



HYDRO ONE NETWORKS INC.

***DISTRIBUTED GENERATION
Settlements & Revenue Metering SLD
Requirements
INTERCONNECTIONS AT VOLTAGES 50kV
AND BELOW***

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HYDRO ONE NETWORKS INC.

LIMITATION OF LIABILITY AND DISCLAIMER

Hydro One Networks Inc.'s ("Hydro One") "Distributed Generation Settlements & Revenue Metering SLD Requirements: Interconnections at Voltages 50kV and Below" (the "DG S&RM SLD Requirements") identifies typical Settlements & Revenue Metering SLD requirements for generation projects connecting to Hydro One's distribution system. Additional requirements may need to be met by the owner of the generation project to ensure that the final connection design meets all local and national standards and codes and is safe for the application intended. The DG S&RM SLD Requirements are based on a number of assumptions, only some of which have been identified. Changing system conditions, standards and equipment may make those assumptions invalid. Use of this document and the information it contains is at the user's sole risk. Hydro One, nor any person employed on its behalf, makes no warranties or representations of any kind with respect to the DG S&RM SLD Requirements, including, without limitation, its quality, accuracy, completeness or fitness for any particular purpose, and Hydro One will not be liable for any loss or damage arising from the use of this document, any conclusions a user derives from the information in this document or any reliance by the user on the information it contains. Hydro One reserves the right to amend any of the requirements at any time. Any person wishing to make a decision based on the content of this document should consult with Hydro One prior to making any such decision.

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HYDRO ONE NETWORKS INC.

REVISION HISTORY

Date	Version	Comments
Oct 14, 2010	Rev 0	New Document
Aug 3, 2011	Rev 1.1	<p>Updates as a result of changed Site Specific Loss Allowance (SSLA) requirements. The length of line between PCC and transformer, and between the transformer and metering is required.</p> <p>Previous note 8 removed. Information is now included on diagrams. Renumbered remaining notes.</p> <p>Updated note 3 to include reference to SSLA.</p> <p>New requirement for the size and number of inverters for solar projects to be included.</p> <p>Added SSLA to acronyms.</p> <p>Replaced EPC with PCC, to align with the usage in Condition of Service.</p> <p>Removed reference to separate metering for ARFA contracts in diagrams on pages 4, 5, 6 & 7.</p> <p>Revision to text describing load side disconnect switch on page 4 and 5.</p> <p>Minor revisions to text describing the identification of loads in note 9.</p> <p>Added PCC location determination diagrams, and notes on pages 12 and 13.</p>
Aug 29, 2011	Rev 1.2	<p>Removed text describing station service requirement on diagrams on pages 4-7.</p> <p>Updated notes on Station Service and Loads on page 9.</p> <p>Added PME bypass switch to diagrams on pages 4 – 7.</p> <p>Added reference to CIA and TIR in general requirements on page 10.</p>
Jan 17, 2012	Rev 1.3	<p>Modified text explaining applicable losses in PCC diagram #1 on page 12.</p> <p>Added requirement to identify ownership of primary line, and removed reference to RESOP exception in metering diagrams and notes.</p>
Aug 28, 2012	Rev 1.4	<p>Modified diagrams to include an indication of the ownership of lines.</p> <p>Updated Note 3 to include POC.</p> <p>Added POC to the list of acronyms.</p> <p>Modified diagrams and note 4 to require both TS and DS station and feeder names.</p> <p>Added number of phases as a requirement in note 5.</p> <p>Updated note 12 to require information on the SLD is legible.</p> <p>Updated the example SLD with to reflect changes for this version.</p> <p>Updated note 9 to include all other loads below the PCC.</p> <p>Changed the email address for SLD and SSLA submissions to TDS.Generator@hydroone.com on page 10 and 13.</p>
Oct 5, 2016	Rev 1.5	<p>Modified station service loads definition for Item No. 9 in Notes for Diagram Callouts section.</p>

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INDEX

Index (This Page).....	Page 1
Acronyms & Definitions.....	Page 2
Legend.....	Page 3
Revenue Metering Single Line Diagram (SLD) for Secondary-Metered Generator....	Page 4
Revenue Metering Single Line Diagram (SLD) for Secondary-Metered Generator & Customer Load.....	Page 5
Revenue Metering Single Line Diagram (SLD) for Primary-Metered Generator....	Page 6
Revenue Metering Single Line Diagram (SLD) for Primary-Metered Generator & Customer Load.....	Page 7
Notes for Diagram Callouts.....	Page 8, 9 & 10
Example of a Single Line Diagram (SLD) for illustrative purposes only.....	Page 11
Examples of PCC location determination	Page 12

ACRONYMS & DEFINITIONS

ACRONYMS

ANSI: American National Standards Institute
ARFA: Advanced RESOP FIT Agreement
BIL / LIL: Basic Impulse Level / Lightning Impulse Level
CSA: Canadian Standards Association
CT: Current Transformer
DG: Distributed Generation
ECP: Embedded Connection Point
ESA: Electrical Safety Authority
FIT: Feed in Tariff
HONI: Hydro One Networks Inc.
LDC: Local Distribution Company
NGR: Neutral Grounding Resistor
IESO: Independent Electricity System Operator
PCC: Point of Common Coupling
POC: Point of Connection
RESOP: Renewable Energy Standard Offer Program
SLD: Single Line Diagram
SSLA: Site Specific Loss Adjustment
S&RM: Settlements & Revenue Metering
VT: Voltage Transformer

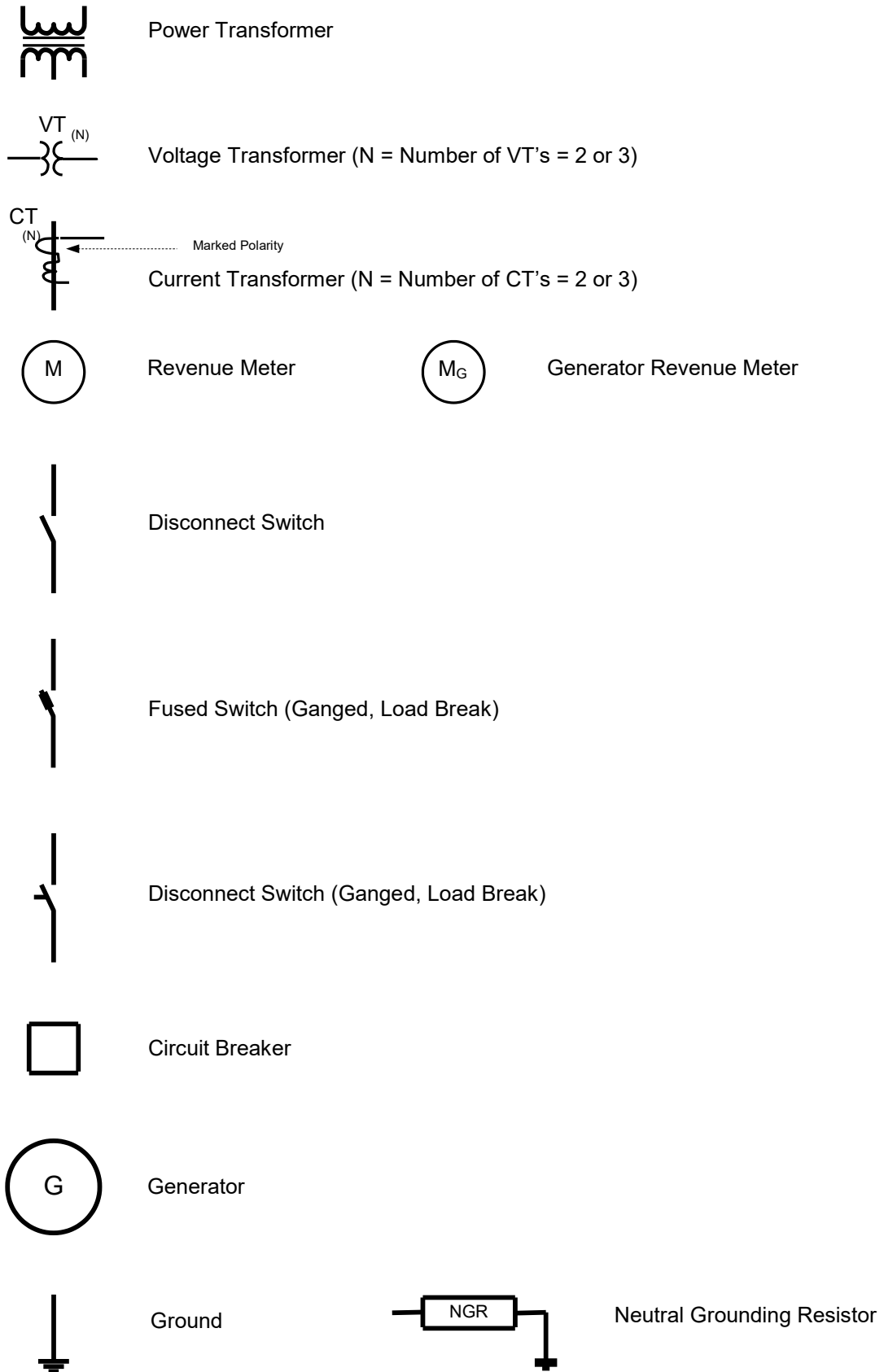
DEFINITIONS

Red Diagram Callouts: The red diagram callouts give the item number of “Settlement & Revenue Metering Information Required” on Pages 8, 9, & 10 of the document.

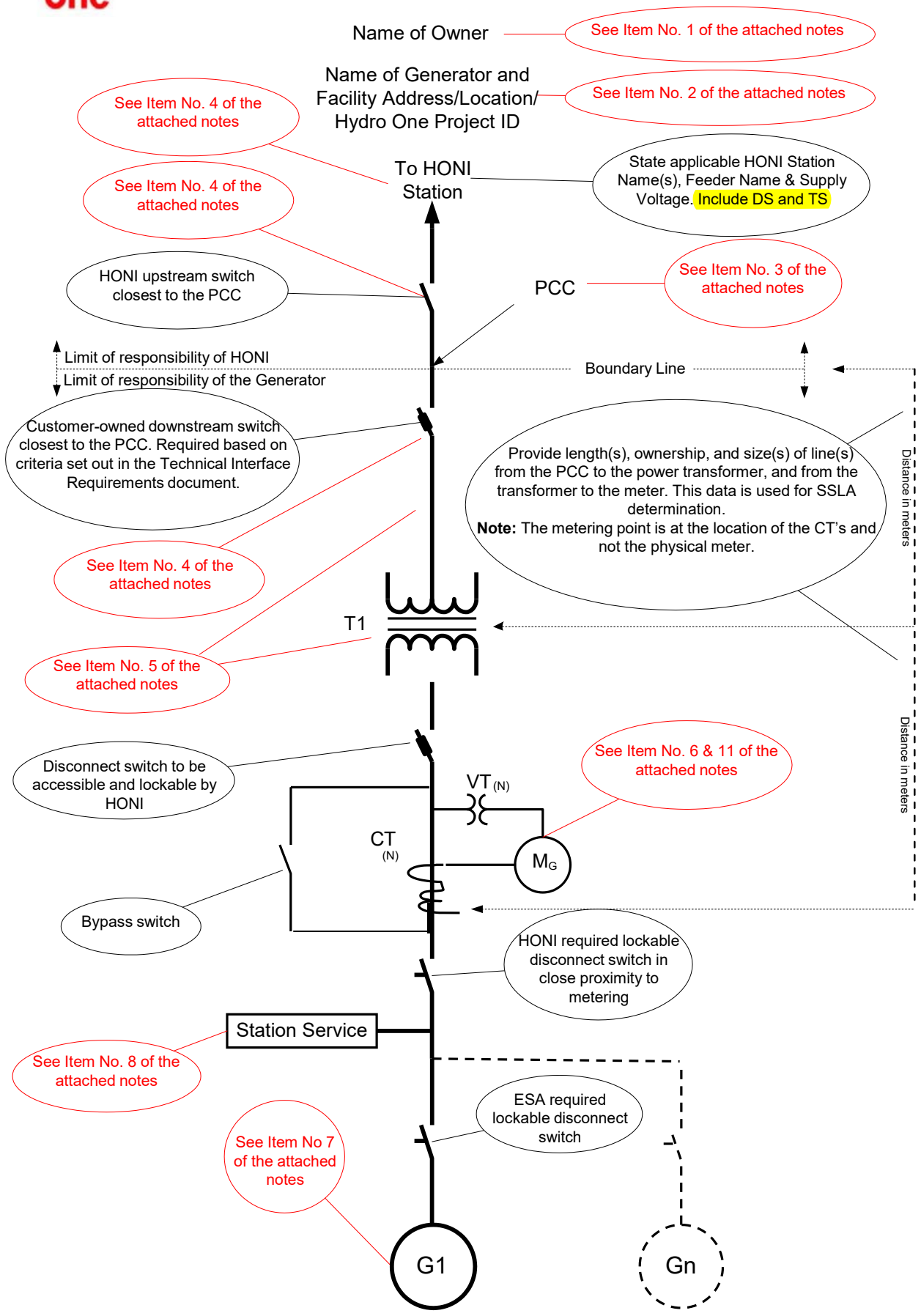
Black Diagram Callouts: The Black diagram callouts give specific information for a device or item shown on the diagram.

Blondel’s Theorem: Blondel’s Theorem states that in a polyphase system of N electrical conductors, N-1 electrical energy or wattmeter elements, properly connected, will measure the power or energy taken. The connection must be such that all potential coils have a common tie to the conductor in which there is no current coil.

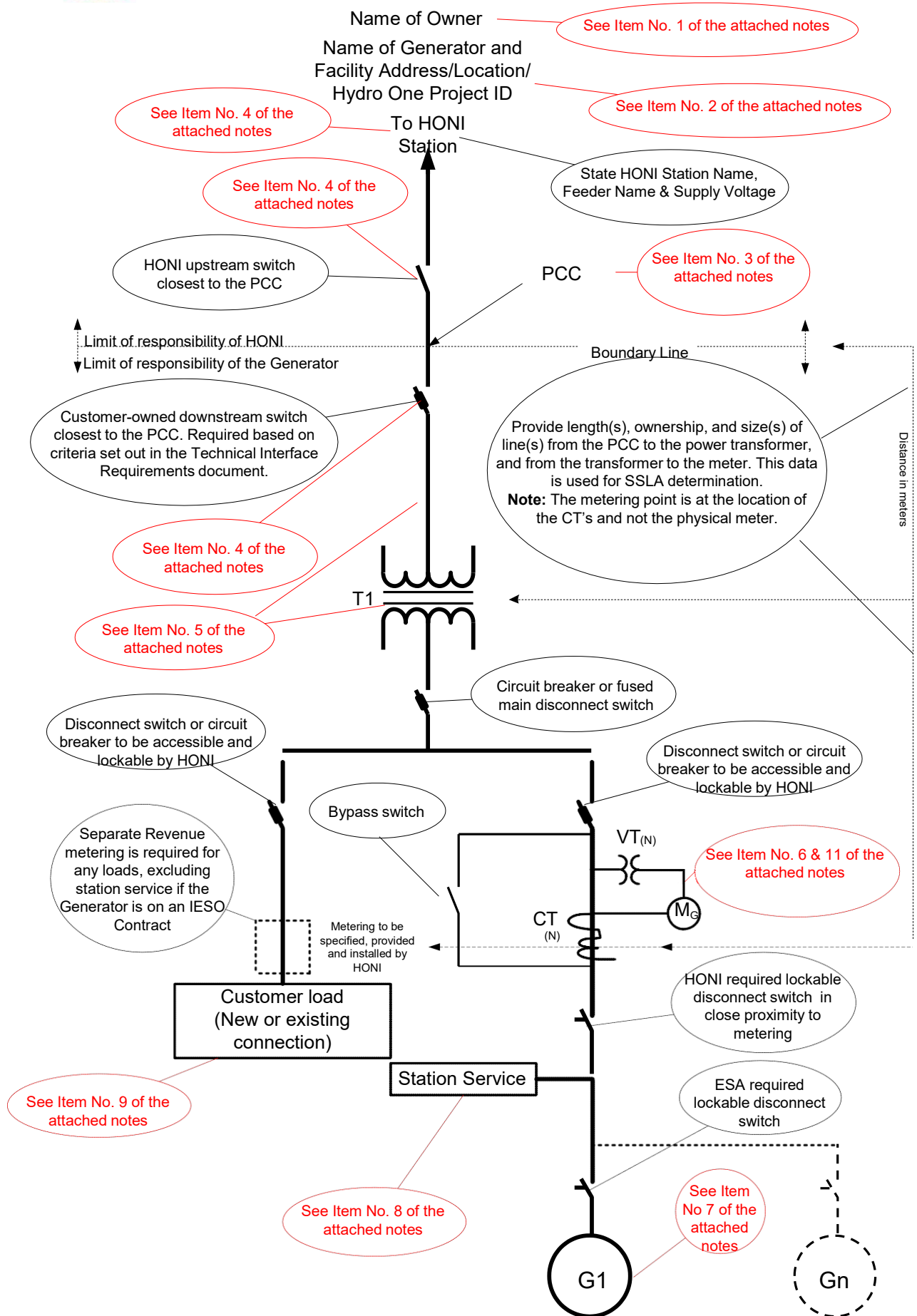
LEGEND of SYMBOLS

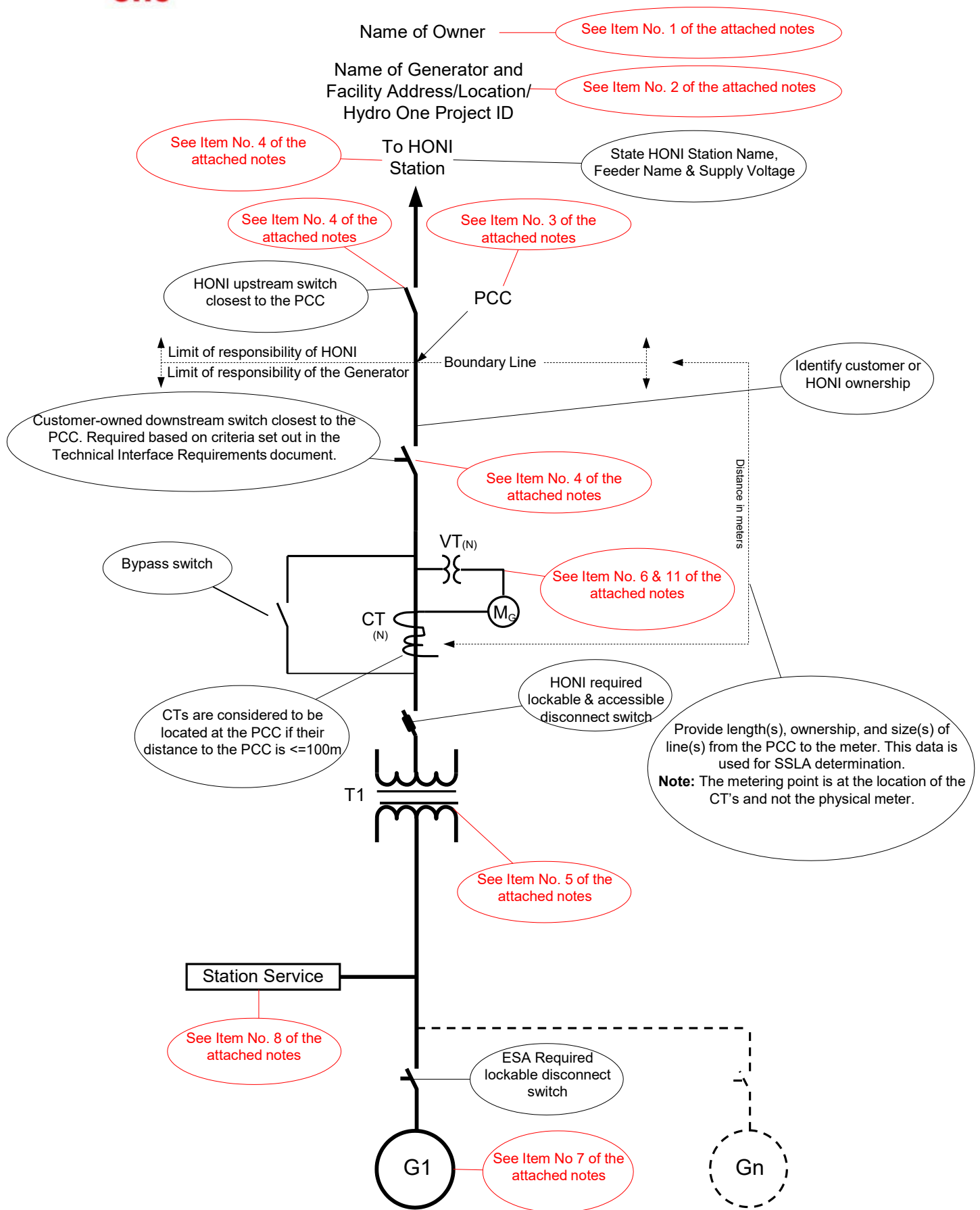


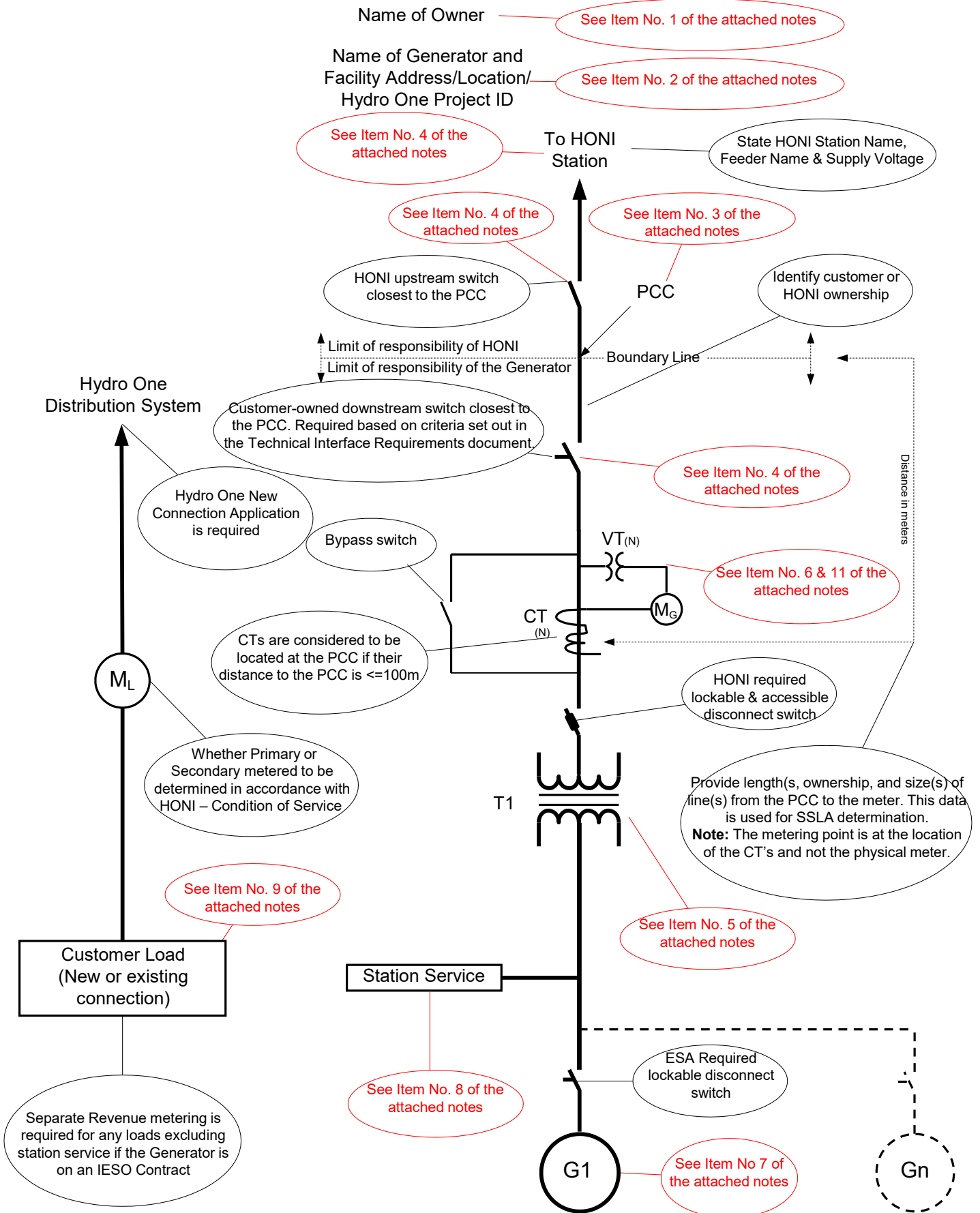
Information Required for Distribution Connected Generators
Revenue Metering Single Line Diagram (SLD) for Secondary-Metered Generator



Information Required for Distribution Connected Generators
Revenue Metering Single Line Diagram (SLD) for Secondary-Metered Generator & Customer Load







Item No.	Description ¹	Comments
1	Owner's Name ²	<ul style="list-style-type: none"> - State the full legal entity name of the Generator's Owner.
2	Generator's Facility Name and Location	<ul style="list-style-type: none"> - State the facility name of the physical generator. - State the precise civic address/geographic location, and / or GPS co-ordinates.
3	Point of Common Coupling (PCC)	<ul style="list-style-type: none"> - Clearly identify and indicate the PCC to the Distributor (LDC). - This is normally shown as a boundary line depicting the limits of responsibility between the embedded generator and the LDC. - See pages 12 and 13 for diagrams and notes for determining the location of the PCC. - A Site Specific Loss Adjustment is applied for any customer owned lines greater than 100 meters. - The PCC and the POC are often at the same location. Sometimes they are not, please see the Form 'B' diagrams to determine the POC for the project.
4	Connectivity – Distribution and Transmission Facility (Station) Name, Type, Feeder & Switches	<ul style="list-style-type: none"> - State HONI's distribution and transmission facility (station) name(s). - State the name of the HONI station feeder to which the generator is connected. - State the nominal distribution supply voltage (e.g. 44 kV). - State the information for the upstream and downstream switches closest to the PCC (nomenclature, type etc.). - HONI to assign nomenclature for up-stream switch.
5	Power Transformer(s)	<ul style="list-style-type: none"> - Used to step-up the generator voltage to the distribution service voltage and / or step down the distribution voltage for customer loads. - State ownership (i.e. Hydro One vs Customer) of transformer and primary line. - Show the number of phases and the power transformer(s) primary and secondary winding configurations (Wye, Delta, and Ground). - Indicate size (kVA or MVA), primary and secondary voltages (V or kV) and include details of any GFR / NGR if applicable. - State operating nomenclature (e.g. T1, T2 etc.) - Specify use and location of Neutral Ground Resistor (NGR) on SLD.
6	Retail Revenue Metering	<ul style="list-style-type: none"> - Wholesale-registered metering must conform to the IESO market rules. - Retail-settled metering must conform to HONI's Condition of Service. - Metering installation shall conform to the latest Hydro One Retail Metering Standard. - Instrument Transformers (CTs & VTs) shall be dry-type (not oil filled), individual units, if primary metered and conform to manufacturers approved by HONI. - The insulation class, and Basic Impulse Level / Lightning Impulse Level (BIL / LIL) shall conform to HONI's standards. - Show the CTs, VTs or PME and meter(s). State the Manufacturer and Model # information. - State the number of CTs and VTs being used. - State the CT and VT ratios including both ratios if they are dual ratio. - State the in-use CT and VT ratios if dual ratio. - State the ANSI/CSA CT & VT accuracy class information. - State whether or not the metering is Blondel compliant. - State Measurement Canada's Notice of Approval for the Instrument Transformers.

1. The terms used are the same as those used in the IESO rules and HONI's TIR document

2. It is the Owner's / Generator's obligation to ensure full compliance with current IESO rules

Item No.	Description ¹	Comments
7	Generator(s)	<ul style="list-style-type: none"> - Show the generator(s) connection(s) to the power transformer(s). - Show the operating nomenclature of the generator(s) (e.g. G1, G2, etc.). - State the nameplate capacity of the generator or individual generators, where there is more than one, in kVA / MVA. or kW / MW. - For solar, state the size(s) and number of inverter(s) - State the operating power factor (PF). - State connection type (Wye, Delta, etc.) and indicate grounding. - State whether the generator is induction or synchronous type.
8	Station Service ²	<ul style="list-style-type: none"> - Refer to the IESO contracts or standard definitions for a definition of station service. - The connectivity and size of the station service must be clearly depicted and comply with current IESO rules. - If operating under an IESO contract, station service load must be captured by the revenue metering for the generator so that the measured generator output is net of station service. - At the sole discretion of Hydro One, may be separately supplied and revenue metered. - Metering of station service shall be at the same voltage as the secondary voltage of the main power transformer. Secondary metering of any station service transformer is not acceptable.
9	Loads at Generation Facility ²	<ul style="list-style-type: none"> - The connectivity and size of all loads at the generating facility must be clearly depicted and comply with the current IESO rules, and any other relevant rules or regulations in the province of Ontario. - Include a depiction of all loads and meters below the PCC, including those not related to the generation facility. - For IESO Contract projects customer loads excluding station service must be metered independently of the generation metering. - “Behind-the-load” or “In-Series” generator metering is not permitted.

1. The terms used are the same as those used in the IESO rules and HONI’s TIR document

2. It is the Owner’s / Generator’s obligation to ensure full compliance with current IESO rules

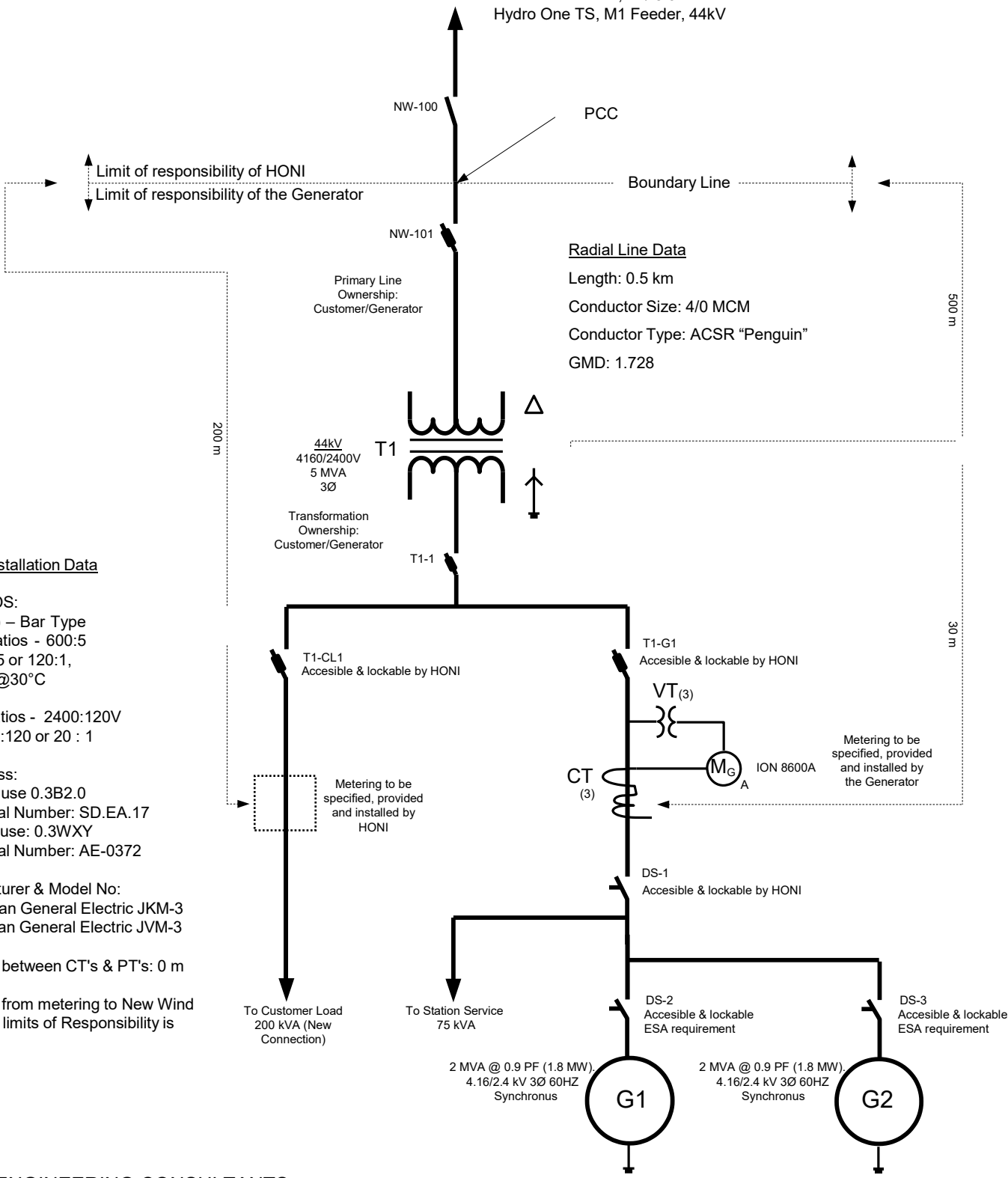
Item No.	Description ¹	Comments
10	Blondel Compliance & Grounding	<ul style="list-style-type: none"> - Generally, compliance with Blondel’s theorem (rule) is required. - Must determine if current can flow in the ground and by-pass the metering point (where the CT’s are located). - When the connections on both sides of the metering point are grounded current can flow in the ground and by-pass the metering point (where the CT’s are located) and possibly cause the metering to be Blondel non-compliant. - Blondel non-compliant metering can also occur where a neutral grounding resistor (NGR) is used with 2 element secondary metering. - In these situations HONI may require primary metering to achieve Blondel compliance.
11	Sizing of Current Transformers (CT) for Generator Metering	<ul style="list-style-type: none"> - Current Transformers must be sized based on the nameplate capacity rating of the generator and conform to the most current version of the following standards and requirements: - The Canadian Standards Association (CSA) standards for Instrument Transformers. - <u>Note:</u> The current version at the time of publication of this document (Oct 2010) is CAN/CSA-C60044-1:7, 1st Edition <i>Instrument Transformers – Part 1: Current Transformers (Adopted CEI/IEC 60044-1:1996, edition 1.2, including Amendment 1:2000 and Amendment 2:2002, with Canadian deviations)</i>. This standard replaces those portions of CSA CAN3-C13-M83, <i>Instrument Transformers</i> that deal with current transformers. - The requirements of Measurement Canada for the use of instrument transformers in revenue metering applications. - The requirements of the Electrical Safety Authority (ESA).
12	General SLD Requirements	<ul style="list-style-type: none"> - SLD must be stamped and signed by a Registered Professional Engineer in the Province of Ontario. - All information on the SLD must be legible, and of a reasonably sized font for ease of reading. - Must state the HONI project no. in the SLD’s title block. - The Connection Impact Assessment provides details regarding the type and configuration of isolation devices required. - The DG facility must comply with all applicable interconnection requirements specified in the “Hydro One Distributed Generation Technical Interconnection Requirements Interconnections at Voltages 50kV and Below” (TIR). - Returned complete, stamped SLDs to the Hydro One Transmission and Distribution Settlements Generator mailbox address at TDS.Generator@HydroOne.com

1. The terms used are the same as those used in the IESO rules and HONI’s TIR document

2. It is the Owner’s / Generator’s obligation to ensure full compliance with current IESO rules

New Wind GS
 100 Wind Trail, Windy Town, ON
 Project #12,345

Small Point DS, F2/ 8.32 kV
 Hydro One TS, M1 Feeder, 44kV



Radial Line Data
 Length: 0.5 km
 Conductor Size: 4/0 MCM
 Conductor Type: ACSR "Penguin"
 GMD: 1.728

Metering Installation Data

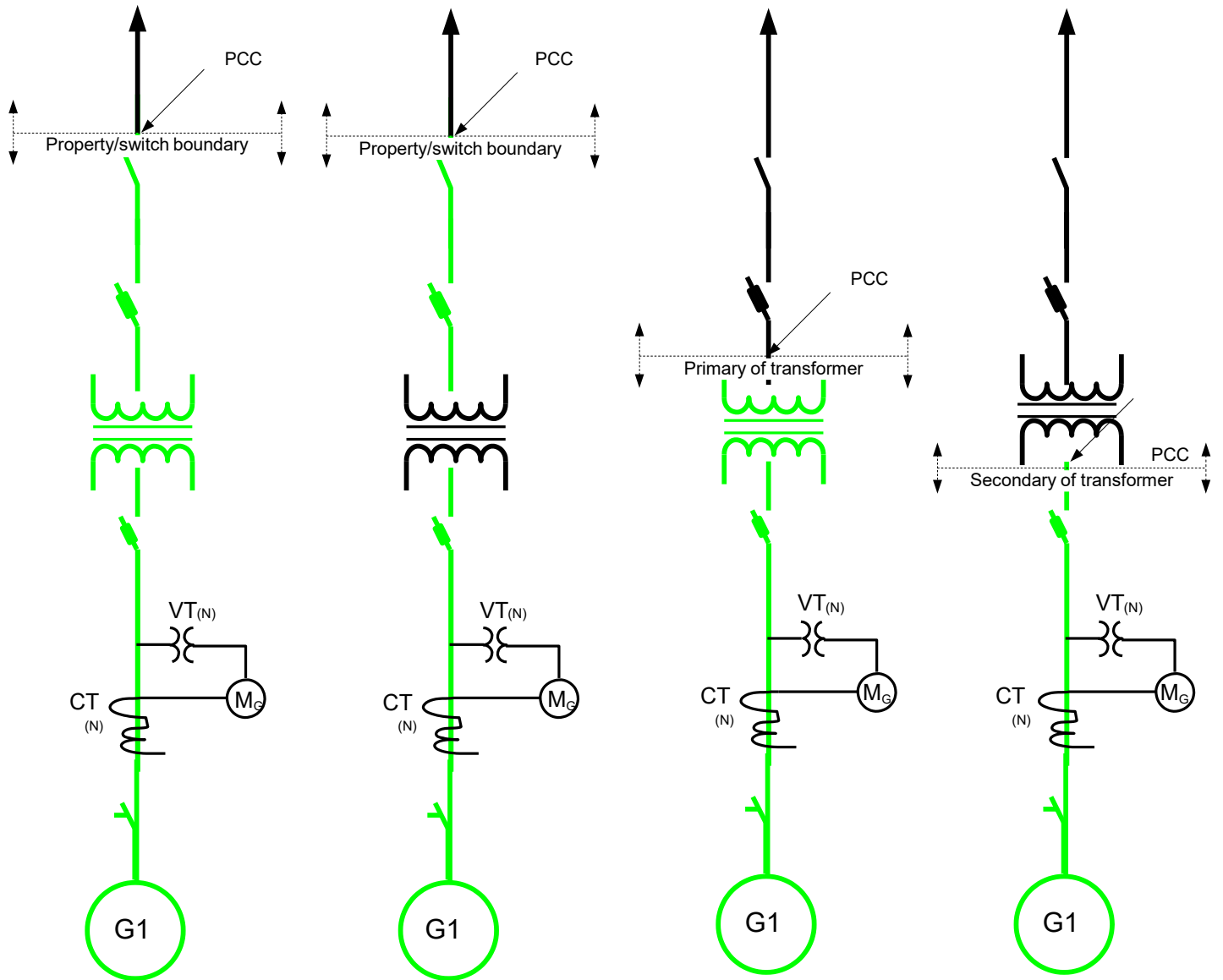
1. IT RATIOS:
 CT ratio (3) – Bar Type
 Available ratios - 600:5
 in use 600:5 or 120:1,
 CCRF=1.5@30°C
 VT ratio (3)
 Available ratios - 2400:120V
 in use 2400:120 or 20 : 1
2. ANSI class:
 CT class in use 0.3B2.0
 MC Approval Number: SD.EA.17
 VT class in use: 0.3WXY
 MC Approval Number: AE-0372
3. Manufacturer & Model No:
 CT: Canadian General Electric JKM-3
 VT: Canadian General Electric JVM-3
4. Distance between CT's & PT's: 0 m
5. Distance from metering to New Wind Energy Inc. limits of Responsibility is 0.5 km

MSP ENGINEERING CONSULTANTS

Title	New Wind Energy Incorporated		Drawing No:	
Address	New Wind GS		Example-1	
Drawn By	JAG	HONI Project No:	Date:	
Approved By	RFL	NWEI-123456	Jul 30, 2010	Rev
				Description

PCC Location Diagrams

An SSLA is required if the length(s) of customer owned line(s) between either the PCC and the transformer, or between the transformer and the meter is >100 meters. Submit an SSLA for any span that is >100 meters. See notes on page 13.



Ownership: 1. Customer owned primary line, and transformer

2. Customer owned primary line. Hydro One owned transformer.

3. Hydro One owned primary line. Customer owned transformer.

4. Hydro One owned primary line, and transformer.

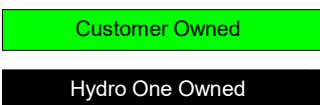
SSLA³ Required: Line loss and transformer loss. *Generator may elect to accept standard Hydro One transformer loss.*

Line loss only. Standard Hydro One transformer loss applied

Transformer loss only. *Generator may elect to accept standard Hydro One transformer loss, in which case SSLA is not required.*

None. No losses applied.

Legend



1. The terms used are the same as those used in the IESO rules and HONI's TIR document
2. It is the Owner's / Generator's obligation to ensure full compliance with current IESO rules
3. SSLA provided by generation proponent, signed and stamped by a qualified engineer.

Item No.	Description ¹	Comments
1	Requirement for SSLA	<ul style="list-style-type: none"> - An SSLA is required for secondary metered projects if the length(s) of customer owned line(s) between either <ul style="list-style-type: none"> o the PCC and the transformer, or o between the transformer and the meter is >100 meters. Submit an SSLA for any span that is >100 meters. <i>Note: The metering point is at the location of the CT's, not the physical meter.</i> - An SSLA is required for primary metered projects if the length(s) of customer owned line(s) between the metering and the PCC is > 100 meters - A radial line loss combining the distance between the meter and the PCC is not permitted. - See the IESO market manual 3.5 at the following address for information to support calculating the loss factors. http://www.ieso.ca/imoweb/pubs/metering/mtr_SiteSpecLosses.pdf. - Completed SSLA Register forms are to be returned to the Hydro One Transmission and Distribution Settlements Generator mailbox address at TDS.Generator@HydroOne.com. SSLA forms must be signed and stamped by a certified engineer containing the applicable loss information. Note that the loss calculation you provide may include transformer losses. If transformer losses are applicable, and are not included in your submission, Hydro One will apply a standard transformer loss. - The loss information you provide, and any other applicable losses, will be used to adjust settlement of the generator output at the facility. Failure to provide accurate SSLA data on time for a project may delay payments for the generator output. - Provide a separate and completed form for each facility.
2	Hydro One standard transformer losses	<ul style="list-style-type: none"> - Standard Hydro One transformer losses will be applied to secondary metered facilities as applicable when: <ul style="list-style-type: none"> o The power transformer is Hydro One owned and is located on a customer owned primary line o The power transformer is customer owned, and the customer has not submitted an SSLA containing transformation loss data - The standard Hydro One transformer losses are: <ul style="list-style-type: none"> o 1% loss applies to transformers >400kVA. o 1.5% loss applies to transformers <=400 kVA. - The loss information you provide, and any other applicable losses, will be used to adjust settlement of the generator output at the facility.
3	Switch or property boundary demarcation	<ul style="list-style-type: none"> - When applicable, the PCC will be located at the customer owned switch connecting to the Hydro One system, or at the customer's property boundary, whichever closer to the power transformer.

1. The terms used are the same as those used in the IESO rules and HONI's TIR document