ONTARIO POWER GENERATION	Engineering & Technical Services	Internal Use Only	
		Document Number: ENG-STD-004	Page: 1 of 64
		Effective Date: Dec. 20, 2016	Revision: 01

Title:
Drawing Presentation Standard and Practices

Applicability (RGPM, Hydro or Thermal):	Associated Document9s)	SCI Number
RGPM	ENG-PRC-051, ENG-MAN-015	01160

STANDARD

PURPOSE

The purpose of this document is to provide the standard for preparing engineering drawings and associated data by OPG Renewable Generation & Power Marketing staff and contracted Suppliers.

AUTHORIZATION

This document was approved electronically by SharePoint workflow:

Recommended by: Jane Travers, P.Eng.
Sr. Manager, ETS Support Services
Engineering & Technical Services, RGPM

Approved by: Robby Sohi, P.Eng.
VP, Engineering & Technical Services
Renewable Generation & Power Marketing

REVIEW/CONCURRENCE

Document Reviewers:	Division/location
ETS and PES Managers	
Technical and Production Support Managers	CO, EO, NAO, NEO, NWO
Production Managers	CO, EO, NAO, NEO, NWO
Project Managers	CO, EO, NAO, NEO, NWO

CONTENT AUTHORITY		ACCOUNTABLE DEPARTMENT/DIVISION
Name:	Arif Indawala	ETS Support Services Engineering & Technical Services, RGPM
Location:	Kipling	
Telephone No.:	416-231-4111 ext. 4184	

NOTE: PLEASE DIRECT INQUIRIES ABOUT THE DOCUMENT TO THE CONTENT AUTHORITY

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1. INTRODUCTION

1.1 General - Purpose of Document

The purpose of this standard is to:

- Identify the requirements, responsibilities and activities in the initiation, production, revision, review, approval and/or acceptance, registration, distribution and filing of Engineering Drawings by Ontario Power Generation Renewable Generation & Power Marketing (OPG RGPM) personnel.
- Ensure engineering drawings are prepared, reviewed, approved/accepted, registered, issued and filed in a consistent manner.

This standard pertains to all engineering drawings, including the handling of and processing of Contractor and Manufacturer submitted drawings.

The management of drawings and associated drawing files is determined by OPG Engineering & Technical Services (ETS) procedures and associated Plant Operations procedures. The procedures cover the entire lifecycle of a drawing:

- ENG-STD-004 Drawing Presentation Standard and Practices.
- ENG-PRC-051 Drawing Management and Services.
- ENG-MAN-015 Contractor-Submitted Drawing Requirements.
- ENG-STD-003 Units of Measurements for Imperial – Unit Sites.

For the purposes of this document, persons preparing drawings will be referred to as a Draftsperson. While their actual job title will be different, they will be performing duties generally associated with the role of a Draftsperson.

1.2 Drafting Objectives

Following are the drafting objectives:

(1) To produce new or revised drawings and other media for engineering design in an acceptable quality and in such quantities as the scheduled work load demands.

(2) To produce all official drawings in electronic format.

(3) To establish and utilize uniform and economical drawing practices.

(4) To maintain identification and numbering systems for effective filing, referencing and retrieval of drawing information.

(5) To use presentation methods and techniques such as models, isometric view, photos, overlays, schematics and standard symbols to improve understanding of drawings.

(6) To incorporate new developments, techniques and reproduction processes where advantageous.

(7) To utilize standardized design practices to ensure clear, concise and consistent technical presentation of all drawings.

(8) To ensure design and data are depicted accurately.

(9) To issue completed work and information to meet established schedules.

(10) To preserve existing presentation when revising drawings, unless the revisions are so extensive the preparation of a new drawing to current practices is justified.

(11) To utilize and adhere to all legal authorities, statutes, regulations and practices.

(12) To maintain this standard by participating in its on-going development and maintenance.

2. DOCUMENT MANAGEMENT

2.1 Drawing Submittals

This section describes the requirement for producing a hard copy and an electronic copy of drawings for drawing management.

2.1.1 Hard Copy

Hard copy drawings are to be plotted, full size at the correct scale, black and white on 20-lb bond paper or approved equal. It is used for the purposes of obtaining drawing approval signatures/initials and creating the official corporate record, i.e. pdf of the drawing.

2.1.2 Electronic Copy

AutoCAD files are to be named in accordance with Section 3.3.2 Electronic File Naming and Numbering Convention.

Electronic copies (.pdf, .dwg, .mil, .tiff, .docx, .xlsx, etc.) are submitted to Records, together with the hard copy, for registration and archiving purposes.

2.2 Revision of Drawings

After a drawing has been approved, issued and distributed, it may be necessary to make changes to the original or subsequent issue. This section sets out the rules and principles to be used in such work.

When revising drawings, existing presentation will continue unless the revisions are so extensive, the preparation of a new drawing to current practices is justified.

The revised AutoCAD drawing file(s) shall include electronic initials and dates in the previous issue blocks.

2.2.1 Conditions for Revision

Following are the conditions for revision:

(1) The need to add, delete, alter or correct any approved issued drawing information including related to Engineering Change.

(2) When the purpose of issue changes, such as 'ISSUED FOR TENDERING' changed to 'ISSUED FOR CONSTRUCTION.

(3) Any modification or addition by OPG RGPM to a Manufacturer's drawing, whether or not general issue is intended.

(4) Drawings identified as Obsolete or Superseded.

2.2.2 Principles of Revision

The conditions of revision may require use of the principles outlined below:

(1) Before revision work commences, the general condition of each drawing file should be examined. The purpose is to judge the suitability of the drawing for further work or replacement.

(2) In most instances, an unwanted portion of the drawing will be deleted. However, when warranted, an alternative to deletion is hatching over the unwanted portion and marking it as 'SUPERSEDED' or 'ABANDONED, 'NOT REQUIRED', etc.

(3) The revision 'particulars' must suit the following intentions:

- Be brief, descriptive and accurate.
- Inform the user of new requirements and/or extent of changes made. With the use of 'revision arrows', the particulars may be quite short in description.
- Assist the user in comparing the revision with previous issues of the drawing.
- Inform the user of the source of the request to revise the drawing, such as engineering change request, as-built conditions, field-marked prints, client request no., etc.

(4) Sample of revision particulars:

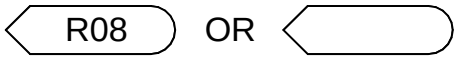
'ISSUED FOR CONSTRUCTION'

'ISSUED TO ACCOMPANY SPECIFICATION…'

'REVISED TO AGREE WITH FMP…'

'ADDED OPG TITLE, NOTES AND REFERENCE DWGS'

(5) Revision arrows in the following form, found in the OPG RGPM AutoCAD menu as a standard drawing symbol, permit highlighting of drawing changes:



They are to be placed adjacent to the appropriate views, notes or tables. Use good judgement in determining that the number of such arrows does not become excessive and confusing.

(6) Any arrows of the immediate past revisions may be left on the drawing if the record of previous changes is required, such as incomplete work. Otherwise, all revision arrows related to previous revisions are to be removed.

(7) During revision work, the Draftsperson and/or Engineer have the obligation to recognize the need to alter other drawings, bills of material, cable/valve list, etc. Through job knowledge and inter-group coordination, it may be realized all affected drawings have not been specified. When the Draftsperson identifies this need, he/she will advise/consult with the Engineer and arrange for other affected drawings to be revised.

(8) In some cases, it may be necessary to highlight revisions by ‘clouding’.

(9) Care should be taken on revising drawings that have the seal of a Professional Engineer to ensure the seal is not carried forward onto the next revision (i.e. the seal is to be removed).

2.2.3 Drawing Holds

A 'hold' is placed on an area of a drawing that is incomplete or where the information is not confirmed when the drawing must be issued. The 'hold' shall be made as follows:

(1) Outline the area with ‘clouded type’ lines on the drawing and add the word 'HOLD' within the outline.

(2) Add a revision arrow to the drawing, as in Section 2.2.3, and a note 'HOLD ADDED' to the revision column.

When the 'HOLD' is removed:

(1) Erase the outline of the area and the word 'HOLD' from the drawing.

(2) Add a new revision arrow symbol, as outlined in Section 2.2.3 and a note 'HOLD REMOVED' to the revision column.

(3) Re-issue the drawing at the next revision number.

2.2.4 Obsolete and Superseded Drawings

2.2.4.1 Obsolete Drawings

An obsolete drawing is a registered drawing which is no longer required. An obsolete drawing number must never be re-used, (i.e. the equipment/system the drawing represents is now obsolete and has been permanently removed from service).

The decision to make a registered drawing obsolete shall be agreed upon by the responsible Engineer and the Draftsperson.

The procedure of making a drawing obsolete shall be treated as a regular drawing revision with appropriate changes made to the revision number, application of `OBSOLETE' stamp and pertinent notes in the revision column of the drawing.

OBSOLETE		
PROJECT		DATE
BY	CHECKED	AUTHORIZED

2.2.4.2 Superseded Drawings

A superseded drawing is a registered drawing that is being replaced by a new drawing and drawing number. A superseded drawing number must never be re-used.

The procedure of superseding a drawing shall be treated as a regular drawing revision to the old drawing with appropriate changes made to the revision number, application of `SUPERSEDE' stamp and pertinent notes in the revision column of the superseded drawing.

SUPERSEDED		
SUPERSEDED BY DWG		
PROJECT		DATE
BY	CHECKED	AUTHORIZED

2.2.5 Revised and Redrawn Drawings

A revised and redrawn drawing is an old drawing which is being replaced by a new drawing with the same drawing number.

The new drawing shall have the next subsequent revision number with a note in the revision column, (i.e. R08 REVISED AND REDRAWN).

2.2.6 Drawing Number Change

A drawing should be superseded when the drawing number is changed, as in Section 2.2.4.2.

2.3 Drawing Presentation Standard and Practices Revision Procedure

There will be a review committee consisting of a representative from each Plant Operations office, and as chairperson, the Senior Technical Officer - Drafting, OPG RGPM ETS or delegate. The representatives on the review committee, if possible, should have expertise in the three primary engineering disciplines.

Proposals to revise the document will be submitted to:

(1) The representatives of the Draftsperson(s) in the Plant Operations affected by the change.

(2) The Senior Technical Officer - Drafting, RGPM ETS for changes to the GENERAL and REQUIREMENTS COMMON TO ALL DISCIPLINES.

The proposed changes are to be reviewed by (1) and (2) and if found acceptable, circulated to all Plant Operations for comments. Comments are to be returned to the Senior Technical Officer - Drafting, or delegate.

For change proposals acceptable to all Plant Operations, the Senior Technical Officer - Drafting or delegate will issue instructions to implement the change, revise this document, OPG RGPM AutoCAD Standards and the AutoCAD menu, if required.

3. REQUIREMENTS COMMON TO ALL DISCIPLINES

3.1 Drawing Presentation - General

This standard shall be considered in all drafting assignments and is to be applied to the full extent possible. Other documents have standard elements which support this particular document.

The design decisions represented in work instructions may determine the type and amount of information which is shown in a new set of drawings. Good drawing presentation should be planned to clarify and amplify the design information.

Personnel preparing drawings are to determine suitable drawing presentation and ensure it is being utilized. Such consideration should be from assignment of work to completion of the drawing.

3.1.1 Principles of Drawing Presentation

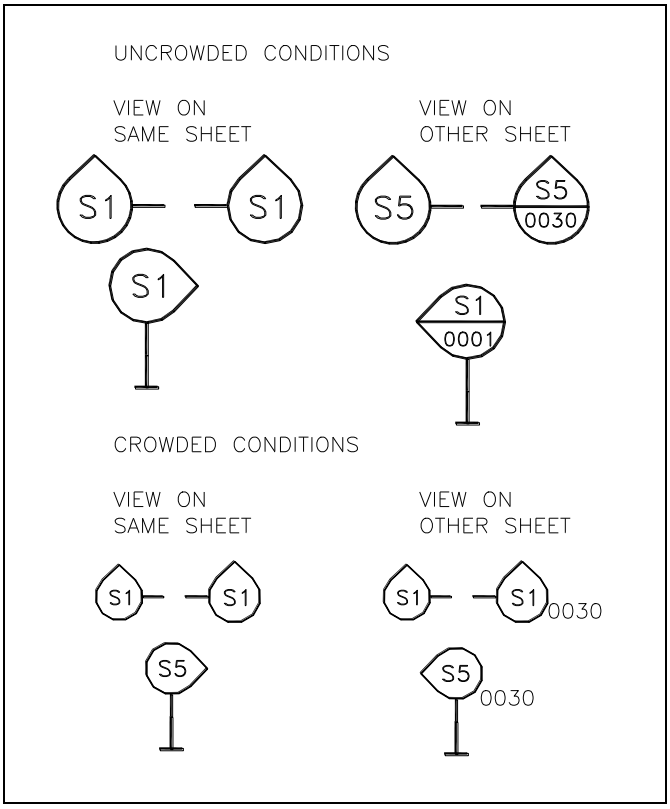
The following items are acceptable in all drafting disciplines unless specific exceptions are shown.

(1) ORTHOGRAPHIC PROJECTION, third angle, will be used when developing several plane views of an object. The normal arrangement of views will be as follows:

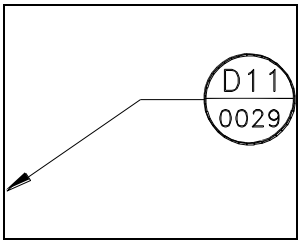
LEFT SIDE	TOP	RIGHT SIDE	BACK
	FRONT		
	BOTTOM		

An alternative to the BOTTOM view is a reflected plan view, for such locations as the underside of concrete slabs or ceiling presentation.

(2) CUTTING PLANES (SECTION ARROWS) to develop object views will be designated with the following basic symbol.



(3) DETAIL DESIGNATIONS on drawings are shown by the following symbol:



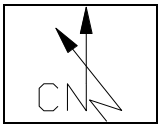
(4) SCALE DESIGNATION; refer to Section 3.3.7.

(5) ORIENTATION of a plan on a new drawing is derived from the following principle:

- Within the project, the north point will appear at the top of the drawings and EITHER the left OR right side, as decided for the project
- On Hydro projects, upstream is normally at the top of the drawing.

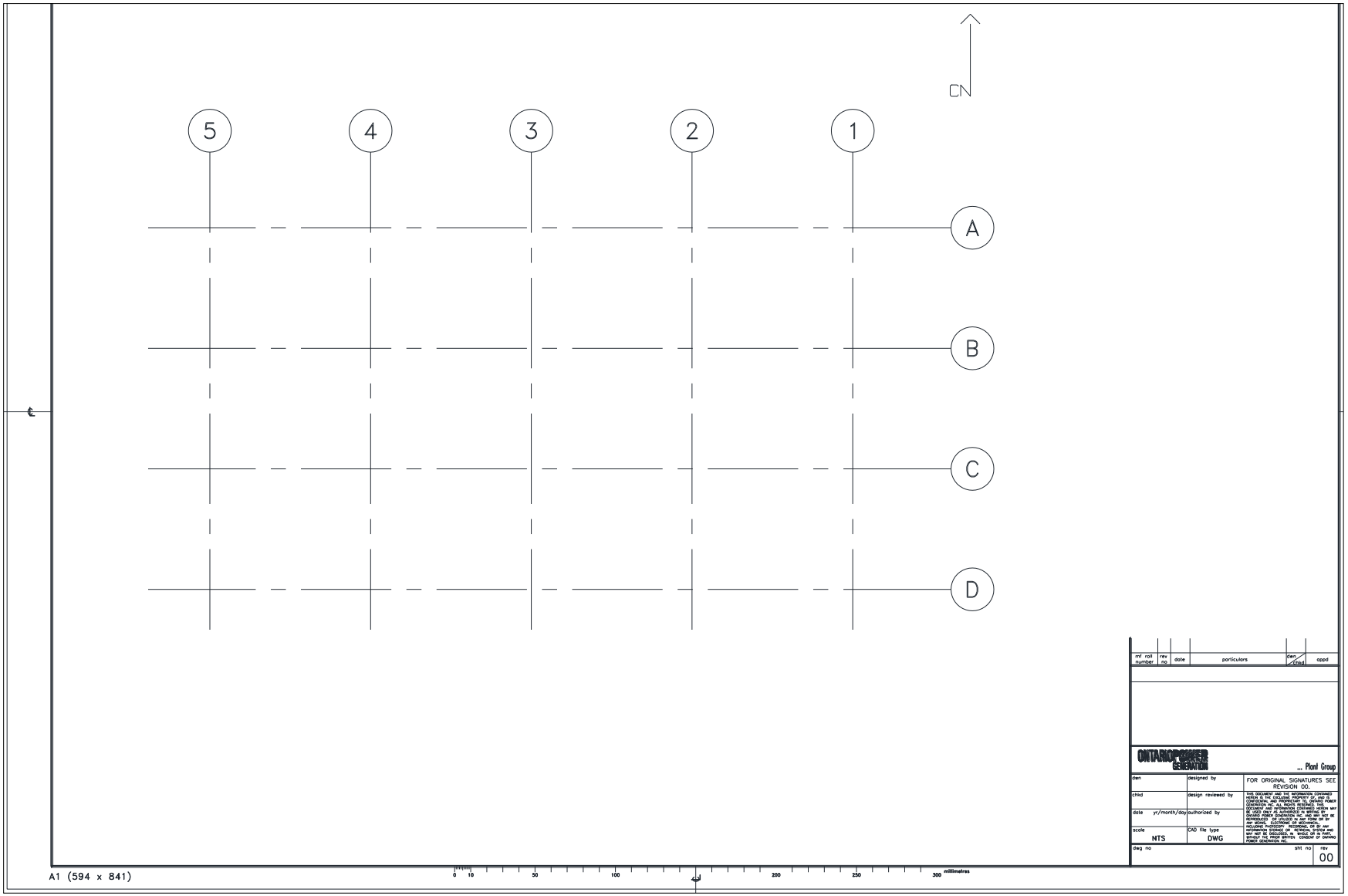
All plan views on one drawing should have the same orientation. If this cannot be achieved, the variations must be clearly noted by arrows and/or title description.

(6) NORTH and CONSTRUCTION NORTH on working drawings is a convenient way of organizing drawing orientations. It is shown perpendicular to that drawing side which is 'north'. Once established on a key drawing with relation to true north, the construction north arrow is frequently the only orientation required:

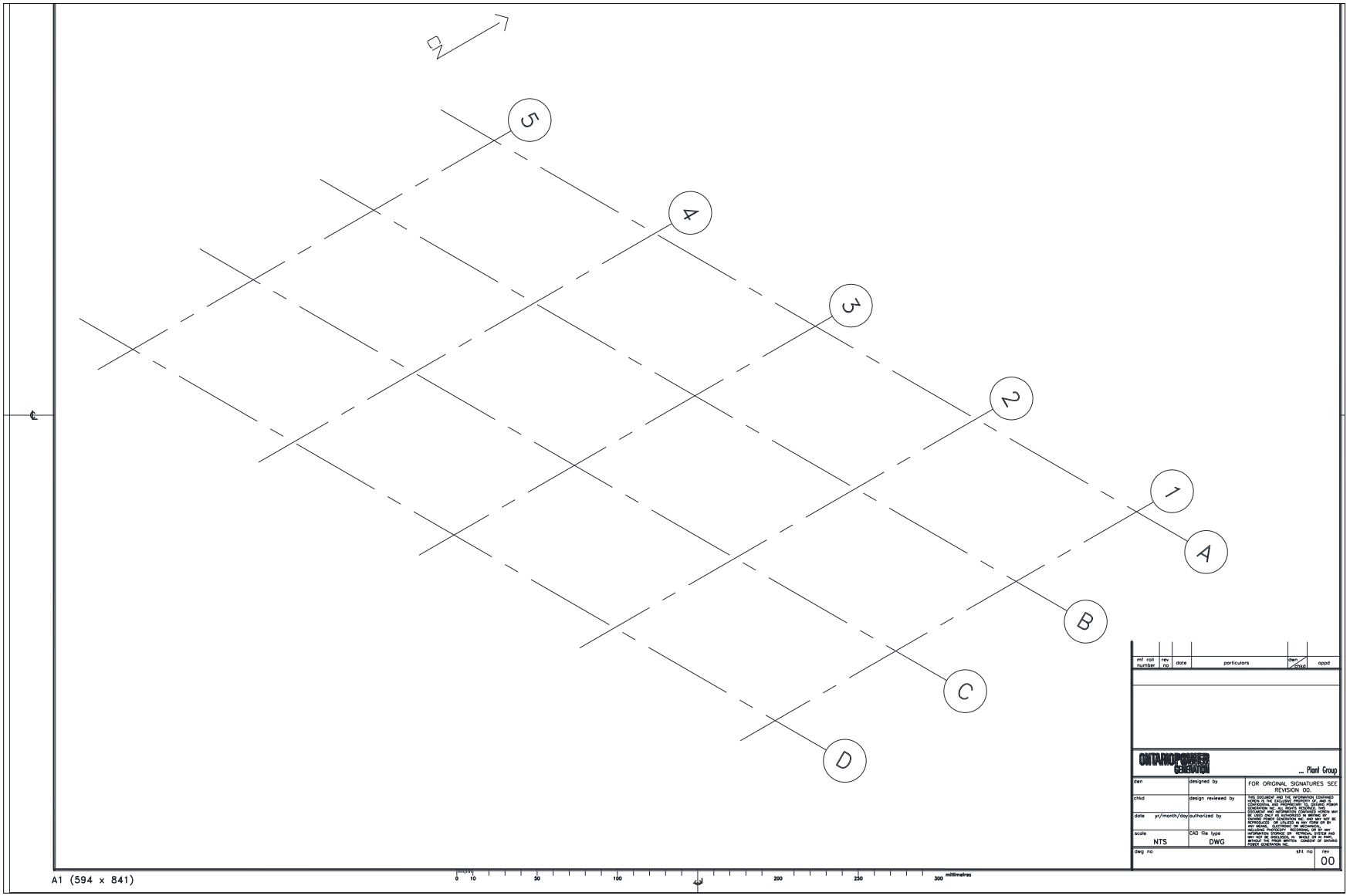


The true north arrow is added when needed.

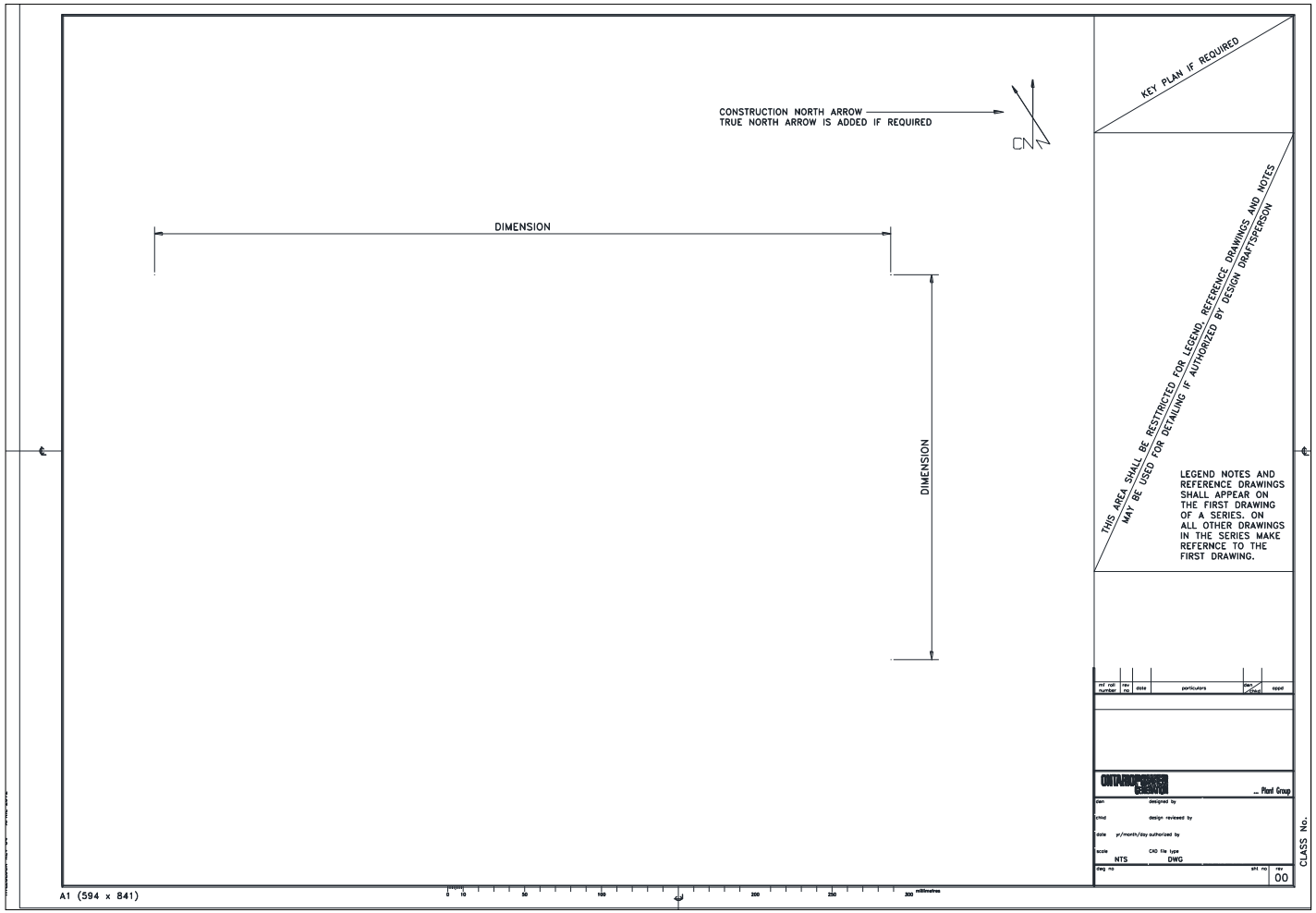
(7) COLUMN GRID DESIGNATIONS on orthographic drawings are to be as shown:



(8) COLUMN GRID DESIGNATIONS on isometric drawings are to be as shown.



(9) DRAWING LAYOUT and surrounding alpha-numeric information is detailed to suit the intended position of the viewer:



VIEWER

(10) NOTES should not be located within the drawn object or system, unless necessary to avoid ambiguity.

(11) KEY PLANS - When the plan on a specific sheet is a part only of a larger plan or complex, a small scale key plan shall be placed on the sheet in the designated area in the upper right hand corner of the drawing sheet. The location of the key plan on the sheet shall be uniform for all sheets in one set. The key plan shall be shaded or crosshatched to indicate the portion concerned with respect to the whole plan.

(12) LEGENDS, REFERENCES AND NOTES should be organized into separate presentations on the right side of the drawing sheet, see Item (9).

(13) REFERENCES listed on a drawing will vary for a number of conditions:

- References should include such primary drawings as flow diagrams, survey plans or basic arrangements which will assist the user in understanding and performing the required work.
- Within sets of drawings, a cross-reference by number and/or title at a view may be clear and sufficient. Such detail then need not be repeated in the reference listing, (optional).
- When there are many complex drawing sets, references should include the project drawing list or index.

(14) WORK RESTRICTION CONSIDERATIONS that apply to the design and detail should be shown on the drawing. These include such features as:

- Working or safety clearances
- Limits of contract
- Limits of ownership
- Material availability
- Reservation of space or equipment/material.

(15) TYPICAL VIEWS when clearly designated may simplify the work of the draftsperson and the drawing user. 'Typical' infers considerable repetition of a work method, or material usage. There is some understandable difference in each application.

3.1.2 Functional Drafting

FUNCTIONAL = SIMPLE + CLEAR PRESENTATION

The basic principles are:

- Avoid repetitive, artistic and unnecessary views and/or details.
- If it is easier to describe, don’t draw it.
- Apply symmetry wherever applicable.
- Take full advantage of standard symbols.
- Adopt and modify, copy and/or refer to existing drawings.

3.1.3 Drawing Format and Layout

(1) Plan drawings carefully to utilize drawing space effectively and avoid crowding.

(2) View information on drawings as a system of storing, preserving and readily accessing engineering information, rather than representing only the communication of an engineering concept.

(3) Draw full size all data using Computer Aided Drafting (AutoCAD) system.

(4) Orient all plans and part-plans in the same direction as the overall site plan.

(5) Include a key where appropriate, to enhance the understanding on the drawing. Show the area being detailed on the drawing, hatched or emphasized and with grid lines and bubbles shown for the boundaries of the plan.

(6) Draw details with the same orientation as the original view.

(7) Identify sections and details by numerical sequence preceded by alphabet, e.g. S1, S2, D1, D2, etc.

3.2 Unit of Measurement

For new facilities, the SI unit of measurement is the governing unit for this document with reference to imperial units where necessary.

The use of the imperial unit of measurement is reserved for drawings that have been created using this system of measurement. See ENG-STD-003 Units of Measurement for Imperial - Unit Sites.

3.3 Standard Drawing Requirements

3.3.1 Electronic Drawing File Format

File types supported and maintained by drafting on a day-to-day operation follow.

3.3.1.1 Vector Data Files

Vector data is a group of mathematical equations that generate drawing entities such as lines, circles or text strings. This is the type of data produced by the drawing application software such as AutoCAD by Autodesk.

AutoCAD is the only approved and supported application software for creating and editing vector data.

AutoCAD is also the base platform for many engineering applications that facilitate drafting as well as engineering functions such as AutoCAD Mechanical, AutoCAD Civil 3D, Autodesk Revit MEP, etc.

For details and usage, see AutoCAD's Help File and User's Manual.

3.3.1.2 Raster Data Files

This is the type of data produced when an original drawing (hard copy) is scanned. A scan is an electronic representation of the information portrayed on a drawing by a series of dots (pixels) at a given image density or resolution, i.e. 200 dpi (dots per inch).

AutoCAD Raster Design is the only approved standard application program for editing scanned images (raster data).

Raster Design allows raster editing, saving and plotting of CALS Group 4 (mil), Image Systems Group4, and CCITT Group4 TIFF files, etc. (monolithic, stripped, and tiled).

Moreover, it is an interactive raster editor program, which is used to bring raster and vector data together for the user to view and edit scanned images and AutoCAD drawings simultaneously on the same screen.

For details and usage, see Raster Design's Help file.

3.3.1.3 Alternative File format for Lists (e.g. cable, valve, indices, etc.)

The excel spread sheet (.xlsx) is an alternative file format for creating lists/databases such as cable, valve, etc.

3.3.2 Electronic File Naming and Numbering Convention

Electronic file identification of the drawings follows the format for drawing numbering with the addition of the revision number and file format extension of the vector and/or raster data.

AutoCAD files will be named in accordance with the following examples:

- The filename will incorporate the Property/Operating designation, Site or River number, actual drawing number, sheet number if applicable and revision number.
- The filename will be revised each time the drawing is revised, (i.e. "Save As …") to correspond to the revision number on the drawing.
- In the case of hybrid drawings, the associated raster file will be named the same as the AutoCAD file but with a .mil extension. In order to create the correct association for hybrid files, perform an "Image, Write, Save As …" in Raster Design. Image file shall be embedded whenever possible to reduce the housekeeping of the files.

Note: Simply editing, (i.e. 'renaming'), the raster filename, will not create the correct association.

The following examples are based on a hybrid drawing. For pure AutoCAD drawings, there will be no .mil file.

River Type	119-d-254-R01.dwg
	119-d-254-R01.mil
Original Old Site Type	NA9-621-e-4325-R03.dwg

	NA9-621-e-4325-R03.mil
Original ES Type	NA9-58192ES-R03.dwg
	NA9-58192ES-R03.mil
SCI Type	NA9-D1S-64200-0005-R03.dwg
	NA9-D1S-64200-0005-R03.mil
	NA9-L4S-64200-0005-R03.xlsx
With Sheet Numbers – All Types	NA9-59128ES-0004-R03.dwg
	NA9-59128ES-0004-R03.mil
	NA9-D1S-64200-0005-0002-R03.dwg
	NA9-D1S-64200-0005-0002-R03.mil

The Property/Operating designation, Site or River number will prefix all original drawing number types. The revision, and if it exists, sheet number; will be added as a suffix, separated by hyphens. No spaces are to be used in the filenames.

3.3.3 Drawing File Storage

Following is the suggested file folder structure for Drafting and Records. Similarly named or additional folders may be required.

3.3.3.1 Drawings - Active Folder

This is a main storage folder used by drafting staff for all active and current working drawing files.

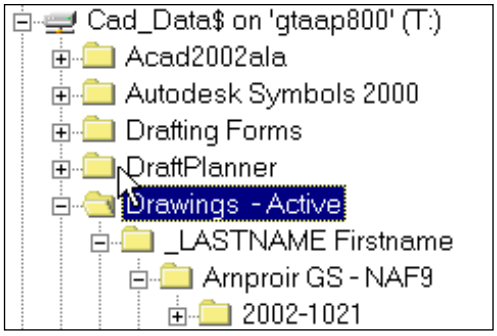
This folder holds sub-folders based on:

(1) Draftsperson name (LAST NAME - First Name)

(2) Station name (Station name - Property number)

(3) Request for Drafting ID number (Year - Request number) or Project Number.

Example:



All drafting, related to the request, will be done in this folder. Files are not to be stored in any other location. Folder names and formats are not to be changed.

3.3.3.2 Drawings - Transfer Folder

This is a common interface folder for Drafting and Records staff.

(1) Transfer files from Records to Draftsperson Folder

A storage folder where Records deposits the requested drawing files that are charged out from the document management system for editing by drafting staff.

This folder holds sub-folders based on:

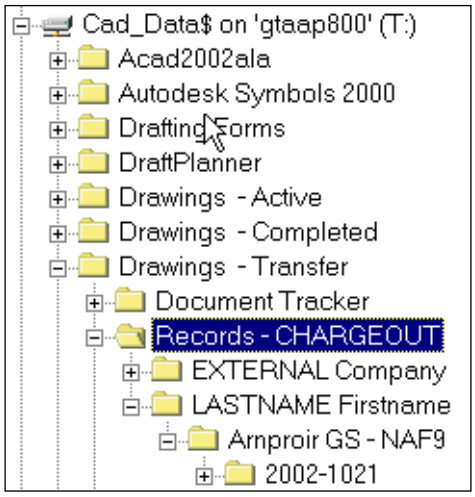
(a) Records - CHARGEOUT

(b) Draftsperson name (LAST NAME First Name)

(c) Station name (Station name - Property number)

(d) Request for Drafting ID number (Year - request number).

Example:



(2) Transfer Completed Work Files to Records Folder

This is a storage folder where Drafting staff deposit the approved drawing files for issue/release to Records.

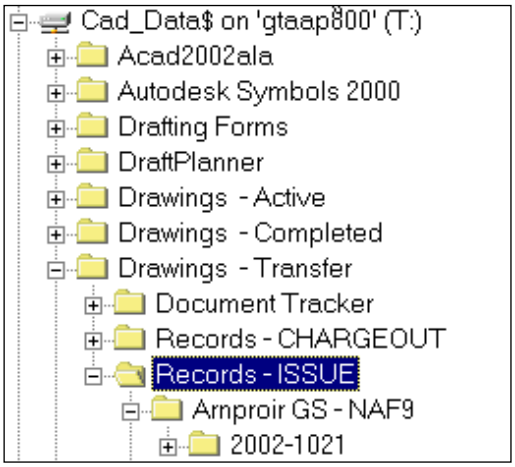
This folder holds sub-folders based on:

(a) Records - ISSUE

(b) Station name (Station name - Property number)

(c) Request for Drafting ID number (Year - request number).

Example:



3.3.3.3 Others

As required to manage electronic data, software, etc. within drafting, such as storing and archiving into CDs, DVDs, etc.

3.3.4 Drawing Sheet Sizes

3.3.4.1 Metric Sheet Sizes

The metric 'A' series paper sizes are based on a sheet having an area of one square metre,

(841 x 1 189 mm) and designated A0. All other sizes in this series are derived by successively dividing the A0 sheet into two equal parts, as shown on the table below.

An intermediate sheet size 'B1' (707 x 1 000 mm) is provided to bridge sizes between A0 and A1.

Table 1 - Metric Sheet Sizes (Standard Border Size)

Dwg Sheet Size Desig	Ident in Dwg No by	Dimensions (W x L), mm			Borders, mm		
		Cut Sheet	Trim Line	Dwg Frame	Top & Bot	LHS	RHS
A0	0	860 x 1220	841 x 1189	801 x 1133	20	40	16
A1	1	610 x 860	594 x 841	566 x 801	14	28	12
A2	2	430 x 610	420 x 594	400 x 566	10	20	8
A3	3	305 x 430	297 x 420	283 x 394	7	20	6
A4	4	305 x 215	297 x 210	283 x 184	7	20	6
B1	5	724 x 1025	707 x 1000	679 x 960	14	28	12
Other	X	As required			As required		
Tolerances:	A0 to A3 and B1:	-0 + 2 mm			A4:	-0 + 1 mm	

Extra long drawings, such as power and communication line route maps, must have widths coinciding with the 'A' series widths.

3.3.4.2 Imperial Sizes

All imperial sheet sizes are obsolete except * 'A' and * 'B' sizes. Table 2 is included for reference only. For report printing, it is acceptable to use 'A' (letter) and 'B' (ledger) size drawings.

Table 2 - Imperial Sheet Sizes (Standard Border Size)

Dwg Sheet Size Desig	Ident in Dwg No. by	Dimensions (W x L), inches			Borders, inches		
		Cut Sheet	Trim Line	Dwg Frame	Top & Bot	LHS	RHS
A*	4	9" x 12"	8 ½" x 11"	8" x 10 ½ "	½"	¼"	¼"
B*	3	12" x 18"	11" x 17"	10 ½" x 16 ½"	½"	½"	½"
C	2	18" x 23"	17" x 22"	16 ¼" x 21 ¼"	½"	½"	½"
D	1	24" x 36"	22" x 34"	21" x 33"	1"	1 ½"	1"
E	0	30" x 48"	28" x 46"	27" x 45"	1"	1 ½"	1"
F	5	30" x 42"	28" x 40"	27" x 39"	1"	1 ½"	1"
Other	X	As required			As required		

Tolerance: 6 1/32"

3.3.5 Drawing and Document Numbers

Drawing numbers are developed from the appropriate Station and/or Project System Classification Index (SCI).

This section provides the method to be used when applying the SCI to all engineering documents.

All documents shall be identified with the appropriate file/account numbers derived from the SCI in order to provide a basis for efficient management information systems.

For the latest governing documents, see OPG-PROC-0019 Records and Document Management.

3.3.5.1 Definitions of Terms

(1) System Classification Index (SCI) Number - A five digit numeric code used to identify, from the general to the specific, those portions of an engineering entity designed, constructed and placed into service.

(2) File Number - A unique compilation of alpha and/or numeric codes designed to facilitate the filing and retrieval of documents. The number consists of property or river or site and system numbers.

(3) Property or River or Site Number - A unique number assigned to an OPG asset such as generating station, river system, service centre, etc.

(4) Document - Any memo, letter, drawing, report schedule, tender, or contract produced within or outside of OPG RGPM, directly or indirectly dealing with an engineering entity which bears a property or river or site number.

(5) Document Type - An alphabetic code used to identify the various types of documents.

(6) Document Source - An alphabetic code used to identify the originators of a document produced within or outside of OPG RGPM.

(7) Serial Number - A sequential order of numerics assigned to all documents within the Document Type or Source and SCI Number.

(8) Revision Number - A sequential order of two numeric values assigned to each document to establish and record the sequence in which revisions are made.

(9) Document Size - An alphabetical or numerical code used to identify various sizes of document for filing purposes. Recognized document sizes are:

Imperial Sizes	ISO Sizes	Dwg Size Identifier
A	A4	4
B	A3	3
C	A2	2
D	A1	1
F	B1	5
E	A0	0
X	X	X

(10) Sheet Number - A field of up to four numeric characters indicating a specific sheet to be used only with alpha/numeric documents.

3.3.5.2 Index Application

For purposes of explanation, a drawing issued as an example of a SCI number and other pertinent data applied to a document identification code is contained within a twenty-two-character field, allowing for the inclusion of the following code elements (see Figure 1):

(1) Property or River or Site Number

(2) Document Type

(3) Document (paper) Size

(4) Document Source

(5) SCI Number

(6) Serial Number

(7) Sheet Number (if applicable)

(8) Revision Number

The order of elements listed above should be strictly adhered to when preparing an identification code. In cases where all the elements are not required on a document, refer to Section 3.3.5.7 Registration of Drawing Numbers.

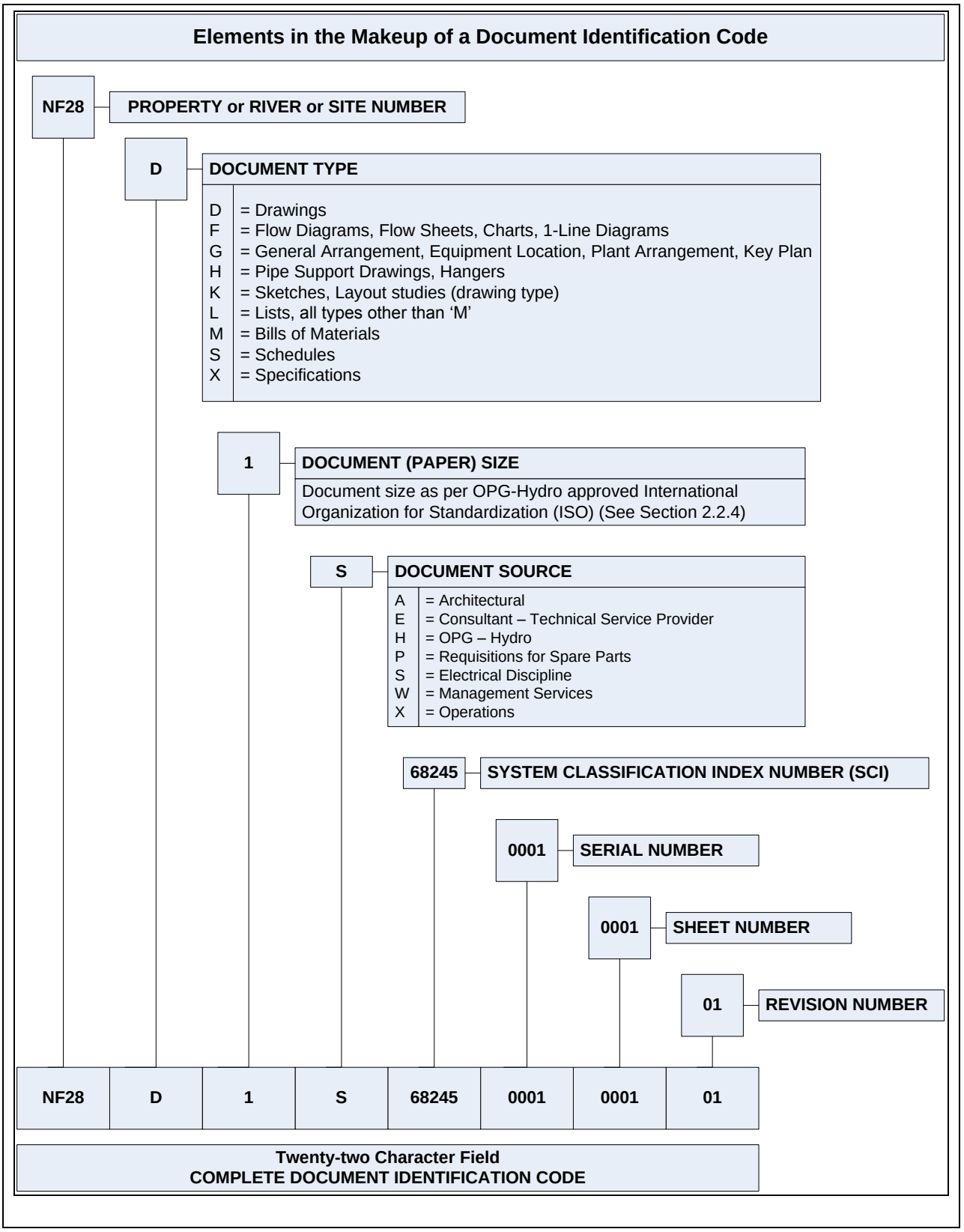
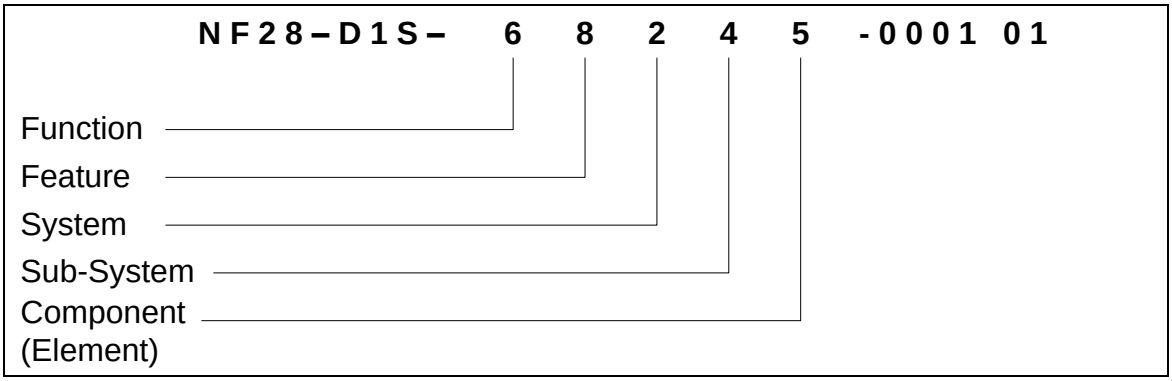


Figure 1 – Elements in the Makeup of a Document Identification Code

3.3.5.3 SCI Number System Breakdown

Each division of the SCI, 0 through 8 is organized into five levels. The levels proceed from the general to the specific in logical steps from left to right. Each level is identified by a single numeric resulting in a five-digit code for system identification. The levels are as follows:



3.3.5.4 Serial Numbers

A sequential order of numerics shall be assigned to documents within Property/File Number and SCI Number.

In order to prevent any possibility of duplicating serial numbers, an OPG RGPM Record Centre will be responsible for assigning/reserving serial numbers to all engineering participants.

All manufacturer documents shall be renumbered to the OPG RGPM System. The responsible Engineer shall select the appropriate SCI number (see Section 3.3.5.3) and Records will assign the serial number.

Note: The serial number for manufacturer documents will commence with a 9. i.e. NF28-D1S - 68245-9001 00

3.3.5.5 Document Source Coding - OPG, Professional Services Provider and Manufacturers' Documents

All documents shall receive a Document Source Code as listed in Section 3.3.5.2 Index Application.

The document code will reflect the discipline or organization responsible for that submission, for example:

Document Source Code	Discipline or Organization Responsible	Example
S	Electrical Discipline	NF28-D1S-63230-0001-00 (OPG RGPM)
H	OPG RGPM	NF28-D1H-63230-9001-00 (Manufacturer Submitted Document)

E*	Professional Services Provider	NF28-D1E-72100-1001

* The use of Document Source Code identifier E = Professional Services Provider is applicable as an identifier for these companies only when they are acting as Design Agent for Ontario Power Generation.

3.3.5.6 Revision Numbers

Revision numbers will always comprise TWO NUMERICS e.g. 00, 01, 02, 03, etc. to 99

3.3.5.7 Registration of Drawing Numbers

All drawing numbers will be registered through the appropriate Record Centre.

3.3.5.8 Bills of Material

Bills of Material - Bills of material will have matching SCI numbers and Serial Numbers to the FIRST drawing they support. i.e. NF28-M4S-68245-0001-0001. The Bill of Material must have a 3-character alpha/numeric field beginning with M.

3.3.5.9 Specifications

A Technical Specification using a SCI Number. i.e. NF28-XAS-68245-0005.

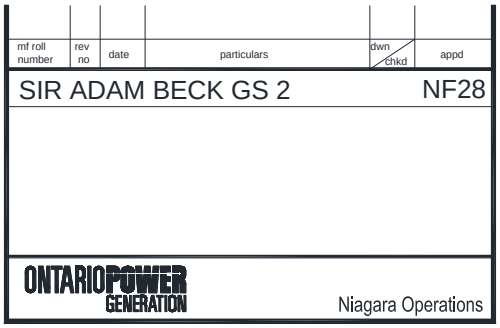
3.3.5.10 Changes to the System Classification Index

Enquiries concerning errors, omissions, revisions or additions must be submitted to Records.

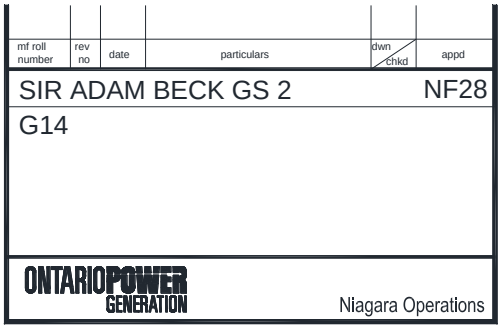
3.3.5.11 Generating Unit Coding

Unit information will be coded in a common location on all drawings, (i.e., first line of the drawing title in the titleblock). When a drawing is common to specific units, unit numbers will be prefixed with COMMON.

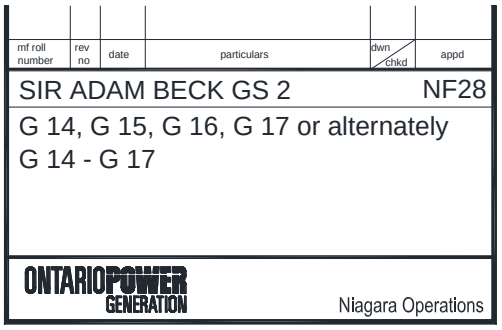
NOTE: For thermal generating stations, unit coding is different than in Hydro stations. Please contact the local thermal drawing office for unit coding direction.



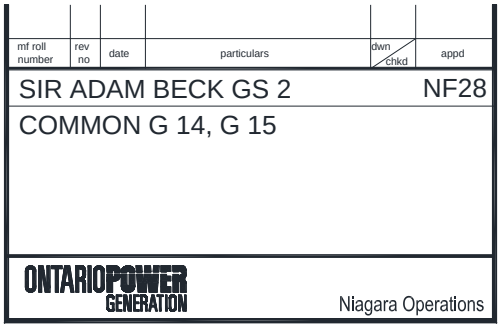
This drawing is not applicable to any Generating Units.



This drawing is applicable to Generating Unit 14 only.



This drawing is applicable to each Generating Unit listed. If applicable to 8 Units, indicate as (i.e. G14 - G21).



This drawing is common to Generating Units G14 and G15, (i.e. covers a Station system which serves a pair of Units).

3.3.5.12 Standard Drawings

In some instances, standard drawings will be prepared. These drawings are approved designs kept on file for future incorporation into larger design and/or construction drawings.

The majority of these drawings will be prepared on ISO A4 Series sized sheets.

In order to accommodate registration and the SCI filing system, these drawings have an originating source code consisting of the prefix alphas STD, followed by the appropriate numeric code designating which engineering discipline is responsible for that standard, e.g. STD9-DA-70002-SM.

Originating Source Codes:

GEOTECH	= 1
CIVIL	= 2
MECHANICAL	= 4
ELECTRICAL	= 5
INST & CONTROL	= 6
CONSTRUCTION	= 8
PIPING	= 9

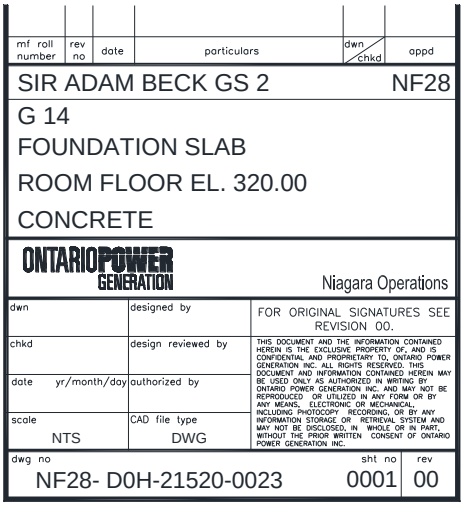
3.3.6 Drawing Title

When applying a title to a drawing, the Draftsperson should be satisfied the identification is clear and unique for the particular project and the type of work. Any unresolved doubt or ambiguity should be discussed with the Engineer.

The following practices pertaining to drawing titleblocks are common to all disciplines.

3.3.6.1 Project Name and Unit Designation

The top window of the drawing titleblock shows the Station/Plant, Site or River name and its designation. For example, a drawing for SIR ADAM BECK GS 2, applicable to Unit 14, would be as shown (see Section 3.3.5.11 Generating Unit Coding):

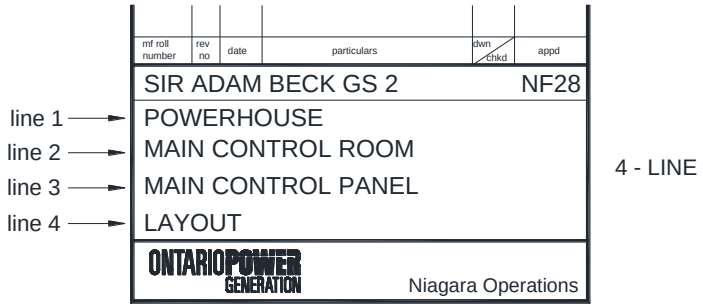


The unit designation will be included on all Ontario Power Generation Station drawings except for drawings where there is no generating unit, e.g. River, in which case the unit designation will not be shown.

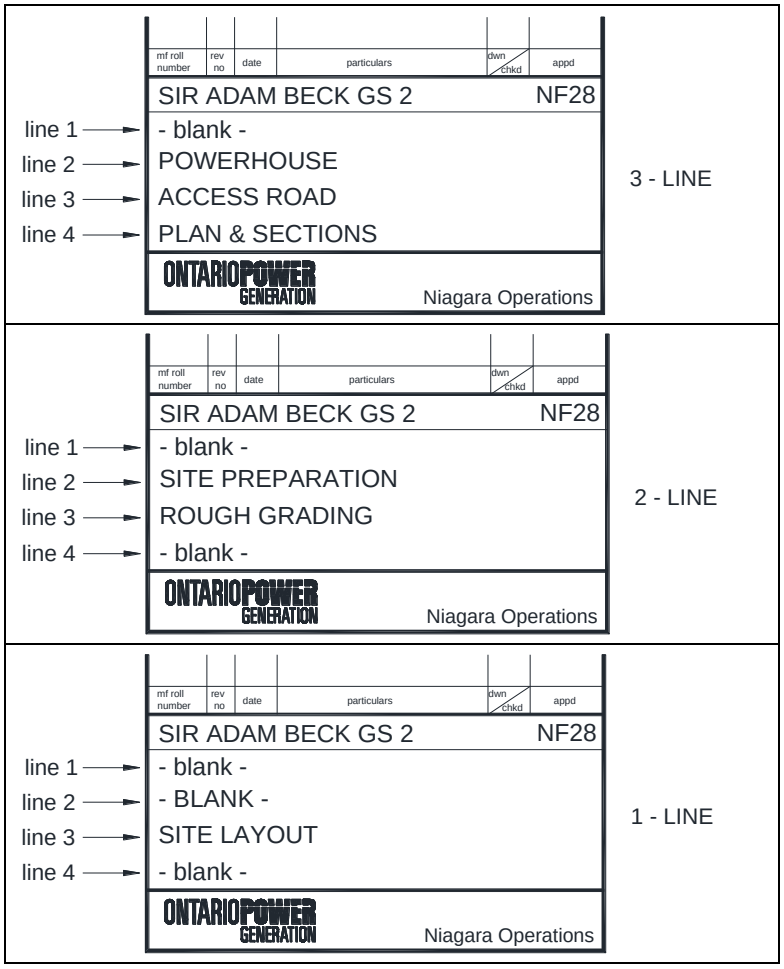
3.3.6.2 Guidelines for Drawing Titleblock

The main window of the titleblock contains a provision for four lines of lettering to identify the drawing title. Each line of lettering will start at the left side of the window space.

The wording of a drawing title usually has a pattern. See Section 4 Discipline Specific Practices, Section 4.1.1 Drawing Titles.



When less than four lines are required for the drawing title, the following will apply:



When applicable, the word ‘STUDY’ occupies the last line of the identification.

3.3.7 Drawing Scales

The proper choice of scales is required for accurate drawing presentation. This standard shall be considered in all drafting assignments.

All drawings should be created full size (1:1) in model space. Standard scaled prints of the drawings should be created in paper space, excluding electrical drawings, which can be created not to scale in model space.

All drawing borders on paper space shall remain full size (1:1).

The Draftsperson shall ensure the proper use of scales and co-ordination between drafting disciplines are properly considered and applied.

3.3.7.1 Factors in Selection of Drawing Scale

The following factors shall be considered when establishing a drawing scale:

(1) The standard scales shall be based on the 1, 2, 5 series as follows:

Metric:	
Full Scale:	1:1
Reduction:	1:2; 1:5; 1:10; 1:20; 1:30; 1:50 1:100; 1:200; 1:500
Enlargement	2:1; 5:1; 10:1; 20:1; 50:1 100:1

Imperial:	
Full Scale:	12” = 1’-0”
Reduction:	3”, 1 1/2”, 1”, 3/4", 1/2", 3/8”, 1/4”, 3/16”, 1/8” = 1’-0” ;1” = 10’
Enlargement	2:1; 4:1

See Section 4 Discipline Specific Practices.

(2) Determine the approximate drawing scale, which adequately displays the amount of detail intended in the view. Crowding of information is to be avoided. The legibility required in the resulting reproducible scans must be considered.

(3) Consider the need or advantage of more than one view on a drawing sheet.

(4) Determine the standard or practical drawing sheet size, which accommodates the intended drawing view(s) and scale.

3.3.7.2 Rules for Recording Drawing Scales

(1) For a drawing without dimensioned views such as schematics, graphs or tabulations, show a small dash in the titleblock scale box.

(2) For a drawing with all views (sections/profiles) to one scale, record the scale in the titleblock scale box as follows:

1:20, 1:50, 1:100, 1:400, 1:1000, 1:2000, etc., or
1/2" = 1’- 0”; 1 1/2" = 1’ – 0”, etc.

(3) For a drawing with views/sections using a dual scale, such as site profile, record the scales in the titleblock scale box in the following manner:

1:1000 HOR	1/8” = 1’-0” HOR
1:200 VERT	1/4" = 1’-0” VERT

(4) For a drawing with views to more than one scale, enter ‘AS SHOWN’ in the titleblock window. In the drawing field, clearly indicate the scale of each view, or group of views, i.e. SCALE: 1:2000 or 1/4" = 1’-0”.

(5) For a drawing with a dimensioned view to no particular scale, mark ‘NTS’ in the titleblock window.

(6) For a drawing with some dimensioned views to no particular scale, mark ‘NTS’ under the title of such views.

3.3.8 Linework and Symbol Usage

This standard shall be applied to all normal drafting assignments. The representations must be suitable for full size and scan reproduction methods. Some details may be affected by computer-aided drafting, statutes or other regulations. The Draftsperson shall ensure line work is performed within the intent of this subject.

3.3.8.1 Linework

The range of line thickness on each drawing should be kept to a minimum.

Example:

Thin (AutoCAD default)	0.00 mm	
Medium	0.70 mm	
Heavy	1.00 mm	
Extra Heavy	1.20 mm	

The thin and medium weights will provide adequate contrast on most drawings. Occasionally, the heavy line (1.00 mm) may be required to develop an adequate view. The extra heavy line is for special purposes such as electrical 1-line diagrams with several voltage levels.

Provision of a clear space between adjacent lines is important for quality of the pdf files. This space requirement varies as the weights of the lines increase in thickness. For adjacent thin lines, the space should be at least 0.80 mm (1/32 inch). With heavier lines, the space should range upward to 1.60 mm (1/16 inch).

3.3.8.2 Symbols Used on Drawings

Symbols in the language of engineering drafting are graphical forms, which represent defined objects. The forms may not indicate the shape, size or any specific detail of the actual object. This standard sets out current practices and definitions of the forms in use. Most of the symbols are included in the OPG RGPM AutoCAD menu. Refer to pdf attachment Word file named Symbols Used on Drawings for discipline specific symbols.

Each Draftsperson shall use the symbols listed in this document for effective communication of information to the drawing user. Any intended variations of symbol definitions must be shown on the drawing in a simple manner. New symbols should be proposed and agree with externally accepted symbols whenever needs or benefits are realized.

The Draftsperson shall ensure all drawings are checked for proper use of symbols. Proposed new symbols shall be authorized for current work to suit stated conditions.

3.3.9 Dimensioning

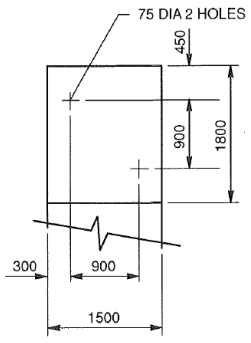
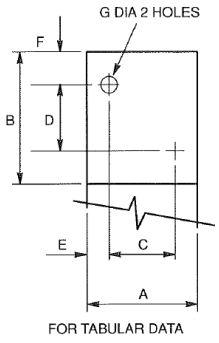
This standard outlines the rules and principles to be used in all drafting assignments. Efficient and uniform dimensioning on drawings requires planned effort. It is expected the Draftsperson will plan and define the dimension style when determining and locating drawing views. This includes reservation of space for dimensioning, which should be suited to the needs of the drawing user. Any approximations or assumptions in the dimensions shall be clearly noted.

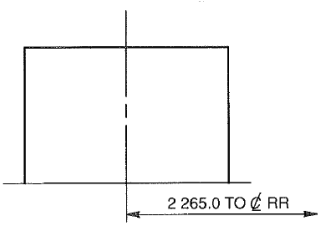
3.3.9.1 Dimensioning Principles

The following are to be considered when dimensioning drawings:

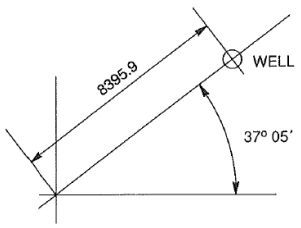
(1) Dimensioning on OPG RGPM drawings will be in agreement with the principles contained in the latest revision of CAN/CSA-B78.2 - Dimensioning and Tolerancing of Mechanical Drawings. Practices detailed in this section take precedence over all related standards.

(2) Acceptable styles of dimensioning are illustrated in the following examples:

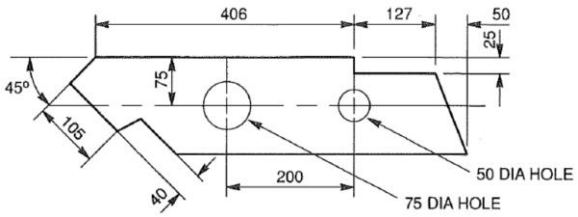
	
Example No. 1	Example No. 2



Example No. 3



Example No. 4



Example No. 5

(3) Unless specified herein, the writing of metric units and symbols in drafting work will be in agreement with the requirements stated in the latest revision of ENG-STD-003 Units of Measurements for Imperial - Unit Sites.

(4) Dimensioning to hidden lines is to be avoided. A partial cutting view is to be used instead.

(5) Circular dimensions should include one of the following as a suffix to aid clarity of meaning:

(a)	DIA	(b)	∅	(c)	R

(6) When possible, only one unit should be used for linear measure on a particular drawing and, where no ambiguity can arise, the symbol for the unit will be discarded.

(7) When metre and millimetre are used on the same drawing:

(a) Symbols may be discarded in accordance with the following rules:

- Numbers without decimal point indicate millimetres
- Numbers with decimal point indicate metres.

(b) To avoid the risk of incorrect interpretation when transferring dimensions from drawings to actual site measurements or when taking off quantities:

- Metres should be written to three places of decimals
- A unit symbol may be included for exceptions if the drawing prominently displays the following note in bold print:

ALL DIMENSIONS IN ___EXCEPT AS NOTED

(8) Where both metres and millimetres are used, avoid the risk of incorrect interpretation when transferring dimensions from drawings to actual site measurements or when taking off quantities. Metres should be written to three decimal places of decimals. For example, 'two point one metres' should be written as 2.100 m, which is visually compatible with and could be used as an alternative to 2 100 mm or 2100 mm.

(9) Where the imperial system is used for machine design, the 'decimal inch' shall be used. Refer to CSA B78.2 - Dimensioning and Tolerancing of Mechanical Engineering Drawings.

(10) When dimensions are not to scale, the fact must be indicated. This may be covered by the dimension suffix 'NTS', a note under the view, a general drawing note or in the titleblock scale indication. All drawings should be created full size (1:1) in model space. Standard scaled prints of the drawings should be created in paper space, excluding electrical drawings, which can be created not to scale in model space.

(11) When an object is detailed in two or more views, each dimension should be shown only once and on the view to which the dimension is important.

(12) The development of graphical data, such as the plotting of readings and curve smoothing will be based on normal design instructions in the work assignment.

(13) Spaces should be used instead of commas to separate digits into easily readable blocks of three. Four digit numbers can be used without a space where no ambiguity can arise.

(14) The decimal point should be used as outlined in Section 3.3.10 Lettering.

(15) When specific tolerance or fit is intended, the specification must be indicated. This may be by explanatory note, or reference to a standard authority.

(16) In angular measurements the minutes and seconds of arc are used normally in site survey data. In other work, these units indicate the accuracy of measurement intended, by inclusion or omission.

(17) Gradients are expressed as the fall or rise per unit of horizontal length.

i.e. 10 mm in 120 mm i.e. 1:12

Note: In the direction of increasing chainage, upward grades are positive (+) and downward grades are negative (-).

(18) Road and railway grades are expressed as a percent slope.

$$\text{i.e.} \quad \frac{\text{Vertical displacement}}{\text{Horizontal distance}} \times 100 = \% \text{ grade}$$

$$\text{i.e.} \quad \frac{3}{100} \times 100 = 3 \% \text{ grade}$$

3.3.10 Lettering

3.3.10.1 General

The standard for lettering on drawings is the upper case ROMANS or ROMAND style. The use of the lower case is restricted to particular abbreviations, equipment codes and the like. Slanted or sloped lettering applies only to specific cases such as water body names.

Drawing Size	Lettering Size in Detail Areas		Section Subtitle and Grid Numbers	
	Metric	Imperial	Metric	Imperial
A4	2.5 mm	3/32"	5 mm	3/16"
A3	2.5 mm	3/32"	5 mm	3/16"
A2	2.5 mm	3/32"	5 mm	3/16"

A1	3.0 mm	1/8”	6.5 mm	1/4”
B1	3.0 mm	1/8”	6.5 mm	1/4”
A0	3.0 mm	1/8”	6.5 mm	1/4”

3.3.10.2 Number Layout

Thousand marker spaces shall be used instead of commas to separate digits into easily readable blocks of three. Four-digit numbers can be without a space where no ambiguity can arise.

Decimal notation point shall be used in numbers less than a unity. A zero must precede the decimal point, e.g. 0.15.

3.3.11 Bills of Material

Bills of material are to be prepared for all drawings, which are intended for procurement, shop fabrication or field construction. This excludes many schematic diagrams, tabulation of functions and layouts for study purposes.

3.3.11.1 Principles

The following are general statements for consideration when preparing Bills of Material:

(1) Bills of Material or item lists may be shown on the drawing where possible, or separately as a drawing sheet.

(2) Bills of Material, if separate, should bear the following identifications similar to the drawing it refers to:

- A distinctive Bill of Material drawing number (e.g. NF28-M4H-22559-0001).
- Project name.
- Work order number, or project number.
- Area of project and/or class of work involved.
- Date of issue.
- Date of any revision, and indication of the items ‘added’, ‘deleted’ or ‘revised’.

(3) Bills of Material may also be prepared to accompany standard drawings.

(4) Each Bill of Material should be cross-referenced to the applicable drawing numbers, or other source of information.

(5) When various external supply sources are available, the words ‘or approved equal’ should suffix the description of an item.

3.3.12 Abbreviations

An abbreviation is a shortened form of a word, expression or phrase used when it is essential to conserve space. When in doubt, spell it out.

Words of five or less letters should not be abbreviated except where abbreviations have been established by long standing practice.

Where abbreviations are used, a legend shall be provided unless the abbreviation is commonly used and is an industry standard.

Abbreviations can be used on drawings, Bills of Material, computer lists and tabulations. They may be combined with symbols and equipment codes into a complete and clear message.

Refer to pdf attachment Word file named Abbreviations Used on Drawings for reference.

4. DISCIPLINE SPECIFIC PRACTICES

The following information is given as a guide for drawing production. The project may require the use of other methods of dimensioning, etc. Examples of older methods, symbology, etc. have been given due to the age of OPG RGPM facilities and their associated drawings.

4.1 Civil Discipline

4.1.1 Drawing Titles

Drawing titles are developed by the Draftsperson. The title must clearly indicate the content of the drawing, utilizing words that will enable future key word searches and contain, as appropriate, the following:

(1) Name of building, structure or feature.

(2) Specific system or part of building, structure or feature.

(3) Drawing identity, distinguishing it from others in the same set.

(4) Class of work (concrete, structural steel, etc.).

Example:

mf roll number	rev no	date	particulars	dwn / chkd	appd
SIR ADAM BECK GS 2					NF28
G 14 FOUNDATION SLAB ROOM FLOOR EL. 320.00 CONCRETE					
ONTARIO POWER GENERATION					Niagara Operations

4.1.2 Drawing Scales

4.1.2.1 Typical Scales Used

Site:		
Type of Drawing	Metric	Imperial
Site plans, Roads, Railway	1:1000 1:2000 1:5000	1”=100’, 200’,400’
Rough Grading	1:2000	1”=200’
Yard Drainage	1:200; 1:1000	1/16”=1’-0”, 1”=100’
Excavation	1:100; 1:200; 1:500	1/8”, 1/16”=1’0”; 1”=20’, 50’,60’

Structural:		
Type of Drawing	Metric	Imperial
Concrete	1:20; 1:50	3/8”, 1/4” = 1’-0”
Reinforcing Steel	1:30; 1:50	3/8”, 1/4” = 1’-0”
Structural Steel	1:20; 1:50	1/4” to 1” = 1’-0”
Supplementary Steel	1:20; 1:50	1/4” to 1” = 1’-0”
Miscellaneous Steel	1:50	1/4” to 1” = 1’-0”
Embedded Parts	1:2; 1:5; 1:10; 1:20	6” to 1/4”=1’-0”

The scale for enlarged view from the main view normally will be selected by the Draftsperson. Such views shall be at least twice the scale of the main view. The scales in common use are as follows:

Type of Drawing	Metric Scales	Imperial Scales
Concrete	1:5; 1:10; 1:20	1-1/2” to 1/2” = 1’- 0”
Reinforcing Steel	1:10; 1:30	1” to 1/2” = 1’ –0”
Structural Steel	1:5; 1:10; 1:20	1-1/2” to 3/8” = 1’- 0”
Miscellaneous Steel	1:5; 1:10; 1:20	1-1/2” to 1/2” = 1’- 0”

4.1.3 Civil Drafting Symbols

The Civil drafting symbols are divided into the following (see Section 4.1 Civil Discipline):

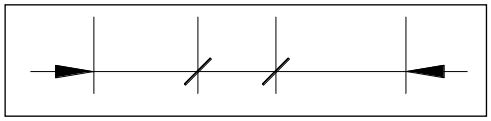
(1) Concrete, Drainage, Grading and Excavation, Roads.

(2) Structural Steel - Structural steel designations are derived from the Canadian Institute of Steel Construction (CISC) - Handbook of Steel Construction.

4.1.4 Dimensioning

The following are to be considered when dimensioning Civil drawings:

(1) Where necessary, diagonal strokes may be used instead of arrowheads:



(2) Typical and minimum dimensions are to be shown as follows:

300 TYP	12” TYP
1 200 MIN	3’-0” MIN

(3) The dimensions for elevations and coordinates on Civil drawings of Site Plans, Roads, Railways, Grading, Yard Drainage and Excavation should be given in metres or feet. The exception will be pipe sizes, smaller layers of granular material and structural items. These shall be given in millimetres or inches.

(4) The dimensions on Civil drawings of Concrete, Reinforcing, Structural Steel, Supplementary Steel, Miscellaneous Steel and Embedded Parts shall be given in millimetres or feet/inches. If these drawings include elevations or coordinates, they alone, (elevations and coordinates), will be given in metres or feet/inches.

(5) Dimensions in millimetres shall be shown as whole numbers to an accuracy of 1 mm.

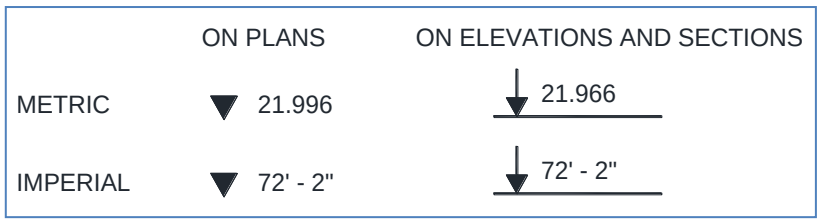
(6) Dimensions in Metres for:

- Structures - shall have 3 digits after the decimal point, i.e. 100.000
- Non-structures - shall have 2 digits after the decimal point, i.e. 100.00

(7) Dimensions in Imperial for:

- Structures - i.e. 100’ - 8”
- Non-structures - shall have 2 digits after the decimal point of a foot i.e. 100.00’

(8) The following symbols shall be used to indicate elevations. The abbreviation EL is not required.



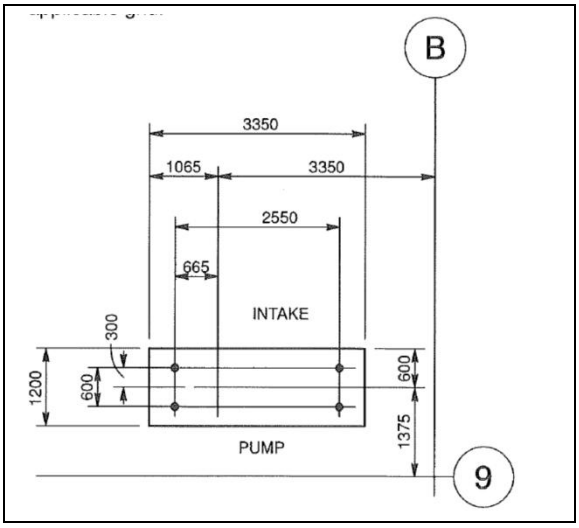
(9) The basic reference for location dimensions within a building shall be the building column grid.

(10) The basic reference for items not located from a building column grid shall be the project/facility/station site grid.

(11) In dimensioning symmetrical objects, the location dimensions may be omitted if a note such as the following appears on the drawing:

ALL COLUMN FOOTINGS ARE SYMMETRICAL ABOUT CENTRE LINE OF COLUMNS EXCEPT AS NOTED

(12) Equipment foundations or supports and anchor bolts shall be located from the centre line or reference lines of the equipment. These lines shall be located from the applicable grid.



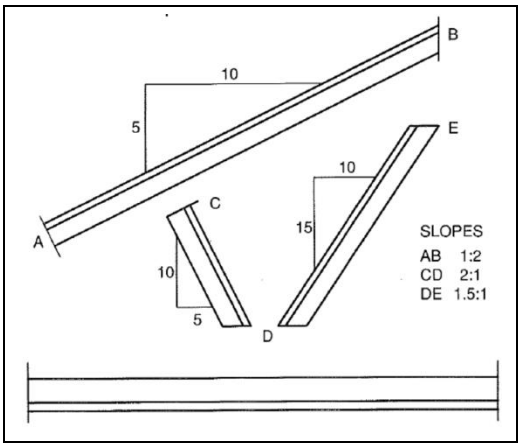
(13) Dimensions shall be used to indicate such things as:

- Thickness of floors
- Depth of keys
- Depth of beams
- Camber of roads
- Depth of corbels
- Depth of catch basins and manholes
- Top of steel floor beams (from finished floor).

(14) The slope of a structural member or surface is usually illustrated, in elevation, by drawing a right-angle triangle, the hypotenuse of which parallels the slope and whose vertical and horizontal sides are labelled proportionate to their lengths. When expressing slope as a numerical ratio, the vertical components will always be written first, i.e. V: H.

(15) Wherever possible, the smaller side of the slope triangle should be written as unity. Thus for slopes shallower than 1:1, the first number will be unity, i.e. 1:2. For slopes steeper than 1:1, the second number will be unity, i.e. 2:1.

(16) Illustration of slope notation.



Note: The use of angular measure in degrees for slopes is acceptable in certain cases where a higher order of accuracy is required.

4.1.5 Drawing Presentation Format

Types of drawings prepared:

(1) Concrete/Construction Joint Location/Embedded Parts Location.

(2) Reinforcing.

(3) Structural Steel.

(4) Miscellaneous Steel.

(5) Site and Improvements.

4.1.5.1 Concrete Drawings

(1) Concrete drawings include Embedded Part location and Construction Joint details. Separate Embedded Part location drawings may be necessary for clarity in congested areas and are detailed as follows:

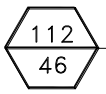
- Embedded Part numbers shall not be repeated within a Project/Station Unit.
- Numbering system of Embedded Parts shall be controlled by the Civil discipline.
- Embedded Parts are listed on the Bill of Material, if required, in the Equipment Code column.
- Embedded Parts located on Concrete Drawings shall be included on the Bills of Material, if required for these drawings, (even if the Parts themselves are detailed elsewhere, i.e. on separate Embedded Parts detail drawings.

(2) Frames and Covers, Embedded Parts:

- When Frame and Cover bear the same Embedded Parts number, add suffix A for Frame and suffix B for Cover.
- When Frame and Cover have no Embedded Parts number, use separate Item Numbers for identification on the Bill of Material, if required.

(3) Pour Identification:

Example:



POUR IDENTIFICATION

CONCRETE VOLUME IN CUBIC METRES
ABOVE 5 CUBIC METRES, ROUND UP TO NEAREST CUBIC METRE.
BELOW 5 CUBIC METRE, USE DECIMALS (SMALLEST UNIT - 0.5 CUBIC METRES)

For Pour Identification number, use three digits. The first digit indicates the type of formwork, for example:

1.	Slab or beam on grade	1
2.	Slab or beam, conventional form	2
3.	Slab or beam on Q-deck	3
4.	Wall	4
5.	Column	5
6.	Arch	6
7.	Footings, Thrust Blocks, Major Equipment Bases	7
8.	Plinths, Curbs, Small Equipment Bases	8
9.	Reserved for Construction	9

The last two digits indicate consecutive pour numbers for a drawing or a set of drawings.

Pour numbers shall not be repeated within a SCI number for any one unit.

4.1.5.2 Reinforcing Drawings

(1) Two types of drawings are prepared to illustrate reinforcing:

- The detail drawing.
- The engineering drawing.

The ‘detail drawing’ consists of two parts, the bar list and the drawing. The bar list may be added to the body of the drawing if space allows. The bar list shall give all of the required cutting and bending information as well as bar numbers.

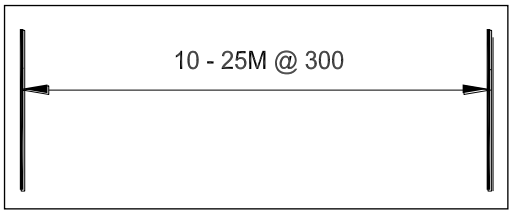
The ‘engineering drawing’ portrays only the size and the spacing of the reinforcing required. For OPG RGPM, this is occasionally incorporated on the concrete drawings.

Concrete outlines and principal elevations shall be shown for the area being reinforced, together with enough of the concrete outline of the adjacent area to orientate the view.

(2) There are two systems of illustrating reinforcing:

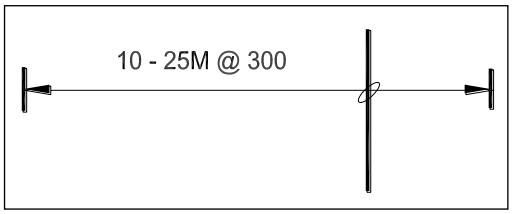
(a) Two-bar system where end bars in a set are shown and all intermediate bars are omitted:

Example:



(b) Single bar system where one bar in a set is shown and delimiters are used to indicate the limits of the end bars in a set:

Example:



Do not mix the two systems on a drawing. The rules for both systems are the same. The difference is in bar presentation.

4.1.5.3 Structural Steel Drawings

Two types of drawings are prepared:

(1) Design Drawings.

(2) Shop Drawings.

Design drawings are prepared to provide the sizes of all members, special connection requirements, loads and forces and any other information required for the preparation of shop drawings.

Shop drawings are prepared to contain all information necessary for fabrication and erection of the steel and are usually prepared by a steel fabricator or OPG RGPM drafting personnel.

4.1.5.4 Miscellaneous Steel

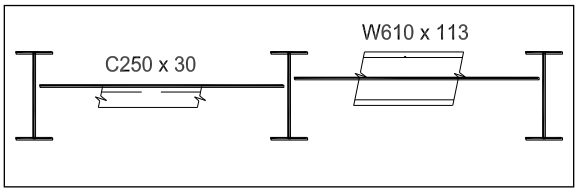
Miscellaneous steel drawings contain all information for fabrication and erection of all metallic elements that are not part of the primary structural building.

4.1.5.5 Site and Improvements

These are construction drawings for site layout, excavation, rough grading, dykes, roads, finish grade, drainage, security, etc.

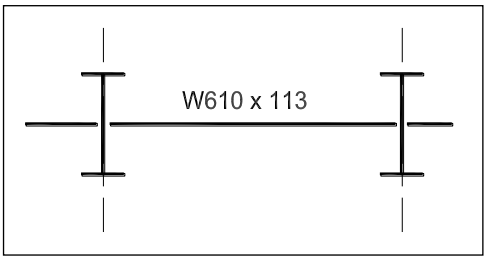
4.1.6 Line Work

A single heavy line usually shows structural steel members. When orientation of the member is necessary, a small portion shall be illustrated.



4.1.7 Member - Identification

The identification of structural steel shapes, bars and plates shall be in accordance with the latest edition of the Handbook of Steel Construction (Metric Structural Steel Design Data), published by the Canadian Institute of Steel Construction.



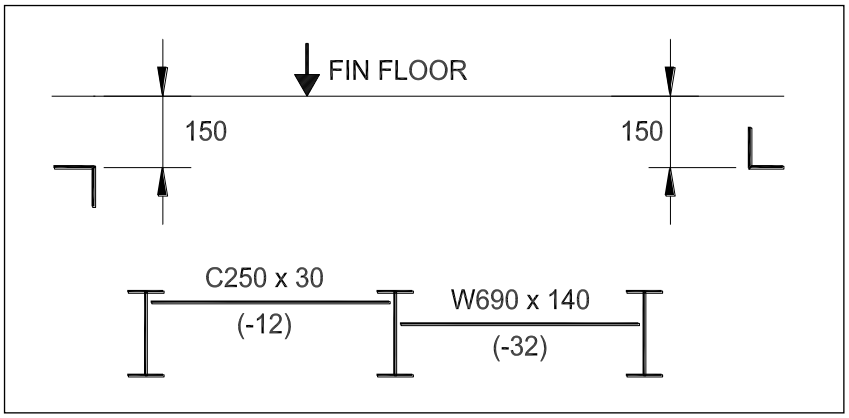
Shapes, bars and plates are identified in full, once only. When identified elsewhere, an abbreviated identification shall be used:

	Full Identification		Abbreviated Identification	
Shape	Metric	Imperial	Metric	Imperial
Wide flange	W610x113	W24x30	W610	W24
Channel	C310x31	C12x20.5	C310	C12
Angle	L150x150x20	L6x6x3/4	L150 x 150	L6 x 6
Plate	PL10x460x2280	PL1/2x15x24	PL10	PL1/2
Bar	BAR10x60x2030	BAR3/8x2x36	BAR10	BAR3/8

When calling up angles and channels frequently repeated, symbols may be used, but must be identified in the legend on the right hand side of each drawing. Members that are repeated in a consecutive run shall be called up by giving the necessary information on the first and last members and placing ‘DO’ (meaning ditto) against each of the intervening members.

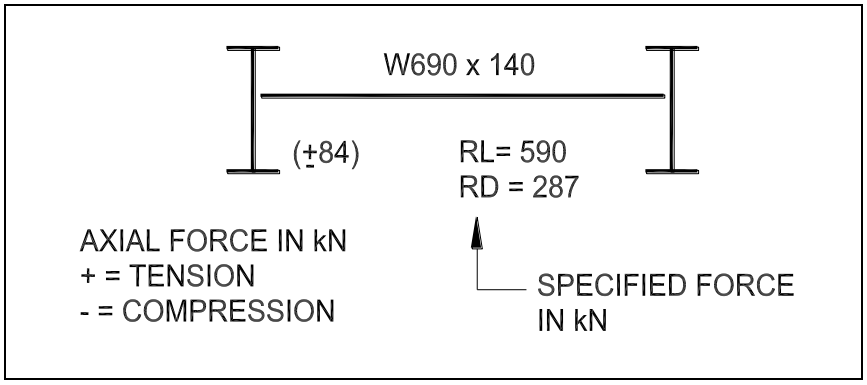
4.1.8 Member - Elevation on Plans

Members shall be located relative to the finished floor or other designated elevation. Dimension shown in brackets applies to location of top of member. When the dimension is applied to angles, it indicates location of back of angle.



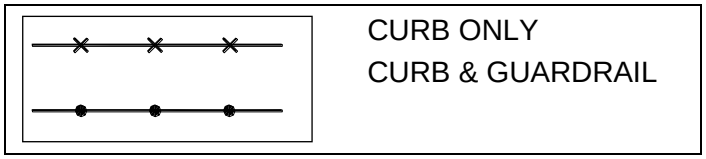
4.1.9 Loading and Forces

Loading information for floors, stairs, etc. are in the general notes or specifications. Any variance of loading must be noted in the area applicable. Forces are noted on member when they exceed allowances of standard connections. (This informs the fabricator that connections must be designed to suit).



4.1.10 Curbs and Guardrails

The extent of curbs and guardrails is indicated on floor plans by symbolic lines.



4.2 Geotechnical, Environmental and Survey Discipline

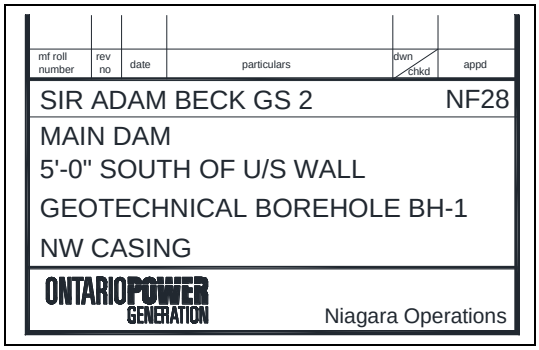
4.2.1 Drawing Titles

4.2.1.1 Geotechnical and Hydraulic

The drawing title is composed by the joint effort of the Draftsperson and the respective Engineer. The title must clearly indicate the content of the drawing, utilizing words that will enable future key word searches and, as appropriate, follow these line descriptions:

Line 1	Building, Structure or Area
Line 2	Specific part of Building, Structure, Area or Feature
Line 3	Type of Drawing
Line 4	Plan(s) or Section(s) or Detail(s)

Example:



Further examples of drawing titles can be obtained from the electronic document management system (i.e. AS7).

4.2.2 Drawing Scales

The following is typical of scales used:

Type of Drawing	Metric	Imperial
Site:		
Site Plans, Roads, Railway	1:1000; 1:2000; 1:5000	1”=100’, 200’,400’
Rough Grading	1:2000	1”=200’
Yard Drainage	1:200; 1:1000	1/16”=1’-0”, 1”=100’
Excavation	1:100; 1:200; 1:500	1/8”, 1/16”=1’0”; 1”=20’, 50’,60’

In special cases, it may be necessary to use other scales as agreed upon by the Draftsperson and Engineer.

1:20	1:50	1:100	1:200
1:500	1:1 000	1:2 000	1:5 000
1:100 000	1:500 000	1:100 000	1:500 000

4.2.3 Symbols

The symbols are divided into the following (see Section 4.2 Geotechnical, Environmental and Survey Discipline):

- General Items.
- Survey Discipline.
- Legal Items.
- Landscaping, Mapping, Railway, Roads, Drainage, Waterways.
- Instrumentation.
- Geotechnical Explanatory Sheet.

4.2.4 Dimensioning

No specific requirements, see Section 3.3.9.1 Dimensioning Principles.

4.2.5 Drawing Presentation Format

No specific requirements, see Section 4.1.5 Drawing Presentation Format.

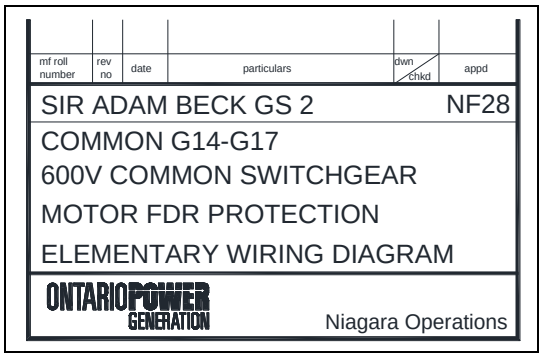
4.3 Electrical Discipline

4.3.1 Drawing Titles

The drawing title is composed by the joint effort of the Draftsperson and the respective Engineer. The title must clearly indicate the content of the drawing, utilizing words that will enable future key word searches and contain, as appropriate, the following:

- Area or system
- Location, views or type of protection
- Type of drawing.

An example of a drawing title, including system identification is shown below:



Further examples of drawing titles can be obtained from the electronic document management system, i.e. AS7.

4.3.2 Drawing Classification Code

Classification code, in OPG, is used primarily to identify a class of electrical drawings.

Refer to pdf attachment Word file named Drawing Classification Code Chart for descriptions and examples related to the descriptive titles commonly found on OPG drawings. For example, a drawing marked Class 36 would be an electrical arrangement on Lighting and Heating.

Sub Class Designation may be used to identify any area of a project or a specific group of drawings within a classification. An example of Sub Class Designation is shown below.

SUB CLASS DESIGNATIONS			
	1 Area only if desired	North or East Area	South or West Area
500 kV	A	F	K
230 kV	B	G	L
115 kV	C	H	M
46 kV	D	I	N
27.6 kV & BELOW	D	J	O

4.3.3 Drawing Scales

4.3.3.1 Selection of Drawing Scale

The following is typical of scales used:

Type of Drawing	Scales	
	Metric	Imperial
Receptacles	1:100	1/8”=1’-0”
Lighting	1:100; 1:200; 1:1000	1/4”,3/16”=1’-0”; 1”=20’, 60’

Grounding	Powerhouse	1:50; 1:100; 1:200	3/16”,1/8”,3/32”,1/16”=1’-0”
	Switchyard	1:100; 1:200; 1:500	1”=10’, 20’, 30’
Switchyard Arrangement		1:50; 1:100; 1:200	1/4”,3/16”,1/8”,1/16”=1’-0” & 1”=20’
Switchyard Conduit		1:100; 1:200; 1:500	1/8”,1/16”=1’-0”; 1”=30’
General Location Plan		1:200; 1:500	1”=20’ 30’ 40’, 50’
Cable Pans/Trays		1:50; 1:100	1/4”,3/16”,1/8”=1’-0”
Powerhouse Conduit		1:50; 1:100	1/4”,3/16”,1/8”=1’-0”
Bus Duct		1:50; 1:100	1/4”,3/16”,1/8”=1’-0”
Switchgear		1:50; 1:100	1/4”,3/16”,1/8”=1’-0”
Communications		1:200	1/16”=1’0”
Building Services		1:100	1/8”=1’-0”
Spec Drawing		1:50; 1:100	1/4”,3/16”,1/8”=1’-0”
Panel Arrangement		1:3; 1:5	2”=1’-0”

The drawing scale for each assignment shall be determined and selected by the Draftsperson in consultation with the Engineer. He/she shall also select the scale for enlarged views, which will be at least twice the main view.

4.3.3.2 Instrumentation and Control Drawings

The following is typical of scales used:

Type of Drawing	Scales	
	Metric	Imperial
Instrumentation and Control	1:1; 1:5; 1:10; 1:20; 1:50; 1:100; 1:200; 1:500; 1:1000; 1:2000	3”, 2”, 1-1/2”, 1”, 3/4", 1/2”, 1/4”, 1/8”, 1/16”=1’–0” and full scale

4.3.4 Electrical Drafting Symbols

The Electrical drafting symbols are divided into the following:

(1) Electrical Diagram Symbols - Derived from IEEE-200-1975, latest edition with some adaptation or additions as used in OPG RGPM Engineering.

(2) Electrical Arrangements Symbols - Adaptations as used in the Electrical disciplines, which produce arrangement drawings.

(3) Lighting and Building Services - Symbols are derived from CSA Z99 latest edition with some adaptation or additions as used in OPG RGPM Engineering.

4.3.5 Dimensioning

No specific discipline requirements (see Section 3.3.9.1 Dimensioning Principles).

4.3.6 Drawing Presentation Format

4.3.6.1 General Practices

(1) FUNCTIONAL DRAFTING will be used to the fullest extent economically possible. See Section 3.1.2 Functional Drafting.

(2) DRAWING SIZE - In general, the use of B1 drawing sheets, (i.e. 5), should not be used.

(3) PRESET FORMS of various types are developed on each project and are applicable to that project only.

(4) CONSOLIDATED CABLE, BOX LISTS AND BUBBLE NUMBERS

- Computer Process - At the present time, no databases exist for the above. The process will be defined when the databases have been developed and populated with the existing data.
- Manual Process - The Draftsperson prepares the lists as per instructions for the specific project on standard, electronic or manual forms. For existing plants, the lists are continued in the established pattern.

4.3.7 Equipment Identification Codes

4.3.7.1 General

Where codes are supplied as part of an assignment, the Draftsperson must not change the markings without the consent of the designer concerned. When difficulty is encountered in assembling a code marking, the Engineer is to be consulted. Repetitive situations, where no code is available, should be brought to the Engineer's attention. An additional code number must not be created by other than the originating group. If a number is missing, it should be requested through normal coordination channels.

The Draftsperson will ensure all code markings on a drawing are checked prior to issue. Additions or corrections to the code lists in this subject should be requested promptly. Use of drawing legends shall be minimized and the Engineer is to be consulted when unavoidable.

This section contains or makes reference to the code systems, which the Draftsperson encounters in normal work assignments. Each list indicates the primary type of drafting work, which utilizes the codes. There may be other types of drawings or tabulations to which the data is transcribed from the primary source.

Coding consists of:

- Unit number.
- System name.
- Device code and serial number.

4.3.7.2 Electrical Device Functions

Reference - IEEE 37.2.

4.3.7.3 Purpose of Device Function Number

A device function number, with appropriate suffix letter or letters where necessary, is used to identify the function of each device in all types of partial automatic and automatic, and in many types of manual switchgear. These numbers are to be used in elementary and connection wiring diagrams, instruction books, publications and specifications. In addition, for automatic switchgear, the number may be placed on or adjacent to each device in the assembled equipment so that the device may be readily identified.

Numbers from 95 to 99 should be assigned only for those functions in specific cases where none of the assigned standard device function numbers are applicable. Numbers which are 'reserved for future application' should not be used.

Refer to pdf attachment Word file named Standard Device Function Numbers, each with its corresponding function name and the general description of each function.

4.3.7.4 Supervisory Control and Indication

Refer to IEEE - Standard C37.2, latest edition.

4.3.7.5 Suffix Letters

Refer also to IEEE - Standard C37.2, latest edition.

Suffix letters may be used with device function numbers. They should be used only when they accomplish a useful purpose.

For example, when all of the devices in the equipment are associated with only one kind of apparatus, (such as a feeder, motor or generator), in order to retain maximum simplicity in device function identification, it is common practice not to add the respective suffix letter F, M or G to any of the device function numbers.

In order to prevent any possible conflict or confusion, each suffix should have only one meaning for individual equipment. Each suffix should not consist of more than two letters in order to keep the complete function designation as short and simple as possible.

The meaning of each suffix used with a device function number should be designated in the following manner on the necessary drawings or publications applying to the equipment:

TC	Trip Coil
V	Voltage
X	Auxiliary Relay

In cases where the same suffix has different meaning in the same equipment, the complete device function number with its suffix letter or letters should be listed in the legend as follows:

63 V	Vacuum Relay
70 R	Raising Relay for Device 70
90 V	Voltage Regulator

Colour Code for Relay Blocking Switches

Blocking Switch Features	Colour	
Standard Switch	*red	4210
Auto-reclosing blocking (blocks the special instantaneous relay used with auto-reclosing)	orange	4260
Master trip blocking	green	4230
Master trip close blocking	yellow	4220
Gas relay blocking	blue	4250
Remote trip blocking	purple	4510
Annunciator blocking	white	4000
Pilot wire relay	black	4160
	with red top	4210
Blocking switching on alternate relays, which are used only when pilot wire relays are out of service	black	4160

*Colour of handles on standard switches.

Application Notes:

(1) The required colour of blocking switch handles will be indicated on the panel CWD, EWD and Panel Arrangement drawings.

(2) The B/M will show all switches in the colour as purchased, (normally standard red).

(3) By instruction or specification any further painting of the handles should be done at the time of panel assembly. This includes the supply of paint.

4.3.7.6 Instrumentation Standards-Instrument Designation Code

Application Notes:

System Flow Diagrams, Control Logic Diagrams and Electrical Schematic (1-Line) Diagram and EWD show the origination of most code numbers for drafting work.

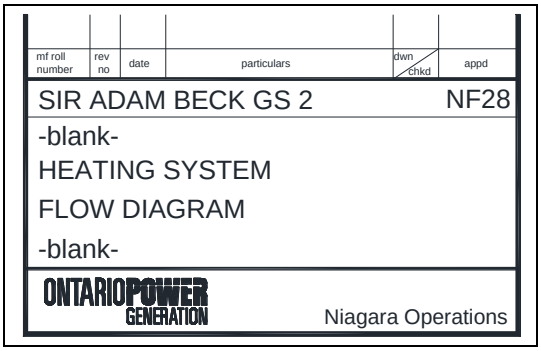
4.4 Mechanical Discipline

4.4.1 Drawing Titles

The drawing title is composed by the joint effort of the Draftsperson and the respective Engineer. The title must clearly indicate the content of the drawing, utilizing words that will enable future key word searches and as appropriate, contain the following:

- Name of building, structure or feature.
- Specific system or part of building, structure or feature.
- Plan or section elevations; drawing identity.
- Type of drawing (plant arrangement, flow diagram, etc.).

Example:



Further examples of drawing titles can be obtained from the electronic document management system (i.e. AS7), searching under 'Drawings', and entering the name or part of the name of the drawing as a keyword.

4.4.2 Drawing Scales

4.4.2.1 Typical Scales Used:

Type of Drawing	Metric	Imperial
Plant Arrangement	1:50; 1:25	1/4" = 1’-0”
Equipment Location	1:100	1/8”, 3/32” = 1’-0”
Substructure Piping	1:100	1/8” = 1’-0”
Yard Piping	1:100	1/8”, 1/16” = 1’-0”
Yard Piping Key Plans	1:100; 1:1000; 1:2000	1’ = 50’, 60’, 200’
System Drawings	1:10; 1:20; 1:50; 1:100	1/2", 3/8”, 1/4", 3/16”, 1/8”, 3/32” = 1’-0”
Specification Drawings	1:10; 1:20; 1:50; 1:100	1’, ¾”, ½”, 3/8”, ¼” = 1’-0”

Ventilation	1:50, 1:100	¼", 1/8" = 1'-0"

The scale for the main view of the drawing shall be established by the Draftsperson. The scale for enlarged views shall be at least twice the size of the main view. The actual scale shall be decided by the Draftsperson concerned.

4.4.3 Symbols

The Mechanical drafting symbols are divided into the following (See Section 4.4 Mechanical Discipline):

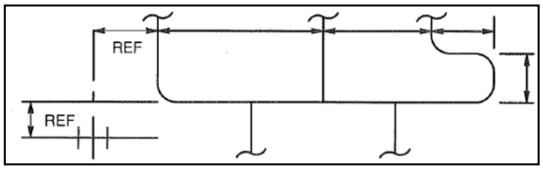
- Air Conditioning, Heating and Ventilation.
- Flow Diagrams.
- Power Equipment.
- Machining.
- Piping.
- Plumbing.
- Valves.
- Welding.
- Instrumentation and Control.

4.4.4 Dimensioning

The following are to be considered when dimensioning Mechanical drawings:

4.4.4.1 Piping

(1) Dimensioning shall be centre line to centre line. In some cases the bottom of the inside pipe elevation is given.

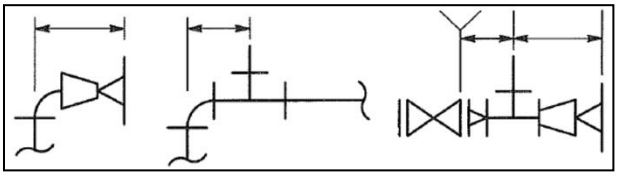


(2) Dimensions shall enable field fabrication, site location and installation.

(3) Pipe supports and hangers shall be dimensioned to building steel or floors.



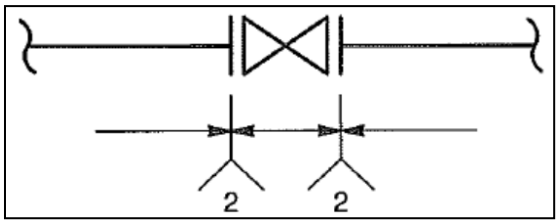
(4) Standard fittings, flanges, etc., are dimensioned for accumulative length, as shown below. For rubber lined systems see Item 15 below.



(5) The elevation of pipe in substructure shall be to the centre line of the pipe.

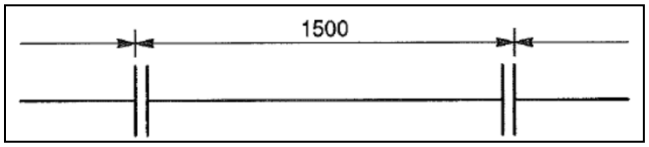
(6) All vertical and horizontal location dimensions shall be to the centre line of the pipe.

(7) All gasket dimensions shall be included in dimensioning by extending extension lines, and using the open arrow head:

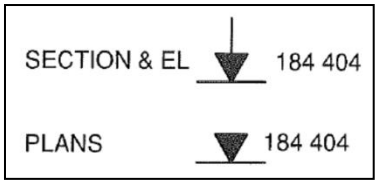


(8) Normally, tolerances will not be included in a piping system.

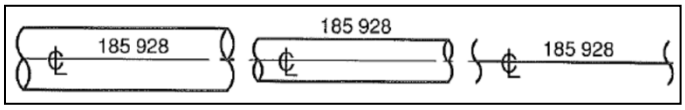
(9) Dimensions shall be above the dimension lines and conform to Section 3.3.10 Lettering.



(10) Floor elevations will be expressed in the following manner:



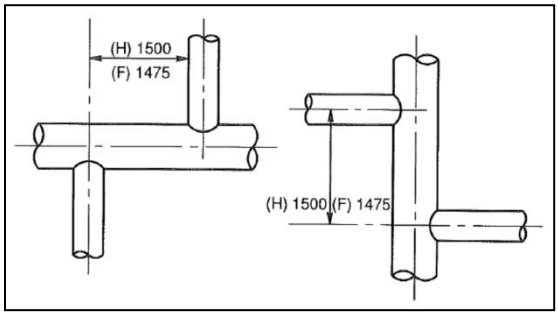
(11) Pipe centre lines will be expressed in the following manner:



(12) Coordinate dimensions on yard drawings will be expressed in metres.

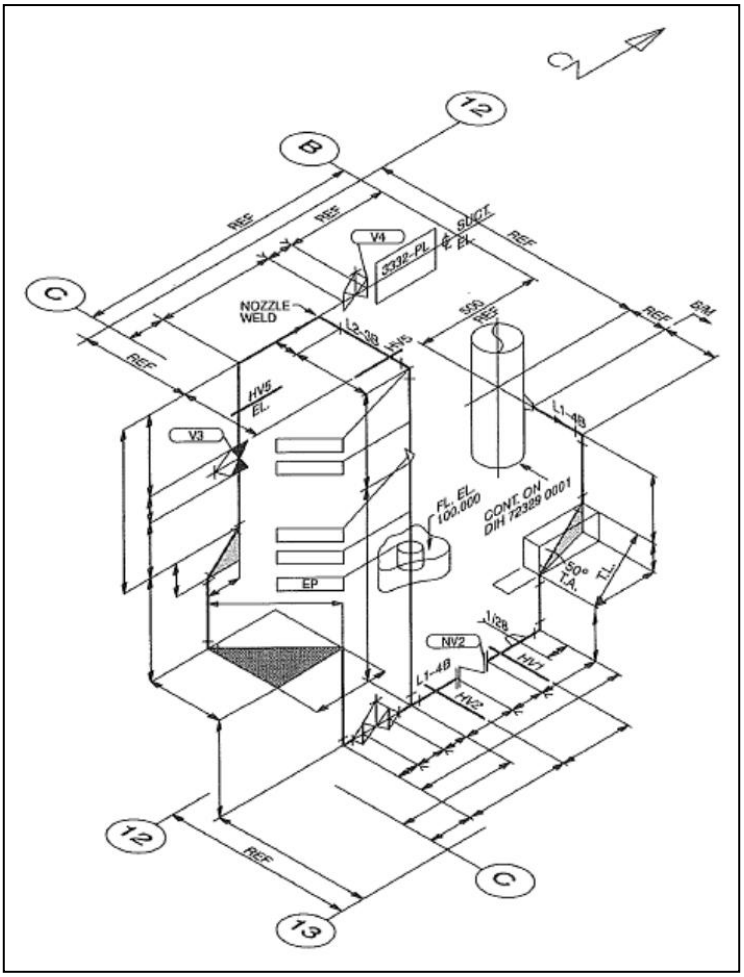
(13) Field run pipe shall be adequately dimensioned to permit field installation. Changes in direction and elevation must be clearly indicated and overall length of the piping shown. All terminal points must be defined and dimensioned.

(14) When dual dimensioning is used on main steam (MS) and hot reheat steam (HRS), or other steam system, the hot dimension (H), shall be shown on top of the dimension line, or to the left. The fabricating dimension (F) shall be shown under the extension line, or to the right.



(15) Rubber lined piping shall be dimensioned centre line to centre line and each length between flanges, and fittings.

(16) The figure below illustrates dimensioning of isometric drawings and certain general mechanical dimensioning practices.



4.4.5 Ductwork

(1) Plan views are dimensioned from grid lines to centreline of ducts.

(2) Where grid lines are likely to be concealed by walls, etc. prior to duct installation, dimensioning shall be to walls or other visible datum points.

(3) Ducts are dimensioned to sheet metal.

(4) Ducts, grilles, diffusers, dampers, etc. shall be dimensioned in millimetres.

(5) In sections and elevations, dimensions are to the bottom of duct.

(6) Use a centreline dimension when connecting ductwork to equipment, i.e. fan inlet.

4.4.6 Equipment Drawings

(1) Plan views are dimensioned to centreline.

(2) Sections and elevations are dimensioned to centreline where necessary or if desirable.

(3) Each component in a built-up equipment unit shall be dimensioned.

4.4.7 Drawing Presentation Format

Types of drawings prepared:

(1) Flow diagrams.

(2) System Drawings.

(3) Plant Arrangement Drawings.

(4) Equipment Location Drawings.

(5) Yard Piping.

(6) Isometric Drawings.

(7) 3-D Drawings.

4.4.7.1 Flow Diagrams

A drawing showing diagrammatically design decisions made to effect the orthographic presentation of a system. The principles to be followed are:

(1) Use an A1 drawing sheet.

(2) Use a medium line weight for pipe headers, both principal and secondary.

(3) Use a thin line weight for equipment and instrument symbols.

(4) Use symbols where possible to draw an object.

(5) Check the symbol section of this document to make sure you represent an object correctly.

(6) Lines intersecting another but not joining should cross over by using a small semi-circle.

(7) Leave adequate space for line and valve numbering, dimensioning, notes and reference remarks.

(8) Keep clear of borderlines on the drawing sheet and do not draw into the right hand column above the titleblock.

4.4.7.2 System Drawings - Orthographic and Isometric

These are drawings portraying the route of a pipe system such that the piping can be fabricated, hung and erected in the field. The principles to be followed are:

(1) The drawing shall contain all necessary information for instrument, valve, and support locations. Bills of Material or item lists may be shown on the drawing where possible, or separately as a drawing sheet.

(2) Due care must be taken to choose a route both economical and practical, permitting good access and withdrawal space around equipment, allowing for expansion or contraction when necessary and supported where possible from existing floor or steel and conforming to safe standards.

(3) Use an A1 drawing sheet.

(4) Supports are detailed on separate A4 sheets or detailed on the same drawing or new drawing.

(5) For orthographic drawing, choose views that will give maximum clarity.

(6) For an orthographic drawing containing several views, start plan on upper left-hand side of sheet.

(7) Make the system stand out by heavier delineation from background delineation.

(8) Piping systems will be drawn single line for all pipes under 8.5 mm. A double line or heavier line will be used for all larger pipe sizes.

(9) Show hanger locations. On orthographic drawing this is normally shown in the plan view.

(10) Don't repeat dimensions unnecessarily.

(11) When a pipe system has slopes in horizontal parts of the system, use the word FALL over an arrow to indicate direction.

(12) For isometric drawings, horizontal and vertical lines should, where possible, be proportionate to each other.

(13) Dimensions not critical to the system piping but used to locate equipment or building steel shall have the abbreviation REF after the dimension.

(14) Dimensions should always be taken to centre line of the pipe when locating to some fixed object.

(15) When drawing field run pipe, dimensioning shall be kept to a minimum and shall only refer to elevations and relative location to building columns, or equipment.

(16) When listing notes and references in right hand column of the drawing sheet, list references first, writing a brief description followed by the drawing reference numbers.

4.4.7.3 Plant Arrangement Drawings

(1) Drawing(s) showing the arrangement of equipment, steel work, concrete, brickwork, electrical ducts, ductwork and piping at chosen positions in the plant.

(2) One view only will normally be shown on each drawing.

(3) Use a ‘B1’ size sheet unless informed otherwise.

(4) The location of the view forms a grid - normally ending on column centre lines. Do not carry over any delineation past the grid lines.

(5) The drawing is an accuracy drawing used to determine clearances and interferences. Therefore, care must be taken to draw to scale.

(6) Size limitation of piping to be shown single or double line.

(7) Whether or not to show 'Field Run' piping to be jointly determined by Draftsperson and coordinating Engineer for the project concerned.

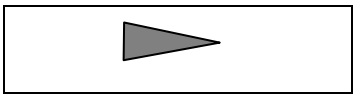
(8) Linework shall be of two weights. Steelwork, equipment, and concrete outlines are to be lighter than piping, cable pans, panels and ductwork.

(9) Dimensions shall be kept to a minimum. Normally only column spacings are dimensioned.

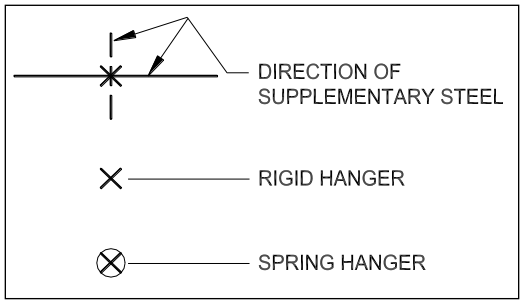
(10) Pipelines in plan shall show pipeline designation and the elevation of the pipe.

(11) Electrical features normally added to the drawings shall include cable pans, panels, bus ducts and switchgear.

(12) Bracing of steel columns shall be shown in plan views by an arrow shaded thus:



(13) Pipe hangers shall be shown in plan view thus:



(14) When listing notes and references in the right hand column of the drawing sheet, list references by first writing a brief description followed by the drawing reference number.

4.4.7.4 Equipment Location Drawings

Equipment location drawing(s) show the location of equipment in the powerhouse and important features, such as stairs, platforms, rooms, openings and isolating phase duct routes. These drawings are used inter-departmentally to effect decisions.

(1) Use A0 sheet size for powerhouse equipment location drawings.

(2) One view only will normally be shown on each drawing.

(3) All building columns will be shown and identified, the extent and thickness of any enclosures shall be shown.

(4) Access or exit openings in the building will be shown.

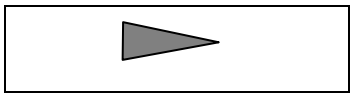
(5) All equipment in nominal outline must be shown and dimensioned in two directions, normally to a fixed point such as building columns.

(6) Centre line elevations of pumps, fans, horizontal coolers and heaters must be given.

(7) Large openings such as access, ducts, pits, are to be dimensioned.

(8) Platform locations are to be shown; their floor elevation and overall dimensions are to be noted.

(9) Bracing of steel columns shall be shown in plain view by an arrow shaded thus:



(10) All equipment shown shall have the manufacturer's drawing referenced in the reference column.

(11) Withdrawal and laydown areas, required for removal of equipment, shall be noted by broken lines.

(12) Future equipment requirements shall be shown by chain dot outline.

(13) Stairwells, direction of stairs, ladders to access platforms, will be shown.

(14) Grated floors, checker plate floors, will be indicated by the appropriate symbol but indication must be kept to a minimum.

(15) Electrical equipment to be shown, such as isolated phase bus, switchgear, cubicles, transformers, motor control centres.

4.4.7.5 Yard Piping Drawings

These are drawings showing the route of all pipe systems exposed and buried that exist in that part of the plant area not contained in a building. Yard features other than piping are also shown but only in outline.

(1) A grid drawing called 'Key Plans' will have divided the site and each rectangle in the grid will have been allocated a number.

(2) The Key Plans are normally drawn at a 1:1 in model space on an A0 sheet for metric and 1/8", 1/16"=1'-0" for imperial drawings to be used in paper space.

(3) Each area (detail) drawing shall be drawn on an A1 sheet.

(4) All major views are plan views, blow ups and details of critical areas within the grid are permitted.

(5) Only details applying to the particular grid shall be shown.

(6) If a detail cannot be shown clearly without interfering with the presentation of the rest of the drawing, a separate detail drawing may be drawn by adding a sheet to the drawing.

(7) Do not carry, beyond the grid lines, any structure, road, pipe system or other feature, except reference marks, dimensions and notes.

(8) All roads, ditches, yard drainage, railways, fences, to be drawn accurately. These drawings are to be checked for clearance as well as detail.

(9) All electrical buried ducts must be shown.

(10) Use medium weight lines to represent piping, all other line weight must be thin.

(11) Use single line for all piping.

(12) Headers travelling the same route but representing a different system should be grouped together where possible.

(13) Normally terminate all piping 1500 mm from a building.

(14) The depth of cover for all water systems should be a minimum of 1 500 mm unless approved otherwise by the Engineer.

(15) Elevations of piping will normally be to the pipe centre line.

(16) The full pipe designation code and colour should be shown for each pipe line.

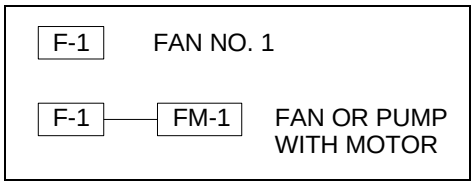
(17) Keep dimensioning to a minimum; all locations of pipe should be by ordinates.

(18) When listing notes and references in the right hand column of the drawing sheet, list references first, writing a brief description followed by the drawing reference number.

4.4.7.6 HVAC/Mechanical Drawings

(1) Isometric drawings shall be used for efficiency to portray piping details, pump and tank connections, etc. Line work shall be done with appropriate piping designations.

(2) On working drawings, all equipment is designated by abbreviation from station equipment device code. The abbreviation and equipment number appears on the drawings as shown below. Designations for valves, strainers, etc. are done in a like manner.



(3) Flow Diagrams - The same form of enclosure as above is used for equipment coding on flow diagrams. An exception is motors, in which case a circle is used. Abbreviations are taken from instrumentation device code. A circular enclosure with the appropriate abbreviation is used for all instrumentation coding.

5. REFERENCES

- ENG-MAN-015 Contractor-Submitted Drawing Requirements.
- ENG-PRC-051 Drawing Management and Services.
- ENG-STD-003 Units of Measurement for Imperial - Unit Sites.
- OPG STD6-C-H-01140-1120 Design and Construction Branch, Instrumentation and Control, Design Standards Manual.
- IEEE Standard 315-1975 Graphic Symbols for Electrical and Electronics Diagrams (Including Reference Designation Letters).
- CAN/CSA-B78.2-M91 (R2002) - Dimensioning and Tolerancing of Mechanical Drawings.
- The Standards of the American National Standards Association (ANSI).
- ANSI C37.2 - 2008 - Electrical Power System Device Function Numbers, Acronyms and Contact Designations.
- The Standards of the Canadian Institute of Steel Construction (CISC).
- Handbook of Steel Construction (Metric Structural Steel Design Data).
- The Land Survey Act.

6. REVISION HISTORY

Revision Number	Revised Section or Pages	Revision Description	Revision Date
R01	1.1	• Purpose of document section rewritten. • Added bullet "ENG-STD-003 Units of Measurements for Imperial – Unit Sites".	Dec. 20, 2016
	2	• New section "Document Management" created, consisting of existing sub-sections in document, for improved organization of information.	
	2.1.1	• Pdf replaces microfilm as the official corporate record of a drawing.	
	2.1.2	• Added electronic file examples "(.pdf, .dwg, .mil, .tiff, .docx, .xlsx, etc.)".	
	2.2	• Deleted "Existing drawings will continue to be used unless the revisions are so extensive, the preparation of a new drawing is justified."	
	2.2.1	• Added "related to Engineering Change" to (1).	
	2.2.2	• Deleted drawing revision condititions (1) to (5).	
	2.2.2 (7)	• Added "and/or Engineer".	
	2.2.4.1	• Added "application of `OBSOLETE' stamp" to last paragraph. Obsolete stamp image inserted.	
	2.2.4.2	• Added "application of `SUPERSEDED' stamp" to last paragraph. Superseded stamp image inserted.	
	2.2.6	• Deleted "A drawing number change occurs when the original drawing number is changed, but the drawing is not being superseded. The changes to the drawing number are the document type, drawing size and drawing source components."	
	3.1.3 (3)	• Wording change to highlight AutoCAD is the only acceptable software for drafting.	
	3.3.1.1	• AutoCAD is the only acceptable software for drafting.	
	3.3.1.2	• AutoCAD is the only acceptable software for drafting.	
	3.3.1.3	• Excel .xlsx replaces .xls.	
	3.3.2	• Added "Image file shall be embedded whenever possible to reduce the housekeeping of the files" to third bullet. • 'Hyphens' replaces 'underscores' in AS7 filename	

		numbering.	
	3.3.3	• Deleted “Drawings - Completed Folder” sub-section.	
	3.3.5.2	• Deleted “and Section 2.2.5.8 - Typical Makeup of other Document File Numbers” before Figure 1.	
	3.3.5.5	• ‘Professional Services Provider’ replaces Consultant. • Information re-organized in table for clarity.	
	3.3.5	• Deleted “Typical Makeup of Other Document File Numbers”, “Correspondence”, “When Filing Numbers are Omitted”, and “Document Registration” sub-sections. • New Sub-sections 2.2.5.8 Bills of Material and 2.2.5.9 Specifications (previously numbered list, no content change).	
	3.3.5.11	• Added “NOTE: For thermal generating stations, unit coding is different than in Hydro stations. Please contact the local thermal drawing office for unit coding direction.”	
	3.3.7	• Added 2nd paragraph “All drawings should be created full size (1:1) in model space. Standard scaled prints of the drawings should be created in paper space, excluding electrical drawings, which can be created not to scale in model space.” • Added 3rd paragraph “All drawing borders on paper space shall remain full size (1:1).”	
	3.3.7.1 (2)	• “Scans” replaces reference to microfilms.	
	3.3.8	• “Scan” replaces “microfilm”.	
	3.3.8.1	• Last paragraph “of the pdf files” replaces “microfilm work”.	
	3.3.8.2	• Symbols Used on Drawings removed from body of document. Added “Refer to pdf attachment Word file named Symbols Used on Drawings for discipline specific symbols.”	
	3.3.9.1 (3)	• “MCD-2-79 Ontario Power Generation Standard Specification - SI Metric Practice Reference Guide” replaced by “ENG-STD-003 Units of Measurements for Imperial Unit Sites”.	
	3.3.9.1 (10)	• Added “All drawings should be created full size (1:1) in model space. Standard scaled prints of the drawings should be created in paper space, excluding electrical drawings, which can be created not to scale in model space.”	

	3.3.10.1	• Lettering size table added for clarity.	
	3.3.12	• Abbreviations Used on Drawings removed from body of document. Added “Refer to pdf attachment Word file named Abbreviations Used on Drawings for reference.”	
	4.1.1	• Deleted “Further examples of drawing titles can be obtained from the electronic document management system, i.e. AS7.”	
	4.3.1	• First sentence changed to “The drawing title is composed by the joint effort of the Draftsperson and the respective Engineer.”	
	4.3.2	• Drawing Classification Codes removed from body of document. Added “Refer to pdf attachment Word file named Drawing Classification Code Chart for descriptions and examples related to the descriptive titles commonly found on OPG drawings.”	
	4.3.4 (1)	• IEEE-200-1975 replaces CSA Z99.	
	4.3.7.2	• Deleted “ANSI Standard C37.2 latest edition”.	
	4.3.7.3	• Standard Device Function Numbers removed from body of document. Added “Refer to pdf attachment Word file named Standard Device Function Numbers.”	
	4.4.1	• First sentence changed to “The drawing title is composed by the joint effort of the Draftsperson and the respective Engineer.” • Added “searching under 'Drawings', and entering the name or part of the name of the drawing as a keyword” to last sentence.	
	4.4.7.5	• (2) “1:10 000” changed to ”1:1 in model space” and added “to be used in paper space” at end of sentence. • Deleted old (3) and (4) numbered items. • (6) For yard piping drawings, item now reads “If a detail cannot be shown clearly without interfering with the presentation of the rest of the drawing, a separate detail drawing may be drawn by adding a sheet to the drawing.”	
	5	• References updated.	
	All	• AS7 replaces SAP/DM throughout.	
R00	All	• New document. Supersedes EPS-DRF-STD-001.	Jun. 30, 2011