



**INTERCONNECTION REQUIREMENTS
FOR
CLOSED-TRANSITION TRANSFER OF STANDBY
GENERATORS**

March 2008

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1.0 INTRODUCTION

1.1 Scope

This document provides a guideline to generator owners and/or their proponents, hereafter called Power Generator (PG), for connecting their standby generators that are normally available at their facilities and can be used as a standby source of power. These standby generators can run in parallel with BC Hydro (BCH) system, either at its primary or secondary voltage distribution system, for a short period of time during the transfer of load from BC Hydro to PG or PG to BC Hydro. The PG shall be a BC Hydro load customer, with a standby power supply to feed its, typically, emergency loads, in case BCH supply is not available. Standby generators fitted for a closed-transition transfer to and from the grid are not to export power to BCH across the revenue meter.

This document states the minimum technical requirements that such a PG must meet.

These requirements will ensure that the PG equipment:

- (a) is compatible with the BCH system, and that the interconnection is safe for BCH employees and agents, for BCH customers and for the general public, at all times,
- (b) meets BC Hydro protection, control, commissioning, operating and maintenance requirements, and

This document does not apply to:

1. generators exporting power to BC Hydro system, or
2. Net Metering projects ("BC Clean" to 50 kW, with some electricity export to BCH)
3. generators that do not fall under closed-transition transfer category, i.e. open-transition transfer systems

BCH general system requirements are specified in *35 kV and Below INTERCONNECTION REQUIREMENTS FOR POWER GENERATORS* Section 2

web: http://www.bchydro.com/rx_files/info/info2154.pdf

1.2 Copyright and Reprint

Copyright © 2008 by BC Hydro.

Reprint Provisions:

- (a) Copying all or any part of this document is permitted provided credit is given to BC Hydro and provided the copies of this document or parts thereof are not sold for profit.
- (b) This document may be stored in any type of electronic retrieval system provided BC Hydro is clearly indicated as the source and provided no profit accrues from such storage.

1.3 Disclaimer

This document is not intended as a design specification or as an instruction manual for the PG, and the PG shall not use it for those purposes. Persons using information included in this guide do so at no risk to BC Hydro, and they rely solely upon themselves to ensure that their use of all or any part of this guide is appropriate in the particular circumstances.

The PG, its employees or agents must recognise that they are, at all times, solely responsible for the plant design, construction and operation. Neither BC Hydro nor any of their employees or agents shall be nor become the agents of the PG in any manner howsoever arising.

BC Hydro's review of the specifications and detailed plans shall not be construed as confirming or endorsing the design or as warranting the safety, durability or reliability of the PG's facilities. BC Hydro, by reason of such review or lack of review, shall be responsible for neither the strength, adequacy of design or capacity of equipment built pursuant to such specifications, nor shall BC Hydro, or any of their employees or agents, be responsible for any injury to the public or workers resulting from the failure of the PG facilities.

In general, the advice by BC Hydro, any of its employees or agents, that the PG's plant design or equipment meets certain limited requirements of BC Hydro does not mean, expressly or by implication, that all or any of the requirements of the law or other good engineering practices have been met by the PG in its plant, and such judgement shall not be construed by the PG or others as an endorsement of the design or as a warranty, by BCH, or any of its employees.

The information contained in this document is subject to change and may be revised at any time. BCH should be consulted in case of doubt on the current applicability of any item.

1.4 Project Responsibilities

The PG owns and is responsible for the design, installation, operation, and maintenance of all equipment, station and distribution line facilities from the Point-of-Interconnection (POI) to the PG facility, unless otherwise agreed to in writing. The PG is responsible for obtaining all regulatory approvals, including environmental assessment approvals, if necessary, for the construction and operation of its facilities. The PG facilities shall be designed, constructed, operated and maintained in compliance with the applicable statutes, regulations, by-laws, and codes.

The PG is also responsible for submitting all specifications of its facilities and detailed plans to BCH for review prior to receiving permission to connect to BCH.

2.0 TRANSFER SYSTEM REQUIREMENT

2.1 General

All PG equipment shall comply with all applicable CSA standards latest versions or equivalent, including but not limited to CSA 22.2 No. 31 Switchgear Assemblies and CSA 22.2 178 Automatic Transfer Switches.

PG and BCH system shall not parallel for more than the pre-set time (≤ 20 seconds). PG system shall not energize an un-energized BCH distribution system.

2.2 Control

Typically the load transfer time from one source to the other, i.e. PG to BCH or BCH to PG, is ranging from 100 ms to approximately 10 seconds, but shall not exceed 20 seconds. A timer is required to ensure the maximum paralleling time is not exceeded. This transfer time does not include breaker opening time. If the closed-transition utility inter-tie circuit breaker does not open within the pre-set time, there shall be a local alarm to inform the PG facility local operator, who shall immediately contact BCTC

Area Control Centre.

2.3 Protection

A protection relay shall be provided for inter-tie protection during PG and BCH parallel mode operation. This protection relay shall provide functions as specified in Table 1.

Table 1. Utility Inter-tie Protection Requirements

Protective Functions	Momentary closed-transition transfer	Soft closed-transition transfer
Under Voltage (27)	X, 3 phase	X, 3 phase
Over Voltage (59)	O	X
Under Frequency (81U)	O	X
Over Frequency (81O)	O	X
Phase-sequence (47)	O	O
Reverse Power Towards Utility (32U)	X	X
Synchronization Check (25)	X	X
Maximum Parallel Timer	X (to be set <= 500 ms)	X

Note: X – Required; O – Optional

For soft closed-transition transfer, utilities inter-tie protection shall be utility grade.

The relays shall trip or block closing the utility inter-tie breaker during abnormal system conditions.

3.0 COMMISSIONING REQUIREMENTS

3.1 General

The PG has full responsibility for the inspection, testing, and calibration of its equipment, up to the Point-of-Interconnection. Commissioning shall be performed by competent personnel. BCH shall be advised 10 days in advance of testing and may send a representative to witness tests.

Commissioning tests confirm the safe, reliable and effective operation of all equipment in the PG's facility under normal and abnormal conditions. A BC Hydro Field Co-ordinator would be assigned to ensure the compatibility with BCH system that may:

- (a) witness any part of the commissioning test,
- (b) request additional testing and
- (c) conduct his own testing.

Deficiencies identified during commissioning must be corrected before the interconnection is approved for operation. A copy of the commissioning reports signed and sealed by the Engineer of Record for the

testing shall be submitted to BCH upon request.

3.2 Protection Equipment

Commissioning of protection equipment should include but not be limited to:

- (a) ratio, phase and polarity testing of current transformers and potential transformers,
- (b) calibration checks of each protective relay by injecting the appropriate ac quantities,
- (c) functional testing of the protective relays to circuit breakers and telecommunications equipment. Testing shall include minimum operating point verification for relays,
- (d) load tests of protective relays immediately after initial energization,

The settings applied to selected relays will be as determined or reviewed by BCH.

4.0 MAINTENANCE REQUIREMENTS

4.1 General

The PG has full responsibility for the maintenance of its equipment, up to the Point-of-Interconnection. Maintenance must be performed by competent personnel.

Equipment used to control, generate, and protect shall be maintained such that the reliability of BC Hydro's system is not affected. BCH reserves the right to inspect and test the equipment given reasonable notice. The PG must perform necessary maintenance requested by BCH within a reasonable period.

4.2 Protection Equipment

Periodic maintenance of protection equipment shall include but not be limited to calibration testing of all protective relays and function testing to circuit breakers at intervals of not more than 2 years.

APPENDIX A DEFINITIONS

Area Control Centre (ACC) – Each ACC is responsible for the control and operation of an exclusive area of responsibility.

BCTC – British Columbia Transmission Corporation

BCH System – Encompasses the transmission lines, substations and distribution system operated by BC Hydro and BCTC.

Distribution – Electrical system operated at 35 kV and below.

Momentary closed-transition transfer — Refers to a PG system interconnecting momentarily (≤ 100 ms) to the BCH distribution system with the purpose of transferring load from the BCH distribution system to the PG or transferring load from the PG to the BCH distribution system.

Point-of-Interconnection (POI) – The physical location in the Distribution system of the change of line ownership between BCH and the PG.

Power Generator (PG) – A resource to produce electricity that is connected and synchronized to the BCH system.

Primary Service – A BC Hydro service voltage of 4.16 kV, 12.5 kV, 25.0 kV or 34.5 kV

Secondary Service – A BC Hydro service voltage of 1-phase 120/240 V, or 3-phase 4-wire 120/208 V or 347/600 V

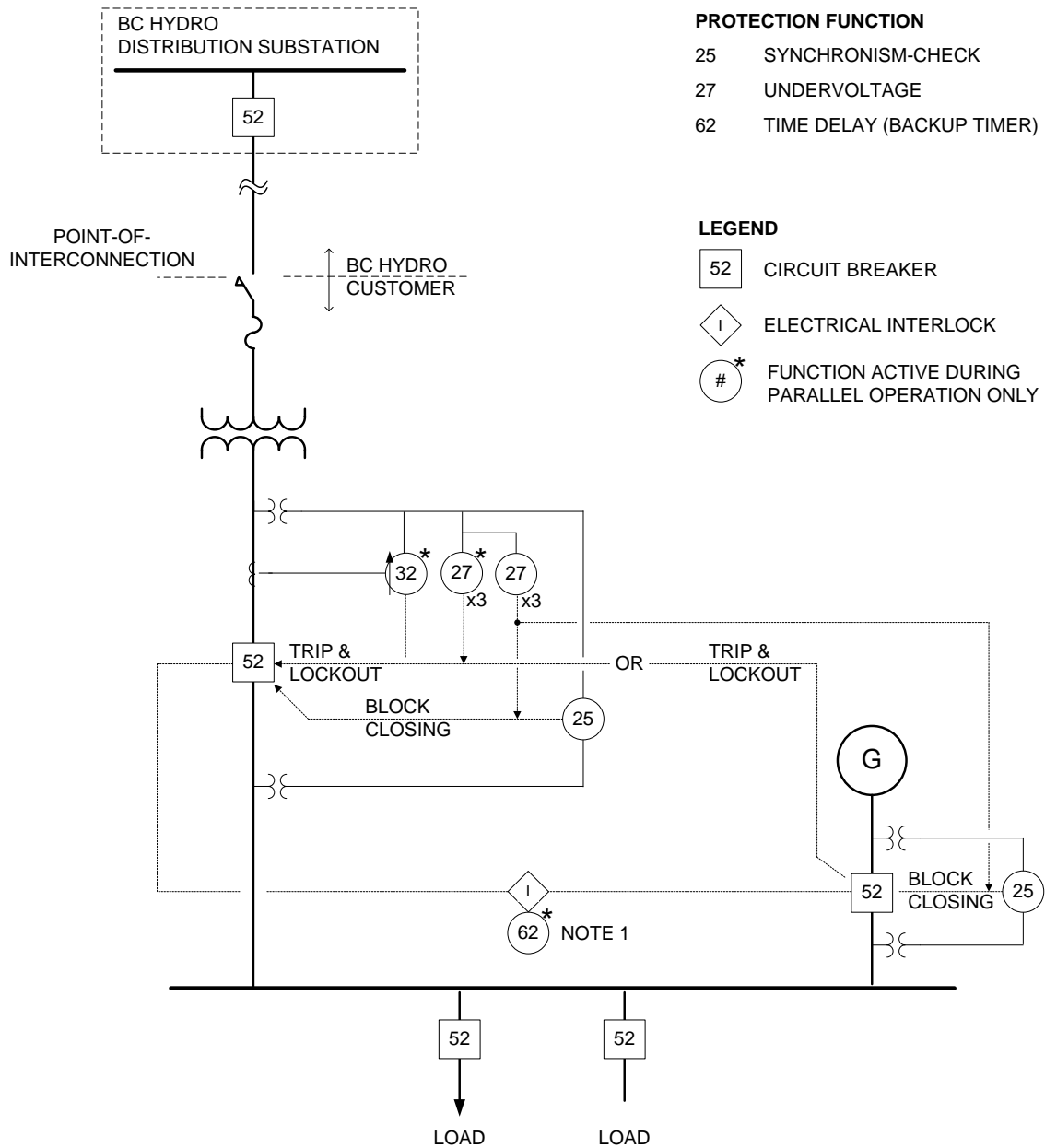
Soft closed-transition transfer — Refers to a PG system interconnecting for a short time (> 100 ms but ≤ 20 seconds) to the BCH distribution system with the purpose of transferring load from the BCH distribution system to the PG or transferring load from the PG to the BCH distribution system.

Transmission – Electrical system operated at 69 kV and above.

APPENDIX B REFERENCES

1. BC Hydro *Requirements for Primary Substations Supplied at 12.0 kV and 25.0 kV*
2. BC Hydro *35 kV and Below INTERCONNECTION REQUIREMENTS FOR POWER GENERATORS*
3. CSA C22.3 No. 9 draft, *Interconnection of Distributed Resources with Electricity Supply Systems*
4. Hydro Quebec, “*Requirements for Temporary Parallel Operation of Emergent Production Equipment with Hydro-Quebec Distribution System*” E.12-08, 2005/12 (title of this document is an unofficial English translation)
5. Manitoba Hydro “*Interconnection Guideline for Connecting Distributed Resources To The Manitoba Hydro Distribution System*” DRG2003 revision 00, January 2003
6. CSA 22.2 No. 31, *Switchgear Assemblies*
7. CSA 22.2 No. 178, *Automatic Transfer Switches*
8. IEEE Std C37.95™-2002, *IEEE Guide for Protective Relaying of Utility-Consumer Interconnections*

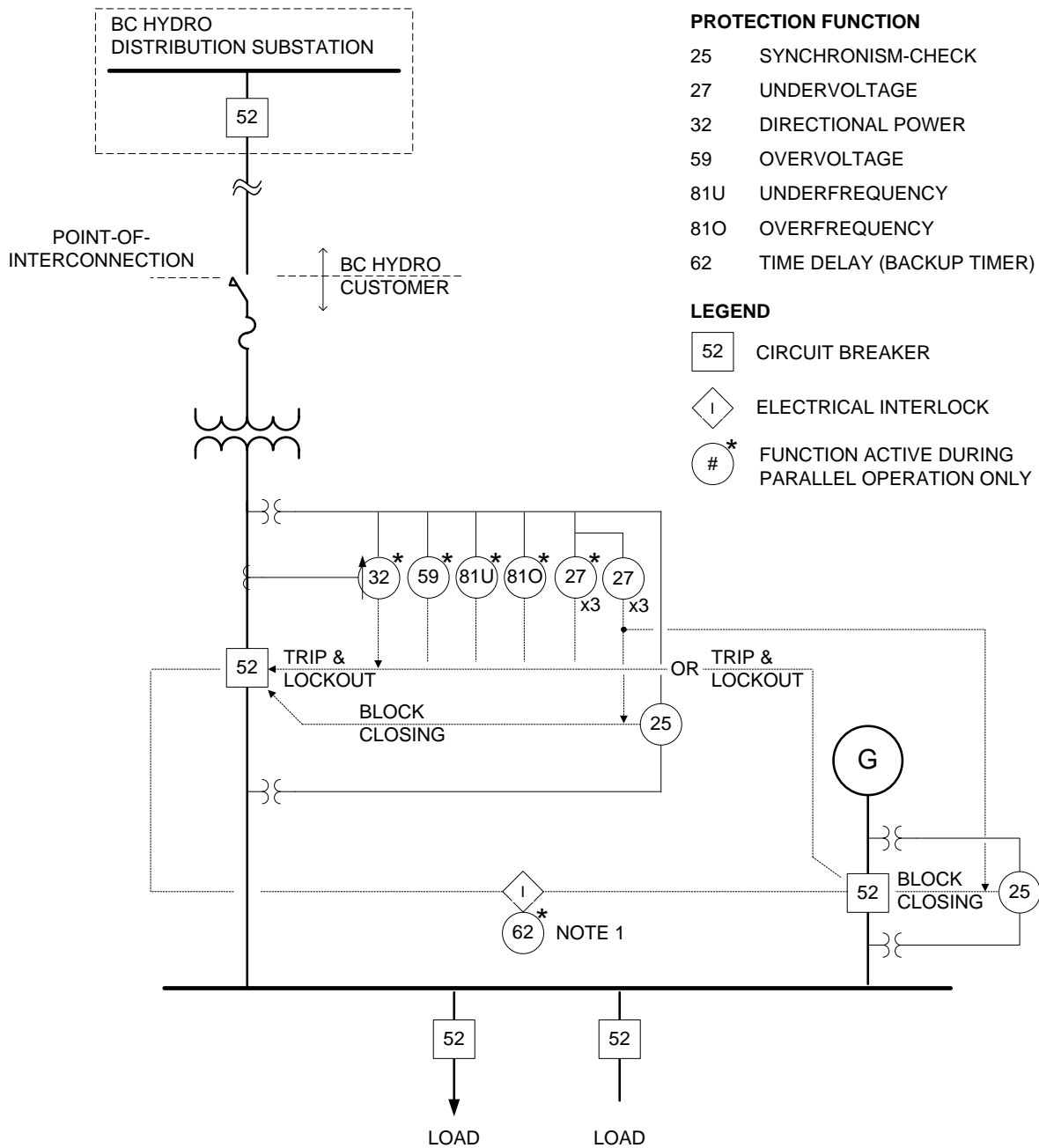
APPENDIX C SINGLE LINE DIAGRAMS, TYPICAL CLOSED-TRANSITION TRANSFER OF STANDBY GENERATORS



NOTES

1. IF GENERATOR PARALLEL TIME EXCEEDS MAXIMUM ALLOWED, THE CLOSED-TRANSITION TRANSFER WILL BE ABANDONED (PRE-TRANSFER SCHEME WILL BE RESTORED) .

FIGURE C-1: SINGLE LINE DIAGRAM, TYPICAL CLOSED-TRANSITION TRANSFER OF STANDBY GENERATOR, TRANSFER TIME <= 100 ms



NOTES

1. IF GENERATOR PARALLEL TIME EXCEEDS MAXIMUM ALLOWED, THE CLOSED-TRANSITION TRANSFER WILL BE ABANDONED (PRE-TRANSFER SCHEME WILL BE RESTORED) .

FIGURE C-2: SINGLE LINE DIAGRAM, TYPICAL CLOSED-TRANSITION TRANSFER OF A STANDBY GENERATOR, TRANSFER TIME > 100 ms

APPENDIX D SUBMISSION REQUIREMENTS

The following outlines data submission requirements.

Wherever possible, all documents shall be provided in both paper and electronic form.

The preferred format for reports and other documents is Word for Microsoft Office 2003 and for data, drawing indexes and the like is Excel for Microsoft Office 2003.

The preferred formats for drawings are: (i) Auto-CADD *.DXF format, (ii) Intergraph MicroStation *.DGN format, or (iii) Portable Document Format (PDF).

Unless legibility will be a problem, all drawings must be submitted on either, 'A'-size (8.5" x 11"; 21.6cm x 27.9cm), or 'B'-size, sheets (11" x 17"; 27.9 cm x 43.2 cm).

- (a) Generating station electrical one-line diagram showing:
 - the connections of all substation equipment with voltage levels and equipment ratings, with legend,
 - all circuit breakers with applicable relay functions, plus fuses with fuse type and rating
 - key interlock scheme where applicable, and
 - the location of the revenue metering equipment.
- (b) Completed "Generator Equipment Statement", "Service Entrance Equipment Statement", "Application – Service Voltage 4 kV to 35 kV" or "Application – Service Voltage 120 V to 600 V". These forms shall be signed and sealed by a registered B.C. Professional Engineer. The forms can be obtained at <http://www.bchydro.com/info/ipp/ipp992.html>.
- (c) Detailed narrative description of PG's closed-transition transfer system operation, including utility inter-tie switch protection and maximum paralleling time.

APPENDIX E DECLARATION OF COMPATIBILITY – GENERATOR (1ST SYNCHRONIZATION)

The compatibility of generation (1st Synchronization) describes conditions that must be satisfied before the PG's facility can be connected to generate electricity for the purposes of testing and commissioning the facility or its components.

Declaration of Compatibility, Generator (1st Synchronization), Generator's Facilities			
Generator:			
Project:			
The Generator shall design, construct, own, and maintain the Customer's Facilities.			
Interconnection		<u>Yes</u>	<u>No</u>
1. BC Hydro has reviewed the Generator's proposed facilities to confirm compliance with BC Hydro's technical requirements for generator commissioning.		<input type="checkbox"/>	<input type="checkbox"/>
2. Accepted by Real Time Operations, BCTC, for energization for generator commissioning.		<input type="checkbox"/>	<input type="checkbox"/>
Field Verification			
1. Utility intertie switch protective relay functions confirmed.		<input type="checkbox"/>	<input type="checkbox"/>
2. Local Operating Order approved by BC Hydro and the Generator. Generator and Control Centre have copies.		<input type="checkbox"/>	<input type="checkbox"/>
3. Electrical Inspection Approval attached.		<input type="checkbox"/>	<input type="checkbox"/>
4. Professional Engineer's declaration(s) that the Generator's Facilities have been designed, constructed, and tested to a state suitable for operation as a load in accordance with prudent electrical utility practice.		<input type="checkbox"/>	<input type="checkbox"/>
5. BC Hydro facilities ready.		<input type="checkbox"/>	<input type="checkbox"/>
6. BCTC Operations approval to energize for generator commissioning received.		<input type="checkbox"/>	<input type="checkbox"/>
Provide explanation if "No" has been checked for any item above.			
The undersigned do hereby declare that the Generator's Substation is compatible for interconnection with the BC Hydro system for the purpose of generator commissioning.			
_____	_____	_____	_____
<i>(Generator or Delegate)</i>	Date	<i>(BC Hydro Field Coordinator)</i>	Date