are available through Drawing Management Services.

1.2. Purpose

The following procedures outline the basic flow of document control activities and responsibilities. These procedures assure the proper maintenance and archival of the company's Renewable Facility Drawings. These procedures meet the company requirements regarding facility documentation and retention. Any changes or comments to this document need to be sent to Drawing Management Services.

1.3. Responsibilities

It is the responsibility of consultants, contractors, and engineering firms providing services or changes on Renewable drawings to follow these steps, when requesting or working on **Renewable** files:

Review the scope of work provided by PacifiCorp and perform the work as defined following **Renewable Procedures and Standards**.

a) When performing work on a project, contractors are responsible for preparing and submitting a request for original drawings to Drawing Management Services who is responsible for the security, and archiving of the drawing files out of Fusion and forwarding the request to the consulting firm. This is **not** the responsibility of the Project Manager or Engineer.

b) All work and changes to Renewable drawings will be subject to examination by Drawing Management Services and Renewable Engineers; they will have the right to reject unsatisfactory work. Work not done in compliance with the current PacifiCorp Renewable Standards and scope will be returned for correction. All corrections must be performed before the work is considered complete.

c) If any file is requested to be worked on by PacifiCorp while it is checked out to an outside company, it is then verified, released back to PacifiCorp at the original checked out revision, and checked into PacifiCorp's Fusion before a new design, As-Built or add-on is started. The consulting firm is responsible for keeping all revision changes and As-Builts of Renewable Resources drawings while they are in construction phase for at least 180 days after work is completed.

d) For FTP site or e-mail (no other means will be accepted) containing drawings, an **External Drawing Transmittal** **(Refer to Section 20.4)** will be submitted that contains the following information: PacifiCorp Facility Name, Project Number, Drawing Number, CAD File Name, Drawing Title and Revision.

e) Design Consultants, Contractors and Engineering firms shall provide **half or full-size** prints of all AutoCAD files for review, plotted to PacifiCorp standards and sent by regular or overnight mail, or files may be up-loaded to a FTP site or e-mail (no other means will be accepted) grouped by document types [i.e. Wiring, Schematics, Layouts, etc.] **(Refer to Section 3.2)**. Early in a project, it is strongly recommended the consultant submit examples of AutoCAD drawings to Drawing Management Services for review.

No files are to be sent to field personnel without first being reviewed and approved for transmittal by the PacifiCorp Project Manager assigned to the project.

f) Revision number or alpha letters will increment according to the type of revision design modification, to indicate the current drawing status of the design each time they are submitted to PacifiCorp for review **(Refer to Section 3.3)**. All files that are submitted to PacifiCorp for review will have approved signatures **(Refer to Section 17)**.

2. Drawing Types to be Issued

A drawing is issued when Drawing Management Services releases a drawing for a specific purpose. The following is a list of reasons for Issuing drawing(s):

2.1. Issued for Construction

Drawings which have design changes that are Issued for the purpose of Construction. Construction drawings are Demolition and Installation sets **(Refer to Sections 18.2 & 18.3)** for more department specific and detailed instructions. Demolition drawing(s) are sent to construction sites for removal of items, but not checked into Fusion as a record.

2.2. As-Built Drawings

A drawing that reflects the actual field conditions as represented by construction documentation received from the field, Post-Project documentation. These marked up drawing's **(As–Builts)** are prepared by the field after construction is complete. The revision cloud will not be removed until the marked up drawings are reviewed and approved by the engineer responsible for the work.

At this time, the revision clouds are removed and the update is made to the master file. Additional changes may be included in the As–Builts that will not have revision clouds. These changes will be added to the revision block and saved to the master file. Once revised to comply with these notes, all revision clouds associated with the project shall be removed at that time, except for clouds showing future changes. In the revision block description area, the words **"As-Built"** shall be entered along with a brief description of the change. If the notes show no changes from the construction issue, the "Status" field in Fusion will be changed to "**As-Built**". The project cannot be closed until this stage is complete **(Refer to Sections 3 thru 10, 15, 18.4, 19 &20.3)**.

2.3. Issued Drawing

A drawing (document of record) that reflects the actual field conditions as represented by documentation received from engineering (Post-Condition).

2.4. Superseded

When a drawing is incorporated into another drawing, it is *superseded* by the drawing into which it is incorporated (excluding 6 digit drawings, **Refer to Section 2.6**). When a drawing is superseded, it is then deleted from the issued drawing list **(Refer to Section 18.4)**.

2.5. Void

When a drawing is no longer valid (the equipment and/or structure no longer exists), it is revised then *voided* and marked as such. **Note that once a drawing is voided, the drawing number cannot be reused.**

2.6. Reserved

The process of moving drawing information from its current drawing number (6 digit only) to a new or different number, or incorporating it into another drawing; and holding this sheet for future use.

2.7. External Drawings

An external drawing is a drawing that is created from a source outside of PacifiCorp. An example of an external drawing is an equipment drawing by a manufacturer referencing the internals of their equipment. A design drawing developed by an engineering consultant would not be considered an external drawing. **(Refer to Sections 18.5, 19 & 20.3)**.

2.8. Issued for Bid

Drawings to be sent to outside firms for bid purposes are considered to be in the design phase and not final (not to be used for construction). Drawings in the design phase are **not** controlled by Fusion and are the responsibility of the Project Manager or Engineer. In order to minimize confusion and to prevent potential problems, the following Procedures will be followed:

a. The drawing(s) will be prepared for the revision & distribution process (revision numbers & clouds).
b. The drawing(s) will not be signed either by hand or electronically.
c. The electronic files will remain with the consultant until they are updated to "Issued for Construction". Issued for Bid drawings do not go into Fusion.

Each print that the Project Manager sends out of office will be stamped with **ISSUED FOR BID** side stamps (**Refer to Sections 3 thru 10, 15, 18, 19 & 20.3)**.

3. Drawing Setup

All CAD drawings shall be created or modified using the lastest version of AutoCAD currently used by Renewable Resources. (Saved format versions subject to change when later version of AutoCAD are used by PacifiCorp, check with Drawing Management Services). Pacificorp will provide a copy of their internal block library for use on all PacifiCorp AutoCAD drawings. A specific sheet order is required to maintain a sensible equipment, panel and schematic drawing sequence within the set. New drawing sheet(s) must be incorporated to maintain this drawing set order.

3.1. Drawing and Sheet Numbers

The Drawing Number will be assigned by Drawing Management Services. There will be several sheets under each Drawing Number. The sheets under each Drawing Number will be assigned a Sheet Number based on the discipline as follows:

Discipline	Dwg No.	Sheet Set
GENERAL:		001-999
CIVIL:		001-999
STRUCTURAL:		001-999
MECHANICAL:		001-999
ELECTRICAL:		001-999
Arch Flash Label		000
Schematic, One Line, Three Line		001-199
Wiring		200-399
Layout		400-599
All Others		600-899, 909-999
PLANT CABLE LIST		900
PLANT CONDUIT LIST		901
NETWORK CABLE LIST		903
DAM CABLE LIST		905
DAM CONDUIT LIST		906
FOREBAY CABLE LIST		907
FOREBAY CONDUIT LIST		908

The drawing numbers are assigned and sheet number ranges are to be developed as shown above.

3.2. Drawing Document Types

The electrical drawings use the following classifications for document types.

Table 1 - Renewable Document Types

Fusion Document Types The following below is a list of acceptable Document Types for Fusion. These go in the BORDER on line 2A						
Exhibit	**Schematics**	**Wiring**	**Layouts**	**Diagram**	**List**	**External**
Document Type Description Below are some of the descriptions for each document type above. These may go with the description in the BORDER on line 3 or 4.						
FERC	**Arc Flash**	**Bench Board Wiring**	**Sketch**	**Piping & Instrument**	**Apparatus List**	**Outside Contractor**
SPCC	**One Line**	**Connection Diagram**	**Nameplate**		**Cable List**	**X-Ref**
NERC	**Three Line**	**Interconnection Diagram**	**Map**		**Conduit List**	
	Control Schematic	**Wiring Diagram**	**Elevations**		**Bill of Materials**	
	Schematic Diagram		**Exhibit**		**Drawing List**	
	Control Scheme		**Block**		**Notes**	
			Level		**Index**	
			Plan		**Key Sheet**	
			Plans & Profile		**Legend**	
			Plans & Section			
			Plans & Details			
			Plans & Elevations			
			Site Plan			
			Site Plan & Section			
			Plans, Sections, Details			
			Erosion Control Plan			
PacifiCorp Border Lines are as follow below. (Refer to Section 6.6) **Line 1: of the border will be Facility Name.** **Line 2A: Fusion Document type.** **Line 3: Document Title Description.** **Line 4: Document Title Description.**						

3.3. Drawing Revision Number Increment

Drawing number revisions will utilize the following numbering sequence:

1. Demolition drawing(s) shall maintain the Fusion revision as it had when it was checked out of the Fusion database, but it will pick up an alpha letter [A-Z]
2. Installation files revision numbers are incremented with an alpha letter [A-Z] added to it.
3. As-Built files revision numbers are rolled up from the installation number and the alpha letters [A-Z] are removed from it. The revision notes for the Construction Phase are removed and only the final numeric revision for this work is kept along with As-Built and description for the work completed.
4. Issued and Reserved file revision numbers are incremented from the most recent number in Fusion. No alpha letters are used.

Use the following for reference of the increment process:

Drawing Revision Number Increment Example

Fusion ……rev: 6	
Demolition drawing ….rev: 6A, 6B, etc.	All alpha letters are to be capitalized.
Installation drawing ….rev: 7A, 7B, etc.	All alpha letters are to be capitalized.
As-Built drawing …….rev: 7	Alpha letters are not used.

4. Drawing Numbers

4.1. General

It is required that each AutoCAD drawing have its own correlating drawing sheet number as a separate file. One AutoCAD drawing file containing multiple sheets/layouts is not preferred, and will not be accepted by Drawing Management Services in any drawing format. Excel files and Word documents are the only files that can use this multi-sheet format.

4.2. Drawing Number Distribution

Drawing Numbering Distribution is a process used to unify the document numbering for all facility drawings managed through Fusion.

4.3. Assignment

New drawing numbers shall be assigned when the need arises for additional drawings to be created for new or existing facilities. Drawing Management Services will issue a list of drawing numbers for all projects to be utilized for each project by in-house engineering staff and contractor/consultant services. Drawing Management Services will assign sheet numbers for existing drawing numbers assigned in the system. If a new drawing number is needed, the designer will email a request to Drawing Management Services, supplying facility name and type of drawing. If the new drawing is an addition to an existing series of drawings, the new drawing shall maintain the drawing series number, but will be given a currently reserved or a new unassigned sheet number**.** Only Drawing Management Services can assign these numbers, any others will be rejected.

4.4. How to use New Drawing Numbers

Once the user has determined how many new numbers are needed, he or she shall contact Drawing Management Services. The user will be assigned the new numbers needed. The numbers shall be the next in the series of numbers available. Any numbers that are not used will need to be released back for future use. Drawings with multiple tabs/sheet/layouts are **not acceptable**. Approval from Drawing Management Services is required prior to use. Each drawing and sheet number must be produced in an individual file.

4.5. Compound Drawing Numbers: XREF and Hybrid

A compound drawing is a CAD drawing that has one or more files attached to it. The attached files can be other drawings External Reference (XREF), Raster images (Hybrid), or both. Both of these conditions create a Parent-Child relationship, where the sheet file is the Parent and the attachment is the Child. This relationship condition also exists in the Fusion drawing database.

XREFs or Raster files should only be used within a single facility. If there is a need to utilize raster files in other facilities, copies should be made and renamed appropriately. A Hybrid drawing is an AutoCAD drawing that has a Raster (scanned image) attached to it, for more information and settings associated with hybrid/scanned images **(Refer to Section 5)**.

4.6. Legacy Numbering Systems

Drawings created prior to the use of the 6-Digit numbering system which is revised to include XREF or Hybrid files (Raster images) will have the appropriate suffix added to the document number and filename being attached. The following examples only show one legacy numbering system but must be applied to other legacy numbering in a similar manner. The legacy drawing numbers may contain an alpha character pre-fix to the 5-Digit number that reflects the original drawing size such as RUD, MUD, PD, PE, etc. These preceding letter references shall remain in the titleblock legacy drawing number, and shall not appear in the saved digital file name.

Title Block	Sheet No.	Digital File Name	Original Size
P**B**-XXXXX	1	XXXXXH01.dwg	B-Size
P**D**-XXXXX	1	XXXXXH01.dwg	D-Size
RU**D**-XXXXX	1	XXXXXH01.dwg	D-Size
P**E**-XXXXX	1	XXXXXH01.dwg	E-Size

The legacy drawing number is followed by an alpha character that separates the 5-Digit drawing number from the sheet number. This alpha character indicates drawing ownership or origin. If the drawing file does not contain the letter H, the drawing ownership should be verified. This is a good indicator that either the file was transferred from another database, or the file is on loan from Power Delivery. Each drawing file should reside in only one drawing database: either Generation (Renewable) or Power Delivery. Contact Drawing Management Services to resolve these concerns.

The following is a guideline to the alpha characters used in the origins of the drawing files:

H: Hydro: Generation
A: Substation: Power Delivery
S: Transmission: Power Delivery
R: Relay Technician: Renewable Generation or Power Delivery

Examples

1. Drawing numbers that will need an xref base attached:
   52362H01.dwg (General Plan)
   52363H01.dwg (Foundation Plan)
   52364H01.dwg (Grounding Plan)
   52365H01.dwg (Conduit & Cable Plan)
   The newly created xref base drawing will be:
   52363H00.XB.dwg
2. Drawing numbers that will need Raster(s) attached:
   52350H01.dwg
   52351H01.dwg
   The newly created Raster(s) will be:
   Multiple tif:
   52350H01.R1.tif
   52350H01.R2.tif
   Single tif:
   52351H01.tif

For concerns regarding unclear legacy numbering, please contact Drawing Management Services.

4.7. Numbering Convention: 5-Digit

The 5-Digit numbering convention is structured as follows **(Figure 1)** and must appear as indicated in the drawing title block.

Figure 1 - Drawing Number Diagram: 5-Digit

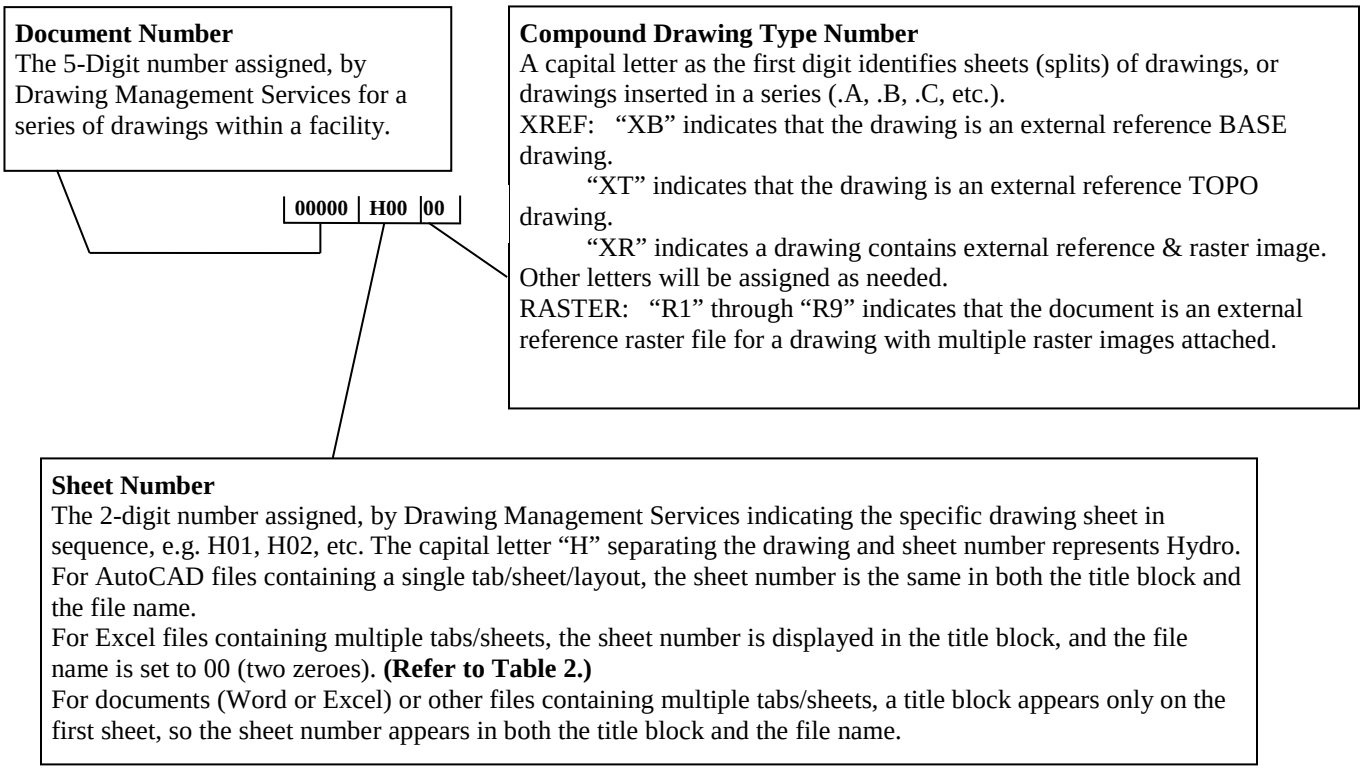


Table 2 - Drawing Number Examples: 5-Digit

DESCRIPTION	FILE NAME	TITLE BLOCK
Single sheet stand-alone drawing	45539H01.dwg	PD-45539 SHEET 01
Drawing with multiple tabs/sheet/layouts: (***Not Preferred Method**: Approval Required Prior. (Refer to Section 2.1)		
Sheet 01 of a Hydro drawing	44755H01.dwg	PD-44755 SHEET 01
Sheet 02 of a Hydro drawing	44755H02.dwg	PD-44755 SHEET 02
Sheet 15 of a Hydro drawing	44755H15.dwg	PD-44755 SHEET 15
Multiple-sheet Excel file (e.g. drawing list, bill of materials, conduit & cable list, etc.):		
Sheet 1 of a Hydro electrical cable list (excel file)	46771H00.xls(x)	PB-46771H00
Sheet 2 of a Hydro electrical cable list (excel file)	46771H00.xls(x)	(n/a)
Sheet 1 of a Hydro electrical conduit list (excel file)	46772H00.xls(x)	PB-46772H00
Sheet 2 of a Hydro electrical conduit list (excel file)	46772H00.xls(x)	(n/a)
Hydro Base XREF for Grading Plan #PD-43283H01	43283H01.XB.dwg	(n/a)
Hydro Topo XREF for Grading Plan #PD-43283H01	43283H01.XT.dwg	(n/a)
Raster image file for #PD-43283H01	43283H01.tif	(n/a)

4.8. Numbering Convention: 6-Digit

The 6-Digit numbering convention is structured as follows **(Figures 2)** and must appear as indicated in the drawing title block.

Figure 2 - Drawing Number Diagram: 6-Digit

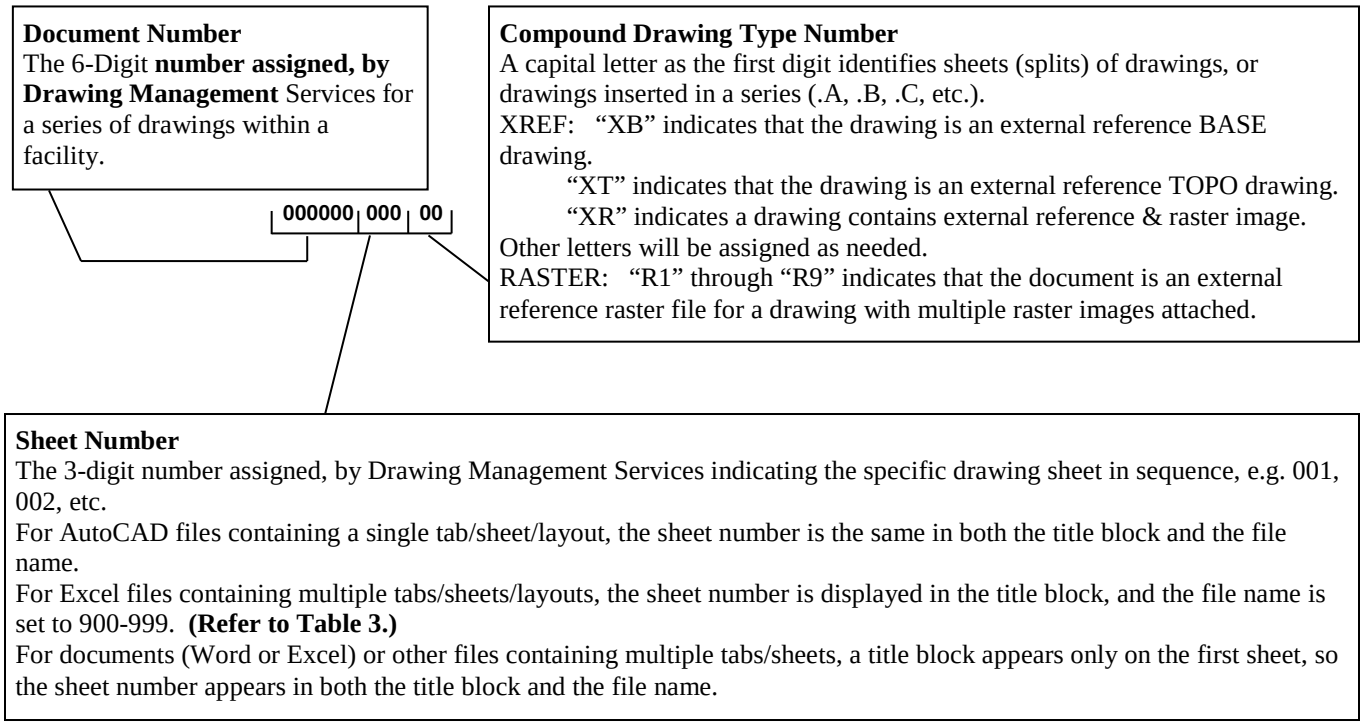


Table 3 - Drawing Number Examples: 6-Digit

DESCRIPTION	FILE NAME	TITLE BLOCK
Single sheet stand-alone drawing	116001.001.dwg	116001 SHEET 001
Sheet 1 of a Hydro drawing	116000.001.dwg	116000 SHEET 001
Sheet 2 of a Hydro drawing	116000.002.dwg	116000 SHEET 002
Sheet 106 of a Hydro electrical drawing (schematic)	116000.106.dwg	116000 SHEET 106
Sheet 210 of a Hydro electrical drawing (wiring)	116000.210.dwg	116000 SHEET 210
Sheet 418 of a Hydro electrical drawing (layout)	116000.418.dwg	116000 SHEET 418
Sheet 900 of a Hydro electrical drawing (cable list, excel file)	116000.900.xls(x)	
	116000.900	
Sheet 901 of a Hydro electrical drawing (conduit list, excel file)	116000.901.xls(x)	
	116000.901	
Drawing with multiple tabs/sheet/layouts: (***Are Not Preferred:**		
Multiple-sheet Excel file (e.g. drawing list, bill of materials, conduit & cable list, etc.):		
Sheet 1 of a Hydro electrical cable list (excel file)	116000.900.xls(x)	116000.900
Sheet 2 of a Hydro electrical cable list (excel file)	116000.900.xls(x)	(n/a)
Sheet 1 of a Hydro electrical conduit list (excel file)	116000.901.xls(x)	116000.901
Sheet 2 of a Hydro electrical conduit list (excel file)	116000.901.xls(x)	(n/a)
Hydro Base XREF for Grading Plan #108395.100	108395.100.XB.dwg	(n/a)
Hydro Topo XREF for Grading Plan #108395.100	108395.100.XT.dwg	(n/a)
Raster image file for #116078.214	116078.214.tif	(n/a)

4.9. Compound Drawing File Naming: XREF and Hybrid

The file names should follow the file naming convention outlined in (Sections 4.5 thru 4.7) **(Refer to Sections 4) Drawing Media Type and Conversion** for more details.

Table 4 - XREF and Hybrid File Suffix:

Drawing File Type	5-Digit (legacy)	6-Digit
Topographic	*.H00.XT	*.000.XT
Base	*.H00.XB	*.000.XB
Electrical	*.H00.XE	*.000.XE
Control House	*.H00.XCH	*.000.XCH
Grounding	*.H00.XG	*.000.XG
Conduit	*.H00.XC	*.000.XC
Landscape	*.H00.XL	*.000.XL
Irrigation	*.H00.XI	*.000.XI
Raster #1	*.H00.R1	*.000.R1
Raster #2	*.H00.R2	*.000.R2

Topographic (XT): This file contains surveyed land contours and features and base lines. This drawing is the only drawing to have the units set to decimal rather than architectural, and keep its world coordinates. This file is based on civil survey data and is not to be modified without first consulting with the civil engineering group.

Base (XB): This file contains existing and proposed property features (e.g., fence, road, property line, control house foot print, foundations and base lines).

Electrical (XE): This file contains existing and proposed electrical facilities, bus layout, connections, and base lines.

Control House (XCH): This file is only needed when the facility is too large to place on one sheet and is seldom used. This file contains detailed control house facilities such as cable tray, lighting and equipment.

Grounding (XG): Also named the Grounding Plan sheet file. This file contains the grounding grid network and ground mats.

Conduit (XC): Also named the Conduit and Cable Plan sheet file, and is used where more than one sheet is required to show the conduit network. The XL (landscape file) or XI (irrigation file) shall follow the same naming conventions as the landscape plan and shall be used where more than one sheet is required.

Erosion Control (XEC): This file is a civil drawing. The title block shall contain the following names: Line 3: Grading Plan; Line 4: Erosion Control. This file is used where more than one sheet is required to show the method of erosion control.

5. Drawing Media Type and Conversion

5.1. General

To improve efficiency and timeliness, computer programs are utilized in developing drawings. All manual drawings are currently being transferred into a computer environment. Hybrid drawings are referred to as a compound drawing(s) with a parent-child relationship. Child drawings **(also referred to as an image attachment)** are an external image file **(TIF)** that is attached to a Parent AutoCAD drawing. The Parent drawing is the master or base file that has an image file **(child)** attached to it. **XREF** drawings are also compound drawings **(Refer to Sections 5.6).**

The purpose of attached raster images is to eliminate manual drafting and reduce drafting time when revising existing manual drawings. Raster drawings should only be used when it is not feasible to produce a full CAD re-draw. Attached raster's may be used when the revision being performed affects 30-60% of the drawing. However, the entire drawing may be redrawn in AutoCAD at the drafter/designer's discretion instead. It should be remembered when creating composites that the goal is to work toward a fully vectorized drawing (the only type of raster edit that should be performed is erasing). Eventually, all drawings will be converted to AutoCAD.

5.2. Attached Raster Drawings

Raster images shall only be linked to drawings using AutoCAD. The company-preferred raster/vector editing software is Raster Design by Autodesk. Other software, such as GTXRaster CAD, Adobe, Hitachi, PixEdit, or CAD Overlay may be used to create or manipulate the raster file before linking.

Before the raster image may be used, it must be de-speckled, de-skewed, cropped, and otherwise prepared as necessary to assure that all portions are legible. Areas that cannot be successfully repaired by such methods shall be redrawn in AutoCAD.

Raster images shall be attached in model space, on layer IMAGE, color 7, transparency set to OFF, and frame turned off. Attached raster images may only be referenced to one parent. If more than one parent drawing uses the raster image, and the image is not inordinately large (as are some Transmission line drawings), copies of the image file will be referenced to each parent.

The image attachment path shall be removed or set to No Path in the Parent (master) file.

5.3. Compound Externally Attached Raster Drawings

Compound raster drawings are created when it is desirable to provide a topological or other land base image behind the actual drawing, and there is no intent to vectorize this image in the future. This normally occurs only with Transmission Lines, although other special cases may be defined.

The following is a list of steps to reformat drawings:

5.4. Scans

1) Scans the manual drawing with the following settings:
    a. TIF (Black and White)
    b. Group 4
    c. Use Mirror and Invert as needed.
2) Submit to Drawing Management Services, who will check the drawing(s) into Fusion.
3) Then sends the old manual original to Central Filing.

5.5. CAD / Hybrid Technology

1) The attached image file when inserted into AutoCAD should have the following settings:
    a. TIF (Black and White)
    b. Group 4
    c. Stripped
    d. Transparency <off
2) All CAD drawings shall be created or modified using **AutoCAD, and shall be saved as AutoCAD format currently used by Renewable**. (Saved format versions subject to change when later version of AutoCAD are used by PacifiCorp, check with Drawing Management Services for what version to be used).
3) **Remove the file path from the Saved Path for each attachment.**

5.6. External Reference Drawings (XREF)

At times it may be necessary to obtain a portion of a drawing from another "parent" drawing, and to have the "child" drawing change automatically any time the parent drawing is changed. This can be done in AutoCAD using the External Referencing function (XREF). Great caution should be used with XREFs to insure that the parent drawing is only changed when appropriate. External Reference (XREF) Drawings should be kept to a minimum. However in some projects, it is the best method for handling the data and sharing information between drawings.

The parent drawing and all xrefs must be included in the submittal of drawings to Drawing Management Services. The XREF path shall be removed or set to No Path in the Parent (master) file.

5.7. XREF File Management

(Refer to Section 4.9) Compound Drawing File Naming: XREF and Hybrid for more information on descriptions of file types and naming conventions.

The XREF Parent-Child Drawing Relationships are shown in Figure 3.

All parent files that use the same child must be checked out of the database and modified.

The illustration below shows XREF relationships across various drawing numbers.

Sheet File (Parent) **XREF File (Child)**

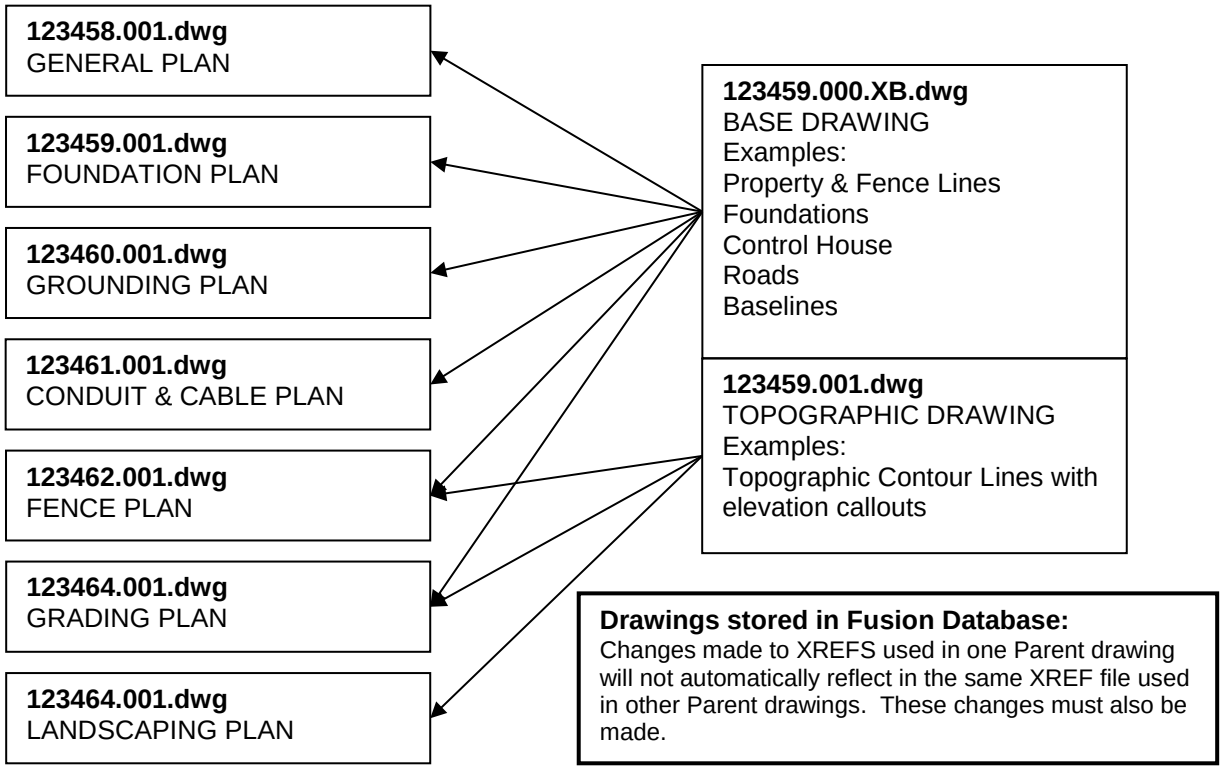


Figure 3 - Parent-Child Drawing Relationships

5.8. XREF Archiving

Prior to returning the files to the Document Management Services, the files must be prepared for storage. Drawings that contain XREFs may be archived by one of the following methods:

- **Store** the XREF drawings along with the final drawing. **NO PATH must exist.**
- **Bind** the XREF drawings to the final drawing

6. Borders

6.1. Scope

This standard is used to standardize the border format which includes consistent drawing areas, revision block layout, and title block for PacifiCorp Renewable Engineering drawings. Although multiple drawing sizes are provided to accommodate various needs, all new and modified drawings shall be created on a "D-Size" (22"x34") border. All existing drawings not currently on a "D-Size" (22"x34") border shall be modified to fit on a D-Size border. Approval must be obtained from **Drawing Management Services** for any exceptions. Modifications may not be made to standard PacifiCorp borders or revision blocks.

If agreed to by PacifiCorp, any consultant's logo or insignia placed on PacifiCorp's drawing shall remain as an independent block or the use of a professional stamp. The location of the consultant's logo or insignia shall be agreed upon on a case by case basis. If agreed upon, the location of the consultant's logo or insignia shall be located to the left of the title block.

6.2. General

All Renewable Engineering drawings shall be drawn full scale in Model Space. The borders shall be inserted full scale (1:1) in Paper Space (layout). During the creation of a new drawing or the editing of an existing drawing, the PacifiCorp standard AutoCAD borders must be used. The borders contain standard layout of the attributed title block.

All borders have a border revision date in the lower right corner just inside the border line. Each AutoCAD drafter/designer is responsible to assure the most current version of the Pacific Power border template is used. The full block library, including the current border and revision block, can be requested from Drawing Management Services.

6.3. Border Insertion Point

All Renewable Engineering drawings shall be drawn full scale in Model Space. The borders shall be inserted in Paper Space (layout) at a coordinate of 0,0 and full scale (1:1). This configuration will set up the drawing area to conform to PacifiCorp standard printing and plotting capabilities.

6.4. FERC and SPCC

All FERC drawings shall use the approved FERC drawing border provided by PacifiCorp Drawing Management Services.

All SPCC drawings shall use the current D-Size" (22"x34") drawing border provided by PacifiCorp Drawing Management Services.

No consultant logo shall appear on the FERC and SPCC drawings.

6.5. Border and Paper Size

The borders shown in Table 5 have been developed for use on all PacifiCorp Renewable Engineering drawings. Where possible, they are in conformance with ANSI Y14.1 standards to utilize maximum paper space. Table 5 lists each border file name and provides drawing size, paper size, and suggested use.

Table 5 - Borders and Sizes

File Name	Size	Rev Date	Paper Size (wxh)	Suggested Use
corp-b-l1.dwg	B		17" x 11"	Landscape. Sketches and details. Approval Required Prior to use.
corp-b-l2.dwg	B		17" x 11"	Landscape. Sketches and details. For SPCC/Exhibit drawings. Approval Required Prior to use.
corp-c.dwg	C		22" x 17"	Landscape. Sketches and details. Approval Required Prior to use.
corp-d.dwg	D		34" x 22"	Landscape. All new and modified standards drawings.
corp-e.dwg	E		44" x 34"	Landscape. No longer in use. Replace with corp-d.
FERC-E-BORDER-SCALE.dwg/Public Safety Plan.dwg & Security Plan.dwg	E		40" x 28"	FERC Exhibit Drawings, Public Safety Drawings & Security Plan Drawings.

6.6. Title Block

The title block is provided as part of the border, and has been attributed for use with the Fusion software. The attributed borders have been designed to be inserted into a new or existing drawing and are required on all PacifiCorp Engineering AutoCAD files. The borders are not to be exploded, or modified in any way. If changes are necessary, please contact Drawing Management Services.

The following is a list of the tag name/attributes in the order that AutoCAD prompts when inserting the Corp-D border.

TAG NAME: PROMPT: Description.

1. **DIVISION**: DIVISION: Hydro
2. **LINE_1**: LINE 1: Facility name and type. For a list of all possible facility names and types available for entry at this prompt, please refer to Fusion, or contact Drawing Management Services. (Type examples: Hydro Plant, Diversion Dam, Canal, Dam, Forebay, etc.)
3. **LINE_2A:** LINE 2a Hydro only: Document type. (**Refer to Drawing Document Types, Table 1**)
4. **LINE_3**: LINE 3: Drawing title.
5. **LINE_4**: LINE 4: Drawing title.
6. **DRAWING_NO**: DRAWING NUMBER: Enter current drawing number.
7. **XX**: REVISION NUMBER: Enter current revision number. (Default = 0)
8. **SHEET**: SHEET NUMBER: Enter current sheet number (e.g. 001 for six digit numbered drawings, 01 for legacy)
9. **SCALE**: DRAWING SCALE: Enter drawing scale. (Default = none)
10. **SAP#**: SAP NUMBER: Project/ER Number/WBS element of original drawing. (Department/project specific)
11. **PL#**: PL NUMBER: Enter Plant Locality Number. (if available)
12. **DATE**: ORIGINAL DRAWING DATE: Date of acceptance of original drawing.
13. **ENGIN**: ENGINEERED BY: Approving Engineer's initials of original drawing.
14. **DESIGNER**: DESIGNED BY: Designer's initials of original drawing.
15. **DRAFT**: DRAFTED BY: Drafter's initials of original drawing.
16. **CHECKED**: CHECKED BY: Checker's initials of original drawing.
17. **APPROVAL1**: APPROVED BY (UPPER): Enter the full name of the Approving PacifiCorp Engineer or Consulting Engineer of original drawing.
18. **APPROVAL2**: APPROVED BY (LOWER): If different from above, enter the full name of the Approving PacifiCorp Engineer of original drawing.
19. **PLOT_SCALE**: PLOT SCALE: Plot scale factor 1 = (Scale factor). The default setting is 1. This item only applies to the corp-d.dwg border.

Initial and date formatting is located on following page.

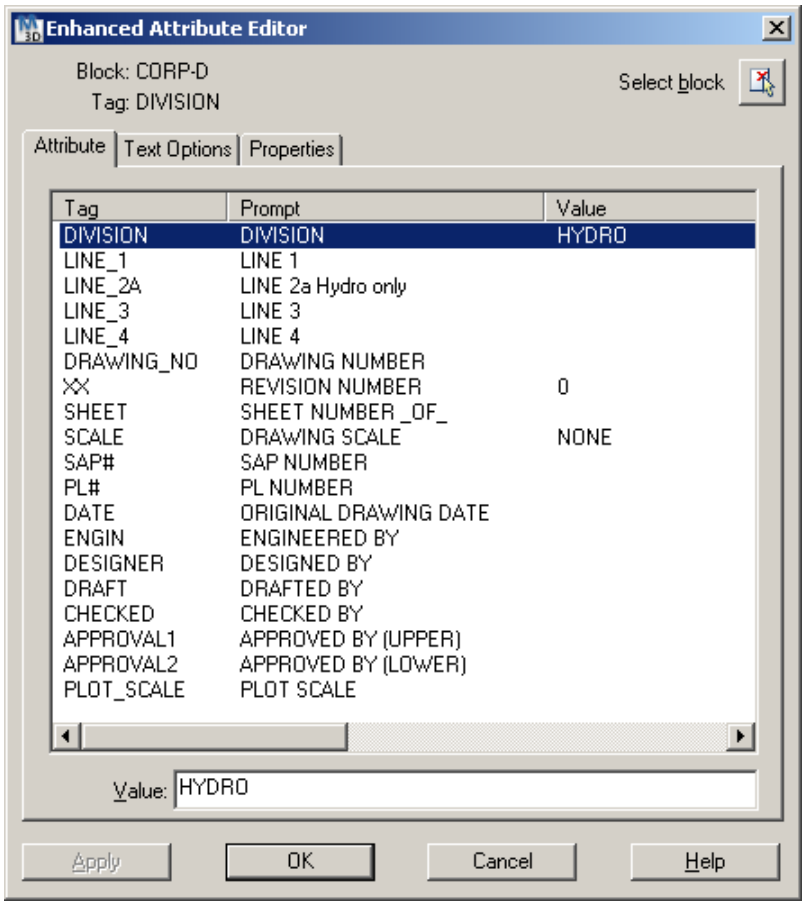


Figure 4 - Border Title Block attributed field population

Initials shall use the following format:

Initials shall be either two or three-letter ALL CAPS. Example: JS or RKG and contractors shall include a three-letter abbreviation of the company, preceded by a slash, if applicable. Example: JFB or XYZ/CRA

Dates shall use the following Format: MM/DD/YY

Approval Signatures, Dates, and SAP # (Tag ITEM numbers 10-18, Figures 5 to 8) shall contain information pertaining to when the drawing and sheet number is originally created. This information shall remain constant for the duration of the existence of the original drawing and sheet number regardless of whether information is moved to a new drawing and sheet number.

The note for Superseded drawing information located above or near the title block shall remain associated with the original drawing and sheet number for the duration of the existence of the original drawing and sheet number regardless of whether information is moved to a new drawing and sheet number.

The bubbles on the following examples represent the prompt numbers described at the beginning of Section 6.6.

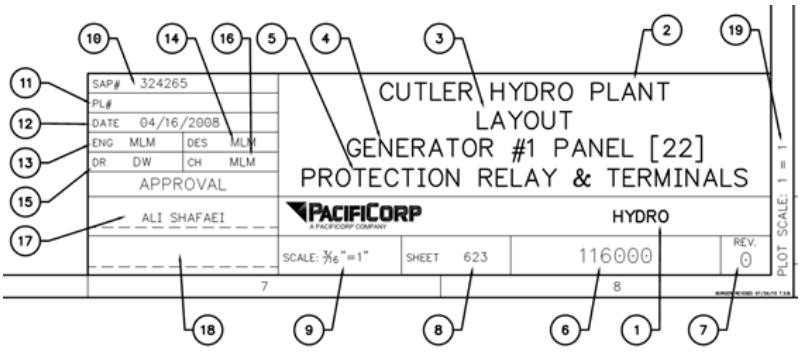


Figure 5 - Example 1: Populated Title Block: 6-Digit Number: Hydro Plant

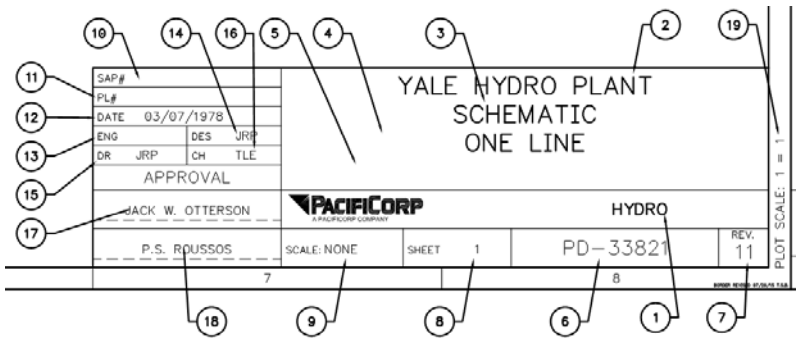


Figure 6 - Example 2: Populated Title Block: 5-Digit Number: Hydro Plant

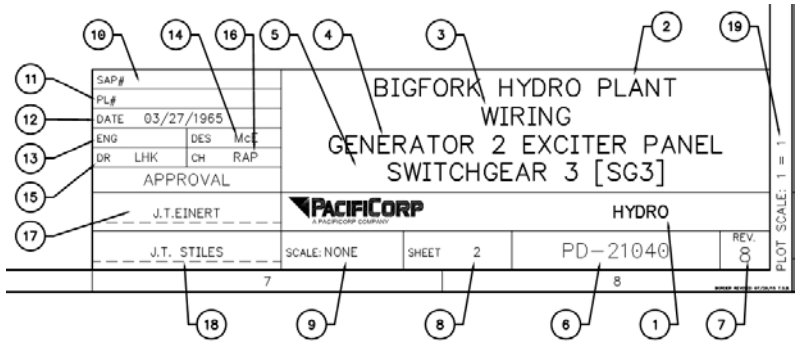


Figure 7 - Example 3: Populated Title Block: Wiring: Panel Labeling

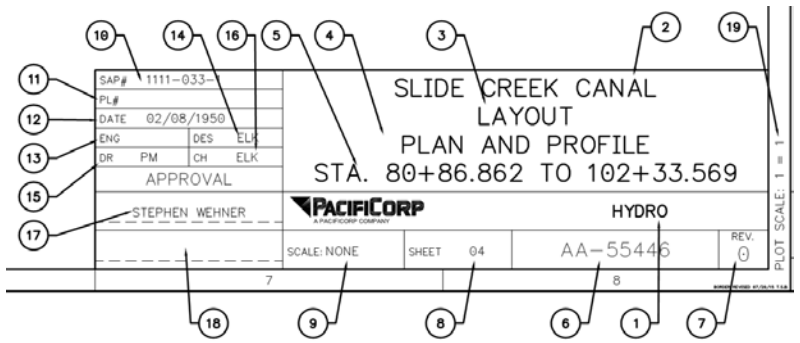


Figure 8 - Example 4: Populated Title Block: 5-Digit Number: Civil Discipline

6.7. Revision Block

An area to record drawing revisions has been provided within each border. Any changes made to a drawing must be recorded in this area by inserting the revision block appropriate to that border. The project name, work order, or WBS Element ID must be included at the beginning of the description in the first occurrence of a revision for the specific project.

The attributed borders and revision blocks have been designed to be inserted into a new or existing drawing and are required on all PacifiCorp Engineering AutoCAD files. Modifications may not be made to standard PacifiCorp borders or revision blocks. Revision blocks are not to be modified, burst, exploded, or replaced with floating single line text, nor is any text to hover over the revision area of the title block. Approval must be obtained from Drawing Management Services prior to modifying the revision block.

Following is a list of the tag name/attributes in the order that AutoCAD prompts when inserting the revision block into the Corp-D border:

1. **Revision Number: (Refer to Section 3.3) Drawing Revision Numbers Incrementation** for more information.
2. **Date of Revision**: Date of acceptance of original drawing, in the format: MM/DD/YY.
3. **Description**:
   - First Revision for Project: Work Order (WO) number. Project Name: Description of change(s)
   - Subsequent Revisions: Description of change(s)
   - As-Built: Work Order (WO) number. Project Name: ASB: Description of change(s)
4. **By**: Designer's or drafter's initials (see format below)
5. **Check**: Checker's initials (see format below)
6. **Approved**: Engineer's initials (see format below)

Initials shall use the following format:

Initials shall be either two or three-letter ALL CAPS. Example: JS or RKG

Consulting and contractors shall include a three-letter abbreviation of the company, preceded by a slash, if applicable. Example: JFB or XYZ/CRA

The AutoCAD user must use the revision block as provided. This information will then be used in the drawing management system to manage document control.

Refer to Section 2 for more information voiding, superseding, and reserving drawings.

7. Text: Style, Font, and Special Characters

7.1. Scope

This standard specifies the font and the special character codes for symbols and fractions for drawings prepared in AutoCAD.

7.2. Text Style and Standard Font

Text on all PacifiCorp drawings shall use the simplex1.shx font as supplied by PacifiCorp. The simplex1.shx font contains all standard keyboard characters, fractions, and other special characters.

Drawing Management Services will provide this font to consultants who develop or edit AutoCAD drawings for Renewable Resources. To obtain a copy of this font, please contact Judy Schwab @ (503) 813-6759 of Drawing Management Services.

If for any reason the simplex1.shx font cannot be used, the only fonts that may be substituted are the AutoCAD built–in fonts. Approval from Renewable Resources must be obtained prior to using a substitute font.

Before simplex1.shx can be used, the font file must be copied to the user's font or support directory.

The style name **Standard** shall be set up for the following attributes:

Text Style: Standard

Font Name: simplex1.shx

Size: Height: 0.00

Effects: Width Factor 1.00

Table 6 - Standard Text Sizes for use in all drawings

Type	**Size	*Layer	Color
Standard	0.09375 (3/32")	*Text	yellow
Title	0.125 (1/8")	*Text2	red
Title	0.15625 (5/32")	*Text2	red

*Refer to Section 8: **Layer Control**

**Refer to Tables 12, Drawing Scales (in feet) and 13 Drawing Scales (in inches).

7.3. Single-line Text: Special Character Control Codes

Special Characters may be used by including control information, or Control Codes (%% codes) in the text string in a single-line text state (DTEXT or TEXT). Use a pair of percent signs (%%) to introduce or end each control sequence. Refer to Tables 7- 9 for special character control codes for text formatting (Table 7), common symbols (Table 8), and text fractions (Table 9).

Table 7 - Special Character Control Codes for Text Formatting

Function	Start Code	End Code
Small Text, 2/3–size	%%200	%%201
Subscript text, 2/3–size	%%202	%%203
Underline/Underscore	%%U	%%U
Overscore	%%O	%%O

Table 8 - Special Character Control Codes for Common Symbols

Symbol	Code	Symbol	Code	Symbol	Code
o *(degree)*	%%127 or D	±	%%128 or P	∅	%%129 or C
℄	%%168	℄	%%169	Ω	%%199

Table 9 - Special Character Control Codes for Common Fractions

Character	Code	Character	Code	Character	Code	Character	Code
1/32	%%144	9/32	%%148	17/32	%%152	25/32	%%156
1/16	%%136	5/16	%%138	9/16	%%140	13/16	%%142
3/32	%%145	11/32	%%149	19/32	%%153	27/32	%%157
1/8	%%132	**3/8**	%%133	**5/8**	%%134	**7/8**	%%135
5/32	%%146	13/32	%%150	21/32	%%154	29/32	%%158
3/16	%%137	7/16	%%139	11/16	%%141	15/16	%%143
7/32	%%147	15/32	%%151	23/32	%%155	31/32	%%159
1/4	%%130	**1/2**	%%160	**3/4**	%%131		

7.4. Multiline Text: Special Characters, Symbols and Unicode Strings

Special Characters (Symbols and Unicode Strings) may be inserted through the in-place Text-Editor (expanded toolbar) or the MTEXT ribbon contextual tab. On either the ribbon contextual tab or expanded toolbar, select Symbol. Select the desired symbol from the list or select "other" to open the Character Map to copy and paste selected symbols into the in-place text editor.

For numeric characters (numbers), stacked text can be created on either side of the following symbols (in conjunction with using the stacked button on the MTEXT expanded toolbar):

Carat (^): [tolerance stack] Stacks text as left justified tolerance values. **1^2**

Forward Slash (/): [vertical fraction] stacks text as center-justified fractional-style values; the slash is converted to a horizontal bar. **1/2**

Pound Sign (#): [diagonal fraction] stacks text with a tall diagonal bar. **1#2**

Use the stack tool a second time to unstack stacked text.

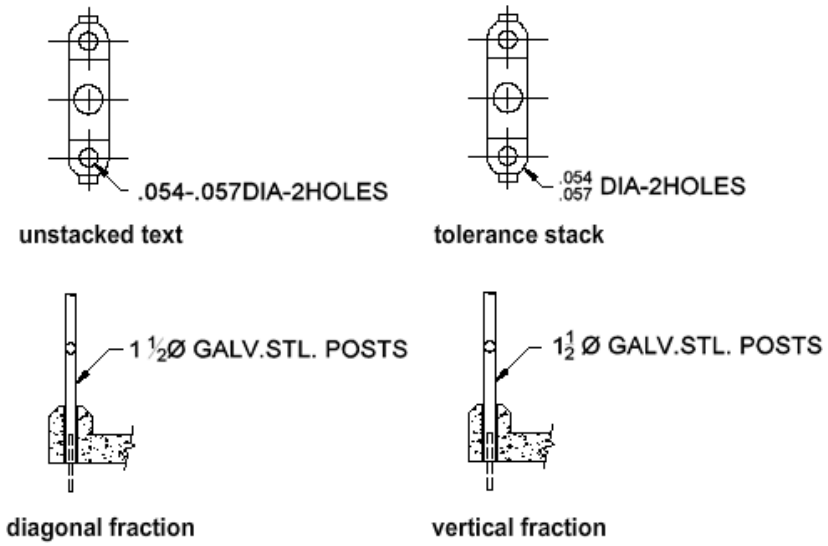


Figure 9 - MTEXT stacked text styles

The automatic stacking feature applies only to numeric characters immediately before and after the slash, pound sign, and carat. For tolerance stacking, the +, -, and decimal character also stack automatically.

To save your changes and exit the editor, use one of the following methods:

- Click OK on the toolbar.
- Click in the drawing outside the editor.
- Press CTRL+ENTER

8. Layers

The layers shown in Table 10 are provided as part of the border drawing to ensure consistency throughout disciplines and to provide a starting point for all new and existing drawings.

Table 10 - Layer Control

Layer Name	Layer Description	Color	Line Type
0	0	7 White	
BDR	Border	Varies	
REV	Revisions	1 Red	
TEXT	*Text	2 Yellow	Continuous
TEXT2	*Text	1 Red	Continuous
OBJ	**Object/Device outlines	4 Cyan	Continuous
CEN	**Center	3 Green	Center
HID	**Hidden	3 Green	Hidden
PHAN	**Phantom	3 Green	Phantom
DASH	**Dash		Dash
HATCH	**Hatch	9 Grey Lt.	Continuous
REV-#	Revision Clouds & Triangles	1 Red	Continuous
REV-#HATCH	Revision Hatch	9 Grey Lt.	Continuous
Defpoints	*Viewports, Boundaries	7 White	Continuous
DEMO	Demolition	9 Grey	Continuous

*Text may be on other layers or color as necessary. Viewports maybe other colors as necessary.

**For use on Electrical Schematic, Wiring & Layout drawings.

Drawing entities shall be placed on their appropriate layer including revision clouds, revision triangles and demolition hatch. **(Refer to Section 13, Revision Cloud)**.

Electrical Schematic ONELINE template drawing can be obtained from Renewable Resource.

Civil & Mechanical drawings shall follow drafting best practices and may use additional layers and colors as needed. Refer to the colors in the Plot Style Table (Table 11) provided in this document.

Unreconciled layers are new layers that have been added to the drawing and have not yet been acknowledged by the user and manually marked as reconciled. A warning icon and balloon appear in the tray when layers are added automatically, such as through xrefs.

To reconcile unreconciled layers:

Either click the warning balloon or open the layers palette.

Right-click the layer and click the Reconcile Layer option.

Once a layer has become reconciled, it is removed from the Un-reconciled New Layers filter. After all new layers are reconciled; the un-reconciled New Layers filter is removed. If layer names appear to be missing, they may have been filtered from the list.

9. Plotting: Style Table: Color, Line weight, and Screening

Object color assignments (Table 11) are made within each AutoCAD drawing file. Each of the first 16 line colors must be set up with the predefined plotter and line width assignment as shown in Table 11. The first 16 Virtual Pen Numbers with the colors are to agree suggested by AutoCAD. PacifiCorp uses color-dependent plot style tables in the current drawing (*.CTB).

Table 11 - Plot Style Table: Color, Lineweight, and Screening Assignment

AutoCAD Color Name	Reference Color Name	Virtual Pen Number	B - Line Weight	D- Line Weight	Screening %	Suggested Color Use
1	Red	1	.010”	.020”	100	Title text, object line (large scales), revision clouds
2	Yellow	2	.005”	.010”	100	Text, object lines (small scales)
3	Green	3	.003"	.006”	100	Text, extension, dimension, center line, phantom, hatching, and hidden lines
4	Cyan	4	.014"	.028”	100	Section and detail lines, device outlines
5	Blue	5	.005"	.010”	100	Discipline specific
6	Magenta	6	.007"	.014”	100	Discipline specific, conduit layout
7	White	7	.005"	.010”	100	Discipline specific, object lines
8	Gray Dk.	8	.004"	.008”	100	Background/gray scale
9	Gray Lt.	9	.003"	.006”	70	Background/gray scale, Demolition hatch
10	Red Br.	10	.009"	.018”	100	Discipline specific
11	Salmon	11	.011"	.022”	100	Discipline specific
12	Red Dk	12	.012"	.024”	100	Discipline specific
13	Salmon Dk.	13	.013"	.026”	100	Discipline specific
14	Red Dk.	14	.008"	.016”	100	Discipline specific
15-16	*varies	15	.007"	.014”	100	Discipline specific
17-29	*varies	17-29	.005"	.010”	100	Discipline specific
30	Orange	12	.012"	.024”	100	Discipline specific
31-150	*varies	31-150	.005"	.010”	100	Discipline specific
151	Lt Blue	14	.008"	.016”	100	Discipline specific
152-189	*varies	152-189	.005"	.010”	100	Discipline specific
190	Dk Blue	190	.007"	.014”	100	Discipline specific
191-210	* varies	191-210	.005"	.010”	100	Discipline specific
211	Lavender	211	.007"	.014”	100	Discipline specific
212-229	*varies	212-229	.005"	.010”	100	Discipline specific
230	Fuchsia	230	.013"	.026”	100	Discipline specific
231-248	*varies	231-248	.005"	.010”	100	Discipline specific
249	Brick	249	.003"	.006”	10	Discipline specific
250	Charcoal	250	.005"	.010”	5	Discipline specific
251	Gray Dk.	251	.004"	.008”	10	Discipline specific
252	Gray Dk.	252	.004"	.008”	20	Discipline specific
253	Gray	253	.004"	.008”	30	Discipline specific
254	Gray Lt	254	.004"	.008”	40	Discipline specific
255	White	255	.005"	.010”	100	Discipline specific

10. Drawing Scale

All Renewable Resource drawing objects shall be drawn in real–world dimensions (Full Scale; 1 to 1) in Model Space. In some instances it is necessary to plot out the drawing in a manner that will allow users to scale off dimensions from the paper copy. Care should be taken when doing this to avoid confusion when copies or reductions of the original plot are made. The borders shall be inserted in Paper Space (layout) at a coordinate of 0,0 and full scale (1:1). Do not "free pick" object lines.

Table 12 - Drawing Scales (in feet)

Drawing		Text Factor	
Scale	Scale Factor	Size 0.09375	Size 0.125
1'=10'	10	0.9375	1.25
1'= 20'	20	1.875	2.5
1'=30'	30	2.8125	3.75
1'=40'	40	3.75	5
1'=50'	50	4.6875	6.25
1'=100'	100	9.375	12.5
1'=200'	200	18.75	25
1'=400'	400	37.5	50
1'=600'	600	56.25	75
1'=800'	800	75	100

Civil Design:

Scale bars shall be added to all sheet files which display site plan views, including:

- General Plan
- Conduit & Cable Plan
- Grounding Plan
- Foundation Plan
- Fence Plan
- Landscaping Plan
- Grading Plan
- Plans & Elevations

The scale bars are to be taken from the Standard Block Library and placed in Paper Space in the lower middle to lower right-hand portion of the drawing.

Table 13 - Drawing Scales (in inches)

Drawing		Text Factor		Text
Scale	Scale Factor	Size 0.09375	Size 0.125	Inverse Multiplier XP factor
3/4”=1”	1.33	0.125	0.17	0.7500
5/8”=1”	1.6	0.15	0.2	0.6250
1/2”=1”	2	0.1875	0.25	0.5000
3/8”=1”	2.67	0.25	0.33	0.3750
1/4”=1”	4	0.375	0.5	0.2500
3/16”=1”	5.33	0.5	.666	0.1875
1/8”=1”	8	0.75	1	0.1250
1/16”=1”	16	1.5	2	0.0625
1”=1”	1	0.09375	0.125	1.0000
1/16”=1’	192	18	24	0.005208
3/32”=1’	128	12	16	0.00780
1/8”=1’	96	9	12	0.010467
3/16”=1’	64	6	8	0.015625
1/4”=1’	48	4.5	6	0.02083
3/8”=1’	32	3	4	0.03125
1/2”=1’	24	2.25	3	0.04167
3/4”=1’	16	1.5	2	0.06250
1”=1’	12	1.125	1.5	0.08333
1–1/2”=1’	8	0.75	1	0.1250
2”=1’	6	0.5625	0.75	0.16667
3”=1’	4	0.375	0.5	0.2500
1”=10’	120	11.25	15	0.00833
1”=20’	240	22.5	30	0.004167
1”=30’	360	33.75	45	0.002778
1”=40’	480	45	60	0.00208
1”=50’	600	56.25	75	0.001667
1”=100’	1200	112.5	150	0.000833
1”=200’	2400	225	300	0.000417
1”=400’	4800	450	600	0.000208
1”=600’	7200	675	900	0.000139
1”=800’	9600	900	1200	0.0001047
1”=1000’	12000	1125	1500	0.0000083

Text Scale Calculation Formula (for all text):
Standard Text size (3/32 text): Scale factor x 0.09375
Title Text size (1/8 text): Scale factor x 0.125
Title Text size (5/32 text): Scale factor x 0.15625
Block Insertion Scale = 1 / Scale factor

11. Model Space / Paper Space

Scope: All non-scalable entities such as one-lines, schematics, wiring diagrams, block and level diagrams, etc. shall be drawn in model space. Detail callouts, labels, scale legends and scale bars shall be located below the object in Paper Space Layout.

11.1. Viewports for scaled objects in Paper Space (Layout)

1. To scale each displayed view in the plotted drawing accurately, set the scale of each view relative to paper space. Refer to Tables 12 and 13 for viewport scales.
2. The suggested primary scale for civil drawings (grading plans, foundation plans, fence plans, etc.) is 1"=20'-0". The suggested primary scale for steel drawings is 1/2"=1'-0".
3. If a desired detail scale differs from the primary drawing scale, a new paper space viewport of the model space detail should be created with the appropriate scale factor.
4. Lock the viewport to prevent accidental viewport scaling.
5. Set the PSLTSCALE variable to 1 and the LTSCALE to 0.25 so that the line types will look identical in all viewports.
6. Line type scaling can be controlled for each viewport. We prefer it be consistent between viewports in the same layout.
7. All object dimensions shall be located in Model Space. The DIMSCALE variable shall be adjusted to match the paper space viewport for the detail.
8. Associative dimensioning is allowed. If viewports overlap, dimensions shall be placed on layers in such a way that the dimensions are only visible in one viewport.
9. Notes, titles, and bills of material shall be inserted into paper space. Each scaled Detail, Plan, Layout, and Elevation viewport shall be labeled in paper space with the drawing scale. Scale bars shall be added to all sheet files which display grading, foundation, site plans, and elevation views.

11.2. Viewports for non-scaled objects in Paper Space (Layout)

1. The viewport window shall be set to the defpoints layer. Assigning the paper space viewports (MVIEWS) to the defpoints layer is preferred, since the defpoints layer does not plot.
2. To scale each displayed view in the plotted drawing accurately, set the scale of each view relative to paper space. Refer to Tables 12 and 13 for viewport scales.
3. Viewport scaling 1:1 is the preferred method. An acceptable viewport scaling range for non-scaled objects varies between 0.75xp and 1.0xp (this applies to D-size borders only, E-size borders should be 1:1 only). This allows for less separation of drawings, and allows the model space standard text size to remain readable.
4. Line type scaling can be controlled for each viewport. Consistency between viewports in the same layout is preferred.
5. Rotating the view of model space objects within a paper space viewport can be easily done with the MVSETUP command or UCS Z-rotate option. This is ideal for rotating wiring diagrams and layout drawings when the best orientation of the panel is rotated 90 degrees to fit the single viewport. Figures 10 and Figures 11 show examples of rotated Panel Layout & Wiring Diagram.

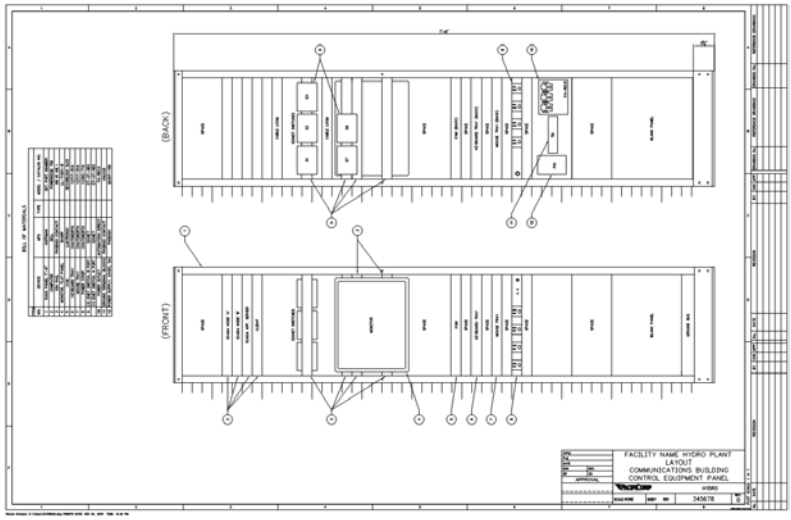


Figure 10 - Rotated Panel Layout

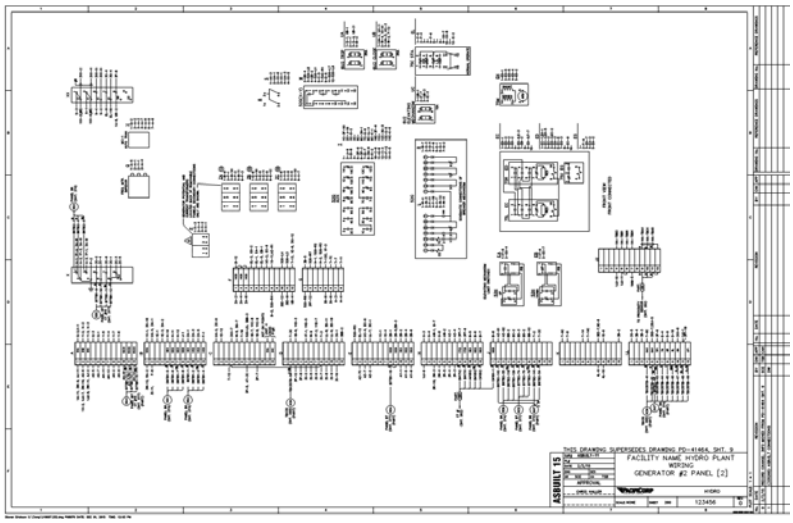


Figure 11 - Rotated Wiring Diagram

11.3. Viewports in Paper Space (Layout)

The paper space drawing area can be split into single or multiple viewports. The viewports can be modified and scaled once they are created. Multiple viewport windows may be used as needed in the paper space layout. The number of paper space viewports allowed is limited to the number that fits appropriately on a full scale (1:1) border, refer to General 5.1. Layer visibility and plotting can be controlled independently as needed for each layout viewport through settings in the layer tool palette.

12. Drawing & Block Usage and Development

12.1. Scope

Blocks may be created for PacifiCorp drawings, however all blocks shall go through an approval process by PacifiCorp Document Management Services before being used. If not approved, the block and drawing file will be rejected. The use of dynamic blocks is allowed. Snap, Line type, and Insertion Point **MUST** be set correctly in all new drawings and blocks.

12.2. Development

All line and object entities that reside in blocks are to be developed on layer 0, with the color and line type attributes set to ByLayer. The attributes and text shall be set to the appropriate text layer. Refer to **(Layers in Section 8)** for more information.

Blocks shall be created with an insertion point at a position where it will be useful in snapping the block to neighboring objects.

12.3. Insertion Point

The insertion point is the reference point for subsequent insertions of the block. It is also the point about which the block can be rotated during insertion. A typical insertion point is the center of the block or its lower left corner.

12.4. Template Drawings

To obtain a copy of these AutoCAD template files (if available), please contact Drawing Management Services.
These will be discipline–specific files containing blocks, layers, dimstyles, and text styles intended for specific drawings.
Electrical Schematic ONELINE template can be obtained from Drawing Management Services.

12.5. SNAP Settings

SNAP settings should be used to ensure alignment, closure and accuracy of lines or objects created by AutoCAD. SNAP should be set to a minimum value of .03125 inches or (1/32 inch) and must be in multiples of .03125 inches multiplied by the scale factor.

12.6. Line Type Scale

The LTSCALE command sets the scale factor to be applied to all line types within the drawing. A global line–type scale factor is provided for each new drawing with a default value of 1.0. To maintain a consistent line type appearance on drawings the line–type scale (ltscale) is usually set at 0.25. If a drawing is plotted to a scale, the ltscale factor should be changed to 1/4 of the dim scale. The PSLTSCALE system variable (setvar) should be set to 1.

PsLtScale <1>: Specifies the linetype scale relative to paper space.

0 - Will Use Model Space scale factor.

1 – Will Use viewport scale factor (Preferred).

13. Revision Cloud

All engineering groups, contractors and consultants shall use the revision cloud to identify changes on drawings that are in design or construction phase by placing a revision cloud around the specific affected details of the drawing. PacifiCorp encourages the use of AutoCAD's REVCLOUD command for creating revision clouds. The arc size of the revision cloud needs to appear consistent throughout the drawing.

13.1. Revision Layer

All revision clouds shall have the following formatting:

- Layer: REV
- Color: Red
- Linetype: Continuous

Demolition details shall be hatched to show the design of what is to be removed or taken out of the drawing/equipment. The scale of the demolition hatch needs to appear consistent throughout the drawing.

All demolition hatches shall have the following formatting:

- Hatch Style: ANSI 31 (lines running at 45° angle)
- Layer: Demo
- Color: 9 Grey Lt.
- Linetype: Continuous

Drawing entities shall be placed on their appropriate layer in model space. Revision clouds are to be placed around entities in their current space (e.g., entities in model space will have the cloud also in model space). **(Refer to Section 8 Layers: for more information)**

In general, ORTHO is to be turned off to avoid linear clouds running parallel to the object being clouded. The clouds shall be a continuous line whenever possible. When the line is in conflict with text associated with graphics, the line may be broken. When revisions are made to large bodies of text, individual text lines shall not be clouded. A revision triangle block shall be placed near the revision and labeled with the revision number that matches the drawing revision number being created.

See acceptable clouds:

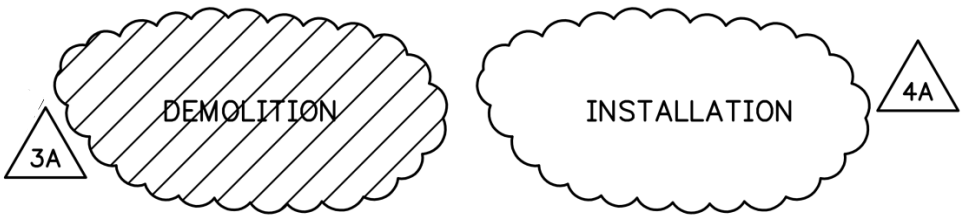


Figure 12 - Revision Cloud Example: Demolition and Installation

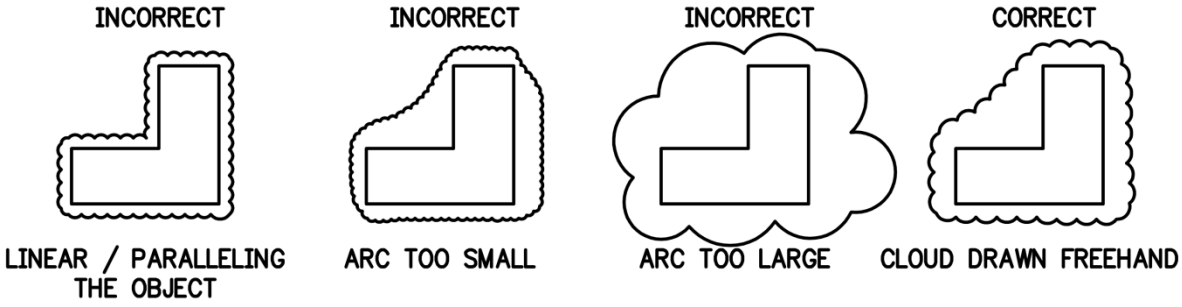


Figure 13 - Revision Cloud Examples

14. Associative Dimensioning

14.1. General

Associative dimensioning will be used on all new and modified drawings. This will ensure that the dimensioning is consistent and dynamic throughout the drawing. Dimensioning shall be placed on a dim layer, color by layer (color 3). The dim style naming convention should be associated with the scale factor. For example, if the scale factor is 48, then the dim style used should be named 48, with the overall scale set to 48. The dimension layer naming convention should also follow this (or a similar) logical method (i.e. DIM-48 = dimensions using dim style 48).

No modification of existing dim styles or the creation of new styles is permitted (i.e.: Modifying existing style 48 (1/4" = 1'-0") to accommodate a change of scale in the view port from a 48 to 32 (3/8" = 1'-0") is not acceptable drafting practice. The style of 48 is to be replaced with the style of 32 to match the new view port scale. The dim style STANDARD is not one that should be used or tailored to fit the scale of the drawing.

14.2. Drawing Units (for Dimensional Type Drawings)

Drawing units are to be Architectural with a precision of no less than 3/32" and the insertion set to inches. An exception to this is the electrical diagrams and civil survey files where the units are to remain decimal.

14.3. System Variables

DIMASO <**On**>: Turns associative dimensioning on.

DIMASSOC <**2**>: Controls how dimensions are created.

<2>: Signifies dimensions are linked to their objects

14.4. Guidelines for Associative Dimensioning

Guidelines for dimensioning variables are outlined below.

- Layer: dim (or desired dim layer)
- Color: ByLayer (layer dim = color 3)
- Linetype: Continuous
- Arrow size: 3/32” (multiplied by scale factor). Use AutoCAD arrowhead.
- Text size: 3/32” (multiplied by scale factor)
- Text Location: Always above or off to the side and centered. Never below or centered on the dimension line. Text location shall be consistent throughout the drawing.
- Dimension Style name: Use logical style names.

Dimension Scale Factor	Dimension Style Name
32 (3/8” = 1’-0”)	Dim-32
48 (1/4” = 1’-0”)	Dim-48
240 (1”=30’-0”)	Dim-240

- When editing existing drawings, stay consistent with dimensioning variables.
- Do not explode or stick build associative dimensioning.
- System Variable DIMASO = On: Turns associative dimension on.
- System Variable DIMASSOC = 2: Dimensions are linked to their objects.
- Do not override dimension values. The exception to this is the addition of a note or text string within the dimension.

14.5. Leaders

All leaders (QLEADER) shall be associative, and drawn in the dimension style matching the scale factor of the viewport. Leaders should be drawn with no more than three points (i.e., two line segments). Leaders associated to text are placed on the same layer as the text.

15. Stamp Information

15.1. Setup

Copy the Printer Support Plot Styles (*.ctb) files to the Appropriate AutoCAD Support Directory for the version of AutoCAD that you are using: **C:\AutoCAD Support\Plot Styles.** In AutoCAD, add the path location of the files to the [TOOLS] [OPTIONS] [\Printer Support File Path\Plot Style Table Search Path] Copy the drawing files and lisp files into: **C:\AutoCAD Support** in AutoCAD, add the path location of the files to the [TOOLS] [OPTIONS] [\Printer Support File Path\Plot Style Table Search Path].

The following files must be located in the appropriate AutoCAD Support directory as noted above according to the version of AutoCAD that is being used and overwrite when prompted

DDTS14R1.LS	IFCD-E.dwg	PRLM-E.dwg
STAMPS.LSP	IFCI-D.dwg	RSVD-D.dwg
STDEX.LSP	IFCI-E.dwg	RSVD-E.dwg
ASB-D.dwg	ISSD-D.dwg	SPSD-D.dwg
ASB-E.dwg	ISSD-E.dwg	SPSD-E.dwg
FRO-D.dwg	NFCS-D.dwg	VOID-D.dwg
FRO-E.dwg	NFCS-E.dwg	VOID-E.dwg
IFCD-D.dwg	PRLM-D.dwg	

In AutoCAD, add the following files into the Startup Suite. Enter APPLOAD at the command line, select CONTENTS (Startup Suite), select ADD, browse to your support folder and select the following files: STAMPS.LSP, DDTS14R1.LSP, STDEX.LSP
Use the following commands to activate the stamps:

- to be used for design phase work and ***are not*** **entered into Fusion**:
  - **PRLM** - **PRELIMINARY** side stamp.
  - **IBID** - **ISSUED FOR BID** side stamp.
  - **FRO** - **NOT FOR CONSTRUCTION** side stamp.
- to be used for construction or issued work and ***are*** **entered into Fusion**:
  - **IFC** - **INSTALLATION** or **DEMOLITION** side stamp.
  - **ISSD** - **ISSUED** side stamp.
  - **ASB** - **ASBUILT** side stamp.
  - **RSVD** - **RESERVED** side stamp.
  - **SPD** - **SUPERSEDED** prompt for THIS DWG IS SUPERSEDED BY DWG: **XXX** and **SUPERSEDED** side stamp.
  - **VOID** - **VOID** side stamp with no watermark.
  - **STDE:** removes the current stamps.
  - **STDEX:** removes the old stamps.

If you have any problems with the lisp routines, please contact Drawing Management Services so that a change can be made. *The drawing limits must be set appropriately; routines will only work if the limits are (34, 22) and (44, 34). The stamps are not for A, B or C size drawings.

DO NOT ATTEMPT to change them on your own

15.2. Support: LISP Routines/Programs/Commands/Extras

The following lisp routines are available for use. To obtain a copy of these routines, please contact Drawing Management Services. The "[ ]" brackets indicate the program or command start function.

15.3. Lisp Routines/Programs/Commands/Extras

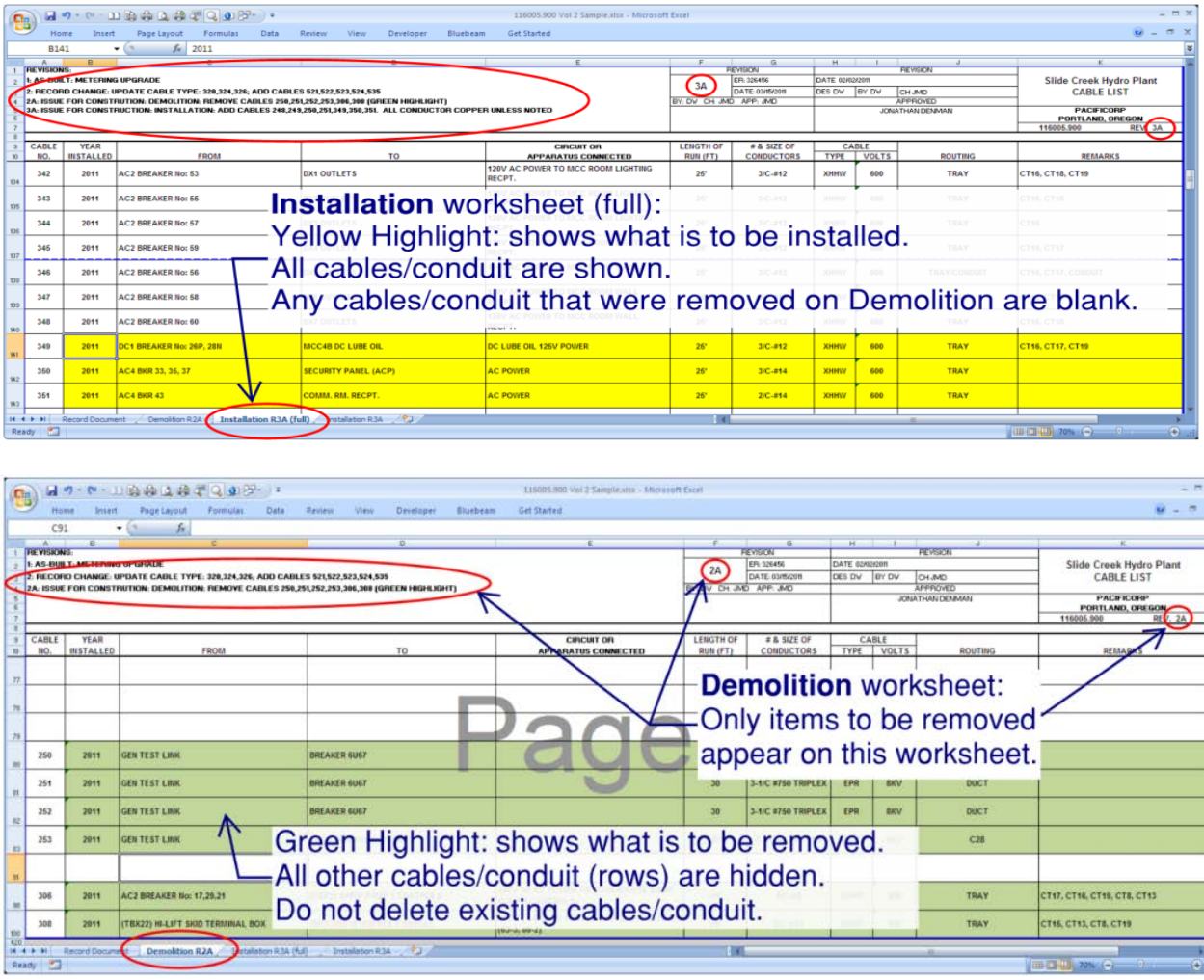
STAMPS.lsp: Adds or removes drawing status stamps.
SWAP.lsp: [SWAP] Swaps two objects with the same base point.
TERMINALS.lsp: [TBK] Inserts the requested quantity of terminal blocks in either a horizontal or vertical position, inserts the terminal strip number, and adds beginning and ending markers for the terminal strip.**TAG2TXT.lsp**: [TAG2TXT] Converts ATTDEF's default TAG value to TEXT objects. In the event that a block has been exploded and the ATTDEF text has been copied and used as DTEXT throughout the drawing; this routine converts the TAG value to DTEXT. Useful in drawing cleanup. **TXT2MTXT**: [TXT2MTXT] Converts Text to Mtext: Converts one or more lines of text to Mtext (Express Tools).

16. Multiple Page Documents: Excel

16.1. Cable & Conduit Lists

These cable and conduit lists exist in a Microsoft Excel workbook. They are also considered drawings, and shall follow all engineering Procedures pertaining to drawings. In addition to the drawing Procedures, the following processes shall be followed when creating or modifying these lists:

123456.000 Rev 1: Document of Record from Fusion
123456.000 Rev 2A: Issue for Construction (IFC) Installation & Demolition for a project
123456.000 Rev 2B: Issue for Construction (IFC) Installation & Demolition for a project, etc.
(Refer to Volume 2, Section 2.3 Drawing Revision Number Increment) for more information.



Figures 14 – Example of Installation & Demolition

Shows examples of how the combined Installation & Demolition would appear. Templates for these forms may be obtained from Drawing Management Services.

The Installation & Demolition file is created from a copy of the Record Document. The new installation portion shall have the cable/conduit that is being installed highlighted with a Yellow Fill Color. The new demolition portion shall have the cable/conduit that is being removed highlighted with a Green Fill Color. To increase visibility, no colored text shall be used. Font strikethrough shall not be used. No cable/conduit rows shall be hidden. Do not delete existing cables/conduit.

17. Approval

When a drawing is created or revised, it requires particular levels of approval. If a drawing does not have the appropriate approval signatures, it cannot be issued as final. Below is a list of the approval block fields and the required signature levels. A drafter/designer cannot approve their own drafting or design work.

17.1. New Drawing Approval (Rev 0 or 0A)

The following people shall perform approval for design work done in-house:

ENGR: .....Engineer (Initials Only)
DES: .....Designer (Initials Only)
CH: .....Drafter or Designer (Initials Only)
DR: .....Drafter or Designer (Initials Only)
Approval Block Line 1:...PacifiCorp Engineer or Engineering Manager

The following people shall perform approval for design work done by outside consultants:

ENGR: .....Consulting Firm Name or Engineer (Initials Only)
DES: .....Consulting Firm Name or Designer (Initials Only)
CH: .....PacifiCorp Engineering/Designer (Initials Only)
DR: .....Consulting Firm Name or Drafter (Initials Only)
Approval Block Line 1:...PacifiCorp Engineer or Engineering Manager

17.2. Revised Drawing Approval

The following people shall perform approvals for design work done in-house:

BY: .....Drafter or Designer (Initials Only)
CH: .....Drafter or Designer (Initials Only)
APP:.....PacifiCorp Engineer or Project Manager (Initials Only)

The following people shall perform approvals for design work done by outside consultants:

BY: .....Consulting Firm Name or Drafter, Designer
CH: .....Consulting Firm Name or Checker
APP:.....PacifiCorp Engineer or Project Engineer

18. New Drawing Design

18.1. Design Change Initiation

If applicable, a new design package will contain two (2) sets of drawing files: **Demolition and Installation. Each will be stamped as follows: ISSUED FOR CONSTRUCTION with Installation or Demolition side stamps, (Refer to Sections 2.1).** Revision number alpha letters will increment for each design modification, to indicate the current status of the design **(Refer to Sections 3.3)**. At the completion of construction, the working set of drawings will be verified by the startup Engineer or Designer **(Refer to Sections 2.2)**.

18.2. Demolition

The detail design of what is to be removed from the drawing. (Wiring, Schematics, One & Three Lines and Layouts). The Demolition of existing information shall be crosshatched at a 45° angle with the color 9 and clouded with a revision triangle for each change made **(Refer to Section 13)**.

Demolition drawings keep the same revision as they had when they were checked out of the Fusion database, but it will pick up an alpha letter [A-Z] **(Refer to Section 3.3)**.

Demolition drawings are to be stamped **(Refer to Section 15)**. Electronic CAD or Scanned Manual drawings will be renamed to match the original drawing number.

After the design has been approved, the drawings will be issued and placed into storage, while the design is out for bid and/or construction. Demolition drawings do not typically go into the Fusion there must be a file store for record until the project is completed **(Refer to Sections 19 to 20)**.

18.3. Installation

The detail design of what is to be installed (Wiring, Schematics, One & Three Line and Layouts) all must be created or updated. All changes to drawing files shall have clouds with a revision triangle for each change made. All Installation file revision numbers are incremented with an alpha letter [A-Z] added to them **(Refer to Section 3.3).** Revision clouds and triangles will not be removed from the drawing file until the As-Built documentation has been received, approved, and processed **(Refer to Sections 2.2)**.

Installation drawings are to be stamped **(Refer to Section 15)**. Electronic CAD or Scanned Manual drawings will be renamed to match the original drawing number and also placed into the **Installation** directory, while work is in the design phase.

These drawings Do Not go into Fusion **(Refer to Sections 19 to 20)**.

18.4. Superseding a Drawing

Superseding a drawing is the process of relocating drawing information from its current drawing number to a new or different number, or incorporating it into another drawing. Note: Only the old LEGACY NUMBERING SYSTEM numbers can be superseded (Refer to Section 5.6 & 5.7). Drawings should not be superseded if at all possible. Superseding drawings creates issues with version history and revision tracking. Before superseding a document, attempt to achieve the desired affect through use of revisions. Drawing Management Services and Renewable Resources Engineering approval is required first.

Have Drawing Management Services locate the drawing in Fusion and check the status of the drawing to prevent drawing revision conflicts before the revisions can take place. If the drawing is Not Checked-Out, have Drawing Management Services Check-Out the drawing to your company **(Refer to Section 20.1)**. Then add the **SUPERSEDED** block stamp somewhere on the drawing showing the drawing number that the information has been moved to including date and Engineer's name.

The revision descriptions for the original drawing and new drawing will read as follows below:

I. INFORMATION MOVED FROM [DRAWING NUMBER(s)]

II. INFORMATION MOVED TO [DRAWING NUMBER(s)]

III. REDRAWN ON CAD THIS FILE REPLACES DRAWING NUMBER (XXX)

Above the title block of the new drawing will be the notation: "THIS DRAWING SUPERSEDES [DRAWING NUMBER]" This note will stay on the drawing throughout its existence. Update the drawing transmittal list and reference drawings (i.e., remove the drawing and/or add the drawing that has been affected by the change **(Refer to Section 3.1)**. Contractor/Consultant Quality of Excellence **(Refer to Section 19).** Prepare a distribution transmittal, signed by your Designer and Engineer and indicate on the transmittal which drawings are superseded. Submit to PacifiCorp **Drawing Management Services and Renewable Resources Engineering** for final approval. Once approved, prepare the electronic file(s) for check-in **(Refer to Section 17 and 20)**.

18.5. External Drawings

An external drawing is a drawing that is created from an outside source that represents equipment or information located in or pertaining to one of PacifiCorp facilities. An example of an external drawing is an equipment drawing by a manufacturer referencing the internals of their equipment. A design drawing developed by an engineering consultant would not be considered an external drawing. Electronic Media must be in either **AutoCAD** format (.dwg, .dxf) or TIF image format **(Refer to Section 5)**. If Internal Drawing number is assigned from Drawing Management Services, **(Refer to Section 2.1)**. External drawings with external numbers can only be modified by the consultant. If you need to modify an external drawing you will need to change it to a PacifiCorp drawing number **(Refer to Section 2.2)**. At the completion of construction, the working set of drawings will be verified by the startup Engineer or Designer. If drawing files are superseded by external drawings, **(Refer to Section 2.4)**.

19. Consultant Quality of Excellence

Scope: Consultant shall perform a quality assurance audit and final publication, before submitting drawing packages to PacifiCorp. If the document doesn't pass the audit once arriving to Drawing Management Services, it will be returned to the contractor responsible. When exiting a drawing, use these procedures to insure that the drawing is in a clean state for other users and to reduce the drawing file size, thus saving disk space. The following should be considered when doing this audit.

19.1. Quality Assurance Audit

Always use appropriate text justifications and height when placing or modifying text. Line weight Settings (LWEIGHT) shall be By Layer and not displayed (unchecked). Prior to transmittal all files shall be scanned for virus detection using the latest anti-virus program. Files found to contain viruses will be returned for immediate cleanup. Check the drawing to ensure it has the proper settings.

I. Limits to Border
II. Limits On
III. Line Type Scale @ .25
IV. Snap @ .03125
V. Zoom Extents
VI. Purge All

Check all the drawings for drafting errors, connections, and layout. Check the drawing to ensure it has the proper approval initials and that they have been entered into the computer-generated drawing title block **(Refer to Section 6.6 & 17).** Verify that the drawing title block information is entered correctly and that you have the correct needed documents listed per transmittal. The distribution transmittal should be completed in full; in the areas listed below **(Refer to Section 6.6 & 20.3)**.

I. General Information
II. Category
III. Dates
IV. Number of Drawings
V. Requested By
VI. Contact Information
VII. Format Requested
VIII. Comments
IX. Drawing List

19.2. Final Publication Audit

All drawings prepared for PacifiCorp must be done neatly and accurately drawn in the model area and only the border and notes are placed in the layout area. Objects should follow good drawing practices, and clearly illustrate the necessary details for the devices represented and the work to be performed. Use colors and appropriate pen widths corresponding to PacifiCorp's plot style table for colors, weights, and screening to differentiate objects, dimension and other lines **(Refer to Plotting, Table 11)**. Object lines should meet at corners. Dimension extension lines should not touch objects. The node of the extension lines should be snapped to objects. In plan views, use a hatched block to fill holes. Solid-fill should not be used to represent surfaces or other features of objects. In elevation view, use solid black to fill holes. Wide lines and dots may be used in schematics and other types of symbol drawings. Standard layers are to be used to depict line weights, line types, and color. All AutoCAD entities are to be "By Layer" and are not to be modified by individually changing the line type scale, color or line type by entity.

19.3. Consultant Final Confirmation

Make sure that limits are set on, paper space layout is current and drawing border is displayed. Zoom extents to display all drawing entities. Purge drawing of all unused and unreferenced blocks and layers. The LTSCALE should be set at 0.25. The compound drawing file attachment paths have been removed (No Path). All entities outside of the border other than the date stamp shall be erased. Repeat this process to verify all unwanted entities have been deleted. Use **Overkill** command to remove objects that are geometry redundant. (Express Tools) After using the PURGE ALL command, all of the un-referenced blocks, layers, line types, and so forth, are no longer attached to the drawing file. Example: If you try to use a layer that is not already on the drawing, AutoCAD will not be able to find the layer. You will have to insert the prototype or create the desired layer. The drawings shall be transmitted in AutoCAD (.dwg, or .dxf) file format on CD, zip file, or other approved media, such as E-mail or an FTP site.

20. Drawing Management Services

The purpose of this procedure is to establish control and handling of Renewable drawings and distribution. This process must be followed when acquiring drawings and/or returning the final CAD/Manual drawing to PacifiCorp Drawing Management Services. The following federal regulations are among those requiring compliance with standards of record keeping: 18CFR12.12 Maintenance of Records, 18CFR125 Preservation of Records of Public Utilities and Licenses, and 36CFR79 Curation of Federally-Owned and Administered Archaeological Collections. PacifiCorp has a Records Retention Schedule for all plant documents, listed below are for all Generating Renewable Plants.

GEN-20-60	Construction & Engineering Projects	6 years Retention Period
GEN-20-62	Original Construction Records	Permanent Retention
GEN-20-64	Drawings	Permanent Retention

PacifiCorp shall maintain and control the company electronic CAD drawing file systems. Only authorized personnel may remove, update, or insert drawings into this system. Updated drawing files are provided to the discipline responsible for the drawings. Use of blocks / template drawings shall be permitted as approved by the discipline with the same control as the drawing files.

20.1. Duties

Receive all drawings and manage distribution of all Drawings for Renewable Resources. Establish requirements/responsibilities and guide lines for incoming/outgoing drawings. Keeps control of all PacifiCorp documentation for Fusion and Drawing Management Services. Assign drawing numbers for all of PacifiCorp's Engineering Drawings and prevent drawing numbers and revision conflicts before the revisions can take place.

20.2. Superseded Drawings

Once a package is submitted to Drawing Management Services, they will check the drawing(s) into Fusion and/or update the document to show file status "SUPERSEDED". Drawing Management Services will change the status of the documents in Fusion to "Superseded" and update the title to "SUPERSEDED BY [DRAWING NUMBER(s)]". Drawing Management Services will note the Engineer, New Number, and Date in "Comment". (i.e.: "Superseded by [drawing number] per Joe Bell, 9/10/02").

20.3. Send/Received

All **RENEWABLE** drawings are to be sent to or received from **Drawing Management Services.** Any **PacifiCorp Project** that involves RENEWABLE drawings being assigned to a contractor for services outside of **PacifiCorp**, MUST BE VALADATED BY Renewable's **Drawing Management Services**. The drawings in each package will be logged and passed on to the Drawing Management Supervisor who will review and forward to each discipline, from the list below or Project Engineer. If a virus is found, the files will be sent directly back to the consultant to be exchanged for a clean copy. (Viruses detected shall be reported to Manager, immediately). All files leaving PacifiCorp will go through Drawing Management Services for control, consistency and security reasons.

Drawing Management Services:……(503) 813-6759

20.4. Distribution

Any time a drawing is created or revised, the drawing shall be distributed to all parties who utilize that drawing. It is critical that all personnel who utilize the drawing have access to the current revision of the drawing. Other facility drawings and the facility print files are distributed to the various field operation personnel as designated by Drawing Management Services.