BC HYDRO

T&D SYSTEM OPERATIONS

SYSTEM OPERATING ORDER 7T-34

SOUTH INTERIOR GENERATION SHEDDING AND OUTAGE REQUIREMENTS

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TABLE OF CONTENTS

1.0 GENERAL....3

2.0 RESPONSIBILITIES....4

3.0 SWITCHING GUIDELINES AND NOTIFICATION REQUIREMENTS....4

4.0 SOUTH INTERIOR REMEDIAL ACTION SCHEMES (SI RAS)....5
4.1 General....5
4.2 SI RAS Description....6
4.3 Pre-Outage Operating Restrictions, Generation Shedding Requirements and DTT RAS Arming Requirements....6
4.4 FBC RAS for Separation from BCH at LEE....7

5.0 SELKIRK 230 KV/500 KV TRANSFER LIMITS....8
Notes for the table of SEL 230 kV / 500 kV Transfer Limits....9

6.0 SYSTEM REQUIREMENTS....15

7.0 OPERATING PROCEDURE FOR CONTROLLED SEPARATION OF THE SOUTHERN INTERIOR(SI) FROM LOWER MAINLAND (LM) AND NORTHERN INTERIOR (NI)....15
7.1 Procedure for Splitting SIW 138 kV System....15
7.2 Voltage Control for Operation of the SIW 138 kV System....16

8.0 GENERATION SHEDDING....16
8.1 Operating Guidelines....16
8.2 Generation Shedding Facilities....17
8.3 Generation Shedding Tables....17

9.0 AUTOMATIC GENERATION CONTROL SUSPENSION....17

10.0 TSA-PM IMPLEMENTATION....17
Alarms Implemented in TSA-PM....18

11.0 REVISION HISTORY....23

Attachment 1....26
SI 500 kV Operation Tables (2L277 Connected to NLY)....26

Attachment 2....27
SEL 230 kV / 500 kV Operation Tables (2L277 Connected to NLY)....27

Attachment 3....28
Table A. SI RAS for SI 500 kV Operation....28
Table B. SI RAS for SEL 230 kV / 500 kV Operation....29

Attachment 4....30
Table 1: BPA Shedding for BDY-BELL Lines, or 2L112 Contingency with 2L277 Connected to BDY....30
Table 2: Maximum Permitted Generation Level at Boundary with 2L277 Connected to BDY....30

1.0 GENERAL

This System Operating Order (SOO) describes Remedial Action Scheme (RAS) generation shedding and line tripping, and also outage requirements for operating in the South Interior (SI) area, excluding Bridge River. RAS in the SI are required to maintain transient and voltage stability, and to avoid equipment overloading and remain within voltage limits. RAS recommendations (shedding and line tripping) are provided by the Transient Stability Analysis (TSA-PM) application in the BC Hydro Energy Management System (EMS). Generation Shedding for voltage stability can be avoided by operating the integrated system within Voltage Stability Analysis Tool (VSAT) limits also provided in the EMS. In this System Operating Order, Generation Shedding refers to removal of generation outputs either by tripping units or unit run back.

In order to manage size, this System Operating Order includes two Attachments published simultaneously as separate documents.

- Attachment 1: SI 500 kV Operation (2L277 Connected to NLY)
- Attachment 2: SEL 230 kV / 500 kV Operation (2L277 Connected to NLY)

References:

The following System Operating Orders should be reviewed together with this order and its Attachments

- SOO 1T-11A “Operating Responsibility and Operating Authority Assignment to Desks”
- SOO 2T-43 “Remedial Action Schemes (RAS)”
- SOO 7T-01D “Daily Operations Plan”
- SOO 7T-17 “BC - Alberta Interconnection”
- SOO 7T-18 “BC - US Interconnection”
- SOO 7T-33 “South Interior Subsystem”
- SOO 7T-64 “Rotational Energy to Support Transfer Limits”

Definitions:

ACK refers to Ashton Creek Substation
ASM refers to A.S. Mawdsley Station (operated by FortisBC)
BDY refers to Boundary Substation (operated by Bonneville Power Administration (BPA))
BEN refers to Bentley Substation (operated by FortisBC)
BKL refers to Brocklehurst Substation
BRD refers to Brilliant Dam Generating Station (operated by FortisBC)
COR refers to the Corra Lynn Generating Stations (operated by FortisBC)
DGB refers to D.G. Bell Substation (operated by FortisBC)
DUG refers to Douglas Substation
ESS refers to Emerald Switching Station (operated by FortisBC)
GFT refers to Grand Forks Terminal Substation (operated by FortisBC)
HLD refers to Highland Substation
KCL refers to Kootenay Canal Generating Station
KET refers to Kettle Valley Substation (operated by FortisBC)
LBO refers to Lower Bonnington Generating Stations (operated by FortisBC)
LEE refers to Lee Substation (operated by FortisBC)
MCA refers to Mica Creek Generating Station
NLY refers to Nelway Substation
OLI refers to Oliver Substation (operated by FortisBC)
REV refers to Revelstoke Generating Station
RGA refers to R.G. Anderson Station (operated by FortisBC)
SEL refers to Selkirk Substation
SEV refers to Seven Mile Generating Station

SLC refers to South Slocan Generating Station (operated by FortisBC)
SVA refers to Savona Substation
UBO refers to Upper Bonnington Generating Stations (operated by FortisBC)
VAS refers to Vaseux Lake Substation
VNT refers to Vernon Terminal Substation
WAN refers to Waneta Generating Station
WHS refers to Waneta Hydro Station (a switching station operated by FortisBC)
WTS refers to Warfield Terminal Station (operated by FortisBC)

Teck-Cominco refers to industrial loads supplied at Transmission voltages from FortisBC's Emerald Switching Station (ESS).
Kootenay River Plants refers to FortisBC's BRD, COR, LBO, and UBO Generating Stations.

SI refers to Southern Interior.
SIW refers to Southern Interior West which includes the subtransmission between Nicola, Ashton Creek and Kelly Lake Substations.

ILM refers to the Interior to Lower Mainland Path which consists of transmission lines: 5L41, 5L42, 5L81, 5L82, 5L83, and 5L87.

2.0 RESPONSIBILITIES

The BC Hydro Control Centre Transmission Coordinator (TC) is responsible for the arming of generation shedding at each plant, and arming line tripping that may be part of the RAS implementation.

Refer also to SOO 1T-11A for operations.

The operating RAS Arming requirements in this order cover the worst case operating conditions. Variations from the limits and arming conditions may be provided through additional Operating Plans, for specific operating conditions on a case basis. Operating Plans are prepared to support outages and short term operating requirements, superseding as necessary any requirements in this System Operating Order. The Operations Planning Manager is responsible for providing these operating plans to the TC. The Daily Operations Plan is one of the forms of Operating Plans (See SOO 7T-01D "Daily Operations Plan")

3.0 SWITCHING GUIDELINES AND NOTIFICATION REQUIREMENTS

1L251 Notify FortisBC prior to switching.

2L112 Notify FortisBC prior to switching.

Notify BPA prior to switching for BPA's disarming of their RAS, and for re-arming after switching.

- Boundary-Waneta line 2L277 (L71) flow must be 0 MW or towards Waneta.

2L255 Notify FortisBC prior to switching.

2L256 Notify FortisBC prior to switching.

2L293 Notify FortisBC prior to switching.

Notify BPA prior to switching for BPA's disarming of their RAS, and for re-arming after switching.

- Boundary-Waneta line 2L277 (L71) flow must be 0 MW or towards Waneta.

2L294 Notify FortisBC prior to switching.

2L295 Notify FortisBC prior to switching.

2L299 Notify FortisBC prior to switching.

5L91 Notify FortisBC prior to switching.

5L96 Notify FortisBC prior to switching.

5L98 Notify FortisBC prior to switching.

KCL T5 Notify FortisBC prior to switching.

KCL T6 Notify FortisBC prior to switching.

4.0 SOUTH INTERIOR REMEDIAL ACTION SCHEMES (SI RAS)

4.1 General

2L277 (L71) is presently connected to NLY. The RAS arming in this operating order is only designed to support this configuration. **Although 2L277 can be manually switched between to terminate at BDY, the switching is not permitted**. 2L277 must be fixed to NLY at present, and this connection is represented in SCADA as 2L277 [71L (North)].

All the generation shedding tables in Attachments 1 and 2 are based on the upgraded SI / FortisBC (FBC) system with 2L277/L71 connected to NLY.

The FortisBC 230 kV system has been meshed into Vaseux Lake 500 kV Substation (VAS). There are two meshing paths, referred to as:

- VAS-VNT path, and
- VAS-WTS path.

Please refer to FortisBC's system operating one-line diagram 4-000-0403 for the following definitions of the two paths.

VAS-VNT path: is defined as the connection of VAS230-RGA230-DG BELL230-LEE230-VNT230. The path consists of four sections connected in series:

- Section 1 is the connection of VAS230-RGA230 which consists of 75L and 76L in parallel. There are parallel lower voltage connections which link this section, therefore, this section of the path shall be treated as closed regardless of its status. Only when 75L AND 76L AND the lower voltage parallel connections are open, this section of the path shall be treated as open.
- Section 2 is the connection of RGA230-DGB230. There is no parallel lower voltage connection to link this section.
- Section 3 is the connection of DGBL230-LEE230. There are parallel lower voltage connections to link this section. When this section is open, the corresponding parallel connections which link this section must be open.
- Section 4 is the connection of LEE230-VNT230. There is no parallel low voltage connection to link this section.

VAS-WTS path: is defined as the connection of VAS230-BEN230-BEN63-BEN161-KET161-GFT161-ASM63-WTS63. The path consists of three sections connected in series:

- Section 1 is the connection of VAS230-BEN230-BEN63 which consists of 40L in series with BEN T1. There are parallel lower voltage connections which link this

section, therefore, this section of the path shall be treated as closed regardless of its status. Only when 40L/BEN T1 AND the lower voltage parallel connections are open, this section of the path shall be treated as open.
    - BC Hydro does not monitor the status of the 60kV loop between BEN and RGA (52L, 53L, 42L, 68L, 69L) which is in parallel with 40L. When 40L is OOS, the TC depends on FortisBC to confirm the loop status as the WAS-WTS may be incorrect on SCADA. The telemetered point from FortisBC to BCH does not consider the underlying 60kV transmission loop. Until FortisBC makes a change to include the parallel 60 kV loop, when 40L is OOS for any reason, the TC must verbally confirm the status of the loop with FortisBC (and manually set the status of the VAS-WTS loop).
- Section 2 is the connection of BEN63--BEN161-KET161-GFT161. There is no parallel low voltage connection to link this section.
- Section 3 is the connection of GFT161-ASM161-ASM63-WTS63. There are parallel low voltage connections to link this section. When this section is open, the corresponding parallel connections which link this section must be open.

The TSA-PM Advanced Application will alarm when it finds no template match for SI or SEL. When this situation arises, the BC Hydro Control Centre TC should verify if it is due to a FortisBC loop mismatch. Refer to the alarms in Section 10.0 for information on determining a FortisBC loop mismatch.

TSA-PM arms/disarms the SI RAS. The BC Hydro Control Centre TC is responsible for the arming and disarming of the SI RAS. When TSA-PM is unavailable, the TC can manually arm/disarm the SI RAS from the EMS Generation Shedding Display.

4.2 SI RAS Description

The SI RAS includes:

- SI generation shedding RAS, and
- SI Direct Transfer Tripping RAS (SI DTT RAS), for various contingencies.

The overall RAS functions are summarized in Attachment 3:

- Table A of Attachment 3 is for SI 500 kV operation.
- Table B of Attachment 3 is for SEL 230 kV / 500 kV operations.

4.3 Pre-Outage Operating Restrictions, Generation Shedding Requirements and DTT RAS Arming Requirements

All of the operating restrictions, generation shedding and DTT RAS arming requirements for contingencies with various system conditions, are specified in each table of Attachment 1 for SI 500 kV operation and Attachment 2 for SEL 230 kV / 500 kV operation.

The purpose of the operating restrictions or/and generation shedding or/and Direct Transfer Tripping lines are to achieve one or more of the following objectives following contingencies:

- To prevent system transient instability, or voltage collapse, or cascading outages.
- To prevent post-contingency loading on remaining circuits or series capacitor banks from exceeding their thermal limits.
- To prevent post-contingency loading on the remaining SEL transformer(s) from exceeding its continuous Daily Average Ambient Temperature (DAAT) dependent rating.
- To prevent post-contingency transient over frequency in the islanding area not exceeding 61 Hz.
- To prevent unacceptable high voltages in the system post contingency and generation shedding.

WAN G1, G2, G3 and G4 have breaker failure protection in service. The unit breakers for WAN G1, G2 and G3 are located at the Waneta Hydro Station (WHS). Failure of one of these breakers to open will result in clearing one of the four bus sections at WHS. Total clearing time from the issuance of the trip signal to G1, G2 or G3 circuit breaker to the clearing of the appropriate bus at WHS is estimated to be 12 cycles, including the breaker failure time setting of 9 cycles plus 3 cycles of WHS breaker open time.

WAN G4 shall not participate in any generation shedding requirement, this is a generic rule in the TSA-PM implementation. If WAN generation shedding is required for any contingency, then keep a minimum of one WAN unit on-line post-shedding, this is a generic rule also.

FortisBC has generation shedding RAS at BRD to prevent instability at BRD units for loss of both 2L288 and 2L289, including 2L289 contingency with 2L288 out of service, or 2L288 contingency with 2L289 out of service. FortisBC will arm all but one unit at BRD for these contingencies. The unit left unarmed should be BRD G4 which should be feeding the station service for the plant. In case of heavy load when Celgar's turbo-generator is down, FortisBC will maintain two BRD units unarmed.

The Teck Cominco RAS consists of relays at the WAN and at ESS that operate on dF/dt in the event that Waneta is islanded with the Trail Operations load. Load or generation will be shed in order to restore a balance in the island. The scheme is armed in the event of a multiple contingency – 2L277 & 77L, or 2L277 & 62L. The 2L277 and 62L line open signals are supplied locally and the 77L line open signal is delivered from the FortisBC RAS.

With the Kootenay system meshed with BC Hydro through Vaseux Lake, the dual outage of 2L277 and 77L will not cause an island to form, but FortisBC is unable to provide a RAS quality line open signal for the WTS to VAS path. If WAN is only connected to the BC Hydro system via VAS, the electrical distance between WAN and the BC Hydro system is now large and there is a danger of instability unless Waneta generation closely balances local load.

Three additional FortisBC RAS are available in order to force an island for some contingencies. These RAS are:

- DTT 62L for loss of 77L with 2L277 OOS to island Teck Cominco:
- DTT 11L at ASM for loss of 2L289 & 2L295 & 2L299 with 2L277 OOS to create the "big island" including Teck Cominco, Brilliant, Kootenay Canal and FortisBC Kootenay River Plants: and
- DTT 62L for loss of 2L277 with 77L OOS to island Teck Cominco.

Refer to Tables A.8, A.10, B.8, and B.10 in Attachment 2 for details of the arming requirements for these FortisBC RAS. Note that loss of communication between VAS and OLI will divert a generation shedding signal to VAS 40L instead of OLI 11L.

4.4 FBC RAS for Separation from BCH at LEE

FortisBC has the forced island logic which is initiated when 2L255 and 2L256 open ended either at ACK and/or at VNT (either disconnects open or CBs open at VNT and/or ACK) or the LEE 230kV bus voltage is less than 80% for 5 seconds. This indicates a problem in the BCH system and the interconnection points at LEE (72L and 74L) needs to be opened to maintain FortisBC system voltage stability.

If there is a loss of supply to VNT from ACK detected and the 'LEE RAS N-2 FORCE ISLAND' point is armed, then the RAS relay will:

- Immediately trip LEE CB1, CB3, CB4, and CB5. This will force a separation from LEE to VNT. LEE CB2 is not tripped to allow LEE T4 to remain connected to 73L and supply the Kelowna area load.

- Shed load in the Kelowna area and insert capacitor banks which are armed for the LEE N-2 contingency. Any remaining Kelowna load would be supplied via LEE T4 and DGB T2.

  FortisBC normally arms 'LEE RAS N-2 FORCE ISLAND' point at all times.

5.0 SELKIRK 230 KV/500 KV TRANSFER LIMITS

Ambient temperature dependent ratings are used to determine Selkirk 230 kV / 500 kV transfer limits with normal operation of SEL 230 kV / 500 kV transformers. These ratings are continuous ratings and shown in Diagrams 1 to 10, found in Section 4 of Attachment 2. The diagrams are programmed in TSA-PM. The diagrams are to be used together with the Table of SEL 230/500 kV transfer limits in this section.

- Refer to Diagram 1 of Attachment 2 for "SELT1MVA_Norm_Rating" or "SELT4MVA_Norm_Rating".
- Refer to Diagram 2 of Attachment 2 for "SELT2MVA_Norm_Rating" or "SELT3MVA_Norm_Rating".
- Refer to Diagram 3 of Attachment 2 for "SELT1&T2&T3MVA_Norm_Rating" or "SELT2&T3&T4MVA_Norm_Rating".
- Refer to Diagram 4 of Attachment 2 for "SELT1&T2&T4MVA_Norm_Rating" or "SELT1&T3&T4MVA_Norm_Rating".
- Refer to Diagram 5 of Attachment 2 for "SELT1&T4MVA_Norm_Rating".
- Refer to Diagram 6 of Attachment 2 for "SELT1&T2MVA_Norm_Rating" or "SELT2&T4MVA_Norm_Rating" or "SELT1&T3MVA_Norm_Rating" or "SELT3&T4MVA_Norm_Rating".
- Refer to Diagram 7 of Attachment 2 for "SELT2&T3MVA_Norm_Rating".

The pre-contingency continuous MVA rating for all SEL 230 kV bus sections can be calculated by:

1.732 * 3000 A * 230 kV * 1.03 pu = 1231 MVA

The allocation factors among SEL (T1, T2, T3, and T4) are listed in the table below.

	Allocation Factor				
SEL Transformer	**SEL T1 & T2 & T3 & T4 I/S**	**SEL T1 OOS**	**SEL T2 (or SEL T3) OOS**	**SEL T2&T3 OOS**	**SEL T4 OOS**
SEL T1	0.289	0.000	0.367	0.500	0.407
SEL T2	0.212	0.298	0.000 (or 0.266)	0.000	0.298
SEL T3	0.210	0.295	0.266 (or 0.000)	0.000	0.295
SEL T4	0.290	0.407	0.367	0.500	0.000

The following table shows the SEL 230 kV / 500 kV transfer limits for all SEL T1, T2, T3 and T4 in service, or one of the four transformers out of service or SEL (T2 & T3) out of service, based on all SEL 5CBs AND 2CBs in service or SEL 5CBs or 2CBs out of service.

Notes for use with the Table of SEL 230/500 kV Transfer Limits

Note 1: SEL 230 kV / 500 kV transfer may be limited by Attachment 5 of SOO 7T-17.

Note 2: This operating condition must be avoided as loss of SEL T4 will cause loss of both 5L91 and 5L96 without initiating the RAS schemes associated with a 5L91 and 5L96 double contingency, which will result in system transient instability. In addition, loss of SEL T4 with SEL 5CB4 breaker failure will blackout the SEL area.

Note 3: This operating condition must be avoided, as loss of SEL T1 will cause loss of 5L92 without initiating 5L94 Tie Tripping RAS associated with a 5L92 contingency.

Note 4: This operating condition must be avoided as loss of SEL T1 will cause loss of SEL T2 & T3 and no connection between SEL 500 kV to SEL 230 kV.

Note 5: This operating condition must be avoided as loss of SEL T1 will cause loss of both 5L91 and 5L96 without initiating the RAS schemes associated with a 5L91 and 5L96 double contingency, which will result in system transient instability.

Note 6: Removed.

Note 7: This operating condition must be avoided, as loss of the remaining SEL transformer with the other two transformers already out of service will black out SEL and open-end 5L91 and 5L96 at SEL.

Note 8: SEL 5CB11 must be open to avoid loss of both 5L91 AND 5L96 for any of the following contingencies:
a) a 5L91 contingency AND SEL 5CB11 breaker failure, or
b) a SEL T4 contingency AND SEL 5CB11 breaker failure.

Note 9: SEL 5CB9 must be open to avoid loss of both 5L91 AND 5L96 for any of the following contingencies:
a) a 5L91 contingency AND SEL 5CB9 breaker failure, or
b) a SEL T1 contingency AND SEL 5CB9 breaker failure.

Note 10: SEL 5CB8 must be open to avoid loss of both 5L91 AND 5L96 for any of the following contingencies:
a) a 5L96 contingency AND SEL 5CB8 breaker failure, or
b) a SEL T4 contingency AND SEL 5CB8 breaker failure.

Note 11: SEL 5CB5 must be open to avoid loss of both 5L91 AND 5L96 for any of the following contingencies:
a) a 5L96 contingency AND SEL 5CB5 breaker failure, or
b) a SEL T1 contingency AND SEL 5CB5 breaker failure.

Note 12: With SEL 5CB1 or/and SEL 5CB2 OOS, loss of SEL T4 will cause loss of 5L92. SEL 5CB3 must be open to assure initiation of the 5L94 transfer tripping RAS scheme for loss of 5L92.

Note 13: This operating condition must be avoided. SEL 5CB9 must be open to avoid loss of 5L96 for a 5L91 contingency AND SEL 5CB9 breaker failure, i.e. avoid loss of both 5L91 AND 5L96. However, with SEL 5CB9 open, SEL T2 & T3 contingency will cause loss of 5L96 without initiating its RAS, which could result in system transient instability or voltage instability.

Note 14: This operating condition must be avoided. SEL 5CB5 must be open to avoid loss of 5L91 for a 5L96 contingency AND SEL 5CB5 breaker failure, i.e. avoid loss of both 5L91 AND 5L96. However, with SEL 5CB5 open, SEL T2 & T3 contingency will cause loss of 5L91 without initiating its RAS, which could result in system transient instability or voltage instability.

Note 15: This operating condition must be avoided. SEL 5CB11 must be open to avoid loss of 5L96 for a 5L91 contingency AND SEL 5CB11 breaker failure, i.e. avoid loss of both 5L91 AND 5L96. However, with SEL 5CB11 open, SEL T2 & T3 contingency will cause loss of 5L92 and 5L96 tied together but separated from SEL 500 kV bus, which could result in system transient instability or voltage instability.

Note 16: This operating condition must be avoided. SEL 5CB8 must be open to avoid loss of 5L91 for a 5L96 contingency AND SEL 5CB8 breaker failure, i.e. avoid loss of both 5L91 AND 5L96. However, with SEL 5CB8 open, SEL T2 & T3 contingency will cause loss of 5L91 and 5L92 tied together but separated from SEL 500 kV bus, which could result in system transient instability or voltage instability.

Note 17: This operating condition must be avoided, as loss of the remaining SEL transformer with the other transformers already out of service will black out SEL, open-end 5L91 & 5L96 at SEL, and cause loss of 5L92 without initiating 5L94 Tie tripping RAS.

Note 18: This operating condition must be avoided, as loss of the remaining SEL transformer with the other transformers already out of service will black out SEL, trip open both 5L91 & 5L96, and cause loss of 5L92 without initiating 5L94 Tie tripping RAS.

Note 19: This operating condition must be avoided, as loss of the remaining SEL transformer with the other transformers already out of service will black out SEL and open-end 5L91 & 5L92 & 5L96 at SEL.

Note 20: This operating condition must be avoided, as loss of the remaining SEL transformer with the other transformers already out of service will black out SEL.

Note 21: This operating condition must be avoided, as SEL T1 contingency will black out SEL and cause loss of both 5L91 and 5L96 without initiating its RAS, which will result in system transient instability.

Note 22: Since the SEL 2CB6 (or 2CB7) rating is lower than SEL T2 & T3 rating, the value of 2076 MVA is based on the calculation:
(SEL 2CB6 (or 2CB7) MVA rating) / (SEL T2 & T3 Allocation factor with SEL T1 or SEL T4 OOS) = 1231 MVA / 0.593 = 2076 MVA

Note 23: This operating condition must be avoided, as 2L293 contingency (or 2L286 contingency) will separate 2L289 & 2L295 & 2L299 from SEL Substation without initiating its RAS, which will result in system transient instability.

Note 24: This condition must be avoided. As indicated in Note 8, SEL 5CB5 OOS must open SEL 5CB11. However, with SEL 5CB11 open, SEL T2 & T3 contingency will cause loss of 5L91 without initiating its RAS, which could result in system transient instability or voltage instability.

Note 25: This condition must be avoided. As indicated in Note 10, SEL 5CB9 OOS must open SEL 5CB8. However, with SEL 5CB8 open, SEL T2 & T3 contingency will cause loss of 5L96 without initiating its RAS, which could result in system transient instability or voltage instability.

Note 26: This condition must be avoided. As indicated in Note 9, SEL 5CB8 OOS must open

SEL 5CB9. However, with SEL 5CB9 open, SEL T2 & T3 contingency will cause 5L91 and 5L92 tied together but separated from SEL 500 kV bus, which could result in system transient instability or voltage instability.

Note 27: This condition must be avoided. As indicated in Note 11, SEL 5CB11 OOS must open SEL 5CB5. However, with SEL 5CB5 open, SEL T2 & T3 contingency will cause 5L92 and 5L96 tied together but separated from SEL 500 kV bus, which could result in system transient instability or voltage instability.

Note 28: SEL T1 (or SEL T4) contingency with SEL 5CB9 (or SEL 5CB11) breaker failure will cause loss of 5L91 with 5L96 already OOS.

Note 29: SEL T1 (or SEL T4) contingency with SEL 5CB5 (or SEL 5CB8) breaker failure will cause loss of 5L96 with 5L91 already OOS.

Note 30: This operating condition must be avoided as 2L293 contingency will separate 2L289 & 2L299 from SEL Substation without initiating its RAS, which will result in system transient instability.

Note 31: This operating condition must be avoided as 2L286 contingency will separate 2L289 & 2L295 from SEL Substation without initiating its RAS, which will result in system transient instability.

Note 32: With SEL T4 & SEL (2CB11 & 2CB12) OOS, 2L286 contingency will separate 2L295 from SEL Substation without initiating its RAS, which may cause overloading on 2L299. Open SEL 2CB10 would resolve the issue.

Note 33: There is no generation shedding table in Attachment 2 of SOO 7T-34 to cover this system configuration. Please contact TDSO Operations Planning for interim operating guidance.

TABLE OF SEL 230/500 kV TRANSFER LIMITS

Note 1 is for all the conditions in this table.

SEL 5CB and SEL 2CB Status	SEL 230 kV / 500 kV Transfer Limit (MVA)					
	SEL (T1 & T2 & T3 & T4) I/S	SEL T1 OOS	SEL T2 OOS	SEL T3 OOS	SEL (T2 & T3) OOS	SEL T4 OOS
All SEL 5CBs AND SEL 2CBs I/S	No limitation	Diag4 of Att2	Diag6 of Att2	Diag5 of Att2	Diag7 of Att2	Diag4 of Att2
SEL 5CB1 or/and SEL 5CB2 OOS	No limitation	To be avoided (Note 2)	Diag6 of Att2	Diag5 of Att2	Diag7 of Att2 (must open SEL 5CB3) (Note 12)	Diag4 of Att2
SEL 5CB3 OOS	No limitation	Diag4 of Att2	Diag6 of Att2	Diag5 of Att2	Diag7 of Att2	To be avoided (Note 4)
SEL 5CB4 OOS	No limitation	Diag4 of Att2	Diag6 of Att2	Diag5 of Att2	To be avoided (Note 3)	To be avoided (Note 5)
SEL 5CB5 OOS	No limitation (must open SEL 5CB11) (Note 8)	To be avoided (Notes 8, 24)	Diag6 of Att2 (must open SEL 5CB11) (Note 8)	Diag5 of Att2 (must open SEL 5CB11) (Note 8)	Diag7 of Att2 (must open SEL 5CB11) (Note 8)	To be avoided (Note 15)
SEL 5CB8 OOS	No limitation (must open SEL 5CB9) (Note 9)	To be avoided (Note 13)	Diag6 of Att2 (must open SEL 5CB9) (Note 9)	Diag5 of Att2 (must open SEL 5CB9) (Note 9)	Diag7 of Att2 (must open SEL 5CB9) (Note 9)	To be avoided (Notes 9, 26)
SEL 5CB9 OOS	No limitation (must open SEL 5CB8) (Note 10)	To be avoided (Notes 10, 25)	Diag6 of Att2 (must open SEL 5CB8) (Note 10)	Diag5 of Att2 (must open SEL 5CB8) (Note 10)	Diag7 of Att2 (must open SEL 5CB8) (Note 10)	To be avoided (Note 16)
SEL 5CB11 OOS	No limitation (must open SEL 5CB5) (Note 11)	To be avoided (Note 14)	Diag6 of Att2 (must open SEL 5CB5) (Note 11)	Diag5 of Att2 (must open SEL 5CB5) (Note 11)	Diag7 of Att2 (must open SEL 5CB5) (Note 11)	To be avoided (Notes 11, 27)
SEL (5CB1 or/and 5CB2) & 5CB5 & 5CB9 OOS (SEL T1 OOS)	N/A	Diag4 of Att2	Diag9 of Att2 (Note 33)	Diag8 of Att2 (Note 33)	To be avoided (Note 18)	To be avoided (Note 17)
SEL (5CB1 or/and 5CB2) & 5CB3 OOS (SEL T2 & T3 OOS)	N/A	To be avoided (Note 17)	N/A	N/A	Diag7 of Att2	To be avoided (Note 19)
SEL 5CB4 & 5CB8 & 5CB11 OOS (SEL T4 OOS)	N/A	To be avoided (Note 7)	Diag9 of Att2 (Note 33)	Diag8 of Att2 (Note 33)	To be avoided (Note 18)	Diag4 of Att2
SEL 5CB3 & 5CB4 OOS (5L92 OOS)	No limitation	Diag4 of Att2	Diag6 of Att2	Diag5 of Att2	Diag7 of Att2	To be avoided (Note 21)
SEL 5CB5 & 5CB8 OOS (5L96 OOS)	No limitation (Note 28)	Diag4 of Att2 (Notes 28, 33)	Diag6 of Att2 (Notes 28, 33)	Diag5 of Att2 (Notes 28, 33)	Diag7 of Att2 (Notes 28, 33)	Diag4 of Att2 (Notes 28, 33)
SEL 5CB9 & 5CB11 OOS (5L91 OOS)	No limitation (Note 29)	Diag4 of Att2 (Notes 29, 33)	Diag6 of Att2 (Notes 29, 33)	Diag5 of Att2 (Notes 29, 33)	Diag7 of Att2 (Notes 29, 33)	Diag4 of Att2 (Notes 29, 33)

Table of SEL 230 kV / 500 kV Transfer Limits, *continued*.

SEL 5CB and SEL 2CB Status	SEL 230 kV / 500 kV Transfer Limit (MVA)					
	SEL (T1&T2&T3&T4) I/S	SEL T1 OOS	SEL T2 OOS	SEL T3 OOS	SEL (T2&T3) OOS	SEL T4 OOS
SEL 2CB3 OOS	No limitation	Diag4 of Att2 (Note 33)	Diag6 of Att2	Diag5 of Att2	Diag7 of Att2 (Note 33)	Diag4 of Att2 (Note 33)
SEL 2CB4 OOS	No limitation	Diag4 of Att2 (Note 33)	Diag6 of Att2	Diag5 of Att2	Diag7 of Att2 (Note 33)	Diag4 of Att2 (Note 33)
SEL 2CB5 OOS	No limitation	The lesser of: • 2076 + (SEV G3 & G4 MW) / 0.593 (Note 22) • Diag4 of Att2 (Note 33)	Diag6 of Att2	Diag5 of Att2	Diag7 of Att2 (Note 33	The lesser of: • 2076 + (SEV G3 & G4 MW) / 0.593 (Note 22) • Diag4 of Att2 (Note 33)
SEL 2CB6 OOS	No limitation	2076 (Notes 22, 33)	Diag6 of Att2	Diag5 of Att2	Diag7 of Att2 (Note 33)	2076 (Notes 22, 33)
SEL 2CB7 OOS	No limitation	2076 (Notes 22, 33)	Diag6 of Att2	Diag5 of Att2	Diag7 of Att2 (Note 33)	2076 (Notes 22, 33)
SEL 2CB8 OOS	No limitation	The lesser of: • 2076 + (SEV G1 & G2 MW) / 0.593 (Note 22) • Diag4 of Att2 (Note 33)	Diag6 of Att2	Diag5 of Att2	Diag7 of Att2 (Note 33)	The lesser of: • 2076 + (SEV G1 & G2 MW) / 0.593 (Note 22) • Diag4 of Att2 (Note 33)
SEL 2CB9 OOS	No limitation	Diag4 of Att2 (Note 33)	Diag6 of Att2	Diag5 of Att2	Diag7 of Att2 (Note 33)	To be avoided (Note 23)
SEL 2CB10 OOS	No limitation	Diag4 of Att2 (Note 33)	Diag6 of Att2	Diag5 of Att2	Diag7 of Att2 (Note 33)	To be avoided (Note 30)
SEL 2CB11 OOS	No limitation	Diag4 of Att2 (Note 33)	Diag6 of Att2	Diag5 of Att2	Diag7 of Att2 (Note 33)	To be avoided (Note 30)
SEL 2CB12 OOS	No limitation	Diag4 of Att2 (Note 33)	Diag6 of Att2	Diag5 of Att2	Diag7 of Att2 (Note 33)	To be avoided (Note 31)
SEL 2CB13 OOS	No limitation	Diag4 of Att2 (Note 33)	Diag6 of Att2	Diag5 of Att2	Diag7 of Att2 (Note 33)	To be avoided (Note 23)
SEL 2CB3 & 2CB4 OOS (SEL T1 OOS)	N/A	Diag4 of Att2	Diag9 of Att2 (Note 33)	Diag8 of Att2 (Note 33)	To be avoided (Note 20)	To be avoided (Note 20)
SEL 2CB4 & 2CB8 & 2CB9 OOS (2L286 OOS)	No limitation	The lesser of: • 2076 + (SEV G1 & G2 MW) / 0.593 (Note 22) • Diag4 of Att2 (Note 33)	Diag6 of Att2	Diag5 of Att2	Diag7 of Att2 (Note 33)	To be avoided (Note 23)
SEL 2CB6 & 2CB7 OOS (SEL T2 & T3 OOS)	N/A	To be avoided (Note 20)	N/A	N/A	Diag7 of Att2	To be avoided (Note 20)
SEL 2CB10 & 2CB11 OOS (SEL T4 OOS)	N/A	To be avoided (Note 20)	Diag9 of Att2 (Note 33)	Diag8 of Att2 (Note 33)	To be avoided (Note 20)	Diag4 of Att2
SEL 2CB5 & 2CB6 OOS (2L222 OOS)	No limitation	2076 (Notes 22, 33)	Diag6 of Att2	Diag5 of Att2	Diag7 of Att2 (Note 33)	2076 (Notes 22, 33)
SEL 2CB7 & 2CB8 OOS (2L221 OOS)	No limitation	2076 (Notes 22, 33)	Diag6 of Att2	Diag5 of Att2	Diag7 of Att2 (Note 33)	2076 (Notes 22, 33)
SEL 2CB9 & 2CB10 OOS (2L295 OOS)	No limitation	Diag4 of Att2 (Note 33)	Diag6 of Att2	Diag5 of Att2	Diag7 of Att2 (Note 33)	To be avoided (Note 6)
SEL 2CB11 & 2CB12 OOS	No limitation	Diag4 of Att2 (Note 33)	Diag6 of Att2	Diag5 of Att2	Diag7 of Att2	Open SEL 2CB10 (Note 32)

SEL 5CB and SEL 2CB Status	SEL 230 kV / 500 kV Transfer Limit (MVA)					
	SEL (T1&T2&T3&T4) I/S	SEL T1 OOS	SEL T2 OOS	SEL T3 OOS	SEL (T2&T3) OOS	SEL T4 OOS
(2L289 OOS)					(Note 33)	Diag4 of Att2 (Note 33)
SEL 2CB12 & 2CB13 OOS (2L299 OOS)	No limitation	Diag4 of Att2 (Note 33)	Diag6 of Att2	Diag5 of Att2	Diag7 of Att2 (Note 33)	To be avoided (Note 31)
SEL 2CB3 & 2CB5 & 2CB13 OOS (2L293 OOS)	No limitation	The lesser of: • 2076 + (SEV G3 & G4) MW) / 0.593 (Note 22) • Diag4 of Att2 (Note 33)	Diag6 of Att2	Diag5 of Att2	Diag7 of Att2 (Note 33)	To be avoided (Note 23)

6.0 SYSTEM REQUIREMENTS

Refer to Section 8.3, Attachments 1 and 2 in this operating order, for the operating restrictions associated with contingencies for various operating conditions.

Refer to SOO 7T-17 for BC/Alberta (Path 1) transfer limits, BC/Alberta RAS arming conditions, and any other operating restrictions related to BC/Alberta tie operation.

Refer to SOO 7T-18 and SOO 7T-64 for BC/US (Path 3), BC/US RAS arming conditions, and any other operating restrictions related to BC/US tie operation.

Refer to Section 7.0 of SOO 2T-43 for AGC suspension for all KCL and SEV units after a contingency has happened resulting in generation shedding at the plant.

If generation shedding is required at MCA for any contingencies in Attachment 1, select the MCA unit(s) above 465 MW for shedding first (to be implemented in TSA).

Operations with one of 5L71 or 5L72 OOS and only one MCA generating unit are no longer supported. There are no plans to operate with one line–one unit configuration for future. However, TSA-PM will shed down to one line – one unit at MCA for contingency responses. This is acceptable in order to address the immediate operating risk posed by insufficient shedding. Operators must take action to returning a second unit or resynchronize a shed unit immediately. If it is not possible to operate with 2 units in service, the plant/unit must be islanded (by opening the remaining 500 kV line). This requirement prevents exposure to self-excitation risks to single unit operation.

7.0 OPERATING PROCEDURE FOR CONTROLLED SEPARATION OF THE SOUTHERN INTERIOR (SI) FROM LOWER MAINLAND (LM) AND NORTHERN INTERIOR (NI)

When NIC Substation is separated from the LM and NI region, there is risk of severe overload and severe undervoltage on the paralleled 138 kV network transmission. This can occur when (two of (5L81 OR 5L82 OR 5L83) AND 5L87 AND (one of 5L71 OR 5L72) are OOS, and there is a loss of the remaining 500 kV circuit (5L81, 5L82, 5L83). This topology would be rare, as normally only one of (5L81, 5L82, or 5L83) is permitted to be planned out of service concurrent with 5L87.

The above topologies can occur during periods of line maintenance and when the lines are out of service for voltage control under light load and/or low transfer on the ILM transmission path, when unexpected forced events occur.

Note: Pre-outage restrictions and gen-shedding RAS implemented in TSA-PM (Attachment 1, Table 2.18) can be ignored. A further TSA-PM is required to remove/revise this table.

When the above extreme topology expected to remain for longer than 8 hours, splitting the SIW 138 kV system should be considered, because the switching requirements requires hours of effort to implement.

7.1 Procedure for Splitting SIW 138 kV System

For extended outage, the SIW 138 kV system must be split at HLD, SVA and DUG by sectionalizing the substations. The purpose of splitting SIW 138 kV system is to prevent post contingency overloading on 1L243 for the contingency loss noted above in Section 7.0.

The following switching sequence is based on the SIW 138 kV system being normal with all lines and equipment in-service.

At SVA:

- Open SVA 1CB8, 1CB10 and 1D21.
- Close SVA 1CB8 and 1CB10.
  - 1L206 to WKA is open-ended at SVA.

At HLD:

- Open HLD 1CB1, 1CB2 and 1D21.
- Close HLD 1CB1 and 1CB2
  - 1L243 to NIC is open-ended at HLD.

At DUG:

- Open DUG 1CB3, 1CB4 and 1D23.
- Close DUG 1CB3 and 1CB4
  - 1L204 to SVA is open-ended at DUG.

7.2 Voltage Control for Operation of the SIW 138 kV System

To control voltage on the 138 kV network, it is necessary to set SVA and BKL bus voltages as prescribed below prior to switching.

At SVA and BKL:

Use the SVA T1 and T3 on-load tap changers and the STATCOMs at BKL and AVO to keep the pre-contingency voltage at the far end of 1L211 between 131 kV (0.95 p.u.) and 152 kV (1.1 p.u.).

8.0 GENERATION SHEDDING

8.1 Operating Guidelines

Generation shedding is required to maintain transient and voltage stability, and to avoid equipment overloading. To reduce the risk of a system voltage collapse after the loss of a critical piece of equipment, the following operating guidelines must be closely adhered to during periods of heavy system load/export or very high S.I. generation (including import from Alberta):

- The SI 500 kV voltage is to be kept between 525 kV and 535 kV.
- Voltage support should first be provided locally by switching reactors out and by switching shunt capacitors in, and then if necessary, by boosting MVAR output from generators and synchronous condensers. The strategy is to provide reserve MVAR capacity in the system from rotating machines for use after a disturbance. All generators and synchronous condensers must have their AVRs in service.
- Have as many generators on the bus as possible.
- Output of each BSY S/C unit with AVR in service should be between 0 and -25 MVAR. The output of units with AVR OOS should be adjusted so that those units with AVR in service can operate within the desirable VAR output range.

Generation shedding must be applied cautiously for voltage stability criteria because the same generator also provides VARs to the system.

Generation shedding is supplemented by Direct Transfer Tripping Remedial Action Schemes (DTT RAS), which will trip various BC Hydro or FortisBC transmission lines, or BC-Alberta tie as described in SOO 7T-17. When it is not possible to operate within VSAT limits, refer to SOO 6T-34.

8.2 Generation Shedding Facilities

Refer to SOO 2T-34 for a detailed description of the SI Generation Shedding facilities. SI RAS are summarized in Sections 4.0 and 5.0.

A computerized generation shedding system is incorporated into the BC Hydro Energy Management System (EMS). With it, the BC Hydro Control Centre TC has supervisory control of the SI RAS, indication of the generation shedding at the major plants including WAN and the status of the DTT RAS.

WAN generation shedding required for other FortisBC contingencies not included in the SI RAS is the responsibility of the FortisBC Dispatcher.

Boundary area generation shedding requirements are summarized in Attachment 4. This attachment also includes a Boundary area generation shedding logic diagram and the maximum permitted generation at Boundary for various combinations of line (three Boundary-Bell lines, 2L112 and 2L293) and RAS status. (Note: All the tables and diagram in Attachment 4 have not been updated yet, but need to be reviewed/updated for 2L277 connected to NLY when BPA information for the BDY RAS is available.)

8.3 Generation Shedding Tables

Generation shedding for the SI is separated into tables which are included in two separate documents called 7T-34 Attachment 1 and 7T-34 Attachment 2. Attachment 1 is for SI 500 kV operation, while Attachment 2 for SEL 230 kV / 500 kV operation. Each table in each Attachment lists all the known operating restrictions and generation shedding requirements for various contingencies for a specific system network configuration. However, there is not enough information currently to cover all possible system configurations. Operations Planning should be contacted for developing necessary or additional shedding requirements for system configurations not included in Attachments 1 and 2.

Section 4.0 of Attachment 1 contains a summary list of tables and applicability to various VAS loop configurations.

Section 2.0 of Attachment 2 contains a summary list of tables and applicability to various VAS Loop configurations, and FortisBC Line reference tables.

9.0 AUTOMATIC GENERATION CONTROL SUSPENSION

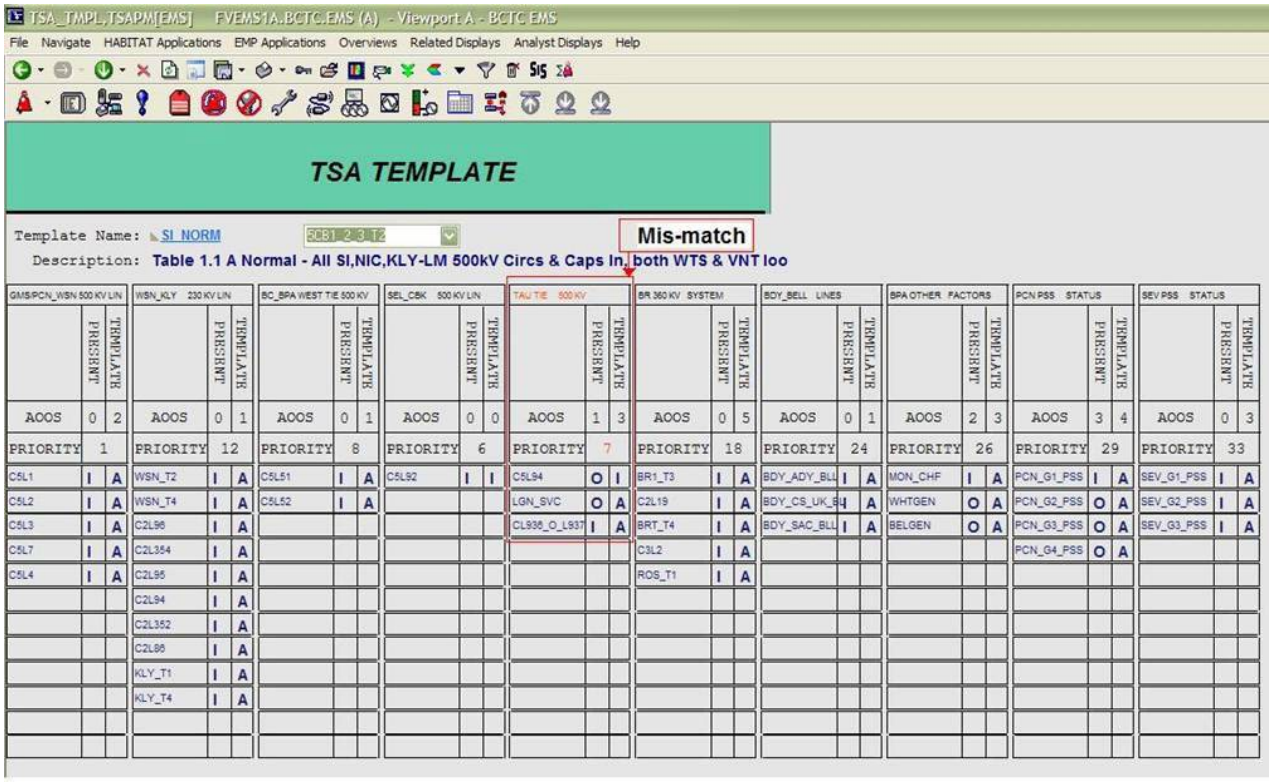
Automatic Generation Control (AGC) is suspended for various contingencies; refer to SOO 2T-43 for more information.

10.0 TSA-PM IMPLEMENTATION

With respect to SOO 7T-34, the EMS Transient Stability Analysis (TSA) advanced application performs the following functions for all tables in Attachments 1 and 2, and Sections 4.0 and 6.0:

- Arming the required generators to be shed and disarming generators on shed when generation shedding is not required.
- Arming/disarming the SI DTT RAS.
- Monitors and initiates alarms if there is a limit violation.

When TSA-PM alerts of no template match for SI or SEL, the BC Hydro Control Centre TC will need to verify if it is due to a mismatch of the VAS loop status. Refer to the alarm in the following list for information on determining a FortisBC loop mismatch.



Alarms Implemented in TSA-PM

ALARM MESSAGE	REFERENCES
REDUCE SEL 230/500 BELOW TRANSFER LIMIT	Section 5.0 – SEL 230 kV/500 kV Transfer Limits Table
AVOID SEL 5CB1 OR/AND 5CB2 OOS	
AVOID SEL 5CB3 OOS	
AVOID SEL 5CB4 OOS	
AVOID SEL 5CB5 OOS	
AVOID SEL 5CB8 OOS	
AVOID SEL 5CB9 OOS	
AVOID SEL 5CB11 OOS	
AVOID SEL 2CB9 OOS	
AVOID SEL 2CB10 OOS	
AVOID SEL 2CB11 OOS	
AVOID SEL 2CB12 OOS	
AVOID SEL 2CB13 OOS	
AVOID SEL T1 OOS	
AVOID SEL T2 OOS	
AVOID SEL T3 OOS	
AVOID SEL T2 & T3 OOS	
AVOID SEL T4 OOS	
OPEN SEL 5CB3	
OPEN SEL 5CB5	
OPEN SEL 5CB8	
OPEN SEL 5CB9	
OPEN SEL 5CB11	
OPEN SEL 2CB10	

ALARM MESSAGE	REFERENCES
REDUCE MCA UNIT(S) G5 AND/OR G6 TO <= 520.3 MW EACH	Attachment 1 – Section 1.2 General Pre-outage Restrictions
REDUCE MCA UNIT(S) G1 AND/OR G2 TO <= 492.0 MW EACH	
REDUCE MCA UNIT(S) G3 AND/OR G4 TO <= 493.5 MW EACH	
5L71_72 MCA FLOW VIOLATION	
MUST NOT OPERATE WITH BOTH MCA 5CB6/5CB9 OOS	
MUST NOT OPERATE WITH BOTH MCA 5CB6/5CB10 OOS	
MUST NOT OPERATE WITH BOTH MCA 5CB7/5CB10 OOS	
MUST NOT OPERATE WITH BOTH MCA 5CB9/5CB11 OOS	
GEN OF EACH REV UNIT1-4 MUST BE LESS THAN 500 MW	
GEN OF REV UNIT5 MUST BE LESS THAN 518 MW	
F5L75_77 REV FLOW VIOLATION	
REDUCE F5L75_77 REV < 2000MW	
ONE OF ACK 5CX1/2 MUST BE IN SERVICE	
AT LEAST ONE OF ACK 5CX1/2 MUST BE AVAILABLE	
BOTH OF ACK 5CX1/2 MUST BE AVAILABLE	
ACK AUTO VAR MUST BE IN SERVICE	
SEL AUTO VAR MUST BE IN SERVICE	
VIOLATION_2L64 KI2 OVER RATING_5L44CTG	Attachment 1 – Pre-outage restrictions for 5L44 contingency, Tables 2.14, 2.15, 2.19, 2.20, 2.23 to 2.27, 2.30 to 2.32, 2.34 to 2.37, 2.44, 2.45
2L112_NLY + BDY MW CROSSED LIMIT	Attachment 1 – Section 2 Pre-outage Restrictions for Contingencies
FLOW 5L91SEL&5L96SEL&2L112NLY&48L_KET CROSSED LIMIT	
REDUCE SUM OF FBC-SEL AREA & AB-BC (7T17/7T34-ATT1)	
VIOLATION_<LINE_NAME>_NORM_RATING	General pre-outage restrictions
VOLTAGE INSTABILITY FOR A LOSS OF 5L87	Attachment 1 – Pre-outage Restrictions for 5L87 contingency regarding BSY SC online units in Table 1.2, 1.3, 1.7, 1.8, 1.14, 1.15, 1.16, 1.23, 1.24, 1.30, 1.31, 1.32, 1.33, 1.35, 1.36, 1.37, 1.38, 1.39
MCA OUTPUT VIOLATION	Attachment 1 – Pre-outage Restrictions regarding MCA MW output limit, Table 1.7, 1.8
MCA GENERATION EXCEEDS LIMIT	Attachment 1 – Pre-outage Restrictions regarding MCA MW output limit, Table 2.7, 2.8
VIOLATION_2L56 (CAM TAP-MAN) OVER RATING_5L44CTG	Attachment 1 – Pre-outage restrictions for 5L44 contingency in Table 1.46, 2.30
VIOLATION_2L27 ING OVER RATING_5L44CTG	Attachment 1 – Pre-outage restrictions for 5L44 contingency in Table 2.30
VIOLATION_2L129 ARN MW LIMIT_5L44CTG	Attachment 1 – Pre-outage restrictions for 5L44 contingency in Table 2.31

TSA-PM alarm table, *continued*.

ALARM MESSAGE	REFERENCES
<CTG NAME>: INSUFFICIENT SHEDDING AT <PLANT(S) NAME>	General Alarm Messages for Various Contingencies in Attachment 1 and 2
<CTG NAME>: MAX ARMED SHED VIOLATION	
<CTG NAME>: MIN# UNITS ONLINE VIOLATION	
<CTG NAME> - GMS/PCN GS<4:1 INFORM PSOSE	
C5L71_1_72_3 MCA G3 & G4 MUST BE SHED C5L71_1_72_3 MCA G1&G2 MUST BE SHED C5L71_1_72_3 MCA G3/G4/G5/G6 MUST BE SHED C5L71_3_72_1 MCA G5 & G6 MUST BE SHED C5L71_3_72_1 MCA G1&G2 MUST BE SHED C5L71_3_72_1 MCA G3/G4/G5/G6 MUST BE SHED	Attachment 1 – Table E, 1.4, 1.5, 1.6
C5L71 MCA G3, G4, G5, AND G6 MUST BE SHED C5L71 MCA G5 & G6 MUST BE SHED C5L71 MCA G1 & G2 MUST BE SHED C5L72 MCA G3, G4, G5, AND G6 MUST BE SHED C5L72 MCA G5 & G6 MUST BE SHED C5L72 MCA G1 & G2 MUST BE SHED C5L72 MCA G3 & G4 MUST BE SHED	Attachment 1 – Table E, 1.4, 1.5, 1.6
AVOID 5L71&72 OOS IF BCH LOAD > 8500MW	Attachment 1 – Table 1.9, 2.9 Pre-outage Restriction
REDUCE 5L77 REV < ITS NORMAL RATING	Attachment 1 – Table 1.10
REDUCE 5L75 REV < ITS NORMAL RATING	Attachment 1 – Table 1.11
OPEN 5L71 OR 72 WHEN 5L87 OOS	Table 2.18 of Attachment 1 –System Requirements for 5L87 & (5L71 or 5L72)
5L81 & 5L82 FLOW EXCEED LIMIT	
TWO MCA UNITS MUST BE IN SC MODE OR EACH GENERATING LESS THAN 100MW	
REDUCE TOTAL MCA MW < 1100 MW	
NIC 5RX3 MUST BE AVAILABLE	
NIC 5RX4 MUST BE AVAILABLE	
NIC 5RX11 MUST BE AVAILABLE	
MCA 5RX3 MUST BE I/S DUE TO 5L71 OOS	
MCA 5RX4 MUST BE I/S DUE TO 5L72 OOS	
ACK 5RX4 MUST BE ON LINE	
SEL 5RX2 MUST BE ON LINE	
CBK 5RX4 MUST BE ON LINE	
CBK 5RX5 MUST BE ON LINE	
CBK 12RX32 MUST BE ON LINE	
ACK 5RX7 MUST BE AVAILABLE	
ACK 5RX8 MUST BE AVAILABLE	
CBK 12CX2 MUST BE OOS	
CBK 12CX3 MUST BE OOS	
SEL 5RX3 MUST BE AVAILABLE	
REDUCE MCA500 VOLTAGE <= 515 KV	
REDUCE REV500 VOLTAGE <= 515 KV	
REDUCE NIC500 VOLTAGE <= 530 KV	
REDUCE KCL230 VOLTAGE <= 237 KV	
REDUCE SEV230 VOLTAGE <= 237 KV	
REDUCE MCA G1 < 450 MW	
REDUCE MCA G2 < 450 MW	
REDUCE MCA G3 < 450 MW	
REDUCE MCA G4 < 450 MW	

TSA-PM alarm table, *continued*.

ALARM MESSAGE	REFERENCES
REDUCE 5L96 SEL < 1300 MW	Attachment 1 – Table 1.19 5L91 OOS, or Table 2.19 5L83 AND 5L91 OOS
REDUCE 5L96 SEL < 1400 MW	
5RX4 AT ACK MUST BE OOS	Attachment 1 – Table 1.18 5L91 OOS, or Table 2.19 5L83 AND 5L91 OOS, 5L76 and 5L79 contingency
5RX7 AT ACK MUST BE OOS	
5RX8 AT ACK MUST BE OOS	
BRING 5L76&5L79 NIC BELOW 100MW	
C5L76_79: MORE THAN 35MW OVERSHED	Attachment 1 – Table 1.19 5L91 OOS, or Table 1.19 5L83 AND 5L91 OOS, 5L76 and 5L79 contingency
C5L76_79: MORE THAN 35MW UNDERSHED	
C5L76_79: MORE THAN 25MW OVERSHED	
C5L76_79: MORE THAN 25MW UNDERSHED	
FLOW 5L91SEL+2L112NLY+Z CROSSED LIMIT	Attachment 1 – Table 1.20 or Table 2.20
5L76&79ACK+2L112NLY+1L209SAM+1L214VNT+U-W>= 2500MW	Attachment 1 - Table 1.20, Table 1.22, or Table 2.20, 2.22 (see Note 1)
5L76 & 79 ACK + 2L112 NLY + 1L209SAM + 1L214 VNT + U – W < -700MW	
REDUCE 5L91 SEL < XXXX MW	
ACK VAR MUST BE IN AUTO MODE	Attachment 1 – Tables 1.20, 1.21, 1.22, 1.25, 2.20, 2.21, 2.22, 2.25
AT LEAST TWO ACK RXS MUST BE AVAIL	
REDUCE 5L91+ 5L96 SEL < XXXX MW	Attachment 1 – Table 1.21, 2.21 (see Note 1), Attachment 1 - Table 1.20, Table 1.22, or Table 2.20, 2.22 (see Note 1)
F5L91_96SEL + F2L112NLY + Z < -700 MW	
5L76&79ACK+2L112NLY+1L209SAM+1L214VNT-W>= 2500MW	Attachment 1 – Table 1.21 & Table 1.22, Table 2.21 & 2.22
5L76&79ACK+2L112NLY+1L209SAM+1L214VNT-W< -700MW	Attachment 1 – Table 1.22, 2.22
F5L91SEL + F2L112NLY < -700 MW	
VAS_VNT_LP OR VAS_WTS_LP MUST BE OPEN	
REDUCE FBC-SEL AREA TRANSFER	Attachment 1 – Table 1.23 5L92 OOS or Table 2.23 5L83 AND 5L92 OOS for 5L91 & 5L96 contingency
REDUCE 5L91 SEL < 1300 MW	Attachment 1 – Table 1.25, 2.25
REDUCE 5L91 SEL < 1400 MW	
LIMIT BDY GEN + 2L112 NLY < 1050 MW	
LIMIT BDY GEN + 2L112 NLY < 1150 MW	
LIMIT VIOLATION ON 2L112 NLY	Attachment 1 – Table 1.27 2L293 OOS, Table 2.27 5L83 AND 2L293 OOS for 5L92 contingency
LIMIT VIOLATION ON L62 WTS	Attachment 1 – Table 1.25, 2.25
VIOLATION_2L64 KI2 OVER RATING_5L82CTG	Attachment 1 – Table 2.32 – 5L83 AND 5L44 OOS

VIOLATION_2L51_COK OVER RATING_2L50CTG	Attachment 1 – Pre-outage Restrictions in Table 1.32 and 2.32.
VIOLATION_2L51_COK OVER RATING_2L11CTG	
VIOLATION_2L51_COK OVER RATING_2L49CTG	
VIOLATION_2L50_OVER RATING_2L51_CTG	
VIOLATION_LM+VI LOAD SUPPLIED FROM ILM+US > 5300MW	Attachment 1 – Table 2.32 – 5L83 AND 5L44 OOS
AT LEAST 3 BSY SC MUST BE ONLINE	
FLOW 5L91SEL&5L96SEL&2L112NLY CROSSED LIMIT	Attachment 1 – Table 1.41, 2.41 Pre-outage Restrictions for 5L44 contingency in Attachment 1 – Table 2.43
VIOLATION_5L44_MDN OVER RATING 2L20CTG	Pre-outage Restrictions for 2L20, 2L22 and 2L129 contingencies in Attachment 1 – Table 1.14
VIOLATION_5L44_MDN OVER RATING 2L22CTG	
VIOLATION_5L44_MDN OVER RATING 2L129CTG	
25L: SLC-BSS_MUST BE OPEN	General alarm for Attachment 2
REDUCE_2L112 NLY <= 400 MW	
REDUCE_2L112 BDY <= 400 MW	
REDUCE_2L293 SEL <= 400 MW	
REDUCE_2L293 NLY <= 400 MW	
REDUCE_2L293 SEL <= 450 MW	
REDUCE_2L293 NLY <= 450 MW	
REDUCE_2L289 BTS <= 2L289_NORM RTG	
REDUCE_34L WTS < 34L NORM RTG	
REDUCE_62L ESS < 62L NORM RTG <LIMIT VALUE>	
REDUCE_2L295 KCL < 2L295 NORM RTG	
REDUCE_2L299 KCL < 2L299 NORM RTG	
REDUCE_2L277 WAN < 2L277_NORM RTG	
C2LXXX_KCL_HI CB REQ VIOLATION	General alarms in Section 2, Attachment 2
CSEL_T1, T2&3,T4 KCL HI CB REQ_VIOLATION	
<CTG_NAME> KCL G1 MUST BE ARMED FOR SHEDDING	
<CTG_NAME> KCL G3 MUST BE ARMED FOR SHEDDING	
<CTG_NAME> KCL MIN UNIT ONLINE VIOLATION	
C2L293_REDUCE 2L112_EXPORT	Attachment 2 – Table A.6
C62L: OVERSHEDDING AT WAN	Attachment 2 – Table A.8
C62L: MATCH WAN UNARM GEN TO TECK AREA LOAD	
C77L: OVERSHEDDING AT WAN	Attachment 2 – Table A.8, B.8
C77L: MATCH WAN UNARM GEN TO TECK AREA LOAD	Attachment 2 – Table A.8
C77L: MATCH WAN UNARM GEN TO WAN-WTS AREA LOAD	Attachment 2 – Table B.8
FBC 11L RAS MUST BE ARMED	Attachment 2 – Table A.8
FBC 62L RAS MUST BE ARMED	Attachment 2 – Table A.8, A.10
C2L277: OVERSHEDDING AT WAN	Attachment 2 – Table A.9, A.10, B.10
C2L277: MATCH WAN UNARM GEN TO TECK AREA LOAD	Attachment 2 – Table A.9, A.10
C2L277: MATCH WAN UNARM GEN TO WAN-WTS AREA LOAD	Attachment 2 – Table B.10
FBC RAS FOR 2L288_289 NOT AVAILABLE	Attachment 2 – Table 2.3, 2.4, 2.19, 2.20, 2.34, 2.35 BSS to BTS transfer should be limited to 15MW per BRD unit plus 30MW.
REDUCE ((7L+8L)MW TO BTS-15*(NO OF BRD UNITS)) < 30MW	
WAN MW MUST BE HIGHER THAN < LIMIT VALUE >	Attachment – Table A.8
LIMIT 2L293 NLY TO SEL FLOW	Attachment 2 – Tables 2.8, 2.23
LIMIT 2L112 BDY TO NLY FLOW	
TSA: REDUCE SUM OF FBC-SEL AREA & AB-BC (7T-17/7T-34-ATT2)	Attachment 2 – Table 2.11 pre-outage restrictions.
REDUCE FBC-SEL AREA TRANSFER	
REDUCE SEV MW < 700 MW	

Note 1: The "XXXX" will be displayed with real time limitation calculated by TSA.

11.0 REVISION HISTORY

Revised by	Revision Date	Summary of Revision
Lixin Bao/ Yingwei Huang/ Bob Cielen	08 October 2020	7T-34 Main Body: o Section 5.0 revised to reference the location of the Transformer temperature diagrams which have moved to Section 4 of Attachment 2, from the main body document o Section 10.0 – TSA Alarm List updated Attachment 1: o Updated 5L76 line ratings in Section 1 o Removed RMR requirement for BSY for 5L87 contingency in pre-outage restrictions in Section 2 o Updated the applicable tables in Section 4 o Revised RMR requirement for BSY for 5L87 contingency in pre-outage restrictions in Tables 1.2, 1.3, 1.7, 1.8, 1.14 -1.16, 1.19 – 1.27, 1.30-1.39, o Added gen-shedding requirement for 5L83 in Table 1.45 o Wording changes in pre-outage restrictions for 5L82 contingency in Table 2.32 o Wording changes in pre-outage restrictions for 5L44 contingency in Table 2.43 o Attachment 2: • Minor formatting changes • Corrected Table Listing to be Section 3. • Added Section 4 – Transformer temperature diagrams moved from Main body to this section.
Lixin Bao/ Yingwei Huang	05 March 2021	7T-34 Main Body: • Section 5.0 - Revised titles and numbers of SEL transformer temperature diagrams Attachment 2: • SEL transformer and 62L rating updates (Section 1 and diagrams in Section 4) • Gen-shedding rule updates for 2L289&2L299CTG, 2L289&2L295CTG with 2L293OOS (Table A.5, B5), 2L295CTG with 2L299OOS, 2L299CTG with 2L295OOS (Table A.7).

Lixin Bao/ Guihua Wang/ Yingwei Huang	11 January 2022	7T-34 Main Body: • Section 10: Alarms updated. • Section 11: Revision history updated. Attachment 1: • Section 1.1: Revised 5L81, 5L76, 2L64, 2L51, 2L20, 2L45, 60L2, 60L7, 60L8 normal and over ratings and removed 2L53 normal and over ratings. • Section 2: Removed pre-outage restriction of 5L44 contingency. • Section 5: Removed Table 1.44 (2L53 OOS) and 2.44 (5L83 and 2L53 OOS) • Revised pre-outage restrictions of 5L44 contingency in all Table 1.xx except Table 1.32 (5L44 OOS) • Revised shedding requirements of 5L44 contingency in Table. 1.1, 1.14, 1.15, 1.17, 1.19, 1.20, 1.23, 1.24, 1.25, 1.26, 1.27, 1.30, 1.31, 1.33, 1.34, 1.35, 1.36, 1.37, 1.38, 1.43, 1.44, 1.45, 2.14, 2.19, 2.20, 2.23, 2.25, 2.26, 2.27, 2.30, 2.34, 2.35, 2.36, 2.37, 2.43, 2.44 • Removed pre-outage restrictions of 2L31 contingency, revised pre-outage restrictions of 2L50 contingency and added pre-outage restrictions of 2L11, 2L49, 2L51 contingencies in Table 1.32 (5L44 OOS) and Table 2.32 (5L83 and 5L44 OOS) Attachment 2: • Section 1: Revised 2L277, 2L288, 2L289, 2L295 and 2L299 normal and over ratings.
Lixin Bao/ Guihua Wang/Bob Cielen	08 March 2022	7T-34 Main Body: • Section 11: Revision History updated. Attachment 1: • Section 1.1: Updated 5L42, 5L71 and 5L72 normal and over ratings. Attachment 2: • Date change only.
Lixin Bao/ Guihua Wang/Bob Cielen	12 January 2023	7T-34 Main Body: • Section 1 reference for 7T-01D added. • Section 2 clarifies the precedence of Operating Plans Attachment 1: • Table 1.6 correct format and missing line return. Attachment 2: • Revised gen-shedding requirements and notes for 2L295 & 2L299 contingency in Tab. 2.51 to Tab. 2.55
Lixin Bao/ Soohan Woo/ Guihua Wang	16 August 2023	7T-34 Main Body: • Section 11: Revision History updated. Attachment 1: • Revised shedding requirements of 5L81&82 and

		5L81&83 contingencies in Table 1.1, Table 1.14-15, 1.19-20, 1.23-27, 1.30-39. • Revised shedding requirements of 5L82&83 contingency in Table 1.24-25. • Replaced 2L112OLRAS_PickupMW with NLYPST_OL_PickupMW in all tables if applicable. • Section 1.1: Updated line ratings for 5L40, 5L41, 5L41_BypassCHP, 5L44, 5L45, 5L75, 5L77, 5L81_BypassAMC1, 5L82_BypassAMC2, 2L50, 2L56, 2L64, 2L294. • Section 1.1: Referred 2L129_0.5hr_Rating to Attachment 3 of SOO 7T-41 • Revised gen-shedding requirements for 5L81 contingency with 5L44 OOS in Table 1.32 Attachment 2: Section 1: Revised 2L294_Over_Rating.

*Only the last 5 revisions are kept in this history.

Attachment 1

SI 500 kV Operation Tables (2L277 Connected to NLY)

An electronic copy of the SI 500 kV pre-outage restriction and generation shedding requirement tables is posted to the Site Information System (SIS) as a separate document under the title Attachment 1 SOO 7T-34. The Attachment is distributed with the electronic notification of the update of this Order. A hard copy is located on the Generation Co-coordinator Desk at the Fraser Valley Office.

Attachment 1, Section 5.0 contains a summary list of the tables and applicability to various VAS loop configurations.

Attachment 2

SEL 230 kV / 500 kV Operation Tables (2L277 Connected to NLY)

An electronic copy of the SEL 230 kV / 500 kV pre-outage restriction and generation shedding requirement tables is posted to the Site Information System (SIS) as a separate document under the title Attachment 2 of SOO 7T-34. The Attachment is distributed with the electronic notification of the update of this order.

Section 1.0 contains General System Information and Requirements for the application of tables.
Section 2.0 contains General Post Contingency Requirements.
Section 3.0 contains a summary list of tables and applicability to various VAS Loop configurations and FortisBC line reference tables.
Section 4.0 contains SEL transformer thermal limit diagrams for various transformer combinations.

Attachment 3

Table A. SI RAS for SI 500 kV Operation

		ND gen-shedding at			SI Generation Shedding at																							
															Direct Transfer Tripping (DTT)													
No.	Contingency	GMS	PCN	KMO	MCA	REV	SEV	KCL	ALH	BRX	WAN	WAX	2L112 NLY	2L277 WAN	5L94 CBK	1L274 POC	1L275 NTL	5L94 UF	1L209 SAM	1L214 VVW	FBC 48L BEN	FBC 73L RGA	FBC 75L/76L RGA	60L223 MCA	sw-in NIC RXs	DTT ACK 5CX1	DTT ACK 5CX2	sw-in SEL 5RX3	2L253 REV
1	5L44				A	A																							
2	5L51				A	A																							
3	5L52				A	A																							
4	5L51 AND 5L52				A	A	A	A	A	A	A	A	A	A		A	A	A							A	A	A	A	
5	5L71 (1P)				A																								
6	5L71 (3P)				A																								
7	5L72 (1P)				A																								
8	5L72 (3P)				A																								
9	5L71 (1P) AND 5L72 (1P)				A																								
10	5L71 (3P) AND 5L72 (1P)				A																								
11	5L71 (1P) AND 5L72 (3P)				A																								
12	5L71 AND 5L72				A																			A					
13	SYA 5CX1				A																								
14	SYA 5CX2				A																								
15	5L75 (1P)					A																							
16	5L75 (3P)					A																							
17	5L77 (1P)					A																							
18	5L77 (3P)					A																							
19	5L75 (1P) AND 5L77 (3P)					A																							
20	5L75 (3P) AND 5L77 (1P)					A																							
21	5L75 AND 5L77					A																							A
22	5L76					A																							
23	5L79					A																							
24	5L76 AND 5L79					A	A	A	A	A	A	A	A	A	A	A	A		A	A	A	A				A	A	A	
25	5L81				A	A																							
26	5L82				A	A																							
27	5L83				A	A																							
28	5L87				A	A																							
29	5L81 AND 5L82	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A								A	A	A	A	
30	5L81 AND 5L83	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A								A	A	A		
31	5L82 AND 5L83	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A								A	A	A		
32	5L41 AND 5L83	A	A		A	A																							
33	AMC 5CX1				A	A																							
34	AMC 5CX2				A	A																							
35	RYC 5CX1				A	A																							
36	GUI 5CX1				A	A																							
37	5L91					A	A	A	A	A	A	A	A	A	A	A	A				A	A						A	
38	5L96						A	A	A	A	A	A	A	A	A	A	A				A		A						
39	5L98						A	A	A	A	A	A	A	A	A	A	A				A	A	A					A	
40	5L91 AND 5L96						A	A	A	A	A	A	A	A	A	A	A				A							A	
41	5L96 AND 5L98						A	A	A	A	A	A	A	A	A	A	A				A		A						
42	5L91 (1P) or 5L96 (1P) or 5L98 (1P)						A	A	A	A	A	A	A	A															
43	5L92					A	A	A	A	A	A	A	A	A															
44	5L92 <2L294 I/S>														A	A	A												
45	5L94					A	A	A	A	A	A	A	A	A															
46	5L94 <MW>															A	A												
47	2L294 <PS>														A	A	A												
48	BPA/NW RAS				A	A	A	A																					
49	BPA/PACI RAS				A	A																							
50	Loss of LM-VI 500 kV Path				A	A																							

Note: “A” means “Available for arming”.

Table B. SI RAS for SEL 230 kV / 500 kV Operation

No.	Contingencies	SI Generation Shedding at						Direct Transfer Tripping (DTT)		
		SEV	KCL	ALH	BRX	WAN	WAX	2L112 @ NLY	2L293 @ NLY	2L277 (71L) @ WAN
1	SEL T1	A	A	A	A	A	A	A	A	A
2	SEL (T2 & T3)	A	A	A	A	A	A	A	A	A
3	SEL T4	A	A	A	A	A	A	A	A	A
4	SEL T1 O/L			A	A	A	A	A	A	A
5	SEL T2 O/L	A	A	A	A	A	A	A	A	A
6	SEL T3 O/L	A	A	A	A	A	A	A	A	A
7	2L112		A	A	A	A	A			A
8	2L288 (79L)		A	A	A	A		A		
9	2L289 (82L)		A	A	A	A	A	A		A
10	2L293		A	A	A	A	A			A
11	2L294			A	A	A		A		
12	2L295		A	A	A	A	A	A		A
13	2L299		A	A	A	A	A	A		A
14	2L295 & 2L299	A	A	A	A	A	A	A	A	A
15	2L289 & 2L295	A	A	A	A	A	A	A		A
16	2L289 & 2L299		A	A	A	A	A	A		A
17	2L289 & 2L295 & 2L299	A	A	A	A	A	A	A		A
18	62L		A	A	A	A	A			
19	77L		A	A	A	A	A			
20	2L277 (71L)			A	A	A		A		
21	2L288 & 2L295		A	A	A	A	A	A		A
22	2L288 & 2L299		A	A	A	A	A	A		A
23	2L288 & 2L295 & 2L299	A	A	A	A	A	A	A		A
24	2L221			A	A	A	A	A		A
25	2L222			A	A	A	A	A		A
26	2L286			A	A	A		A		A

Note: “A” means “Available for arming”.

Attachment 4

Table 1: BPA Shedding for BDY-BELL Lines, or 2L112 Contingency with 2L277 Connected to BDY

(Note: This table needs to be updated for 2L277 connected to NLY when BPA information is available.)

CONDITION	CONTINGENCY	SHEDDING REQUIREMENTS
2L112 OOS	One BDY-BELL 230 kV Line	BPA will shed Boundary generation units in excess of 650 MW
All Conditions	One BDY-BELL 230 kV Line	BPA will runback Boundary generation to 650 MW.
All Conditions	Two BDY-BELL 230 kV Lines	BPA will shed Boundary generation units in excess of 200 MW.

Table 2: Maximum Permitted Generation Level at Boundary with 2L277 Connected to BDY

(Note: This table needs to be updated for 2L277 connected to NLY when BPA information is available.)

Line Status	Boundary RAS Status	Maximum Boundary Generation (MW)
All three Boundary-Bell lines in-service	In-service	1055
	Out-of-service	650
One Boundary-Bell line out-of-service	In-service	1055
One Boundary-Bell line out-of-service AND 2L112 in-service	Out-of-service	200
One Boundary-Bell line out-of-service AND 2L112 out-of-service	Out-of-service	800
Two Boundary-Bell lines out-of-service	In-service	450
	Out-of-service	200
2L112 out-of-service OR 2L293 out-of-service	In-service	1055
	Out-of-service	650