DRAFTING STANDARD

APPROVALS

Name	Title	Signature	Approval Date
Ian Rowe	Manager, Drafting & Document Control		2018-08-13
Andy Sifrer	Supervisor, Drafting		2018-08-13

PURPOSE

The purpose of this document is to describe the minimum requirements and expectations for the development of engineering drawings for Pembina.

INTENDED AUDIENCE

This document is intended for use by project managers, internal drafting, contractors and consultants.

DOCUMENT INFORMATION

DOCUMENT OWNER

This document is owned by Drafting & Document Control.

REVISIONS

Revision #	Revision Date	Revision Notes	Revised By
0	2018.08.13	Issued for Use	Carolyn Donaldson

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1.0 PURPOSE

This standard outlines the minimum requirements to be used in the development of engineering drawings for Pembina. This standard is intended to ensure a consistent standard and format of CAD drawing presentation by all drafting personnel preparing drawings for Pembina.

This standard is not meant to influence the methods, means or practice of EPC's or Contractors in using CAD when creating the drawing.

2.0 SCOPE

This standard applies to all drawings produced for Pembina by internal Drafting, contractors or consultants. This standard covers the general requirements for creating new, and revising existing engineered drawings.

2.1 Exclusions

- Vendor Documents

2.2 Deviations or Variance

Requests for exceptions and deviations (with comments and justifications) shall be submitted at the time of quotation and shall be resolved prior to proceeding with further consideration of the proposal or award of order.

3.0 KEY TERMS, ACRONYMS AND ABBREVIATIONS

Must is a mandatory requirement, which is required to meet legislation requirements.

Shall is an absolute requirement, which is to be followed strictly in order to conform to the standard.

Should is a recommendation. Alternative solutions having the same functionality and quality are acceptable.

May indicates a course of action that is permissible within the limits of the standard permission.

Can is conditional and indicates a possibility open to the user of the standard.

Table 1. Key Definitions

Term	Definition
As-built	Updating of any changes which took place during construction that were not on the original drawings Issued for Construction (IFC), or confirmation that the facility or modifications were built as per the IFC drawings.
BOM	Bill of Materials
CAD	Computer Aided Drafting
Contractor	Any person or firm contracted by Pembina to provide services.
Electrical Drawings	All drawings that are not mechanical drawings.
EPC	Engineering Procurement Construction
Greenfield	New or proposed facility.
IFC	Issued for Construction
Instrumentation	A collection of instruments, devices, hardware, or functions or their application for the purpose of measuring, monitoring, or controlling an industrial process or machine, or any combination of these.
Match Line	A line on a drawing that references the continuation of one drawing to another.
Mechanical Drawings	All drawings that are not electrical drawings.
MFD	Mechanical Flow Diagram – Shows detailed process connections, drains, utility connections and location of instrumentation, but no details with respect to the devices or methods that control them. Demarks spec changes and lists equipment details, capacities, flow rates, models, etc. MFD only appropriate if P&ID is not available.
Pembina	Pembina Pipeline Corporation
PFD	Process Flow Diagram – Shows only the main process flow and connections and the location of instrumentation, but no details with respect to devices or methods that control them. They demark spec changes and list major equipment
P&ID	Piping and Instrumentation Diagram - Shows detailed process connections, drains, utility connections, details about instrumentation connections and details with respect to the devices or methods that control them, such as PLC's. Demarks spec changes and lists equipment details, capacities, flow rates, models, etc.
Redline Drawings	Drawings that accurately depict and incorporate the field mark-ups and the As-built state of the site by the Contractor. These are the working copies what will be used to create the back drafted As-built drawings.
TOS	Top of Steel
Xref	Externally Referenced File

4.0 REFERENCE DOCUMENTS

4.1 Applicable Standards and Guidelines

- ESS 3.42 Facility Piping Specifications
- ESS 3.42A Pipe Class Tables for Pipeline Facilities
- ESS 3.42B Pipe Class Tables for Facilities

Table 2. Reference Documents

Document Number	Document Name
E1.01-3-00100	Standard Mechanical Flowsheet Symbology
E1.01-3-00101	Standard Electrical Symbology
EG 3.45	Piping and Instrumentation Diagram Checklist
EG 4.102	Instrument Tagging
ESS 2.20	Pipeline As-built Survey and Alignment Sheet Requirements
ESS 3.20	Facility As-built Mechanical Drawing Requirements
ESS 4.20	Facility As-built Electrical Drawing Requirements
TSU-TPS-DC-PRO-STD-001	Document Control Process
TSU-TPS-DC-STND-STD-002	Document Numbering Standard
TSU-TPS-DC-REF-IST-005	Bluebeam Redline Instruction

5.0 COMPLIANCE WITH STANDARDS

The delivery of new engineered drawings and the revising of existing engineered drawings by Pembina or Contractors shall comply with this standard on the latest date shown in the revision history table of this standard.

5.1 Typical and Standard Drawings

Pembina has Standard and Typical drawings of commonly installed infrastructure. Some of these drawings pre-date this technical standard. If these drawings are to be used as a base for project specific drawings, then the new drawings shall comply with this standard.

Standard and Typical Drawings used for Pembina facility and pipeline projects are available as pdfs or in AutoCAD format. These can be requested through Pembina's Document Control (DocumentControl@Pembina.com).

5.2 Existing Non-Compliant Drawings

There may be a requirement to work on or modify existing drawings that do not conform to the current standard. Drafting protocol is to maintain the standards that were applied at the time of the drawing creation, unless major modifications to the content are required. It is the responsibility of the drafting provider to seek clarification from Pembina when required.

Pembina requires that an existing drawing shall be migrated onto the current title block when being modified.

If an existing non-conforming drawing is being used as a base for a drawing with a new drawing number, then the new drawing shall conform to the current version of TSU-TPS-DC-PRO-STD-001.

6.0 GENERAL CAD REQUIREMENTS

Documentation under this category is for the purpose of clarifying procedures and guidelines in order to reduce drafting costs and improve quality. The procedures listed identify the steps required to accomplish a task. The guidelines listed identify recommended practices. All new drawings shall be delivered with the following settings in place.

General CAD Requirements are as follows:

- All new drawings produced for Pembina shall be presented with the current title block. The title block shall not be modified or exploded,
- All new drawings produced for Pembina shall contain a single layout tab. Multiple tabs in a drawing will be rejected,
- All drawings shall be legible when plotted/printed at A3 size.

6.1 Acceptable File Format

AutoCAD deliverables shall be saved in version 2013. Preferred CAD software by Pembina is AutoCAD, ProCAD and CADWorx. Any other CAD file format or software other than what has been previously listed must be preapproved by the Pembina Project Manager and Pembina's Drafting Supervisor.

The use of Excel (.xls & .xlsx) files may be used for critical drawings such as: line designation tables, tie-in lists, specialty item lists, shutdown keys, etc.

7.0 INFORMATION SUPPLIED BY PEMBINA

7.1 Drawing Title Blocks

It is the responsibility of the drafting provider to ensure that the current version of the Pembina title block is being used.

All metric engineering drawings shall use the standard PPC-Asize or PPC-Dsize Pembina title blocks. All imperial engineering drawings shall use the standard PPC-Dsize-Imperial Pembina title block. These title blocks are set up with attributes for relevant title block information, and shall not be exploded under any circumstance. Refer to Section 24.2 Title Block Quick Reference.

CADWorx generated isometrics drawings from ISOGEN shall use the Pembina_D_ISO title block.

7.1.1 Standard Title Block Names and Sizes

Table 3. Standard Title Block Names and Sizes

File Name	Description	Plot to Size
PPC-Asize	ANSI A 215.9mm x 279.4mm (8.5”x11”) Standard Title Block	215.9mm x 279.4mm (8.5”x11”)
PPC-Dsize	ANSI D 558.8mm x 863.6mm (22”x34”) Standard Title Block	279.4mm x 431.8mm (11”x17”)
PPC-Dsize_Imperial	ANSI D 22”x34” (558.8mm x 863.6mm) Standard Title Block	11”x17” (279.4mm x 431.8mm)
Pembina_D_Iso (for CADWorx Isometrics)	ANSI D 558.8mm x 863.6mm (22”x34”) Standard Title Block	279.4mm x 431.8mm (11”x17”)

8.0 DRAWING REQUIREMENTS

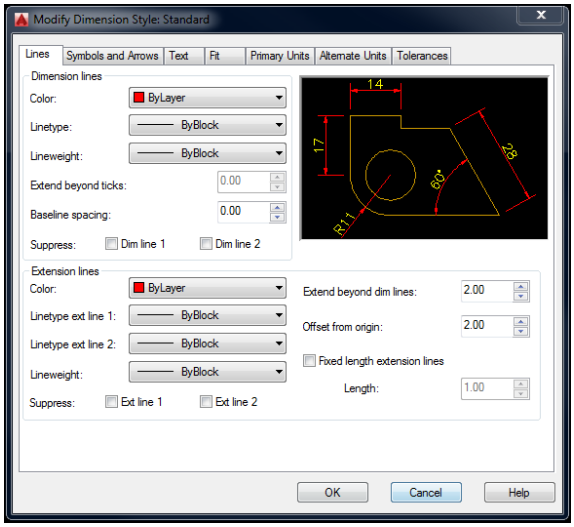
8.1 Drafting Space

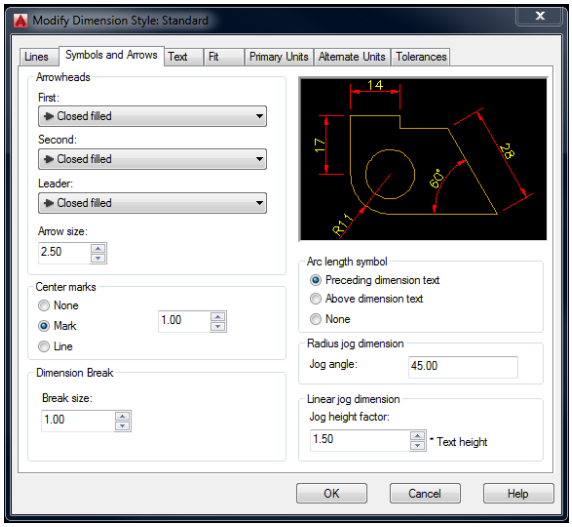
All drawings are drawn in model space at a scale of 1:1. Title blocks shall always remain in paper space using viewports to show the model.

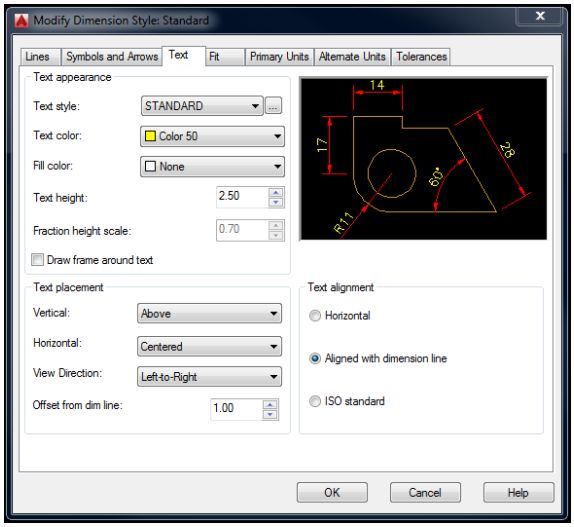
8.2 Dimension Style

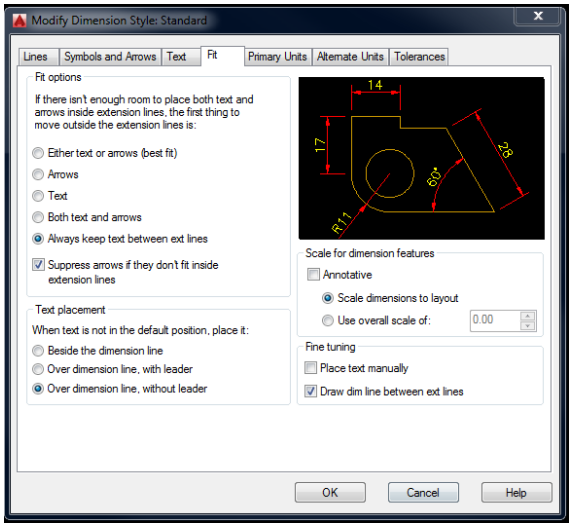
All dimensions shall be in paper space and shall not be exploded.

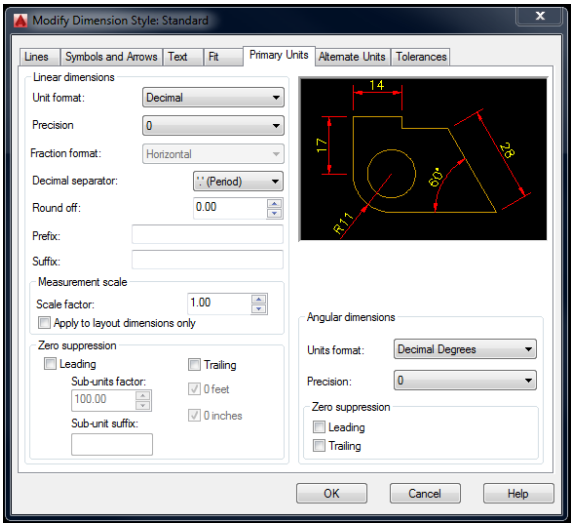
8.2.1 Metric Dimension Style Setup

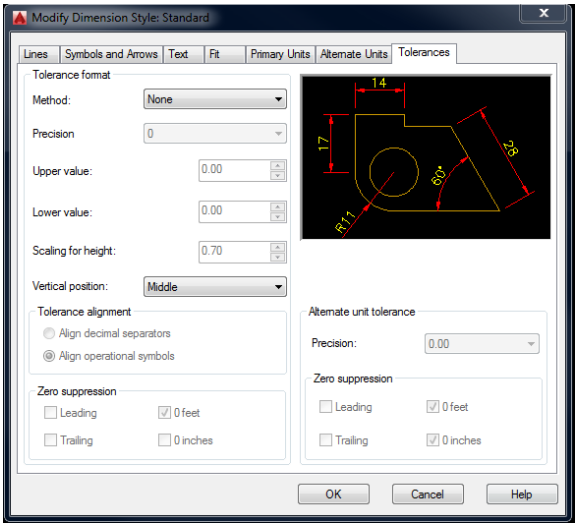




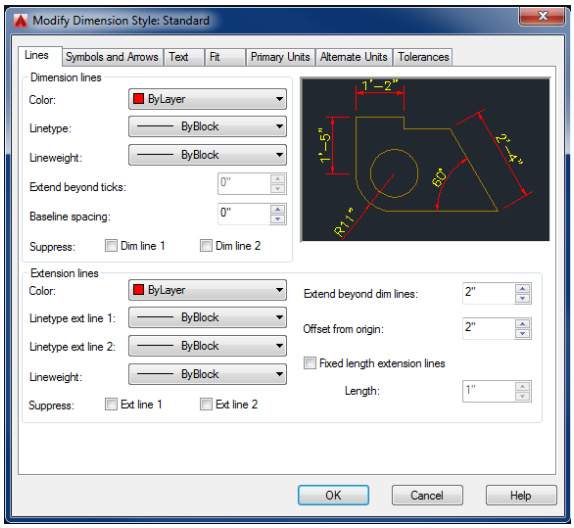


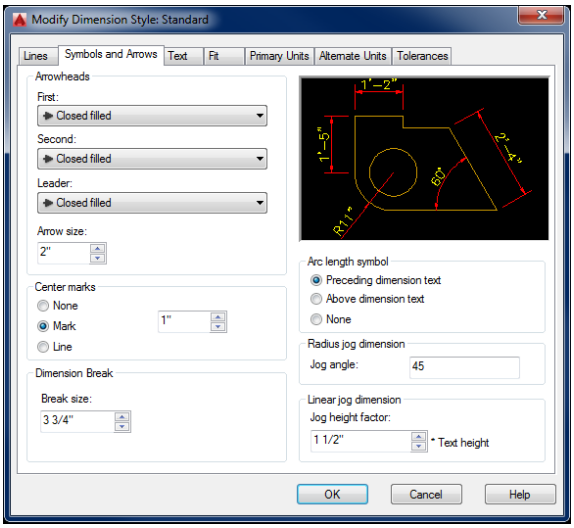


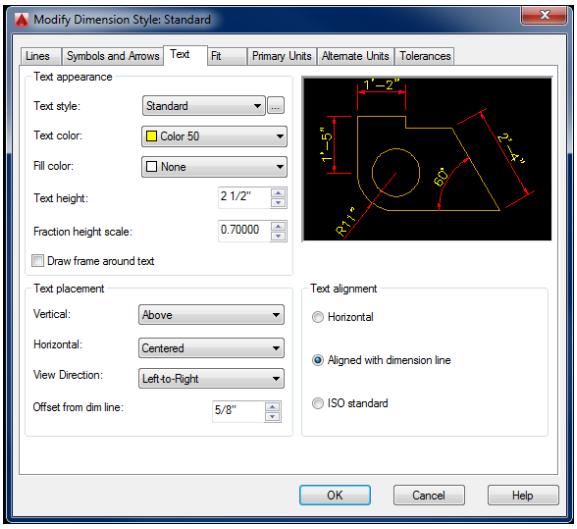


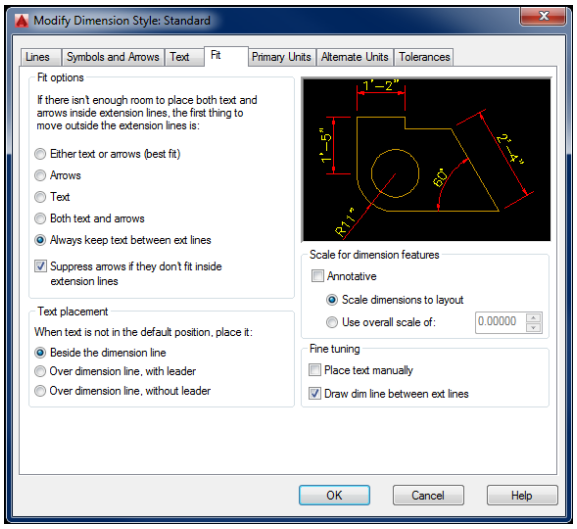


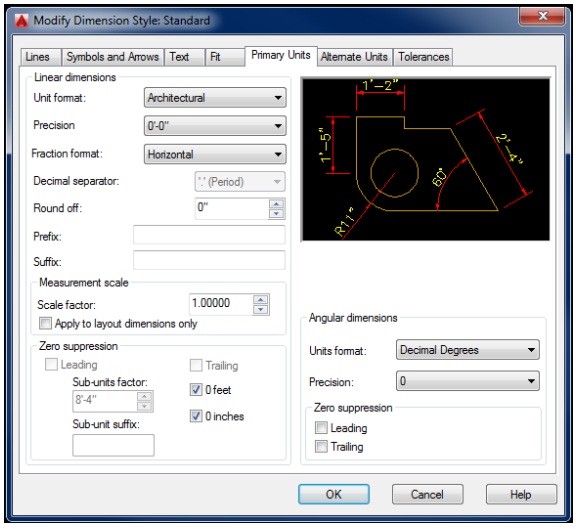
8.2.2 Imperial Dimension Style Setup

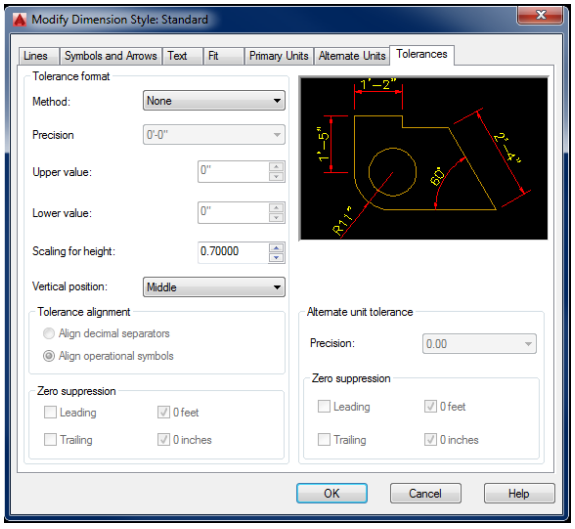












8.3 Text Style

Standard text style should be set to Romans. Arial, OptimaB and other font types may be used as a text style, but not as the standard style. All text should have a width factor of 1, however is it permissible to reduce this to fit in the drawing or title block.

For drawings that have a scale factor viewport, all text should reside in paper space only. For non-scaled viewports or 1:1, text is acceptable in model space.

Text Height	Usage
2.5mm	General notes, labels, tables, dimensions, etc.
4.0mm	Major Headings

8.4 Line Types

The standard AutoCAD line types are found in the ACAD.lin file. Line types are set using the linetype command. It is prohibited to associate line types with layers. All line properties – Color, Line weight and Line Type shall be set to ByLayer.

Install ACAD.lin
Install Pembina BW.ctb

Linetype Scale

LTSCALE: 10 x drawing scale
PSLTSCALE: 0 (paper space)

8.5 Layers

Use the default layer settings provided by Pembina's specified acceptable software.

Layer names on existing drawings do not need to be revised to reflect the latest layering guideline. This layering guideline is recommended for all new drawings or the creation of new layers on existing drawings.

8.6 Drawing Scales

Industry accepted scales may be used. Every effort should be used to reduce the number of different scales displayed on a single drawing.

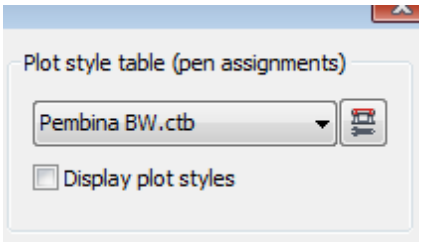
If a single scale is applied for the entire drawing, this shall be clearly indicated in the title block. Individual views with differing scales shall have the scale clearly indicated below the view heading.

8.7 Drawing Units

Canadian Pembina asset engineered drawings are drawn in millimeters with the AutoCAD units set in decimal with four decimal places. USA Pembina asset engineered drawings are drawn in inches with the AutoCAD units set in architectural, precision: 0'-0 1/16".

8.8 Plot File

Plot style shall be set to Pembina BW.ctb

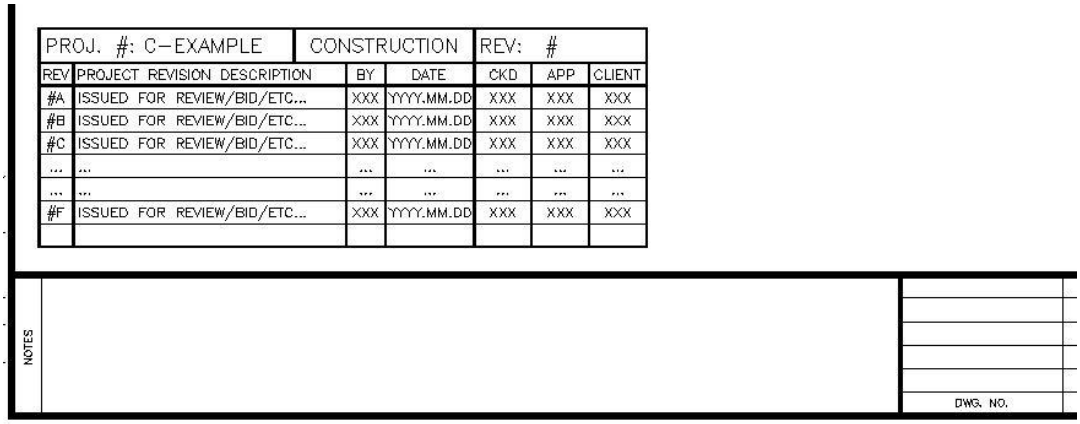


8.9 Revisions

Revision clouds and adjacent revision triangles reside in paper space and are to be used for the current revision where appropriate. Revision clouds and triangles for previous revisions shall be removed (once verified as as-built), however the details shall remain in the title block's revision table.

8.9.1 Soft Revisions

For detailed Issue Stages (e.g.; Issued for Review) requiring soft revisions, refer to the Document Control Process Standard TSU-TPS-DC-PRO-STD-001. Soft revisions shall be documented in the temporary revision block PPC_CONSTR_BLK.dwg and can be placed in any free space within the drawing, preferably above the title block.



PROJ. #: C-EXAMPLE		CONSTRUCTION		REV: #		
REV	PROJECT REVISION DESCRIPTION	BY	DATE	CKD	APP	CLIENT
#A	ISSUED FOR REVIEW/BID/ETC...	XXX	YYYY.MM.DD	XXX	XXX	XXX
#B	ISSUED FOR REVIEW/BID/ETC...	XXX	YYYY.MM.DD	XXX	XXX	XXX
#C	ISSUED FOR REVIEW/BID/ETC...	XXX	YYYY.MM.DD	XXX	XXX	XXX
...	...	...	...	...	...	...
...	...	...	...	...	...	...
#F	ISSUED FOR REVIEW/BID/ETC...	XXX	YYYY.MM.DD	XXX	XXX	XXX

8.9.2 Hard Revisions

For detailed Issue Stages (e.g.; Issued for Construction) requiring hard revisions, refer to the Document Control Process Standard TSU-TPS-DC-PRO-STD-001. Hard revisions are recorded with the Pembina issued title block and the PPC_CONSTR_BLK.dwg shall be removed from the drawing.

4	ISSUED FOR CONSTRUCTION/AS BUILT/ETC.	XXXXXX	XXX	XXX	XXX	YYYY.MM.DD
…	…	…	…	…	…	…
…	…	…	…	…	…	…
1	ISSUED FOR CONSTRUCTION/AS BUILT/ETC.	XXXXXX	XXX	XXX	XXX	YYYY.MM.DD
0	ISSUED FOR CONSTRUCTION/AS BUILT/ETC.	XXXXXX	XXX	XXX	XXX	YYYY.MM.DD
NO.	REVISION	AFE/CC/MOC	DRAWN	CHK.	APPR.	DATE YYYY.MM.DD

8.10 Preparing CAD Files for Submission

CAD files shall be prepared as follows prior to submission to Pembina's Document Control:

- Any drawing model space items not used in the final view shall be deleted,
- All files shall be purged to remove unused items,
- All sheets shall be zoomed to extents,
- Any raster images used shall be embedded in the drawing,
- All electronic images (Engineering and Permit stamps) shall be detached,
- All related Xrefs shall remain attached to the drawing,
- All unrequired Xrefs shall be detached from the drawing,
- All required reference drawings shall be included in handover.

9.0 PIPING & INSTRUMENTATION DIAGRAMS

Refer to Pembina's guideline document, EG 3.45 Piping and Instrumentation Diagram Checklist.

10.0 PLOT PLAN, SITE PLAN AND KEY PLAN GUIDELINES

- Utilize survey drawings to establish existing pins (survey monuments) at lease corners, or field locate. The south-west corner pin is to be used as the DATUM point shown for engineering drawings, and is identified in either the following formats:
  - N 000.000m, E 000.000m
  - N 0+00ft, E 0+00ft
- If not already provided by surveyors, establish a benchmark by taking a fixed point of reference from an onsite piece of equipment or building corner. This point shall be marked as such in a permanent manner with coordinates and elevation so as not to be erased,

- If required, establish project north with respect to true north,
- Use a confirmed two-point datum system when tying into existing Facilities,
- For Plot and Site Plans, a Key/Location plan shall be shown in the upper right corner,
- If required, underground piping shall be shown by a dashed line type,
- Xrefs are not permitted.

11.0 GENERAL ARRANGEMENT DRAWING GUIDELINES

- Use a confirmed two-point datum system when tying into existing Facilities,
- If required, cable trays that are located above piping shall be shown with break lines,
- If required, piping that is located above cable trays shall be shown with break lines,
- If required, underground piping shall be shown by a dashed line type,
- Pipe racks, platforms and ladders/staircases shall be located with coordinates/dimensions and TOS elevations,
- Match line coordinates and drawing limits are marked clearly and are consistent with key plan drawing,
- If required, Xrefs are permitted,
- If required, Xrefs shall be inserted, using layer 0, at 0,0,0,
- If required, 2DREP command shall be used in layout space.

12.0 EQUIPMENT NUMBERING

Refer to Pembina's Standard Mechanical Flowsheet Symbology Sheet, E1.01-3-00100.

13.0 LINE NUMBERING SYSTEM

Refer to Pembina's Standard Mechanical Flowsheet Symbology Sheet, E1.01-3-00100.

14.0 INSTRUMENT TAGGING

Refer to Pembina's standard document, EG 4.102, Pembina Engineering Guideline – Instrument Tagging.

15.0 MECHANICAL FLOWSHEET SYMBOLOGY

Refer to Pembina's Standard Mechanical Flowsheet Symbology Sheet, E1.01-3-00100.

16.0 ELECTRICAL SYMBOLOGY

Refer to Pembina's Standard Electrical Symbology Sheet E1.01-3-00101.

17.0 PROCAD SETUPS AND SETTINGS

Use ProCAD layering and default set-up.

18.0 CADWORX SETUPS AND SETTINGS

The Pembina CADWorx environment is supplied by Pembina's Drafting group and is contained within a single folder that the end user is required to use for all Pembina CADWorx projects.

The environment is delivered as a .ZIP file. Extract this data to a central location where all users can access this information.

The folder contains several subfolders which contains essential information:

- Iso Folder – Pembina's preferred Isogen style for fabrication (use I-configure the map path)
- Plant Folder
    - Spec Folder
        - Pembina .prj files
        - Custom_PipeSupport
        - Custom_Topworx
        - Custom_Usershape
    - System Folder
        - .cfg file (edit to match the network location)

18.1 Catalog and Library Files

These files are the latest version and follow Pembina's specifications. Spec files are not to be modified and have been issued by Pembina as the current version.

18.2 ISOGEN Setup and Overview

A fabrication type iso style has been built and delivered by Pembina. This style was created using i-configure and is not to be modified without written consent by Pembina Drafting. This set up contains additional features including the attribute definition file, xlsm file that contains a macro to export the xls file to a csv file in the correct format, all positioning of attributes and BOM set up.

18.3 ISOGEN Isometrics

When creating isometrics from CADWorx using ISOGEN use the Pembina Isogen Template and the Pembina_D_ISO_title block. Title block must be in paper space.

18.4 Use of Attribute Files

The information required to produce isometric drawings is named isodata.xlsm. This requires the isodata file is filled in correctly.

	A	B	C	D	E
1	LINENUMBER	DRAWINGNUMBER	TITLE1	TITLE2	TITLE3
2	----------	----------	----------	----------	
3	4"-P-1000-AP1	ISO DRAWING 1	SAMPLE ISO TO SHOW ATTRIBUTES	TITLE 2	TITLE 3

The xlsm file is the master document. Changes made require you to update the file and then re-export the .csv file. The Macro executes this in the correct format. To export the file to a csv file hit CTRL+SHFT+S within the xlsm file. This will bring up a window to export the contents of the file to a format that isogen can read to populate the title blocks.

DO NOT MODIFY THE COLUMN ORDERS OR LINES 1 & 2 OF THE XLSM FILE.

The file name when exported must be named ISODATAPEMB.csv. If there is a need to use a different name for the csv file please contact Pembina Drafting for instructions on how to do this.

Do not modify any other files contained in the C:\CW_PEMBINA\ICONFIG\PEMBINA\PEMBINA_FAB folder. All changes to iso style must be done within i-configure and only with permission from Pembina.

18.5 Supporting File Setup

Custom components and custom supports have been included in zip file for use of predefined supports and equipment.

19.0 3D MODEL DEVELOPMENT

The purpose of this section is to detail the creation of 3D model drawings for new facilities.

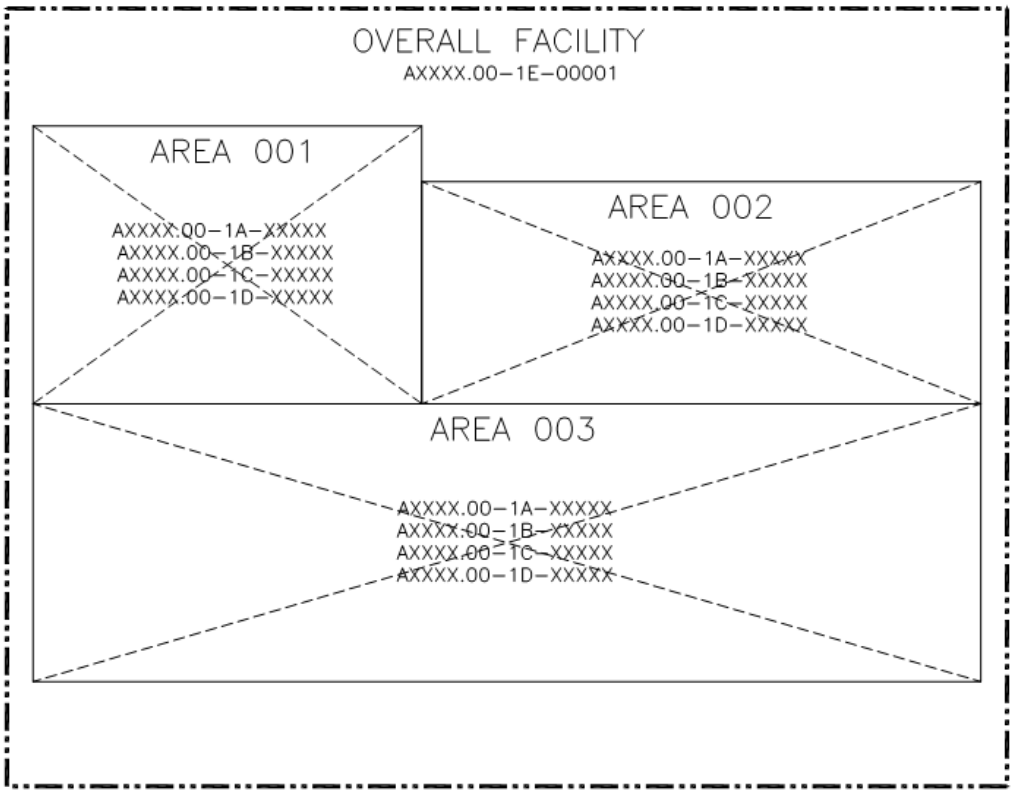
19.1 3D Model Drawing Number

3D models are separated by disciplines and by the area the model resides in and are assigned a unique number by Pembina's Document Control. Refer to TSU-TPS-DC-STND-STD-002.

19.2 3D Model Key Plan and Area Layout

New facilities shall have a Key Plan that outlines the area layout. An area is a natural or logical break of the site design. Within each area are the associated disciplines, these disciplines are defined by the controlled drawing number. The only exception being a Civil discipline designation which is not required to be split into areas and can be one single model per site.

Example:



19.3 3D Model Plant Coordinates

3D models created shall be drawn to the correct elevation and plant coordinates.

19.4 Creating General Arrangements Using 3D Models

General arrangement drawings are the only Pembina drawings permitted to have externally referenced files (Xrefs). Xrefs shall be inserted in model space at coordinate 0,0,0. As with all scaled drawings, all annotations are to be in paper space. Likewise, 3D models and Xrefs are to be 2D represented in paper space (2DRep command for CADWorx). Only the applicable Xrefs may be attached to the drawing, and all Xref links that aren't necessary must be detached.

19.5 3D Model Title Block

All models shall have Pembina's Standard title block inserted in paper space at coordinate 0,0,0, on layer 0. Where:

- TITLE MAJOR – Full Facility Name
- TITLE MINOR – Drawing Discipline
- DRAWING DESCRIPTION – Three Digit Area Number

- DRAWING NUMBER: Pembina Assigned Number

Pipeline Corporation		FULL FACILITY NAME PIPING AND INSTRUMENTATION MODEL AREA 001		
	DATE:	LSD XX-XX-XXX WXM	LEGACY NO. _	REV.
	SCALE:	DRAWING NO. AXXXX.00-1A-00001		0
	APPR. BY:			

The viewport within the title block shows the extent of the 3D model in plan view with no specific scale.

20.0 PREPARING AS-BUILT DRAWINGS

Refer to ESS 2.20, ESS 3.20 and ESS 4.20

21.0 OBSOLETE DRAWINGS

Drawings are Issued for Obsolete (IFO), at the next available hard revision, when the drawing is no longer valid in its entirety. Refer to Section 24.3 Obsolete Drawing Example ‘A’. A drawing may be IFO when the content is replaced by another and shall be updated to cross reference the new record. Refer to Section 24.3 Obsolete Drawing Example ‘B’. In paper space the text OBSOLETE shall be typed diagonally across the drawing in OPTIMAB font, at a height of 50 (or equivalent for imperial units).

22.0 DEMOLITION DRAWINGS

A Demolition Drawing is a separate drawing issued to represent assets or equipment to be removed from service. Demolition Drawings shall be issued in conjunction with the authenticated drawing that is Issued for Construction (IFC). Demolition Drawings are numbered as the (IFC drawing number)_DEMO and issued at the same revision as the IFC drawing.

Assets to be removed will be covered by a revision cloud filled with a 45° Hatch-lines on the Demolition Drawing. Refer to Section 24.5 Demolition Drawing Example.

23.0 CANCELLED DRAWINGS

Drawings are Issued as Cancelled, at the existing revision of the cancellation, when the content is no longer valid due to a change in scope or design. In paper space the text CANCELLED shall be typed diagonally across the drawing in OTIMAB font, at a height of 50 (or equivalent for imperial units). Refer to Section 24.6 Cancelled Drawing Example.

24.0 APPENDICES

24.1 Drawing Checklist

A quick review to ensure the drawings are setup and completed correctly before returning to Pembina

1.0 SET-UP CHECKLIST

- ❑ One layout tab per drawing
- ❑ Ensure layout tab is named: Layout1
- ❑ Install font styles OPTIMAB.shx and ARIAL.ttf
- ❑ All Xref shall be inserted at 0,0,0 on Layer 0
- ❑ Insert Pembina Pipeline Standard title block at 0,0,0 in the Layout1 tab
- ❑ Follow Pembina's preferred software layering system
- ❑ PSLTSCALE: 0
- ❑ LSTSCALE: 10 X drawing scale

2.0 DRAWING CHECKLIST

- ❑ Never modify or explode the title block
- ❑ All objects are created on their proper LAYERS
- ❑ Drawing content is created in model space (except 2DREP)
- ❑ Title block, viewports, are created in paper space
- ❑ Drawings with scale factor viewport - dimensions and annotations are created in paper space
- ❑ Revision clouds and revision number triangles are in paper space and shall not be removed until verified as as-built.

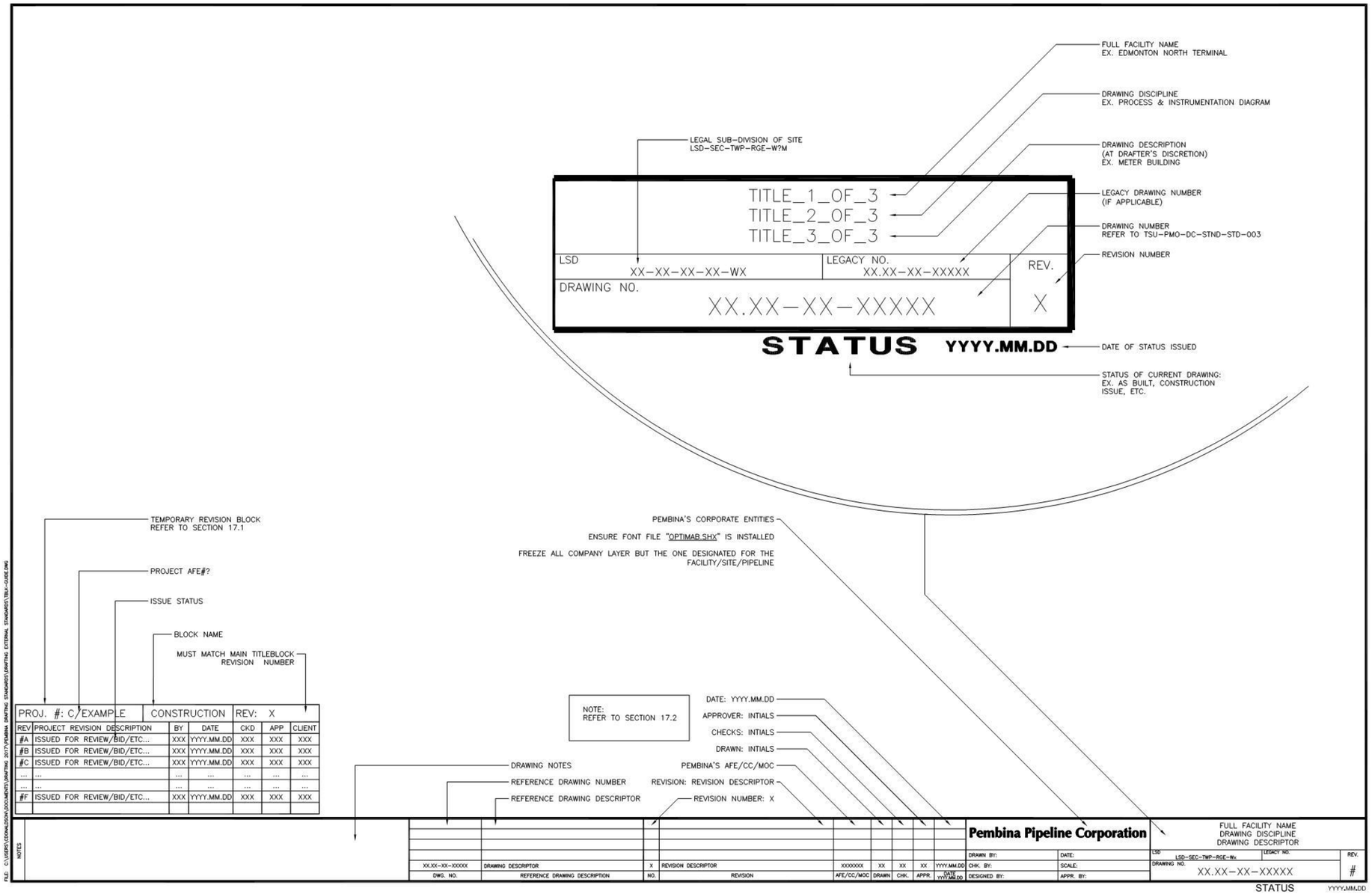
3.0 HANDOVER CHECKLIST

- ❑ CAD drawings are saved as 2013 version
- ❑ PURGE all unused layers and contents
- ❑ EMBED any raster images
- ❑ Detach all electronic Engineering and Permit Stamps
- ❑ Remove Internal Temporary Revisions and block PPC_CONSTR_BLK.dwg
- ❑ All reference drawings are included in the Handover
- ❑ All related Xrefs are to remain attached
- ❑ Detach any unrequired Xrefs
- ❑ Title block Attributes filled out correctly

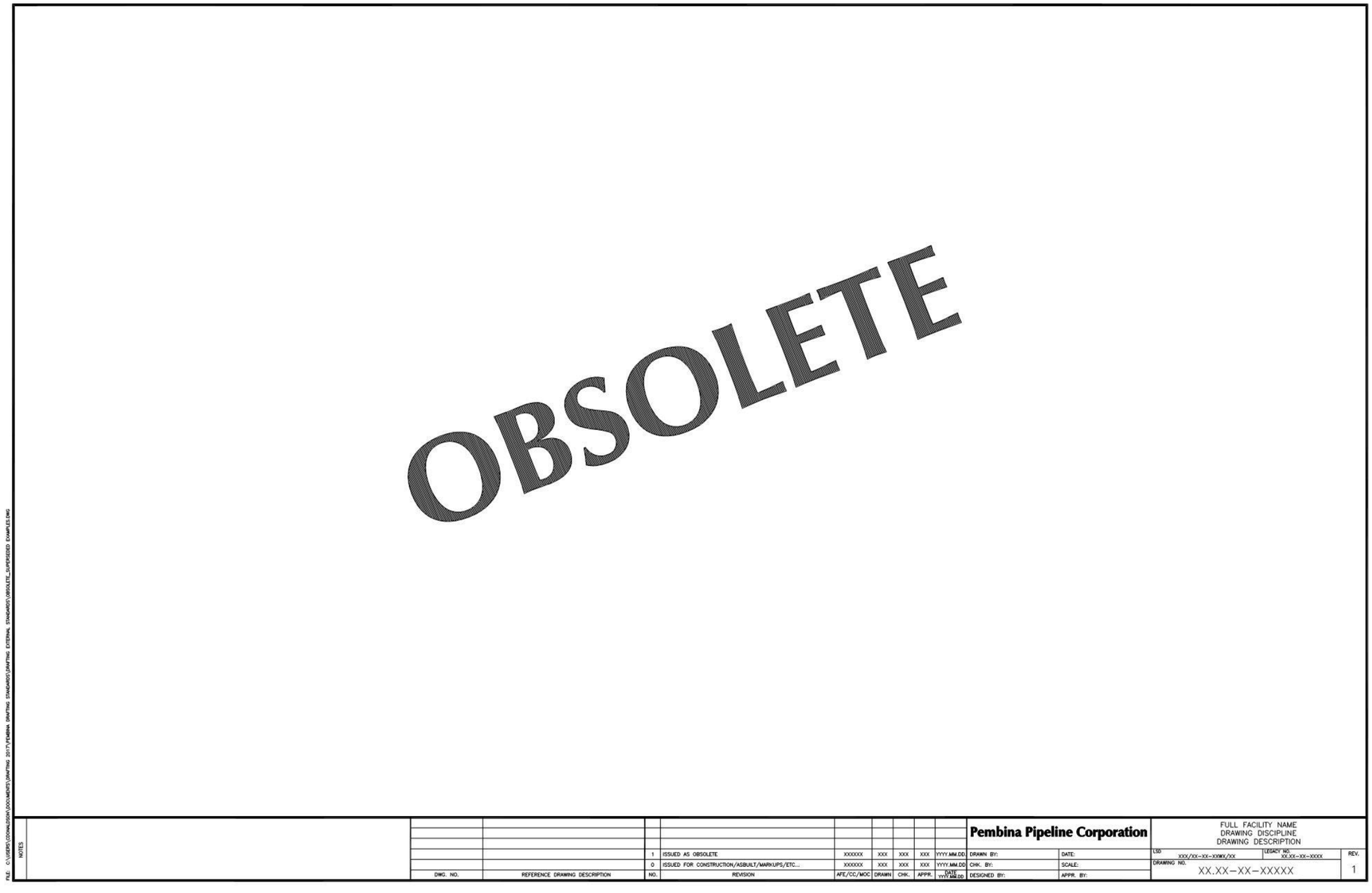
4.0 CADWorx Drawings

- ❑ 2DREP (solids-and-centerlines) all viewports in paper space
- ❑ Turn off the display viewport

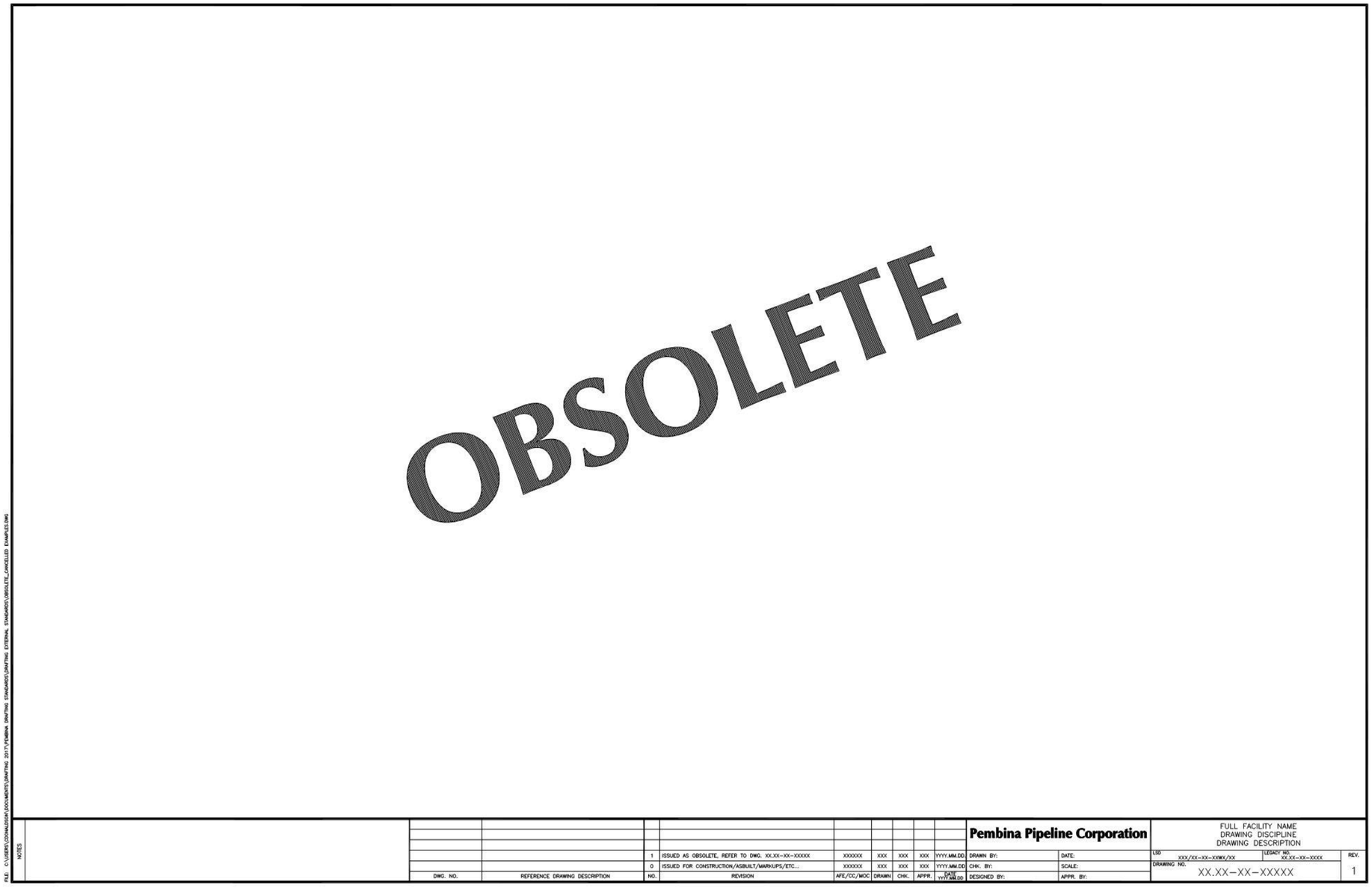
24.2 Title Block Quick Reference



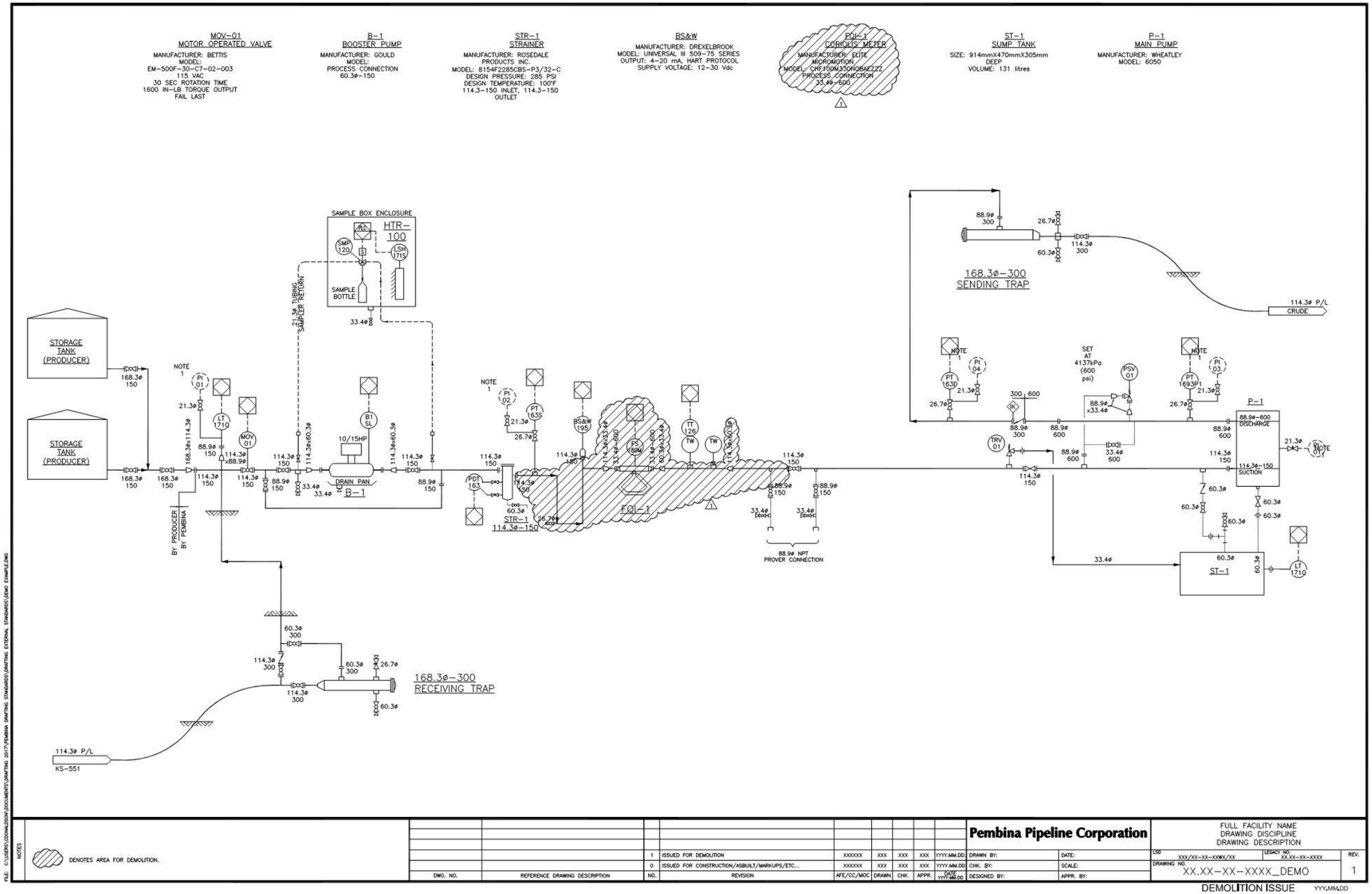
24.3 Obsolete Drawing Example ‘A’



24.4 Obsolete Drawing Example ‘B’



24.5 Demolition Drawing Example



24.6 Cancelled Drawing Example