Ontario Energy Board
P.O. Box 2319
27th Floor
2300 Yonge Street
Toronto ON M4P 1E4
Telephone: 416- 481-1967
Facsimile: 416- 440-7656
Toll-free: 1-888-632-6273

Commission de l'énergie de l'Ontario
C.P. 2319
27e étage
2300, rue Yonge
Toronto ON M4P 1E4
Téléphone: 416- 481-1967
Télécopieur: 416- 440-7656
Numéro sans frais: 1-888-632-6273

Ontario

BY EMAIL AND WEB POSTING

December 20, 2017

NOTICE OF PROPOSAL TO AMEND THE TRANSMISSION SYSTEM CODE

OEB FILE NO.: EB-2016-0299

To: All Licensed Transmitters
All Licensed Generators
Independent Electricity System Operator
All Other Interested Parties

The Ontario Energy Board (OEB) has issued proposed amendments to the Transmission System Code (TSC) for stakeholder comment. The proposed amendments are made pursuant to section 70.2 of the *Ontario Energy Board Act, 1998* (OEB Act). The purpose of the proposed amendments is to eliminate requirements that may conflict with evolving reliability standards adopted by standards authorities and in force in Ontario, and to bring remaining obligations in line with current good utility practice.

The OEB will not be granting cost awards in this matter.

A. Background

Reliability standards are intended to ensure the integrity of the interconnected North American bulk electricity system. Reliability standards are those standards which have been adopted by the North American Electric Reliability Corporation (NERC) including any amendment or revision thereto, and those criteria that are developed and adopted by the Northeast Power Coordinating Council Inc. (NPCC), as well any amendment or revision thereto.

The TSC sets out the reliability obligations of electricity transmitters with respect to transmission customers, including performance standards, technical requirements, and

provisions for expansions and connections. It applies to any assets in Ontario owned by a licensed transmitter.

When the TSC was first issued in July 2000, it incorporated a small number of reliability requirements that were a subset of the reliability standards of NERC and NPCC. This is because compliance with the reliability standards at that time was voluntary and expected only as a matter of good utility practice. The TSC also contains, in sections 8 through 10, a number of prescriptive provisions that were derived from the design standards of the former Ontario Hydro.

In this Notice, reliability standards together with design specifications are collectively referred to as “reliability obligations”.

Many of the clauses of the TSC are implemented through requirements in the standard form connection agreements included in Appendix 1 of the TSC in both Version A for Load Customers and Version B for Generators. Together, these three chapters and standard form agreements represent the reliability obligations embedded in the TSC.

Since the 2003 Northeast blackout, Ontario, as well as a number of other North American jurisdictions, have taken steps to make the reliability standards mandatory and enforceable. In Ontario, the IESO is the entity accountable to NERC and NPCC for compliance with the reliability standards. The IESO’s market participants are subject to compliance with reliability-related Market Rules, which include reliability standards. As well, by the terms of their OEB licences, electricity transmitters are required to adhere to the Market Rules and, by extension, the reliability standards.

B. Changes to Reliability Obligations

The reliability standards have, from time to time, undergone amendment since they were first made mandatory and enforceable in Ontario. In this light, the OEB identified certain provisions within the TSC that the OEB considered duplicative of, or out of date with, the NERC and NPCC reliability standards. In a Notice of Proposed Amendment to a Code dated October 19, 2016, the OEB proposed removing these provisions from the TSC. In response to that Notice, stakeholders noted that the NERC standards apply only to the bulk electricity system (BES) that is generally 100kV and above and the NPCC criteria apply only to the bulk power system that is a subset of the BES. These stakeholders suggested that there was value in having some requirements apply to assets outside the jurisdiction of NERC.

The OEB established a working group to develop recommendations for the OEB to consider in making changes to the reliability obligations embedded in the TSC. OEB staff and the OEB’s technical consultant led the working group that included

representatives of the IESO, Hydro One Networks Inc. and Ontario Power Generation Inc.

The OEB has carefully considered the recommendations of the working group members and is now proposing amendments to the TSC and Appendix 1 of the TSC.

The OEB is requesting interested persons to review the proposed amendments and to provide comments. The OEB is particularly interested in hearing from stakeholders as to whether alternative descriptions of the remaining prescriptive reliability obligations may relieve a barrier to innovation.

C. Proposed Amendments to the TSC

Attachment A to this Notice contains the proposed amendments to the TSC. The majority of changes are to sections 8, 9, and 10 of the TSC.[1] In addition, consequential changes are being made to Appendix 1 Versions A (Form of Connection Agreement for Loads) and B (Form of Connection Agreement for Generators). More specifically, the OEB proposes:

- The removal of certain provisions from the TSC which are duplicative of, or out of date with, the mandatory reliability standards enforced by the IESO through its Market Rules.
- Where applicable, to ensure that those provisions continue to apply to the assets of licensed transmitters that are outside the jurisdiction of NERC or NPCC.
- Clarifying that the onus of TSC compliance is on the licensed transmitter.
- Where possible, moving technical requirements to the standard form connection agreements.
- Updating the design requirements to current utility practice.

Where a section is proposed to be deleted in its entirety, the OEB has not proposed a change to the section's numbering. This is primarily because stakeholders within the industry may be familiar, and may already be relying on, existing numbering as referencing specific actions or obligations. In these instances where an item has been deleted in its entirety, the wording of the relevant section will be replaced with, "Intentionally left blank."

Finally, in the light of the necessary update to the Code revision date, the language at sections 6.1.5, 6.1.7, and 6.8.3 is being modified in order to maintain their original intent.

[1] As well, the OEB will making non-substantive revisions to the identified sections of the TSC, in order to correct minor typographical errors.

D. Anticipated Costs and Benefits

The OEB believes that the proposed amendments to the TSC are necessary in order to better align the TSC with the NERC reliability standards, the NPCC criteria, the Market Rules, good utility practice, and the OEB's standard form electricity transmitter licence. It is intended that the proposed amendments will allow for more efficient functioning of the sector and therefore reduced cost to the stakeholders.

E. Coming into Force

The OEB proposes that the final TSC amendments, which will be determined after stakeholder comments have been received and considered, come into force on the date that the final TSC amendments are published on the OEB's website.

F. Invitation to Comment

All interested parties are invited to submit written comments on the proposed TSC amendments, as set out in Attachment A, by **January 26, 2018**.

Three (3) paper copies of each filing must be provided, and should be sent to:

Kirsten Walli
Board Secretary
Ontario Energy Board
P.O. Box 2319
2300 Yonge Street, Suite 2700
Toronto, Ontario M4P 1E4

All communications should be directed to the attention of the Board Secretary at theaddress below, and filings are to be received no later than **4:45 p.m.** on **January 26, 2018.**

A member of the public can submit a letter of comment by using the following link or by sending a letter by email or post using the contact information provided. Additionally, interested parties are requested to follow the document naming conventions and document submission standards outlined in the document entitled "RESS Document Preparation – A Quick Guide" also found on the e-filing services web page. If the OEB's web portal is not available, electronic copies of filings may be filed by e-mail at boardsec@oeb.ca.

All filings to the OEB must quote the file number **EB-2016-0299** and be made in searchable/unrestricted PDF format electronically through the OEB's web portal at https://www.pes.ontarioenergyboard.ca/eservice/. If the web portal is not available parties may email their documents to the address below. Those who do not have

internet access are required to submit all filings on a CD in PDF format, along with two paper copies. Those who do not have computer access are required to file two (2)paper copies.

This Notice, including the proposed amendments to the code set out in Attachment A, and all written comments received by the OEB in response to this Notice will be available for public viewing on the OEB's web site at www.oeb.ca and at the office of the OEB during normal business hours.

If you have any questions regarding the proposed code amendments described in this Notice, please contact Laurie Reid at Laurie.Reid@OEB.ca or at 416-440-7623. The OEB's toll free number is 1-888-632-6273.

DATED December 20, 2017

ONTARIO ENERGY BOARD

Original signed by

Kirsten Walli
Board Secretary

Attachment: Attachment A – Proposed Amendments to the TSC

Attachment A – Proposed Amendments to the Transmission System Code

ONTARIO ENERGY BOARD

Transmission System Code

Last Revised ~~August 26, 2013~~TBD

(Originally Issued on July 14, 2000)

TABLE OF CONTENTS

2. DEFINITIONS

2.0.46 "NERC" means the North American Electric Reliability ~~Council~~ Corporation;

2.0.47A "OPA" means the Independent Electricity System Operator or successor company;

2.0.55 "reliability organization" means NERC, ~~NERC's reliability councils~~ the Northeast Power Coordinating Council, and the IESO;

6. CUSTOMER CONNECTIONS

6.1 GENERAL REQUIREMENTS

6.1.5 Intentionally left blank. ~~A transmitter shall file its connection procedures for the Board's approval within one year of the Code revision date. A transmitter shall also file any material amendments to those procedures for the Board's approval. The transmitter may not give effect to such connection procedures or any material amendments thereto until the connection procedures or amendments have been approved by the Board or amended by the Board under section 6.1.6.~~

6.1.6 The Board may, on application or on its own motion, amend a transmitter's connection procedures and any amendments thereto that have been previously approved or amended by the Board.

6.1.7 Intentionally left blank. ~~Where, prior to the Code revision date, a transmitter had filed its connection procedures with the Board and such connection procedures do not contain all of the material required by section 6.1.4, the transmitter shall file the missing material within one year of the Code revision date. The Board may make a decision regarding the incomplete connection procedures pending the filing of the missing material.~~

6.8.3. Where a transmitter had an executed agreement with a neighbouring Ontario transmitter on August 26, 2013, the parties shall amend that agreement as may be required to ensure that it complies with the requirements of sections 6.8.1 and 6.8.2. Such amendment shall be made as soon as any other amendment to the agreement is being made by the parties and in any event no later than ~~the date that is five years from the Code revision date~~ August 26, 2018.

8 GENERAL TECHNICAL REQUIREMENTS

8.1 ~~GUIDELINES OF RELIABILITY ORGANIZATIONS~~ INTENTIONALLY LEFT BLANK

8.1.1 Intentionally left blank. ~~8,1,1 A transmitter shall ensure compliance with the standards of all applicable reliability organizations.~~

8.1.2 Intentionally left blank. ~~8.1.2 A transmitter shall provide to a customer, upon request, the name and address of a contact person for each applicable reliability organization.~~

8.2 PROTECTION AND CONTROL

8.2.1 j) the two protection systems shall be supplied ~~either~~ from separate secondary windings of a voltage and current transformer or from separate voltage and current transformers. ~~On one voltage transformer or potential device and from separate current transformer secondary windings (using two current transformers – one current transformer for each protection system)~~; and

8.3 INSULATION COORDINATION

8.3.2 The transmitter shall ensure that a ~~A~~ tap connected to a shielded transmission circuit is ~~shall~~ also ~~be~~ shielded.

9. TECHNICAL REQUIREMENTS FOR TAPPED TRANSFORMER STATIONS SUPPLYING LOAD

9.1 SUPPLY CONSIDERATIONS

9.1.2 The transmitter shall ensure that the grounding of ~~neutrals of the~~ power transformer ~~primary~~ windings at ~~transmission system~~ tapped transmission system stations ~~are normally not grounded~~ do not adversely affect the reliability of the transmission system.

9.2 PROTECTION REQUIREMENTS

9.2.1 The transmitter's protection and teleprotection requirements will be identified in the connection agreement. These requirements apply to the facilities that interface between the customer and the transmitter systems. T~~t~~ypical technical requirements ~~for a transmitter's tapped transformer stations protection~~ are set out in Exhibit E.1, Schedule E of the applicable version of the connection agreement set out in Appendix 1, and Exhibits F.1 and F.2, Schedule F of version A of the connection agreement set out in Appendix 1.

9.2.2 Intentionally left blank. ~~Line protections are required when transformers connected to separate supply circuits are operated in parallel on the low voltage side, or if a large synchronous infeed exists at the low voltage bus.~~

9.2.3 Intentionally left blank. ~~Directional current sensing relays may be required to detect infeed into faults within the transmission system and to isolate a tapped transformer station's contribution to the fault. Distance or impedance (21) relays as specified in Exhibit F.2, Schedule F of version A of the connection agreement set out in Appendix 1, may serve this need.~~

9.2.4 Intentionally left blank. ~~If the tapped transformer is connected ungrounded wye or delta on the primary, then ground under voltage (64 27) and ground over voltage (64 59) protections as shown in Exhibit F.2, Schedule F of version A of the connection agreement set out in Appendix 1 are required to detect ground faults.~~

9.2.5 Intentionally left blank. ~~Where the tapped transformer is connected wye grounded on the primary (Yg/D or Yg/Yg), a ground over current relay (64) as indicated in Exhibit F.2, Schedule F of version A of the connection agreement set out in Appendix 1, connected in the transformer neutral, may be used for detection.~~

10 PROTECTION SYSTEM REQUIREMENTS

10.1 TELECOMMUNICATIONS

10.1.2 A transmitter shall specify to all customers telecommunication channel media and protective systems in the connection agreement. These requirements shall apply to the facilities that interface between the customer and the transmitter systems.

10.1.4 Intentionally left blank. ~~Where each of the dual protections protecting the same system element requires communication channels, a shall ensure that the equipment and channel for each protections system is separated physically and designed to minimize the risk that both protections might be disabled simultaneously by a single contingency.~~

10.1.6 The transmitter shall include a maximum annual specification on major disturbances caused by telecommunication failures in the connection agreement. ~~Major disturbances caused by telecommunication failures shall have annual frequency of less than 0.002 per year from the dependability aspect and less than 0.002 per year from the security aspect.~~

10.1.7 The transmitter shall include a maximum annual specification for unavailability of the telecommunication protection for a single transmission system circuit and for two circuits in the connection agreement. ~~A transmitter shall ensure that telecommunication protection for a single transmission system circuit shall be unavailable for no more than 42 minutes per year, and for two circuits, no more than four minutes per year.~~

10.1.8 The transmitter shall include a maximum annual specification for telecommunication false trip rate in the connection agreement. ~~A transmitter shall ensure that the telecommunication false trip rate used as part of a protection system for a single transmission system circuit is no more than 0.1 false trips per year, and for two circuits, no more than 0.001 false trips per year.~~

10.1.9 The transmitter shall include a maximum annual specification in the connection agreement for total transmission system circuit trips coincident with telecommunications failure. ~~A transmitter shall ensure that total transmission system circuit trips coincident with telecommunications failure are no more than~~

~~0.001 per year.~~

10.2 TEST SCHEDULE FOR RELAYING COMMUNICATION CHANNELS

10.2.2 Intentionally left blank. ~~Signal adequacy testing for unmonitored channels shall be done at one month intervals. Signal adequacy testing for monitored channels shall be done at twelve month intervals.~~

10.2.3 Intentionally left blank. ~~Channel performance testing on leased communication circuits shall be conducted at 24 month intervals, while intervals for testing power line carrier equipment shall be equipment specific.~~

10.3 VERIFICATION AND MAINTENANCE PRACTICES

10.3.1 The transmitter shall establish verification intervals for protection systems not otherwise covered by the requirements of a reliability organization. Verification is required after any change is made to an existing protection system. ~~A transmitter shall use the maximum verification intervals established by reliability organizations and in accordance with applicable reliability standards: (a) four years for most 115kV elements, most transformer stations, and certain 230kV elements: (b) two years for all other high voltage elements. All newly commissioned protection systems shall be verified within six months of the initial in service date of the system.~~

10.3.2 Intentionally left blank. ~~Routine verification shall ensure with reasonable certainty that the protection systems respond correctly to fault conditions.~~

10.3.3 Intentionally left blank. ~~A transmitter shall use an electrically initiated simulated fault clearing check to verify new protection systems, after any wiring or component changes are made to an existing protection system, and for the routine verification of a protection system.~~

10.4 FUNCTIONAL TESTS AND PERIODIC VERIFICATION

10.4.1 For direct current circuitry checks, a transmitter shall thoroughly check the logic of the auxiliary circuitry with the direct current applied and the initiating devices suitably energized to initiate the process. ~~When primary relays are the initiating device, the initiation shall be achieved by secondary injection of appropriate electrical quantities to the measuring elements. In cases where the sequence of operation is critical, monitoring by a portable sequence of events recorder may be required for proper analysis.~~ Operation or tripping of any interrupting or isolating device shall always be verified, as well as local and/or remote annunciation and target operation.

10.5 FAILURE PROTECTION FOR HIGH VOLTAGE INTERRUPTING DEVICES

10.5.4 A transmitter shall not use automatic ground switches for any transmitter owned new installations for triggering line protection operation ~~following the failure of a HVID~~.

10.6 INSTRUMENT TRANSFORMERS

10.6.2 A transmitter shall ensure that current transformers are connected so that adjacent relay protection zones overlap and, where they do not overlap, shall ensure appropriate mitigation is provided.

10.7 BATTERY BANKS AND DIRECT CURRENT SUPPLY

10.7.1 The transmitter ~~customer~~ shall ensure that if either the battery charger fails or the AC supply source fails, the station battery bank shall have enough capacity to allow the station to operate for at least eight hours for a single battery system or at least six hours for each of the batteries in a two battery system.

10.7.2 The transmitter shall ensure that ~~C~~critical DC supplies such as relay protection circuits and high voltage interrupters (HVIs) shall be monitored and alarmed. ~~annunciated such as relay protection circuits and high voltage interrupters (HVIs).~~

10.7.3 The transmitter shall ensure that ~~For~~ all generating facilities connected to the transmission system~~,~~ have two separately protected (fuse/breaker) and monitored DC station battery systems ~~are required~~ unless the transmitter and IESO determine otherwise.

10.7.4 The transmitter shall ensure that ~~For~~ tapped transformer stations~~,~~ have at least one protected (fuse/breaker) monitored DC station battery system. The transmitter may specify that ~~is required unless~~ two systems ~~are specified by the Transmitter~~ are required.

APPENDIX 1

VERSION A - FORM OF CONNECTION AGREEMENT FOR LOAD CUSTOMERS SCHEDULE E

GENERAL TECHNICAL REQUIREMENTS

1.1 Intentionally Left Blank ~~Guidelines of Reliability Organizations~~

1.1.1. Intentionally left blank. ~~Customers and Transmitters shall follow all reliability organizations= standards as they may be amended from time to time.~~

1.1.2. Intentionally left blank. ~~The Transmitter shall provide to Customers upon request, the address and contact persons at the relevant reliability organization.~~

1.3. Protection and Control

1.3.1. The protection systems, which protect~~s~~ transmission system elements, shall be capable of minimizing the severity and extent of disturbances to the transmission system while themselves experiencing a first-order single contingency such as the failure of a relay protection system to operate or the failure of a breaker to trip. In particular:

1.3.1.1. the elements designated by the Transmitter or the IESO as essential to system reliability and security shall be protected by two protection systems. Each system shall be independently capable of detecting and isolating all faults on those elements. These elements shall have breaker failure protection, but breaker failure protection need not be duplicated. Both protection systems shall initiate breaker failure protection;

1.3.1.3. the use of two identical protection systems should be avoided ~~is not generally, recommended~~, because it increases the risk of simultaneous failure of both systems due to design deficiencies or equipment problems;

1.3.1.10. the two protection systems shall be supplied either from separate secondary windings of a voltage and current transformer or from separate voltage and current transformers; ~~on one voltage transformer or potential device and from separate current transformer secondary windings, i.e., from two separate current transformers;~~

1.8. Procedures for Maintenance and Periodic Verification

1.8.1. The Transmitter, using good utility practice, may specify the maintenance criteria and the maximum time intervals between verification cycles for those parts of Customers'~~=~~ facilities that may materially adversely affect the transmission system. The obligations for maintenance and performance re-verification shall be stipulated in the appropriate schedule to this Connection Agreement.

SCHEDULE F
ADDITIONAL TECHNICAL REQUIREMENTS FOR TAPPED CONNECTIONS ~~TRANSFORMER STATIONS SUPPLYING LOAD~~:

(a) Transmitter'=s Tapped Transformer Stations; and
(b) ~~Distributor'=s and Consumer~~ Customer'=s Tapped Transformer Stations

1.1. Supply Considerations

1.1.4. Transmitter approval is required before grounding the neutral of power transformer windings at tapped transmission system stations. ~~The neutrals of the power transformer primary windings at transmission system tapped stations are normally not grounded. Transmitters shall approve grounded transformers by exception only.~~

1.1.5. Customers ~~Consumers and Distributors~~ shall participate in load shedding to meet reliability standards.

1.1.6. A transmission system breaker of a Customer ~~Consumer or Distributor~~ shall not autoreclose without Transmitter'=s approval.

1.1.7. A Customer ~~Consumer or a Distributor~~ shall not manually energize a Transmitter'=s line without the Transmitter'=s approval.

1.2. Protection Requirements

1.2.1. The typical technical requirements for Customer ~~Distributor and Consumer~~ protection shall be followed, as presented in Exhibit E.1 of Schedule E and Exhibits F.1 and F.2 of this Schedule F.

SCHEDULE G

PROTECTION SYSTEM REQUIREMENTS

1.1 Telecommunications

1.1.2 A Transmitters shall specify to the Customer the telecommunication channel media and protective systems. These requirements apply to the facilities that interface between the Customer and the Transmitter.

1.1.4. Intentionally left blank. ~~Where each of the dual protections protecting the same system element requires communication channels, the equipment and channel for each protection shall be separated physically and designed to minimize the risk that both protections might be disabled simultaneously by a single contingency.~~

1.1.6. Major disturbances caused by telecommunication failures shall have annual frequency of less than 0.002 per year from the dependability aspect and less than 0.002 per year from the security aspect or as otherwise prescribed by the Transmitter.

1.1.7. Telecommunication protection for a single transmission system circuit shall have an unavailability less than forty two (42) minutes per year, and for two circuits it shall be ~~less~~ no more than four (4) minutes per year or as otherwise prescribed by the Transmitter.

1.1.8. The telecommunication false-trip rate used as part of a protection system for a single transmission system circuit shall be not more than 0.1 false trips per year, and for two circuits it shall be not more than 0.001 false trips per year unless otherwise prescribed by the Transmitter.

1.1.9. Total transmission system circuit trips coincident with telecommunications failure shall be not more than 0.001 per year unless otherwise prescribed by the Transmitter.

1.2. Test Schedule for Relaying Communication Channels

1.2.1. Communication channels associated with protective relaying shall be tested at periodic intervals in accordance with applicable reliability standards to verify that the channels are operational and that their characteristics ~~lie~~ are within specific tolerances. Testing should include signal adequacy tests and channel performance tests. The Transmitter shall establish testing intervals for any communication channels not otherwise subject to reliability standards. ~~The testing consists of signal adequacy tests and channel performance tests.~~

1.2.1.1. Intentionally left blank. ~~Signal adequacy test intervals are:~~

1.2.1.1.1. Intentionally left blank. ~~Channels - for Protection (unmonitored) at one (1) month intervals; and~~

1.2.1.1.2. Intentionally left blank. ~~Channels - for Protection (monitored) at twelve (12) month intervals.~~

1.2.1.2. Intentionally left blank. ~~Channel performance testing on leased communication circuits shall be conducted at 24 month intervals, while intervals for testing power line carrier equipment shall be equipment-specific.~~

1.3. Verification and Maintenance Practices

1.3.1. Customers shall perform routine verifications of protection systems on a scheduled basis in accordance with applicable reliability standards. The Customer shall establish verification intervals for any protection systems not otherwise covered by the requirements of a reliability organization. The reverification period for those protections systems is to be entered in the agreement and initialed by the parties. A Customer shall re-verify after a change is made to an existing system. ~~The maximum verification interval is four years for most 115 kV elements, most transformer stations, and certain 230 kV elements and two years for all other high- voltage elements. All newly commissioned protection systems shall be verified within six months of the initial in-service date of the system.~~

1.3.2. Intentionally left blank. ~~Routine verification shall ensure with reasonable certainty that the protections respond correctly to fault conditions.~~

1.3.3. Intentionally left blank. ~~An electrically initiated simulated fault clearing check is mandatory to verify new protections, after any wiring or component changes are made to a protection, and for routine verification of a protection.~~

1.3.6. The Transmitter and the Customer shall consult on the functional test procedures. The tests shall not begin until the procedure is accepted by the Transmitter. If they cannot agree, the supply of continuity of supply shall depend on the performance of the tests that the Transmitter shall require. ~~Transmitters and Customers shall agree upon the final functional test procedures before the tests begin. If they cannot agree, the supply or continuity of supply shall depend on the performance of the tests that the Transmitter shall require.~~

1.3.8. Customers shall make available to the Transmitter records of relay calibrations and protection verifications, so that records of the facility'~~=~~s performance can be maintained. The specific records required shall be identified in this Connection Agreement.

1.4. Functional Tests and Periodic Verification

1.4.3. For direct current (DC) circuitry checks, a Transmitter shall thoroughly check the logic of the auxiliary circuitry ~~shall be thoroughly checked~~ with the DC applied and the initiating devices suitably energized to initiate the process. ~~When primary relays are the initiating device, the initiation shall be achieved by secondary injection of appropriate electrical quantities to the measuring elements. In certain cases where the sequence of operation is critical, monitoring by a portable sequence-of-events recorder may be required for proper analysis.~~ Operation or ~~/~~tripping of ~~all~~ any interrupting or ~~/~~isolating device~~s~~ shall always be verified, as well as annunciation and target operation.

1.5. Failure Protection for High-Voltage Interrupting Devices (HVIs)

1.5.2. The HVI failure protection will initiate remote or transfer trip circuits and opening of the motor-operated disconnection switch unless otherwise prescribed by the Transmitter. ~~In general, the transmission system will require the HVI failure protection to be achieved by using remote or transfer trip circuits.~~

1.5.4. Automatic ground switches are not acceptable for any new installations for triggering line protection operation ~~following the failure of a HVI~~.

1.6. Instrument Transformers

1.6.2. Current transformers ~~shall~~ should be connected so that adjacent relay protection zones overlap. Where they do not overlap, the Transmitter may approve alternative mitigation at its discretion.

1.7. Battery Banks and Direct Current Supply

1.7.2. Critical DC supplies such as relay protection circuits and high voltage interrupters (HVIs) shall be monitored and alarmed. ~~annunciated such as relay protection circuits and high voltage interrupters (HVIs).~~

1.7.3. For all generating facilities connected to the transmission system, two separately protected (fuse/breaker) and monitored DC station battery systems are required unless the Transmitter and the IESO determine otherwise.

1.7.4. For tapped transformer stations, one protected (fuse/breaker) monitored DC station battery system is required unless two systems are specified by the Transmitter.

APPENDIX 1
VERSION B - FORM OF CONNECTION AGREEMENT
FOR GENERATOR CUSTOMERS

SCHEDULE E

GENERAL TECHNICAL REQUIREMENTS

1.1 Intentionally left blank. ~~Guidelines of Reliability Organizations~~

1.1.1. Intentionally left blank. ~~Customers and Transmitters shall follow all reliability organizations= standards as they may be amended from time to time.~~

1.1.2. Intentionally left blank. ~~The Transmitter shall provide to Customers upon request, the address and contact persons at the relevant reliability organization~~.

1.3. Protection and Control

1.3.1. The protection systems, which protect~~s~~ transmission system elements, shall be capable of minimizing the severity and extent of disturbances to the transmission system while themselves experiencing a first-order single contingency such as the failure of a relay protection system to operate or the failure of a breaker to trip. In particular:

1.3.1.1. the elements designated by the Transmitter or the IESO as essential to system reliability and security shall be protected by two protection systems. Each system shall be independently capable of detecting and isolating all faults on those elements. These elements shall have breaker failure protection, but breaker failure protection need not be duplicated. Both protection systems shall initiate breaker failure protection;

1.3.1.3. the use of two identical protection systems should be avoided ~~is not generally, recommended,~~ because it increases the risk of simultaneous failure of both systems due to design deficiencies or equipment problems;

1.3.1.10. the two protection systems shall be supplied from separate secondary windings of a ~~on one~~ voltage and current transformer or ~~potential device and~~ from separate voltage and current transformers ~~secondary windings, i.e., from two separate current transformers~~;

1.8. Procedures for Maintenance and Periodic Verification

1.8.1. The Transmitter, using good utility practice, may specify the maintenance criteria and the maximum time intervals between verification cycles for those parts of Customers'~~=~~ facilities that may materially adversely affect the transmission system. The obligations for maintenance and performance re-verification shall be stipulated in the appropriate schedule to this Connection Agreement.

SCHEDULE F

ADDITIONAL TECHNICAL REQUIREMENTS

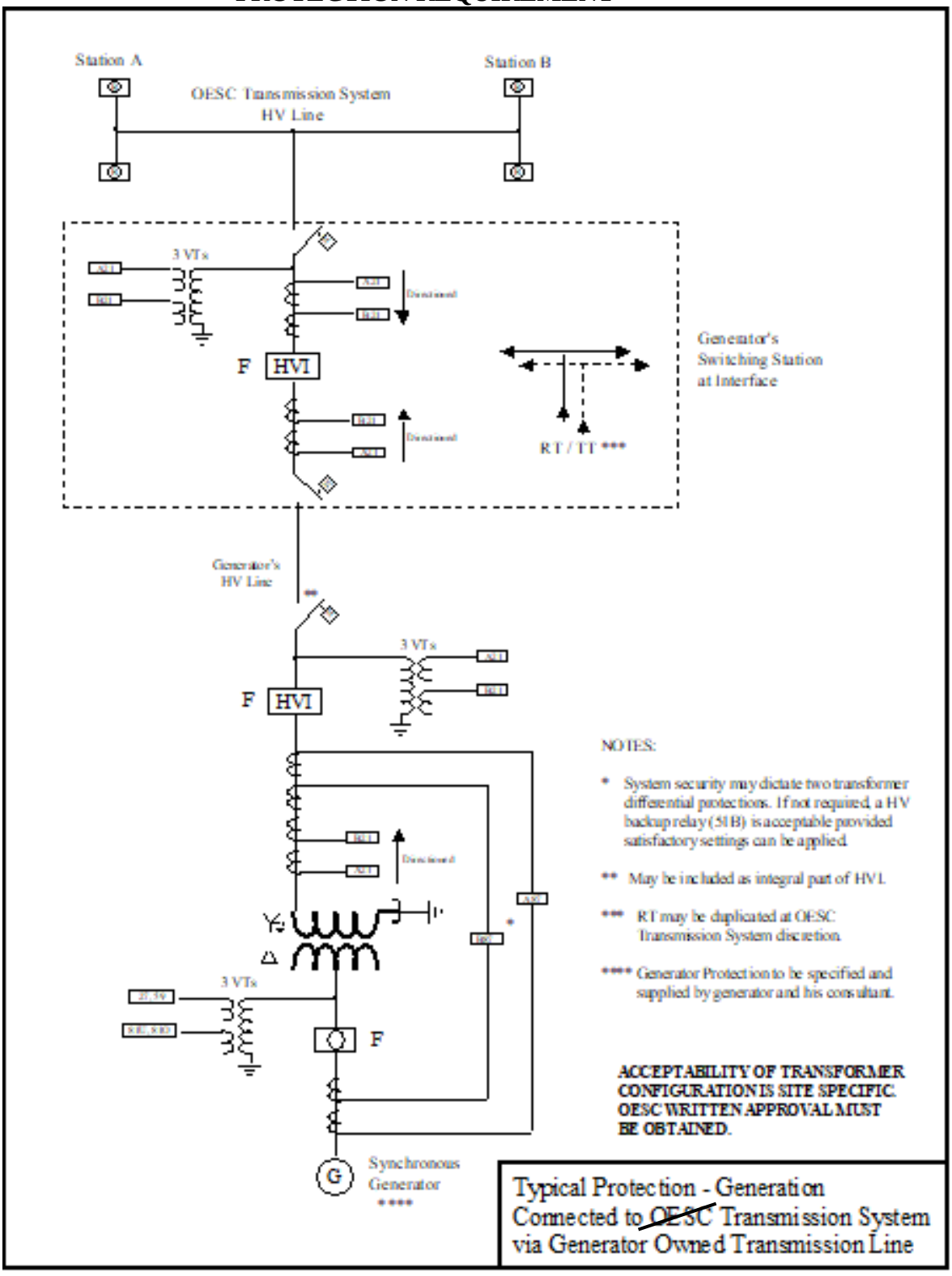
1.1 Supply Considerations

1.1.5 Transmitter approval is required before grounding the neutral of power transformer windings at tapped transmission system stations. ~~The method of grounding the neutral of all power transformer primary windings shall require the approval of the Transmitter. The Transmitter shall give its approval if it is satisfied that the reliability of its transmission system is not affected.~~

1.5 Autoreclosure and Manual Energization

1.5.2 Following a protection operation on a transmission line, the transmission breakers, located mainly in network switching and/or transformation stations, shall autoreclose after a certain time delay. Where the Generator is directly connected to the transmission line, or for configurations where the Generator could be damaged by autoreclosure of the line, the Generator shall provide a reliable means of disconnecting its equipment before autoreclosure. The Generator is responsible for protecting its own equipment and the Transmitter is not liable for damage to the Generator'=s equipment except as stipulated in section 15 of this Connection Agreement. The Generator may request a means of supervising the transmission autoreclosure prior to the disconnection of its equipment e.g. changes in protection logic at one or both stations to reduce the risk of such events. The criteria governing the use of reclosures are set out in the Ontario Hydro ~~A~~"Policies, Principles & Guidelines"@ document A"C-3.4.1(R1), Automatic Reclosure and Manual Energization on Bulk System Electricity Circuits"@, which was in effect as of April 1, 1999.

EXHIBIT F.2 TYPICAL GENERATOR-OWNED TRANSMISSION LINE PROTECTION REQUIREMENT



SCHEDULE G

PROTECTION SYSTEM REQUIREMENTS

1.1 Telecommunications

1.1.2. A Transmitter shall specify to all Customers the ~~Transmitters shall specify~~ telecommunication channel media and protective systems. These requirements apply to the facilities that interface between the Customer and the Transmitter.

1.1.4. Intentionally left blank. ~~Where each of the dual protections protecting the same system element requires communication channels, the equipment and channel for each protection shall be separated physically and designed to minimize the risk that both protections might be disabled simultaneously by a single contingency.~~

1.1.6. Major disturbances caused by telecommunication failures shall have annual frequency of less than 0.002 per year from the dependability aspect and less than 0.002 per year from the security aspect or as otherwise prescribed by the Transmitter.

1.1.7. Telecommunication protection for a single transmission system circuit shall be unavailable for no more ~~have an unavailability less~~ than forty two (42) minutes per year, and for two circuits no more ~~it shall be less~~ than four (4) minutes per year or as otherwise prescribed by the Transmitter.

1.1.8. The telecommunication false-trip rate used as part of a protection system for a single transmission system circuit ~~shall be not~~ is no more than 0.1 false trips per year, and for two circuits ~~it shall be not~~ is no more than 0.001 false trips per year unless otherwise prescribed by the Transmitter.

1.1.9. Total transmission system circuit trips coincident with telecommunications failure ~~shall be not~~ are not more than 0.001 per year unless otherwise prescribed by the Transmitter.

1.2. Test Schedule for Relaying Communication Channels

1.2.1. Communication channels associated with protective relaying shall be tested at periodic intervals in accordance with applicable reliability standards to verify that the channels are operational and that their characteristics ~~lie~~ are within specific tolerances. Testing should include ~~The testing consists of~~ signal adequacy tests and channel performance tests. The Transmitter shall establish testing intervals for any communication channels not otherwise subject to reliability standards.

1.2.1.1. Intentionally left blank. ~~Signal adequacy test intervals are:~~

1.2.1.1.1. Intentionally left blank. ~~Channels - for Protection (unmonitored) at one (1) month intervals; and~~

1.2.1.1.2. Intentionally left blank. ~~Channels - for Protection (monitored) at twelve (12) month intervals.~~

1.2.1.2. Intentionally left blank. ~~Channel performance testing on leased communication circuits shall be conducted at 24 month intervals, while intervals for testing power line carrier equipment shall be equipment specific.~~

1.3. Verification and Maintenance Practices

1.3.1. Customers shall perform routine verifications of protection systems on a scheduled basis in accordance with applicable reliability standards. The Customer shall establish verification intervals for any protection systems not otherwise covered by the requirements of a reliability organization. The reverification period for those protections systems is to be entered in the agreement and initialed by the parties. The Customer shall re-verify after a change is made to an existing protection system. ~~The maximum verification interval is four years for most 115 kV elements, most transformer stations, and certain 230 kV elements and two years for all other high- voltage elements. All newly commissioned protection systems shall be verified within six months of the initial in-service date of the system.~~

1.3.2. Intentionally left blank. ~~Routine verification shall ensure with reasonable certainty that the protections respond correctly to fault conditions.~~

1.3.3. Intentionally left blank. ~~An electrically initiated simulated fault clearing check is mandatory to verify new protections, after any wiring or component changes are made to a protection, and for routine verification of a protection.~~

1.3.6. The Transmitter~~s~~ and the Customer~~s~~ shall consult on the ~~agree upon the final~~ functional test procedures ~~before the tests begin~~. The tests shall not begin until the procedure is accepted by the Transmitter. If they cannot agree, the supply or continuity of supply shall depend on the performance of the tests that the Transmitter shall require.

1.4. Functional Tests and Periodic Verification

1.4.1. Upon verification that the Customer'~~=~~s static tests on protection and control equipment, outlined in the Code and this Connection Agreement have been satisfactorily completed, a series of tests shall be performed with the equipment in a dynamic mode. These tests shall ensure that the equipment performs correctly when it should and also that it will not operate improperly.

1.4.3. For direct current (DC) circuitry checks, a Transmitter shall thoroughly check the logic of the auxiliary circuitry ~~shall be thoroughly checked~~ with the DC applied and the initiating devices suitably energized to initiate the process. ~~When primary relays are the initiating device, the initiation shall be achieved by secondary injection of appropriate electrical quantities to the measuring elements. In certain cases where the sequence of operation is critical, monitoring by a portable sequence-of-events recorder may be required for proper analysis.~~ Operation or ~~/~~tripping of ~~all~~ any interrupting or ~~/~~isolating devices shall always be verified, as well as annunciation and target operation.

1.5. Failure Protection for High-Voltage Interrupting Devices (HVIs)

1.5.2. The HVI failure protection will initiate remote or transfer trip circuits and opening of the motor-operated disconnection switch unless otherwise prescribed by the Transmitter. ~~In general, the transmission system will require the HVI failure protection to be achieved by using remote or transfer trip circuits.~~

1.5.4. Automatic ground switches are not acceptable for any new installations for triggering line protection operation ~~following the failure of a HVI~~.

1.6. Instrument Transformers

1.6.2. Current transformers ~~shall~~ should be connected so that adjacent relay protection zones overlap. Where they do not overlap, the Transmitter may approve alternative mitigation at its discretion.

1.7. Battery Banks and Direct Current Supply

1.7.2. Critical DC supplies such as relay protection circuits and high voltage interrupters (HVIs) shall be monitored and alarmed. ~~annunciated such as relay protection circuits and high voltage interrupters (HVIs).~~

1.7.3. For all generating facilities connected to the transmission system, two separately protected (fuse/breaker) and monitored DC station battery systems are required unless the Transmitter and the IESO determine otherwise.

1.7.4. For tapped transformer stations, one protected (fuse/breaker) monitored DC station battery system is required unless two systems are specified by the Transmitter.