ONTARIO POWER GENERATION	Engineering & Technical Services	Internal Use Only	
		Document Number: ENG-MAN-015	Page: 1 of 37
		Effective Date: Dec. 20, 2016	Revision: 01

Title:
Contractor-Submitted Drawing Requirements

Applicability (RGPM, Hydro or Thermal):	Associated Document(s)	SCI Number
RGPM	ENG-STD-004, ENG-PRC-051	01160

MANUAL

PURPOSE

The purpose of this manual is to provide Contractors with a requisite OPG-RGPM standard requirement for the preparation, revision, submittal and acceptance of engineering drawings and associated documents.

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1. INTRODUCTION

The purpose of this manual is to describe the requisite Ontario Power Generation (OPG) - Renewable Generation & Power Marketing (RGPM) standard requirements for the preparation, revision, submittal, acceptance and registration of engineering drawings and associated documents.

This manual applies to a Contractor engaged in supplying drawings to OPG - RGPM.

2. DEFINITIONS

RGPM	OPG Renewable Generation & Power Marketing
PES	OPG Plant Engineering Services
Contractor	The party named in the contract to whom OPG has awarded the contract to design and supply the equipment (the supplier, the Subcontractor, the supplier's personnel or any other person the Supplier or a Subcontractor is responsible for at law).
OPG Representative	Engineer employed by, or representing OPG, responsible for ensuring that the Contractor is adhering to the specification.
Draftsperson	Personnel 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.
Document	A document, design, drawing (including as built drawings), diagram, illustration, schedule, performance chart, brochure, specification, plan, progress photograph, report, certificate or manual (including operating and maintenance manuals).
Engineering Drawings	Form of legal documents, which constitute graphical instructions to manufacturers, construction forces and/or operations, staff for fabrication, installation and/or operation of components or systems, created to a set of rules, codes and standards.

Contractor's Drawings:	Drawings produced by an external engineering agency, under contract to OPG-RGPM, including Manufacturers' drawings obtained by the Contractor. Contractor's drawings are produced under the following types of contract: Type 2 Contract: Contractor selected and engaged by OPG-PES in the execution of work packages as defined in the Terms of Reference by OPG-RGPM. Work is performed in the Contractor's offices and not supervised by the OPG Representative. The Contractor is not responsible for Construction Management. Type 3 Contract: The Contractor is selected and engaged by Project Management in the execution of complete Engineering and Construction work packages as detailed on the Engineering, Procurement and Construction Management (EPCM) package. The Contractor is responsible for procurement of materials, installation contract with 3rd party contractor and day-to-day project management.
Manufacturer Drawings	Drawings prepared by a manufacturing organization and approved for use by OPG-RGPM, including drawings approved for use by Contractors on behalf of OPG-RGPM. Drawings types are: Standard Item Drawings: Drawings prepared and owned by a Manufacturer representing products mass-produced to a standard design or specification. Non-Standard Manufacturer Drawings: Drawings representing products custom designed and fabricated, produced by a Manufacturer, acting as a Contractor, under contract to OPG-RGPM.
Fabrication Drawings	Usually applies to Civil/Structural drawings which are prepared by the Contractor, or his agent, for such items as rebar bending and placing, or steel shop drawings.
Request For Drafting	A form used to initiate a request for drafting service and to communicate relevant information between Engineer/Client and Drafting personnel.
Field Marked Print (FMP)	A marked-up copy of the latest existing OPG drawing showing the changes to the existing plant facilities and equipment. These marked-up drawings are processed after the installations are complete and the existing drawings revised, or new drawings produced to reflect the latest configuration. FMP reflects the latest plant configuration before the drawing is updated.
As-Built Drawings	Marked up copies of construction drawings from site, showing all changes made during construction/commissioning which must be initialed by the person responsible for construction at site. These drawings should not be sealed and issued at Revision 00.
Record Drawings	Seals should be applied only in those cases where the engineer or their delegate have visited the site, reviewed the project during construction and have verified every change in detail. The changes must be clearly marked on the drawings and a note referencing the original sealed drawings should be attached. These documents are referred to as

	'record drawings' to distinguish them from 'as-built drawings'. Record drawings verified in detail by the engineer and issued to a third party must be sealed.

3. RESPONSIBILITIES

3.1 Contractor

The Contractor shall be responsible for:

(1) The preparation and/or revision of engineering drawings as required by the contract and in accordance with ENG-STD-004 Drawing Presentation Standard and Practices and this instruction, including the obsolescence and/or superseding of existing OPG drawings, if required.

(2) Requesting access to drawing information from the OPG Representative.

(3) Requesting copies of OPG drawings identified for revision purposes from the appropriate Record Centre.

(4) Ensuring assigned drawing numbers are reserved through the appropriate OPG-RGPM Record Centre.

(5) Ensuring that Manufacturer originated drawings are assigned an OPG drawing number and submitted.

(6) Ensuring all drawings (after tender and construction issues, including Manufacturer/Contractor drawings) submitted to OPG-RGPM, incorporate as-built conditions prior to turnover.

(7) Ensuring revision to an existing drawing is made on drawing file(s) that are retrieved from the appropriate OPG-RGPM Record Centre.

(8) All drawings created for OPG-RGPM are produced with AUTOCAD and submitted at version that is approved by OPG-RGPM.

(9) OPG drawing symbology shall be applied and maintained.

(10) Contractors must destroy all old information/drawings used for past projects to ensure the most up-to-date information (i.e. drawings) is being used.

3.2 OPG-Representative

The OPG Representative shall be responsible for:

(1) Checking with OPG-RGPM personnel for any outstanding Field Marked Prints requiring modification/change prior to proceeding with the work.

(2) Authorizing the release of existing OPG-RGPM drawings and/or associated electronic files to the Contractor, who may be required to revise existing OPG-RGPM drawings in accordance with the requirements of the contract. Electronic files could be either be;

.mil, .dwg, .xls or for hybrid drawings, (.dwg + .mil) file formats.Ensuring any outstanding FMPs are forwarded to the Contractor which may affect the Project /Engineering work.

(3) Advising the Contractor to include FMP updates to existing OPG-RGPM drawings as a drafting service.

(4) Ensuring drawings submitted by the Contractor are in accordance with the requirements of the Type 2 or 3 Project scope and are reviewed, accepted and issued through drafting to ensure adherence to OPG-RGPM - ENG-STD-004 Drawing Presentation Standard and Practices.

(5) Establishing SCI numbers to be used on a project and, if required, creating new SCI numbers. Requirements for any new SCI numbers will be approved and processed through the appropriate OPG-RGPM Record Centre.

(6) Arranging for bubble, cable, valve, etc. numbers as required as per local practice.

(7) Ensuring submitted drawings have been prepared/revised in accordance with OPG-RGPM - ENG-STD-004 Drawing Presentation Standard and Practices.

(8) Ensuring Contractor drawing submittals are forwarded to drafting personnel for OPG-RGPM processing (review and issue).

3.3 OPG-RGPM Record Centre

The OPG-RGPM Record Centre shall be responsible for:

(1) The registration, distribution, storage, retrieval, maintenance and obsolescence of all drawings and the import of associated electronic files and documents into the electronic document management system

(2) Arranging for the maintenance of the System Classification Index and updating the Property/Site/River designation listings

(3) The administration and allocation of OPG-RGPM drawing serial numbers

(4) When authorized, the release of drawings and/or associated electronic files to external personnel (e.g. Contractors, etc.), through the OPG-RGPM individual responsible for contracting with the Contractor or delegate.

4. PROCESS

4.1 Project Start-Up Meeting

It is strongly recommended a representative of OPG-RGPM drafting attend the project start-up meeting. The OPG-RGPM drafting representative provides the Contractor with detailed information regarding OPG-RGPM drawing requirements to ensure the Contractor produced/revised drawings adhere to OPG-RGPM's - ENG-STD-004 Drawing Presentation

Standards and Practices, when submitted. If required, the drafting representative should meet with the Contractor's drafting personnel.

At the initial project start-up meeting, the OPG individual responsible for contracting with the Contractor will provide the Contractor with the following information package:

(1) A copy of this manual.

(2) A copy of standard ENG-STD-004 Drawing Presentation Standard and Practices

(3) A copy of standard ENG-STD-003 Units of Measurement for Imperial - Unit Sites.

(4) Electronic files of OPG-RGPM drawing sheets and titleblock in AutoCAD (.dwg) file format.

(5) Sample Elementary Wiring Diagrams (EWD) and Connection Wiring Diagrams (CWD) in Acrobat (.pdf) or AutoCAD (.dwg) file format.

(6) Bubble/Cable/Valve list templates in Excel (.xlsx) file format.

(7) Electronic symbols in AutoCAD (.dwg) file format:

  (a) Obsolete Stamp (see Appendix A).

  (b) Superseded Stamp (see Appendix A).

  (c) OPG Ownership Stamp (see Appendix B).

  (d) Approved for Use Stamp (see Appendix C).

  (e) Market Compliance Drawing Stamp (see Appendix D).

  (f) Revenue Metering Drawing Stamp (see Appendix E).

  (g) Transmitter Interface Drawing Stamp (see Appendix F).

(8) Electronic forms:

  (a) ENG-FRM-007 Drawing Access/Release Request by External Users Form.

  (b) ENG-FRM-003 Obsolete Drawings Form.

  (c) ENG-FRM-004 Superseded Drawings Form.

4.2 Access to Drawings and Other Associated Documents

(1) The Contractor will prepare and complete ENG-FRM-007 Drawing Access/Release Request by External Users Form and submit for approval to the OPG Representative.

(2) The OPG Representative will conduct a drawing search/browse at the appropriate OPG-RGPM Record Centre upon submission of the authorized form.

(3) The OPG Representative will identify and charge out the required drawings for the purpose of revision.

(4) The Contractor will be provided with electronic copies of the requested drawings in external file media.

4.3 Preparation and Submission of Drawings

(1) The OPG Representative will arrange and reserve the new OPG-RGPM drawing numbers at the appropriate Record Centre.

(2) The Contractor will prepare and revise drawings as described in this document.

(3) The Contractor will submit all drawings and associated electronic files, including appropriate drawing forms, through the responsible individual contracting with that Contractor.

(4) The Contractor will provide record drawings signed and sealed full-size hard copy and electronic files for all drawings produced/revised under the contract, including obsolete and/or superseded drawings. See Section 7 - Drawing Submittals for detail requirements.

5. DRAWING REQUIREMENTS

5.1 Unit of Measurement

For new facilities, the SI unit of measurement is the governing unit of this guide, 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. For reference see standard ENG-STD-003 Units of Measurement for Imperial Unit Sites.

5.2 Drawing Number (Identification Code)

The drawing number is contained within a twenty-two-character field, allowing for the inclusion of the following code elements:

(1) Property/Operating Designation, or Site or River Number.

(2) Document Type.

(3) Drawing (paper) Size.

(4) Drawing Source.

(5) System Classification Index (SCI) Number.

(6) Serial Number.

(7) Sheet Number.

(8) Revision Number.

The order of elements listed above must be strictly adhered to when preparing an identification code. See Appendix G.

OPG-RGPM Record Centres manage and maintain the official Drawing Numbers and should always be consulted prior to applying drawing serial numbers.

5.2.1 Property/Operating Designation or Site or River Number

This is a unique number assigned to an OPG asset such as a generating station, service centre, etc.

An approved Property/Operating Designation, Site or River Number shall be used for all drawings related to the project. The OPG-RGPM individual responsible for contracting with the Contractor normally provides for this element.

5.2.2 Document Type

This is an alphabetic code used to identify the various types of drawings. The correct usage of these codes will provide sub-lists of drawings by type, eliminating the need to assign sorting logic in other drawing number components, see Appendix G for document type codes.

5.2.3 Drawing (paper) Size

All drawings shall be sized according to International Organization for Standardization (ISO) as per supplied AutoCAD files. For reference, see Appendix H.

5.2.4 Drawing Source

This is an alphabetic code used to identify the originators of drawings. A following code ‘E’ is to be used by all Contractors.

5.2.5 System Classification Index (SCI) Number

This is 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. To better understand SCI numbers see the following example based on the SCI number 66412.

Example:

60000	Function Description	Instrumentation & Control
6**6**000	Feature Description	Control Centre Equipment
66**4**00	System Description	Supervisory Control, Remote Annunciation & Telemetering Equipment
6641**1**0	Sub System Description	Supervisory Control - Non computer Assisted

66412	Component (Element) Description	Remote Station (Including Dedicated Inverter)

The OPG-RGPM individual responsible for contracting with the Contractor usually provides this number. One to several SCI classifications may be used on one project.

The SCI classifications that will describe the drawing content will be under the following Function Description levels (see above example):

10000	Site and Improvements
20000	Buildings and Structures
30000	N/A
40000	Power Generation Facilities
50000	Electrical Power Systems
60000	Instrumentation and Control
70000	Plant Auxiliary Processes and Services

Drawings will generally have a SCI classification to at least the System Description level (see above example).

Note: There are general SCI classifications as well as the OPG-RGPM SCI classifications which consist of SCI numbers approved for use on OPG-RGPM projects.

5.2.6 Serial Number

This is a sequential order numeric assigned to all drawings within the Property Number/Operating Designation, Site or River Number.

As a general rule, no logic shall be applied to this number with the exception of Manufacturer's drawings (see Section 5.2.7).

The appropriate OPG-RGPM Record Centre personnel will provide a block of approved-for-use serial numbers for any given SCI number.

Note: With any change to the code elements, the use of the proposed serial number must be confirmed with OPG Record Centre.

5.2.7 Serial Number - Manufacturer's Drawing

For a Manufacturer's drawing submitted to Ontario Power Generation, the Serial Number shall begin with the numeric **9**xxx for each SCI. The serial number will commence at the next sequential available 9000 series number (i.e. NF28-D1E-68245-**9**023-R00).

5.2.8 Sheet Number

This is a field of four numerics with leading '0's', as required, indicating a specific sheet.

This field is an extension of the drawing number. Therefore, a series of sheet numbers will have the same Document Type, Drawing Size, Drawing Source, SCI and Serial Number. Generally, the use of sheet numbers is discouraged except in cases where it cannot be avoided.

5.2.9 Revision Number

This is a sequential order of two numerics assigned to each drawing to establish and record the sequence in which revisions were made, (e.g. 00, 01, 02, 03, etc. to 99). For all new drawings, the revision number will be '00' when submitted to OPG.

5.3 Drawing Title

5.3.1 Station/Plant, Site or River Name and Unit Designation

The top window of the drawing title block 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.

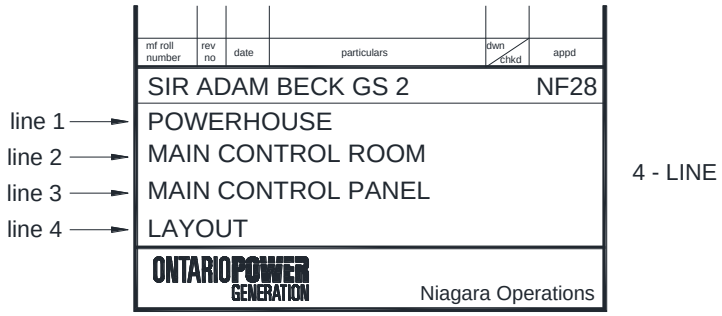


mf roll number	rev no	date	particulars	dwn / chkd	appd
SIR ADAM BECK GS 2					NF28
G 14 FOUNDATION SLAB ROOM FLOOR EL. 320.00 CONCRETE					
ONTARIO POWER GENERATION					Niagara Operations
dwn		designed by	FOR ORIGINAL SIGNATURES SEE REVISION 00.		
chkd		design reviewed by	THIS DOCUMENT AND THE INFORMATION CONTAINED HEREIN IS THE EXCLUSIVE PROPERTY OF, AND IS CONFIDENTIAL AND PROPRIETARY TO, ONTARIO POWER GENERATION INC. ALL RIGHTS RESERVED. THIS DOCUMENT AND INFORMATION CONTAINED HEREIN MAY BE USED ONLY AS AUTHORIZED IN WRITING BY ONTARIO POWER GENERATION INC. AND MAY NOT BE REPRODUCED OR UTILIZED IN ANY FORM OR BY ANY MEANS, ELECTRONIC OR MECHANICAL, INCLUDING PHOTOCOPY RECORDING, OR BY ANY INFORMATION STORAGE OR RETRIEVAL SYSTEM AND MAY NOT BE DISCLOSED, IN WHOLE OR IN PART, WITHOUT THE PRIOR WRITTEN CONSENT OF ONTARIO POWER GENERATION INC.		
date yr/month/day		authorized by			
scale NTS		CAD file type DWG			
dwg no NF28- D0H-21520-0023				sht no 0001	rev 00

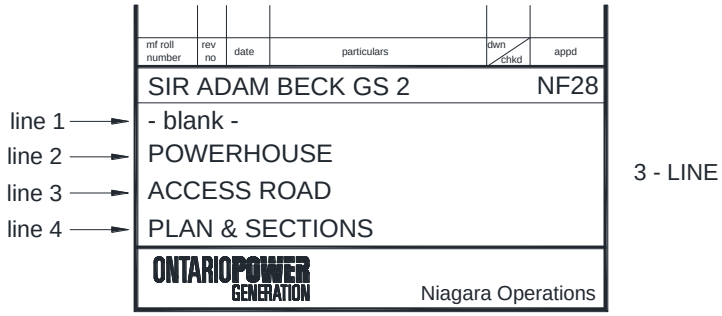
The unit designation will be included on all Ontario Power Generation Station drawings except for drawings where there is no generating unit, e.g. 'River', in which case the unit designation will not be shown.

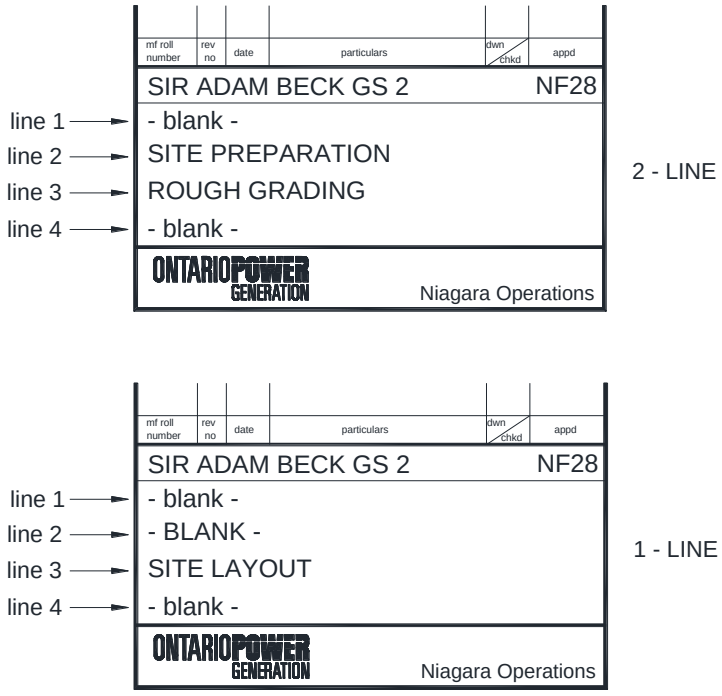
5.3.2 Guidelines for Drawing Titleblock

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.



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.

5.3.3 Generating Unit Coding

Unit information will be coded in a common location on all drawings, (i.e., line 1 of the drawing title in the titleblock).

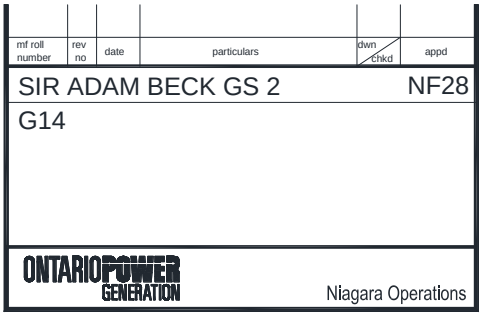
(1) To the extent possible, individual drawings will be produced for each generating unit. Unitized drawings will allow for nomenclature to be shown, specific to the unit and aid in future trouble shooting/maintenance, plant configuration, etc.

(2) When a drawing applies to specific units, all unit numbers will be shown, or as a range of unit numbers.

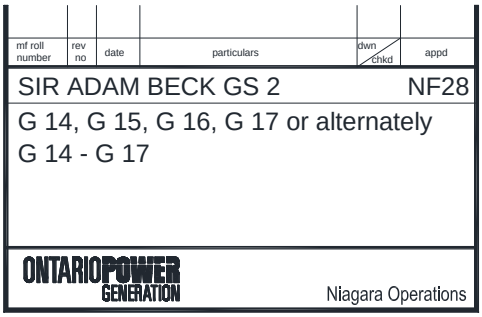
(3) When a station system drawing applies to more than one generating unit, the unit numbers will be prefixed with ‘COMMON’.

(4) For drawings where there is no generating unit to refer to, (i.e. 'River'), this area will be left blank.

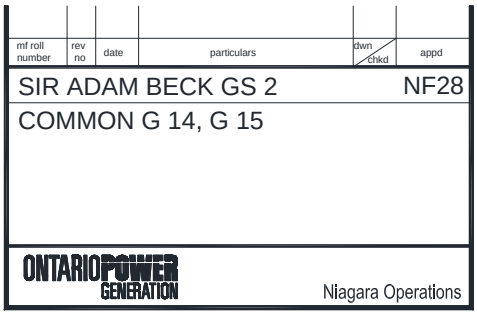
NOTE: For thermal generating stations, unit codings are different than Hydro stations. Please contact local thermal drawing office for unit coding direction.



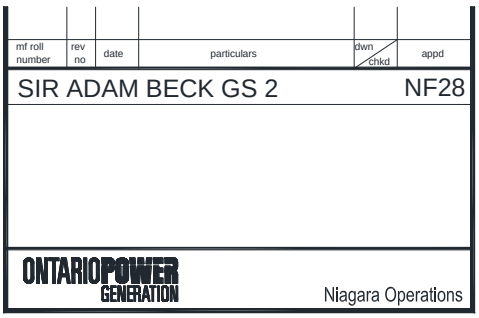
This drawing is applicable to Generating Unit 14 only.



This drawing is applicable to each Generating Unit listed. If applicable to 8 Units, indicate as (i.e. G 14 – G 21).



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



This drawing is not applicable to any Generating Units.

5.3.4 Title Description Guidelines

Drawing titles, in addition to the generating unit(s) if applicable, shall contain the following:

(1) **Civil/Structural Drawings:**

- Name of building, structure or feature.
- Specific system or part of building, structure or feature.

- Drawing identity, distinguishing it from others in the same set; (Plan, Section, Detail, etc.).
- Class of work (concrete, structural steel, etc.).

(2) **Electrical Drawings:**

- Area or system.
- Location, views or type of protection.
- Type of drawing (elementary, connection, etc.).

(3) **Mechanical Drawings:**

- 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.).

(4) **Geo-Technical/ Environmental Drawings**

- Specific part of building, structure, area or feature.
- Type of drawing.
- Plan(s) or section(s) or detail(s).

5.4 Lettering Used on Drawings

The preferred standard for lettering on drawings is the upper case ROMANS or ROMAND Autodesk 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. Custom font shapes are not to be used in any drawings.

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”

5.5 Number Layout

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

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

5.6 Linework

OPG's preferred method of showing lineweight is by use of 'p-lines' to ensure consistent hard copy output. Plotting by colour is rarely used in OPG.

This standard shall be applied to all normal drafting assignments. The representations must be suitable for full size and scan reproduction methods.

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 one-line diagrams with several voltage levels.

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

5.7 Electrical Wiring Diagrams

OPG-RGPM utilizes two wiring diagram types to show the functionality, devices, logic, connection locations, cable numbers, etc. associated with a circuit/system. While outside industry typically uses one diagram to reflect the above information, it is essential that OPG-RGPM be provided with the two diagrams in order to properly integrate the drawing into the existing plant configuration/maintenance systems.

Based on the following general description of each drawing type, and in conjunction with the samples provided, the Contractor produced new electrical wiring diagrams must meet OPG-RGPM's requirements. Further clarification, if required, can be obtained from a Plant Engineering Services Protection & Control representative.

5.7.1 Elementary Wiring Diagram (EWD)

This is a simplified diagram showing the elements/components of a circuit/system, with the elements represented mostly by industry standard symbols. It includes the connections to all the elements/components. The layout of the diagram may not resemble the actual physical layout of the circuit/system. These diagrams are intended to show the protection and/or control schemes, ac circuits, dc circuits, etc. Bubble numbers (see below) serve as references to other diagrams.

The EWDs will contain, but are not limited to phasing, ground points, CT polarity, ratios, CT links, VT fuses, FT switches, draw-out devices, +/- dc buses, meters, relays, PLC addresses, etc. The information portrayed will be dependent upon the intent of the diagram. All devices are labelled with their site (field) nomenclature. Typically, there is a pure EWD, ac EWD and a dc EWD with associated Connection Wiring Diagrams.

5.7.2 Connection Wiring Diagram (CWD)

This is a simplified diagram showing the electrical and mechanical relationship between elements/components of the circuit/system and the actual wire connections, as an aid to installation, performance and maintenance. The diagram may not resemble the actual physical devices being connected. Bubble numbers (see below) serve as references to other diagrams.

The CWDs will contain, but are not limited to cable numbers, cable size and bubble number reference. Terminal strips will be labelled with their strip number and block number. Conductors are labelled with their destination information not covered in Thermal convention. Jumps within the diagram, are shown by an arrow within a circle. Devices in a panel/cabinet will be shown in a simplified manner with the actual terminals drawn and listed with cross reference labels. The device will be labelled with model information, engineering designation and a cross reference label.

Each of the two diagram types, in addition to the official drawing number, (see Section 5.2), will be assigned a bubble number. The bubble number is unique to that specific drawing and used as a means of showing the continuation of a circuit(s) between different drawings. The bubble number is numeric/alpha code within a circle. Bubble numbers will be provided by the Plant Group contact for each type of electrical diagram. Elementary and Connection Wiring Diagrams will each use a different series of numbers.

5.8 Electronic File Naming and Numbering Convention

CAD 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. Note: Simply editing, (i.e. renaming, the raster filename) will not create the correct association; embed the Image file in AutoCAD with drawing file.

The examples are based on a hybrid drawing. For pure AutoCAD drawings, there will be no .mil file. **In all cases, there shall be only one file (two files for hybrids) per drawing.** Multiple drawings/sheets shall not be contained in one electronic 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-64200-0001-R00.xls
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, the sheet number, will be added as a suffix, separated by hyphens. No spaces are to be used in the filenames.

5.9 Contractor's Logo on OPG Drawings

The Contractor’s logo shall only appear on **new** drawings. See Appendix I for the recommended application of a Contractor's logo in an OPG titleblock (do not explode titleblock) and alternate location, to the left of the OPG titleblock. The Contractor's logo is not to be embedded in the supplied OPG drawing sheets and titleblocks.

5.10 Contractor's Drawing Numbers

Contractor's drawing numbers, if desired, may be applied in addition to Ontario Power Generation's drawing number, on the bottom of the drawing, to the left of the OPG titleblock. See Appendix I for the recommended application of a Contractor's drawing number in a drawing.

5.11 Engineer's Seal and Signature

Contractor's submitted drawings must be sealed and signed per Table 1. Refer to Table 1 for detailed application requirements.

A Professional Engineer's seal (stamp), together with full signatures, 'P. Eng.' Designation, and 'date' shall be applied to prints. The same will apply to Pre-health and Safety Reports, scaffolds, formwork, falsework, and reshoring drawings, which are kept on site during construction. Sealing is not required on originals except at submittal to OPG-RGPM (see Section 4.3 - Preparation and Submission of Drawings). A duplicate copy of the sealed/signed prints shall be kept with the paperwork for permit/registration submissions as part of the project close out document or as part of the design file.

A Contractor's engineer seal shall be applied to the left of the OPG titleblock. See Appendix I for the recommended location.

Table 1: Contractor's Drawing Submission and Signature, Seal and Format Requirements

	Drawings for Review	Drawings for Permits [8]	Drawings for Tender [8]	Drawings for Construction (All revisions) [5] [6] [8]	Record Drawings (Site Record Prints) [5] [8]		Manufacturer Equipment Drawings [3] [5] [8]	Fabrication Drawings [4] [5] [8]	Revisions to OPG Drawings [5] [8]
					Type 2 [1] [7]	Type 3 [2]			
Hard Copy Submission	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Printed Names required	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Signature required	No	Yes	Yes	Yes	Yes	Yes	Optional/Yes [b]	Yes	Yes
Seal/Signature required	No	As Required	Yes	Yes	Yes	Yes	Optional/Yes [b]	Yes	Yes
Electronic Submission[9] Vector (.dwg)	Optional (To encourage electronic communication)	Optional	Optional	Yes	Yes	Yes	Yes	Yes, if available. See note on Hybrid type of electronic submission below.	Yes
Printed Names required	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Signature required	N/A	No	No	No	No	No	No	No	No
Seal/Signature required	N/A	No	No	No	No	No	No	No	No
Electronic Submission[9] Hybrid – Vector (.dwg) + Raster (.mil)	Optional (To encourage electronic communication)	Optional	Optional	Yes	Yes	Yes	Yes, if vector file is not available	Yes, if vector file is not available.	Yes
Printed Names required	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Signature required	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No
Seal/Signature required	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	No
Purpose	For OPG information/ comments	Official submission or for OPG information/comments as determined by Projects		Official submission					
Revision Number	N/A	1st official submission is R00 with OPG drawing number. Every subsequent revision will increase revision number by one.							

Notes:

(1) Type 2 Contracts: The Contractor is selected and engaged by OPG-RGPM in the execution of engineering work packages, as defined in the Terms of Reference by OPG-RGPM. The Work is performed in the Contractor's offices and is not supervised by OPG's Engineering Authority. The Contractor is not responsible for Construction Management.

(2) Type 3 Contracts: The Contractor is selected and engaged by OPG Project Management in the execution of complete Engineering and Construction work packages, as detailed on the EPCM (Design-Build or Design-Bid-Build) package. The Contractor is responsible for procurement of materials, installation contracts with 3rd party contractors and day-to-day project management.

(3) Manufacturer's Equipment Drawings fall into two categories:

  (a) Standard Item drawings: Representing products mass-produced to a standard design or specification. This type usually does not require a seal and signature by a Professional Engineer.

  (b) Non-Standard Item drawings: Representing products custom designed and fabricated under contract to OPG. This type requires a seal and signature by a Professional Engineer (e.g. HVAC and Cable tray drawings).

(4) Fabrication Drawings usually apply to Civil/Structural drawings prepared by the contractor or his agent for such items as rebar bending and placing, or steel shop drawings.

(5) Project Manager to define additional requirements.

(6) All engineering changes to the original construction issue including 'as-builts' shall be documented as an official revision to the construction drawing. No construction shall proceed without proper approval of the changes and revision to construction drawings.

(7) Type 2 'as-built' should include only minor changes/'as-builts' which are not 'engineering' in nature. Engineering 'as-builts' are to be classified under drawings for construction revisions.

(8) Hard copy seal and signature is an OPG-RGPM requirement. Electronic signature approval is not accepted for use in OPG.

(9) Electronic submissions to OPG-RGPM, for information/comments, can be in.pdf file format. Official submissions must be in AutoCAD .dwg file format for vector drawings and/or AutoCAD .dwg + .mil file formats for hybrid drawings.

5.12 Manufacturer's Drawings Submitted to Contractors

The Contractor shall assign OPG drawing numbers and CAD filenames to each of the Manufacturer/Contractor drawings submitted to them, as provided by the OPG Representative prior to turnover. See Section 5.2.7 for 'Serial Number - Manufacturer`s Drawing' and Section 5.8 - Electronic File Naming and Numbering Convention.

The Contractor shall apply an Approved for Use stamp (see Appendix C) to the Manufacturer submitted drawings and shall authorize (sign) the drawings for use on behalf of OPG-RGPM.

The Contractor shall also obtain all 'as-built' Manufacturers' drawings from Contractors, stamped 'AS-BUILT' by the contractor as a Record Drawing. Electronic files for these drawings shall be obtained and submitted to OPG-RGPM at project completion.

Note: Manufacturer drawings re-submitted to OPG-RGPM that have been issued as OPG drawing(s) shall be processed as revisions to existing OPG-RGPM drawings.

6. REVISION OF EXISTING OPG-RGPM DRAWINGS

Any change made to a drawing shall result in a submission to OPG and shall be clearly noted against the revision number.

The revised CAD drawing file shall include initials (over typed-in approving person's full name) and dates of the previous issue blocks.

Attention and care shall be exercised when revising OPG drawings and shall be done in accordance with the following requirements:

6.1 Legacy Drawings

Ontario Hydro, the predecessor to OPG, created most existing OPG drawings. Revisions of these drawings include:

- The application of the 'OPG Ownership Stamp' (see Appendix B).
- Transferring the information from the old drawing titleblock to the new titleblock such as: Scale, date, class no., drawing title and original initials or signatures.
- For Hydroelectric electrical drawings, the drawing bubble number should be positioned exactly as determined by the new border arrangement.

6.2 Hybrid Drawing Files

To facilitate the revision of raster drawings, it is acceptable to create hybrid files. However, the following should be taken into account:

- Hybrid drawing files should not be created/maintained just to capture signatures. A note on the drawing that states 'FOR ORIGINAL SIGNATURES SEE REVISION R00' will suffice.
- Normally, the raster portion of the drawing is not scaled when inserting a new OPG border. OPG border units are in metric, while most legacy drawings are in imperial units. If scaling is required, insert at appropriate scale factor. The preferred drawing unit setting is the Decimal unit.
- Upon completion of revision, embed the raster portion with the AutoCAD file.

6.3 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 procedure of making a drawing obsolete shall be treated as a regular drawing revision with appropriate changes made to the revision number and pertinent notes in the revision column of the drawing.

- Apply the 'Obsolete Stamp' or symbol (see Appendix A), adjacent to the titleblock, add pertinent notes, names or initials of the approving authorities in the appropriate space of the stamp and revision column and change the revision number.
- Prepare and complete ENG-FRM-003 Obsolete Drawings Form.

6.4 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 and pertinent notes in the revision column of the superseded drawing.

- **Superseded Drawing**: Apply the 'Superseded Stamp' or symbol (see Appendix A), add names of approving authorities to the appropriate space in the stamp and revision column, change the revision number, and add the note in the revision column stating 'SUPERSEDED BY DRAWING NUMBER…'

- **Superseding Drawing***:* Add the note in the revision column for (REV 00) stating 'SUPERSEDES DRAWING NUMBER '.
- Prepare and complete ENG-FRM-004 Superseded Drawings Form.

6.5 Revised and Redrawn Drawings

This is an old drawing 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. REVISED AND REDRAWN).

6.6 Drawing Number Change

When a drawing number change is required for an existing drawing; the drawing shall be superseded with the new drawing.

6.7 Market Compliance Drawing

There are some electrical drawings designated as Market Compliance Drawings (see also LP-TC-01 Market Rules – Technical Compliance):

- Single Line Drawings.
- Station Operating Diagrams.
- Revenue Metering Single Line Diagram.

Note: Not all single line, station operating and revenue metering drawings are considered as Market Compliance Drawings. If the revision affects other related Market Compliance Drawings, they must be revised and issued at the same time.

The procedure of revising Market Compliance Drawings shall be treated as a regular drawing revision with appropriate changes made to the drawing, revision number, pertinent notes in the revision column and the application of the Market Compliance stamp (see Appendix D) to indicate the drawing as a Market Compliance Document.

In the stamp, the Draftsperson will indicate the recipients of the drawings, (e.g. IESO, HONI and/or MSP).

The Draftsperson will also indicate on ENG-FRM-002 Drawing Routing Sheet Form that the drawing package contains Market Compliance Drawings and a reminder that for drawings where the IESO is indicated, an Adobe Acrobat .PDF of the drawing is to be forwarded to Reliability Compliance Lead Single Point of Contact (See ENG-LST-002 IESO Ontario Reliability Compliance Program (ORCP) Contact List).

For Revenue Metering drawings, the Draftsperson also applies the Revenue Metering Drawing stamp (see Appendix E) at a location below the title block.

6.8 Transmitter Interface Drawings

Transmitter Interface Drawings are drawings, which had been identified in the demerger of the old Ontario Hydro. The intent is to separate and file these drawings between Hydro One (HONI) and OPG. These are primarily GS switchyard drawings, including but not limited to standards, installation units, service/work centres, telecommunications, architectural, survey, etc. in nature.

These drawings are categorized as 'Mutual Subject Matter Drawings' and 'Mutual Interest Drawings' between OPG and HONI.

'Mutual Subject Matter Drawings' refers to drawings which show Subject Matter owned by OPG and Subject Matter that is owned by HONI, such as, but not limited to interface for P & C, shared infrastructure (ac and dc Station Service, HP Air Systems, etc.).

'Mutual Interest Drawings' refers to drawings relating to Subject Matter owned by both OPG and HONI. This primarily covers manufacturer drawings and possibly some geotechnical drawings.

Ownership of the Subject Matter in a drawing is accomplished on each Mutual Subject Matter Drawing by the placement of mutually agreed to line(s) of demarcation between the Subject Matter owned by one company and that which is owned by the other company. Each company will mark one copy of such Drawing that is in their possession or control, and reference the other Company's corresponding drawing.

The procedure of revising these drawings shall be treated as a regular drawing revision with appropriate changes made to the drawing, revision number, pertinent notes in the revision column and the application of the 'Transmitter Interface Drawing' stamp (see Appendix F) at a location immediately below the title block.

For every revision to the 'Mutual Subject Matter Drawings', the Draftsperson will indicate on ENG-FRM-002 Drawing Routing Sheet Form that the drawing contains a Transmitter Interface Drawing and that an Adobe Acrobat .PDF electronic copy of the drawing shall be sent to HONI's Records Supervisor for information.

For the initial registration of drawings identified as 'Mutual Interest Drawings', assign an OPG drawing number and apply the 'Transmitter Interface Drawing' stamp (see Appendix F) at a location immediately below the title block.

7. DRAWING SUBMITTALS

The minimum drawing submittal requirements upon project completion are:

(1) The use of OPG – RGPM's standard drawing borders.

(2) One approved sealed and signed full size plot, black on white, on 20-lb bond paper or approved equal. See Section 5.11 for engineer's seal and signature requirements and Table 1.

(3) One equivalent electronic file, in **AutoCAD** format (.dwg) or two files for hybrid file format (.dwg+.mil) per drawing. The current OPG-RGPM standard, for Autodesk software, is **AutoCAD 2012** and Raster Design 2012. Multiple drawings/sheets shall not be contained in one electronic file. Under no circumstances are files, converted through .dxf, acceptable. Where possible, embed the Image file in AutoCAD with drawing file to reduce the file management.

(4) Hard copies of the Drawings must be submitted in monochrome.

(5) Minimum standard requirements for each drawing file are:

- (a) Limits set.
- (b) Zoomed to Extents.
- (c) Purged.
- (d) Hybrids (raster file) cropped.
- (e) Landscaped orientation.
- (f) Long filename.
- (g) All entities (symbols, lines, text, linetype, etc.) to be set by layer. The layer colour should be set to monochrome.
- (h) Bind x-ref files or use etransmit command to include all associated x-ref.
- (i) Titleblock or ownership, if required.
- (j) Current existing layers within the drawing must be available.

Note: OPG-RGPM will be developing comprehensive CAD Submittal Requirements which will include the minimum requirements as outlined, above. When released, consultants will be provided with a copy of the CAD Submittal Requirements.

- Equivalent electronic files, in excel format (.xlsx), for cable, valve lists, etc. as required
- A listing of hard copy and all electronic files submitted, detailing the relationship between the electronic file and hard copy
- If required, ENG-FRM-003 Obsolete Drawings Form and/or ENG-FRM-004 Superseded Drawings Form.

OPG reserves the right to reject submittals that do not comply with the requirements detailed herein.

8. DISCLAIMER

Information supplied to OPG on magnetic media or transmitted by electronic means is to be considered official documentation.

Neither OPG nor any of its employees shall be liable for damages arising from any errors or inaccuracies therein, nor from any misuse, misinterpretation or misapplication thereof. In the event of inconsistencies between said information and hard copy data, the hard copy shall govern.

9. REFERENCES

- ENG-PRA-001 HTO Engineering Practice.
- HED-PRC-016 Engineering Change Control Requirements.
- ENG-STD-004 Drawing Presentation Standard and Practices.
- ENG-STD-003 Units of Measurement for Imperial - Unit Sites Standard.
- ENG-FRM-003 Obsolete Drawings Form.
- ENG-FRM-004 Superseded Drawings Form.
- ENG-FRM-007 Drawing Access/Release Request by External Users Form.

10. REVISION HISTORY

Revision Number	Revised Section or Pages	Revision Description	Revision Date
R01	General	• Document re-named to Contractor-Submitted Drawing Requirements.	Dec. 20, 2016
	2	• Deleted definition for Engineer. • Added definitions RGPM, PES, Contractor, OPG Representative, Draftsperson, Document, Request for Drafting. • Updated definition for As-Built Drawings. Added “These drawings should not be sealed and issued	

Revision Number	Revised Section or Pages	Revision Description	Revision Date
		at Revision 00." • Site Record Prints renamed and redefined as Record Drawings.	
	3	• New Sections 3.1 Contractor responsibilities, Section 3.2 OPG Representative responsibilities, Section 3.3 OPG-RGPM Record Centre.	
	3.1	• Added (8) All drawings created for OPG-RGPM are produced with AUTOCAD and submitted at version that is approved by OPG-RGPM, (9) OPG drawing symbology shall be applied and maintained, and (10) Contractors must destroy all old information/drawings used for past projects to ensure the most up-to-date information (i.e. drawings) is being used.	
	3.3	• OPG Representative looks after both Type 2 Contract and Type 3 Contract, previously Hydro Engineering Authority and Project Manager, respectively.	
	4.1	• Added (2) A copy of standard ENG-STD-004 - Drawing Presentation Standard and Practices. • (6) .xlsx replaces .xlt. • (7) (d) Accepted for Use replaced by Approved for Use. Note this change used throughout document.	
	4.2	• (4) Contractor to be provided drawings in external file format.	
	4.3	• (4) Added "record drawings".	
	5.2.1	• Deleted "For a complete list of Generating Station Property Codes, River Name and Numbers, and Dam Name and Numbers, (see APPENDIX 13, APPENDIX 14 and APPENDIX 15) respectively."	
	5.2.5	• Replaced 'element' with 'number' in second paragraph. • Tables used for clarity around SCI numbers.	
	5.2.6	• Deleted example, last paragraph.	
	5.2.9	• Moved "e.g. 00, 01, 02, 03, etc. to 99" to first	

Revision Number	Revised Section or Pages	Revision Description	Revision Date
		sentence.	
	5.3.3	• Added “NOTE: For thermal generating stations, unit codings are different than Hydro stations. Please contact local thermal drawing office for unit coding direction.”	
	5.3.4 (1)	• Added “(Plan, Section, Detail, etc.)” to third bullet.	
	5.4	• Replaced text with table for the requirements for lettering used on drawings.	
	5.6	• Microfilm replaced by scans throughout section.	
	5.7.1	• Added “mostly” to first sentence (industry standard symbols used on EWDs).	
	5.7.2	• Added “not covered in Thermal convention” in second paragraph.	
	5.8	• Added “embed the Image file in AutoCAD with drawing file” to second paragraph. • Hyphens replaces underscores in file numbering per AS7.	
	5.9	• Added “(do not explode titleblock)” when applying a Contractor’s logo.	
	5.11	• Deleted “As-built changes should be approved and initialled over the typed-in Approving Person’s full name in the Revision Approval Column. Initials of the approving person are not acceptable.” • Table 1 Contractor’s Drawing Submission and Signature, Seal and Format Requirements moved to this section (previously an Appendix). Type 2 Record Drawings require Seal/Signature – Table 1 updated from N/A to Yes. • Table Note (8) Deleted ”Currently, microfilm (aperture card) is the official corporate record.”	
	5.12	• Added “as provided by the OPG Representative” to first sentence. • Added “as a Record Drawing” in third paragraph.	
	6.2	• Added third bullet “Upon completion of revision, embed the raster portion with the AutoCAD file.”	

Revision Number	Revised Section or Pages	Revision Description	Revision Date
	6.6	• Entire Section replaced with sentence "When a drawing number change is required for an existing drawing; the drawing shall be superseded with the new drawing." • Drawing Number Change Form is obsolete.	
	6.7	• Added "(see also LP-TC-01 Market Rules – Technical Compliance)". • Added "Note: Not all single line, station operating and revenue metering drawings are considered as Market Compliance Drawings." • Draftsperson replaced by OPG Representative in third paragraph. • Clarified wording to read "...Market Compliance Drawings and a reminder that for drawings where the IESO is indicated, an Adobe Acrobat .PDF of the drawing..." in second last paragraph. • Replaced "Technical Compliance" with "Reliability Compliance Lead Single Point of Contact (See ENG-LST-002 IESO Ontario Reliability Compliance Program (ORCP) Contact List) to second last paragraph.	
	6.8	• Added last two paragraphs.	
	7	• Added "(1) The use of OPG – RGPM's standard drawing borders." • (3) - The current OPG-RGPM standard for Autodesk software is AutoCAD 2012 and Raster Design 2012. Deleted "Files created with other software and converted to or 'Save As...' a .dwg file must be guaranteed to be 100% accurate." Added "Where possible, embed the Image file in AutoCAD with drawing file to reduce the file management." • Added "(4) Hard copies of the Drawings must be submitted in monochrome." • (5) (g) deleted "one colour per layer" and added "The layer colour should be set to monochrome." Added to (5) (h) "<u>or</u> use etransmit command to include all associated x-ref". Added (j) Current existing layers within the drawing must be	

Revision Number	Revised Section or Pages	Revision Description	Revision Date
		available.	
	9	• Updated References.	
	Appendices	• Deleted copies of forms in Appendices. • Deleted “Dam Names and Numbers”, and “Generating Station Property Names and Codes”. • Appendices re-ordered.	
	All	• References to superseding drafting forms ENG-FRM-003, 004, and -007 throughout.	
R00	All	• Supersedes EPS-DRF-MAN-001.	Sep. 10, 2010

APPENDIX A – OBSOLETE AND SUPERSEDED STAMPS

OBSOLETE		
PROJECT		DATE
BY	CHECKED	AUTHORIZED

SUPERSEDED		
SUPERSEDED BY DWG		
PROJECT		DATE
BY	CHECKED	AUTHORIZED

APPENDIX B – OPG OWNERSHIP STAMP

ONTARIO POWER GENERATION

ONTARIO POWER GENERATION INC. IS ONE OF THE SUCCESSOR COMPANIES OF ONTARIO HYDRO. AS OF APRIL 1, 1999 THIS DOCUMENTATION IS THE PROPERTY OF ONTARIO POWER GENERATION INC.

APPENDIX C – APPROVED FOR USE STAMP

ONTARIO POWER GENERATION

☐ approved for use
☐ approved for use with changes noted
☐ NOT approved

Please sign (Department Name, Project or Division Name)

Approval for use or acceptance by Ontario Power Generation Inc., the Company's Drawings/Data shall, in no way construe or imply relief of the Company from its responsibility for error or omission therein of from any obligation under the Contract or implied by law.

ver 2001-11

APPENDIX D - MARKET COMPLIANCE DRAWING STAMP

ELECTRICITY MARKET COMPLIANCE DOCUMENT

IESO HONI MSP

APPENDIX E - REVENUE METERING DRAWING STAMP

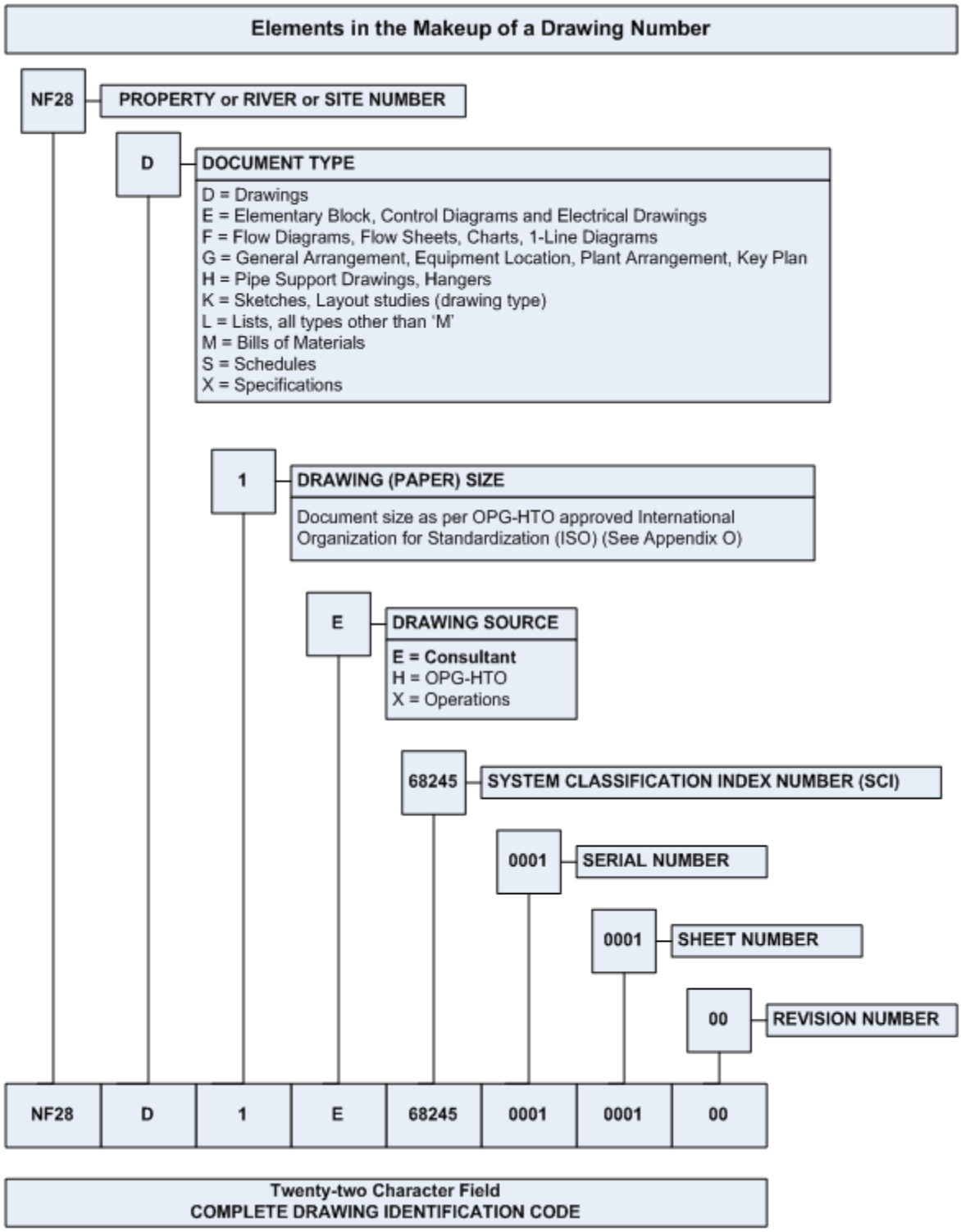
REVENUE METERING DRAWING

ALTERATIONS ARE CONTROLLED BY THE METER SERVICE PROVIDER

APPENDIX F - TRANSMITTER INTERFACE DRAWING STAMP

TRANSMITTER INTERFACE DRAWING

APPENDIX G – ELEMENTS IN THE MAKEUP OF A DRAWING NUMBER



APPENDIX H – DRAWING SHEET SIZES

Table for Metric Sheet Sizes (Standard Border Size)

Dwg Sheet Size Design	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.

All imperial sheet sizes are obsolete except A* & B* sizes. Table shown below is included for reference only.

Table for Imperial Sheet Sizes (Standard Border Size)

Dwg Sheet Size Design	Ident. in Dwg No by	Dimensions (W x L), inches			Borders, inches		
		Cut Sheet	Trim Line	Dwg Frame	Top & Bot	LHS	RHS
A*	1	9” x 12”	8 ½” x 11”	8” x 10 ½ ”	½”	¼”	¼”
B*	2	12” x 18”	11” x 17”	10 ½” x 16 ½”	½”	½”	½”
C	3	18” x 23”	17” x 22”	16 ¼” x 21 ¼”	½”	½”	½”
D	4	24” x 36”	22” x 34”	21” x 33”	1”	1 ½”	1”
E	5	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: 61/32”

APPENDIX I – OPG DRAWING BLOCK

