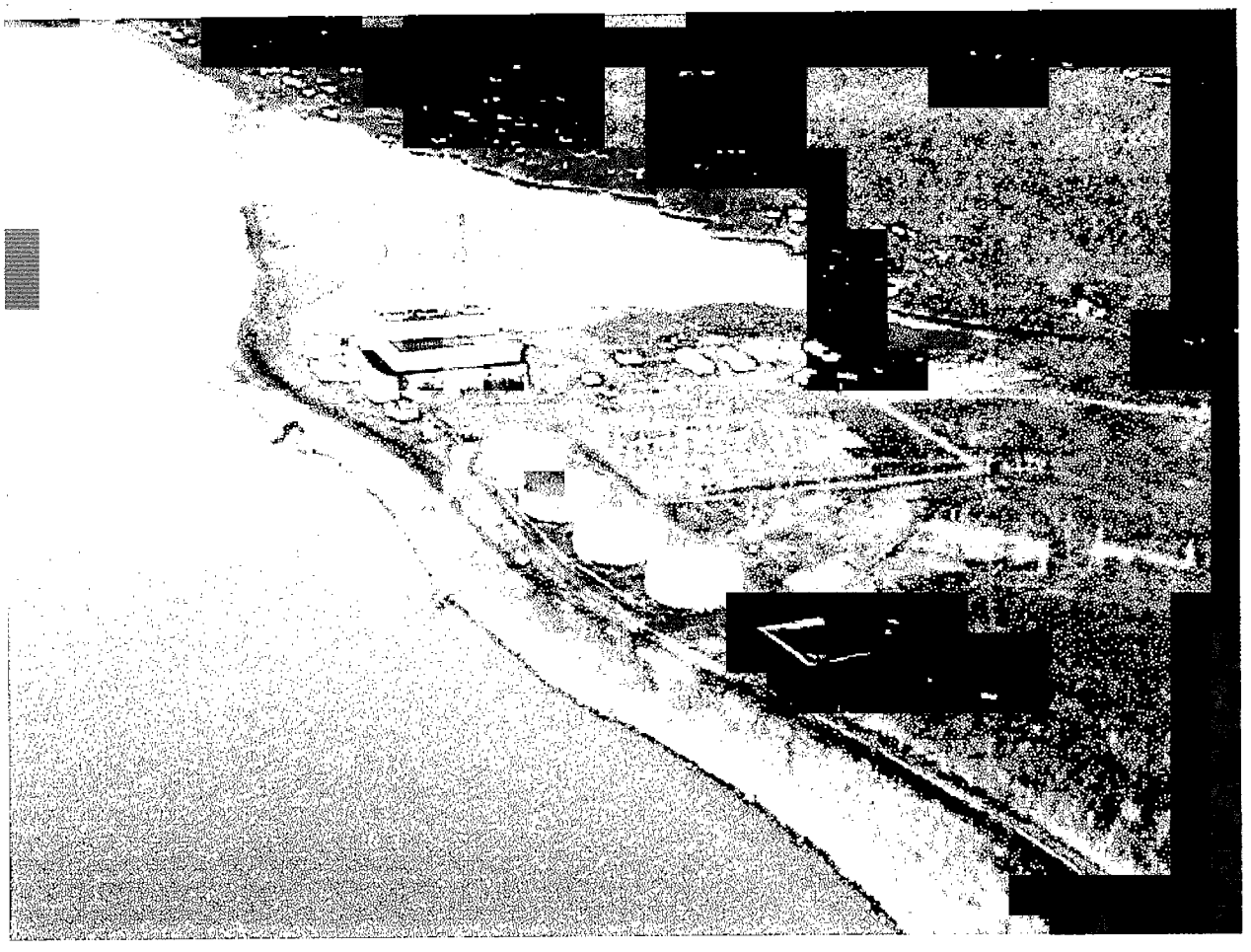
Q. The report entitled *Update to the Report to the Board of Commissioners of Public Utilities on the Status of Remedial Actions Arising out of the December 1994 Outage Jointly Prepared by: Newfoundland & Labrador Hydro and Newfoundland Light & Power, January , 1996* (Attachment 4 of IC-NLH-010) states at page 6 that:

> *Black start and station services operating procedures were reviewed and revised to reflect the WDPF changes. A program for starting a Holyrood generating unit under black start conditions has been initiated. This annual program will provide training to the operators under such emergency conditions. During 1995, Unit 3 was successfully started under black start conditions.*

Provide any documentation that this annual training program was carried out and that any units, after 1995, were successfully started under black start conditions. In the absence of this documentation, provide any documentation that authorizes the discontinuation of this annual training program and gives reasons for the discontinuation.

A. Annual "Black Start Test Reports" are attached for 2004 through 2009 (PUB-NLH-014 Attachments 1 to 6). Blackstart testing was not performed in 2010 or 2011 as the gas turbine was deemed to be used for emergency purposes only. In January 2012 the gas turbine was deemed out of service. Please see Hydro's response to PUB-NLH-013.



HOLYROOD THERMAL GENERATING STATION

BLACK START ANNUAL TEST

2004

HYDRO

File #102.01.00/1

Black Start Test (Partial- Stage 2)

Monday, August 23, 2004

ATTENDING:

Ross Norris (Shift Supervisor)
Dave Fifield (LTPO)
Glen Kennedy (LTPO)
Tom Compton (TPO)
Doug Gillard (TPO)
Greg Burry (TPO)
Jim McNeill (TPO)
Baxter Pinsent (TPO)
Bob Woodman (Plant Electrical Engineer)
Tom Jensen (Labour Manager Operations – Thermal)

The Procedure, POP-074 (Black Start Procedure), used was a modified version pertaining only to Stage 2 of the Plant. Please refer to the attachment.

Plant Status prior to the Black Start Test;

- **Unit No.1**: Planned Outage 'P.O.'
- **Unit No.2**: Operating at 70Mw
- **Unit No.3**: Maintenance Outage 'M.O.'

Events of Black Start Test;

(1) The E.C.C. was notified of Black Start Test
(2) Contractors were notified
(3) Plant Personnel were notified
(4) An announcement was made over the Plant Public Address System five (5) minutes prior to the start of the test
(5) The Diesel Bus Tie 'DBT' was placed in the 'Manual' mode
(6) The Black Start Test commenced when the E.C.C. was requested to 'Open' 4KV Breaker 'B6L3', in the site switchyard, which resulted in a power loss to Stage 2
(7) Stage 2 Diesel Generator started, in the 'Auto' mode and synchronized due to the resulting Power loss to Diesel Bus 'DB34'

(8) 4KV Power was restored to Stage 2 Station Board 'SB34 and through 'TB3' to Unit Service Board 'UB3' from Stage 1 Station Service Board 'SB12' via 'Tie' Breakers 'SSB4' and 'TB12'

(9) 600V Power was subsequently restored to Stage 2 from its 4KV Unit and Station Boards

(10) The E.C.C. was requested to 'Close' 4KV Breaker 'B6L3'

(11) The Normal 4KV Power Supply, to Stage 2, was restored when Station Service Transformer Breaker 'ST34', was 'Closed' and 'TB12' 'Opened' as per Switching Logic selection

(12) Stage 2 Diesel Generator was then shutdown and resulted in a power loss to Diesel Bus 'DB34'

(13) The Diesel Bus Tie 'DBT' was placed in the 'Auto' mode and it 'Closed', due its sensing no voltage on the Diesel Bus 'DB34', powering up same

(14) The Diesel Bus Tie 'DBT' was then 'Re-Opened' and resulted, once again, in a power loss to Diesel Bus 'DB34'

(15) Breaker 'DB34' was then 'Closed' to power up Diesel Bus 'DB34' (normal condition)

(16) The Diesel Bus Tie 'DBT' was placed back in the 'Auto' mode (normal condition)

(17) Stage 2 Diesel Generator was then placed back in the 'Auto' mode (normal condition)

(18) An announcement was then made over the Plant Public Address System that the Black Start Test was completed

Tom Jensen
Labour Manager Operations - Thermal

Document is valid for 14 days from 09/21/2004

HYDRO

HTGS Procedures

Procedure No: 0646	Entered By: Cheryl Oliver Date: Nov 27th, 2000 10:51 AM
Title	POP-074 Black Start Procedure

Archive Information

Issue Date:	08/15/1995 Aug 15th, 1995
Distribution:	Labour Manager Operations - Thermal, Lead Thermal Plant Operator, Shift Supervisor, Thermal Plant Operator, Training Co-ordinator - Operations
Manual/Group:	Plant Operating Procedures, Plant Operations
Revision No:	14
Revision Date:	09/04/2003 Sept 4th, 2003
Prepared By:	Jerry Goulding
Controller:	Tom Jensen
Reviewers:	Gerard Cochrane
Approved By:	Terry LeDrew/HO/NLHydro

Procedure Scope

To return the Plant to service from a Total Power Outage.

Reference Information

Procedure Details

NOTE: Confirm status of the following equipment prior to commencement of Black Start Testing. (1) Air Compressors and (2) Sample Cooling pumps.

PLANT DIESEL GENERATOR

On loss of plant service, breaker DBT will try to close to transfer station service. If this transfer is unsuccessful breaker DBT will open. Breakers DB3-4 and C-16 will also open to allow essential services boards to be powered by way of their respective diesel generators.

Diesel generators #1 and #2 should start automatically and when rated voltage is achieved, breakers D-2 and C-19 should close automatically, allowing the diesels to re-power their respective essential service boards.

Two sources of start-up power are now available for the gas turbine.

Either diesel can be selected by the position of the changeover switch located in the gas turbine MCC room.

PROCEDURE

It should also be noted that the diesel fire pump will start and continue to run on loss of AC power. This should be left in service until AC power becomes available for the electric fire pump.

GAS TURBINE

Before starting the gas turbine, Operations should:

1. Select manual sync mode for the gas turbine on the WDPF system in the control room. The synchronizer should also be turned "off" in the gas turbine control room.

2. Ensure that the following 4160 V breakers are open (as shown on the WDPF screen) SSB-1, SSB-2, SSB-3, SSB-4, ST3/4, TB12, UT3, UB2-1, UB1-2, UB2-2, UB1-3, TB-3.

3. Ensure that the following 600 volt breakers are open (as shown on the WDPF screen) A-9, C-15, C-16, B-2, ATB-3, ATB-12, DB-3/4.

The gas turbine can now be started. If the start is successful, the generator will accelerate to and hold at a speed of 4600 R.P.M. The operator will then have to raise the speed to 4800 R.P.M. by use of the Raise/Lower control switch. At a speed of 4800 R.P.M. and 60 cycle frequency the operator can request breaker SSB-2 to close manually.

The manual sync switch must be held selected as breaker SSB-2 is requested to close. Approximately five (5) seconds after breaker SSB-2 closes, the gas turbine will switch from station service power to its own unit service. The station board for Unit 1 and Unit 2 is now re-powered.

Please ensure that whenever the Gas Turbine is Operated, that the Time (Start / Synchronized / Shutdown), Load, and other Pertinent Items Normally checked are entered in the Gas Turbine Log Book.

GAS TURBINE EXHAUST CONE TEMPERATURES 'ECT'

Please be advised that whenever the Gas Turbine is in operation, Channels 17 & 18,

on the Temperature Monitor located in the Gas Turbine Control Room, are monitored closely to ensure that the temperatures do not decrease to 565°C. These temperatures are to be recorded, in the Gas Turbine Log Book, each time that the Unit is operated. In the event that the temperatures fall below 600°C, it is essential that a Work Request be submitted to have the thermocouples checked.

Rolls-Royce has suggested that the above measures be taken as a means of detecting and monitoring combustion flame tube, discharge nozzle or burner distress to allow corrective action to be taken.

POWER RESTORATION

With the station board for Unit #1 and Unit #2 powered from the gas turbine, the following sequence should allow for a rapid, orderly restoration of power:

1. Select screen SB-1/2 Breakers/Sync.
2. Select Control Station 7.
3. Push start (two breaker operation is enabled).
4. Select screen SB-1/2 Breakers/Sync,
5. Select Control Station 2 (SSB-4).
6. Push close. Breaker SSB-4 should close and all other breakers should stay in the same position.
7. Select screen SB-3/4 Breakers/Sync.
8. Select Control Station 6.
9. Push start (one breaker operation is enabled).
10. Select Control Station 2 (TB12).
11. Select 'Manual OFF'.
12. Push close TB 12.
13. Select screen Bus UB-3.
14. Select Control Station 2 (TB-3).
15. Push close. TB-3 should close.

NOTE:

At this point both the 4160 V and 600 V boards on Unit #3 will be powered. Unit #3 lighting MCC's and compressors are now available.

16. Select screen - Bus SB-12 Breakers/Sync.

17. Select Control Station 3 (SSB-3).

18. Push close. Breakers SSB-3 and C-1 should close.

19. Select screen - Bus UB-2 Breakers/Sync.

20. Select Control Station 2 (UB2-12).

21. Push close if required. (This breaker should be closed already).

22. Select screen - Bus UB-1 Breakers/Sync.

23. Select Control Station 2 (UB1-1).

24. Push close if required. (This breaker should be closed already).

25. Select screen - Bus UB-1 Breakers/Sync.

26. Select Control Station 3 (UB1-3).

27. Push close. Breakers UB1-3 and A-1 should close.

28. Select screen - Bus UB-2 Breakers/Sync.

29. Select Control Station 3 (UB2-2).

30. Push close. Breakers UB2-2 and B-1 should close.

NOTE:

After this switching is complete, an operator has to go to Power Centres A, B, and C and manually reclose all feeder breakers with the exception of the electric fire pump breaker. This feeder breaker can be reclosed electrically from the control room.

The operator should reset all undervoltage (type 27) relays as well.

NOTE:

Provided all equipment operates normally, this sequence of events allows for an orderly restoration of 4160/600V power for all three units.

There are provisions for alternate power transfers in case of breaker or transformer failure. These should be covered off separately. Emergency diesel shutdown and diesel fire pump shutdown should also be covered off separately.

Speed in implementing this sequence is essential but not critical. Top priority must be to get the gas turbine running using whatever diesel is available. The UPS battery banks must be prevented from running down.

When a unit is available to be placed on line serious consideration should be given to keeping station service supplied from the gas turbine until good system stability is achieved. The definition of good system stability is a decision which the plant would have to make in consultation with ECC.

Further information relative to POP #074:

The black start exercise has revealed that in the event of an extreme emergency one diesel generator can be used to power both diesel busses. This emergency would be defined as only one diesel generator running and the gas turbine unavailable for an extended period.

In this situation, battery banks would be rapidly discharged and vital plant equipment such as air heater drives, lube oil pumps and turning gear motors would be unavailable. To prevent this from happening the following procedure could be used:

SCENARIO (A)

Stage I diesel has started automatically on power failure after an unsuccessful transfer on breaker DBT, and has closed in breaker C-19 repowering stage I diesel bus. The gas turbine is not available. Stage II diesel didn't start.

1. D2 should be in manual, if not, manual should be selected.

2. Breaker DBT should be open and in manual.

3. Breaker DB-34 should be open, if not open DB-34.

4. Close breaker DBT from the WDPF station service console to re-power stage II diesel bus.

5. Critical loads on stage II diesel bus can now be re-started. Monitor

kilowatt load on stage I as this is being done. Keep loading, to within diesel generator capability, only start loads that are critical.

SCENARIO (B)

Stage II diesel has started automatically on power failure after an unsuccessful transfer on breaker DBT, and has closed in breaker D-2 re-powering stage II diesel bus. The gas turbine is unavailable and stage I diesel generator did not start.

1. D-1 should be in manual. If not, select manual.

2. Breaker DBT should be open and in manual. If not, open DBT and put it in manual.

3. Breakers C-16 and C-19 should be open. If not, open C-16 and C-19.

4. Close breaker DBT from the WDPF station service console to re-power stage 1 diesel bus.

5. Critical loads on stage I diesel bus can now be re-started. Monitor kilowatt load on the stage II diesel as this is being done. Keep kilowatt loading within the diesel capability and only start what is critical.

After the gas turbine has been started and is online supplying station service power, restore the diesel busses to their normal operating condition i.e. being supplied by way of breakers DB-34 and C-16, respectively.

RESTORING STATION SERVICE FROM THE SWITCHYARD

After the Plant and ECC has decided that system stability is acceptable, restore station service from the switchyard:

1. Confirm B6L3 & B7L2 are closed.
2. Select screen SB-1/2 Breakers/sync.
3. Select Control Station 7.
4. Push start (two breaker operation is enabled).
5. Select Control Station 1 (SSB-1) and place in manual to enable scopes.
6. Check for synchronism, push close. SSB-1 should close and all other breakers should stay in the same position.
7. Select screen SB-3/4 Breakers/sync.
8. Select Control Station 6.
9. Push start (one breaker operation is enabled).
10. Select Control Station 1 (ST34) and place in manual to enable scopes.
11. Check for synchronism, push close. ST34 should close and TB12

should open.

12. Select screen SB-1/2 Breakers/sync.
13. Select Control Station 2 (SSB-4).
14. Push open.
15. Select Control Station 6.
16. Push start (one breaker operation is enabled.
17. When the shift supervisor and ECC determine the system is stable:
    a. Shut down the diesels,
    b. Re-energize the diesel boards, and
    c. Shut down the gas turbine.

Note:

1. Breaker SSB-1 will not close if breakers SSB-2 and ST34 are closed.

2. SSB-3 does not open on undervoltage.

3. If performing this test with Unit 3 synchronized, do not open UT-3 in step 2 of the gas turbine section and skip step 5 in the power restoration section. Ensure all auxiliaries are on unit service.

HYDRO

File #102.01.00/1

Black Start Test (Partial – POP-133) – Stage 1

Thursday, September 16, 2004

ATTENDING:

Evan Cabot (Temp. Shift Supervisor)
Kevin Burfitt (LTPO)
Glen Kennedy (LTPO)
Larry O'Shea (TPO)
Kent Brophy (TPO- Gas Turbine)
Jim McNeill (TPO - #3 Air Compressor)
Gerard Molloy (TPO - #3 Air Compressor)
Bob Woodman (Plant Electrical Engineer)
Gerard Cochrane (Training Coordinator)
Tom Jensen (Labour Manager Operations – Thermal)

The Procedure, POP-133 (Partial Stage 1 Black Start Test Procedure) used was modified due to Unit No.3 operating and pertained only to Stage 1 of the Plant. Please refer to the attachment.

Plant Status prior to the Black Start Test:

- **Unit No.1**: Planned Outage, 'P.O.'
- **Unit No.2**: Planned Outage, 'P.O.'
- **Unit No.3**: 148Mw

Events of Black Start Test:

(1) The E.C.C. was notified of Black Start Test
(2) Contractors were notified
(3) Plant Personnel were notified
(4) An announcement was made over the Plant Public Address System five (5) minutes prior to the start of the test
(5) Diesel Bus Tie Breaker 'DBT' was placed in the 'Manual' mode
(6) The Black Start Test commenced when the E.C.C. 'Opened' 4KV Breaker 'B7L2' in the site switchyard, which resulted in a power loss to Stage 1
(7) Stage 1 Diesel Generator started, in the 'Auto' mode and synchronized due to the resulting power loss to Diesel Bus 'DB12'

(8) The Gas Turbine was started with power supplied from Stage 1 Diesel Generator and supplied power to Stage 1, 4KV Station Service Board 'SB12"

(9) 600V Power was subsequently restored to Stage 1 from its 4KV Unit and Station Boards

(10) 600V Power was then isolated to Stage 1 from the 4KV Unit and Station Boards prior to shutting down the Gas Turbine

(11) The Gas Turbine was then shutdown and ECC was requested to close 'B7L2'

(12) Stage 1, 4KV Station Service Board was powered up again by closing 'SSB1' (normal power supply)

(13) 600V Power was restored again to Stage 1 from its 4KV Unit and Station Boards

(14) Stage 1 Diesel Generator was then shutdown which resulted in a Power loss to Diesel Bus 'DB12'

(15) The Diesel Bus Tie Breaker 'DBT' was placed back in the 'Auto' mode (normal condition)

(16 Stage 1 Diesel Generator was then placed back in the 'Auto' mode (normal condition)

(17) An announcement was then made over the Plant Public Address System that the Black Start Test was completed

Tom Jensen
Labour Manager Operations - Thermal

Document is valid for 14 days from 09/21/2004

HTGS Procedures

Procedure No: 0864	Entered By: Mary Slaney Date: July 7th, 2003 11:49 AM
Title	POP-133 Partial Stage 1 Black Start Test Procedure

Archive Information

Issue Date:	07/07/2003 July 7th, 2003
Distribution:	Labour Manager - Operations - Thermal, Lead Thermal Plant Operator, Shift Supervisor, Turbine Plant Operator
Manual/Group:	Plant Operating Procedures, Plant Operations
Revision No:	1
Revision Date:	07/07/2003 July 7th, 2003
Prepared By:	Bob Woodman
Controller:	Tom Jensen
Reviewers:	Gerard Cochrane
Approved By:	Terry LeDrew/HO/NLHydro

Procedure Scope

To return the Plant to service from a Stage 1 Power Outage by use of a 'Black Start Procedure', for testing purposes.

Reference Information

POP-074

Procedure Details

PLANT DIESEL GENERATOR

Place DBT on manual so that it will not try to close automatically. Request ECC to open B7L2. Breaker C-16 will open to allow the essential services board to be powered by the respective diesel generator.

Diesel generator #1 should start automatically and when rated voltage is achieved, breaker C-19 will close automatically, allowing the diesel to re-power the essential service board. Select Stage 1 diesel via the position of the changeover switch located in the Gas Turbine MCC Room.

PROCEDURE

It should also be noted that the diesel fire pump will start and continue to run on loss

of AC power. This should be left in service until AC power becomes available for the electric fire pump.

GAS TURBINE

Before starting the Gas Turbine Operations should:

1. Select manual sync mode for the Gas Turbine on the WDPF system in the Control Room. The Synchronizer should also be turned **"off"** in the Gas Turbine Control Room.

2. Ensure that the following 4160V breakers are open (as shown on the WDPF screen) SSB-1, SSB-2, SSB-3, SSB-4, TB-12, UB2-1, UB1-2, UB2-2, UB1-3.

3. Ensure that the following 600 volt breakers are open (as shown on the WDPF screen) A-1, A9, B1, B2, C1, C-15, & C-16.

The Gas Turbine can now be started. If the start is successful, the generator will accelerate to and hold at a speed of 4600 RPM. The Operator will then have to raise the speed to 4800 RPM by use of the Raise/Lower control switch. At a speed of 4800 RPM and 60 cycle frequency the Operator can request breaker SSB-2 to close manually.

The Manual Sync Switch must be held selected as breaker SSB-2 is requested to close. Approximately five (5) seconds after breaker SSB-2 closes, the Gas Turbine will switch from Station Service power to its own Unit Service. The Station Board for Unit #1 is now re-powered.

POWER RESTORATION

With the Station Board for Unit #1 powered from the Gas Turbine, the following sequence should allow for a rapid, orderly restoration of power.

1. Select screen - Bus UB-2 Breakers/Sync, select Control Station two (2), close breaker UB2-12 if required. (This breaker should be closed already)

2. Selected screen - Bus UB-1 Breakers/Sync, select Control Station two (2), close breaker UB1-1 if required. (This breaker should be closed already)

3. Select screen - Bus UB-1 Breakers/Sync, select Control Station three (3), push close and breakers UB1-3 and A-1 should close.

4. Select screen - Bus UB-2 Breakers/Sync, select Control Station three (3), push close and breakers UB2-2 and B-1 should close.

5. Select screen - Bus SB-12 Breakers/Sync, select Control Station three (3), push

close and breakers SSB-3 and C-1 should close.

NOTE:

After this switching is complete an Operator has to go to Power Centres A, B, and C and amanually reclose all feeder breakers with the exception of the Electric Fire Pump breaker. This feeder can be reclosed electrically from the Control Room.

The Operator should reset all undervoltage (type 27) relays as well.

NOTE:

This sequence of events allows for an orderlly restoration of 4160/600v power for Stage 1 units providing all equipment operates normally.

There are povisions for alternate power transfers in case of Breaker or Transformer failure. These should be covered off separately. Emergency Diesel shutdown and Diesel Fire Pump shutdown should also be covered off separately.

Speed in implementing this sequence is essential but not critical. Top priority must be to get the Gas Turbine running using whatever diesel is available. The UPS Battery Banks must be prevented from running down.

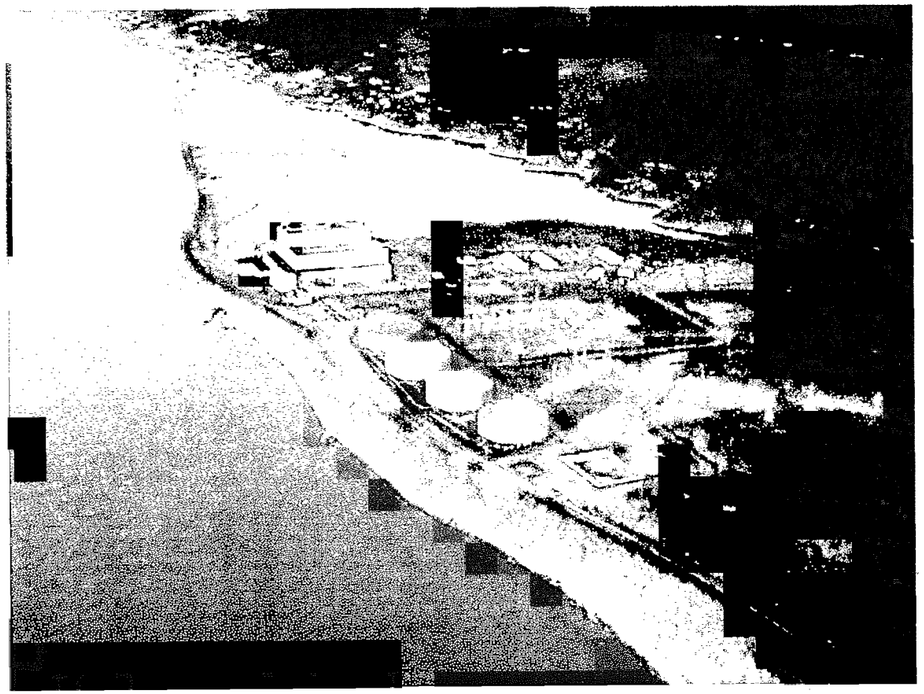
When a unit is available to be placed on-line serious consideration should be given to keeping Station Service supplied from the Gas Turbine until good system stability is achieved. The definition of system stability is a decision which the Plant would have to make in consultation with ECC.

When Testing is complete:

1. Verify SSB-1 open;
2. Request ECC to close B7L2;
3. Restore Station Services through SSB-1; c
4. Shut-off the Gas Turbine, Diesel Generator, and Diesel Fire Pumps.

HYDRO

Newfoundland & Labrador Hydro
Holyrood Thermal Generating Station



BLACK START ANNUAL TEST

2005

HYDRO

File #102.01.00/1

Holyrood Thermal Generating Station

Black Start Test (Full)

Friday, August 19, 2005

'A' Shift Personnel
Don Maloney (Shift Supervisor)
Bill Morris (LTPO)
Bob Pretty (TPO)
Jim Senior (TPO)

'Extra' Personnel
Francis Skinner (LTPO – Major Permit Issuing Authority 2005)
Bob Woodman (Plant Electrical Engineer)
Tom Jensen (Labour Manager Operations – Thermal)

Procedure POP-074 (Black Start Procedure) is attached.

A copy of the Holyrood Generating Station Powerhouse and Switchyard Single Line Diagram (Dwg. # A0-1403-500-E-001) is attached.

Plant Status prior to the Black Start Test;

- **Unit No.1**: Planned Outage 'P.O.'
- **Unit No.2**: Planned Outage 'P.O.'
- **Unit No.3**: Available but not Operating 'ABNO' – Hot Stand-by.

Events of Black Start Test (Full);

(1) E.C.C. was notified of Black Start Test.

(2) Contractors were notified.

(3) Plant Personnel were notified.

(4) Both Plant Elevators were disabled prior to commencement of Black Start Test.
Note: Both Elevators were enabled once Power was restored.

(5) An announcement was made over the Plant Public Address System five (5) minutes prior to the start of the test.

(6) The Diesel Bus Tie-Breaker 'DBT' was placed in the 'Manual' mode.

(7) The Black Start Test commenced at 1230hrs when Stage 1 and Stage 2 Station Service Board Breakers 'SSB1' and 'ST34' were 'Opened' which resulted in a power loss to Stage 1 followed by Stage 2. **Note:** In the past, ECC would be requested to 'Open' 4KV Breakers 'B7L2' and 'B6L3', which are located in the Plant Switchyard 'upstream' of Breaker 'SSB1' & 'ST34' which is located in the Plant, during a Black Start Test.

(8) Stage 2 Emergency Diesel Generator started at 1237hrs, in the 'Auto' mode and Synchronized due to the resulting Power loss to Diesel Bus 'DB34'.

(9) The Gas Turbine was started at 1250hrs from power supplied from Stage 2 Emergency Diesel Generator and was Synchronized to Stage 1 Station Service Board ' SB12' via Breaker 'SSB2'.

(10) Stage 1&2 4KV Station Boards 'SAB12 & 'SB34' 'Tie-Bus' Breaker 'SSB4' was 'Closed' as per a 'Two (2) Breaker Operation'.

(11) Stage 2 Unit Board 4KV 'Tie' Breaker 'TB3' was 'Opened'.

(12) Stage 1&2 4KV Station Boards 'SAB12 & 'SB34' 'Tie-Bus' Breaker 'TB12' was 'Closed' as per a 'One (1) Breaker Operation', to power-up Stage 2 Station Board 'SB34.

(13) 4KV 'Tie-Bus' Breaker 'TB3' was 'Closed' and Unit Service Board 'UB3' was powered-up from Stage 2 Station Service Board 'SB34'.

(14) Power was subsequently restored to Stage 2, 600V Station and Unit Auxiliary Boards, 'SAB34' & 'UAB3' respectively from its 4KV Unit and Station Boards, 'SB34' & 'UAB3' respectively.

(15) Started both 4KV Forced Draft Fans and the West 4KV CW Pump on Unit No.3, to provide extra loading for the Gas Turbine.

(16) Gas Turbine supplied the majority of Plant Power with Stage 2 Emergency Diesel Generator supplying Stage 2 Essential Service Bus 'MCC ESB34'.

(17) Stage 1, 4KV Station Service Breaker 'SSB1' was 'Closed' in to Stage 1 Station Service Board 'SB12' by 'Manual' Synchronization as per a two (2) Breaker operation.

(18) 'Closed' 4KV Breaker 'ST34' as per a 'One (1) Breaker Operation' and Stage 1&2 Station Boards 'SAB12 & 'SB34' 4KV 'Tie-Bus' Breaker 'TB12' 'Opened' automatically in order to return the Power Supply to Stage 2 Station and Unit Service Boards 'SB34' & 'UAB3' respectively (normal condition).

(19) 'Opened' Stage 1&2 Station Boards 'SAB12 & 'SB34' 4KV 'Tie-Bus' Breaker 'SSB4'.

(20) Stage 2 Emergency Diesel Generator was shutdown at 1355hrs.

(21) Stage 2 Diesel Bus 'DB34' was re-energized by 'Closing' 600V Breaker 'DB34' (normal condition).

(22) Stage 2 Emergency Diesel Generator was then placed back in the 'Auto' mode (normal condition).

(23) The Diesel Bus Tie Breaker 'DBT' was placed back in the 'Auto' mode (normal condition).

(24) 'Opened' Gas Turbine 4KV Breaker 'SSB2' and Shutdown Gas Turbine @ 1356hrs.

(25) An announcement was then made over the Plant Public Address System that the Black Start Test was completed

Note:

- Stage 1 Emergency Diesel Generator not available due to mechanical problems.

Tom Jensen
Labour Manager Operations – Thermal

/ms

HTGS Procedures

Procedure No: 0646	Entered By: Cheryl Oliver Date: Nov 27th, 2000 10:51 AM
Title	**POP-074 Black Start Procedure**

Archive Information

Issue Date:	08/15/95 Aug 15th, 1995
Distribution:	Labour Manager Operations - Thermal, Lead Thermal Plant Operator, Shift Supervisor, Thermal Plant Operator, Training Co -ordinator - Operations
Manual/Group:	Plant Operating Procedures, Plant Operations
Revision No:	14
Revision Date:	09/04/2003 Sept 4th, 2003
Prepared By:	Jerry Goulding
Controller:	Tom Jensen
Reviewers:	Gerard Cochrane
Approved By:	Terry LeDrew/HO/NLHydro

Procedure Scope

To return the Plant to service from a Total Power Outage.

Reference Information

Procedure Details

NOTE: Confirm status of the following equipment prior to commencement of Black Start Testing. (1) Air Compressors and (2) Sample Cooling pumps.

PLANT DIESEL GENERATOR

On loss of plant service, breaker DBT will try to close to transfer station service. If this transfer is unsuccessful breaker DBT will open. Breakers DB3-4 and C-16 will also open to allow essential services boards to be powered by way of their respective diesel generators.

Diesel generators #1 and #2 should start automatically and when rated voltage is achieved, breakers D-2 and C-19 should close automatically, allowing the diesels to re-power their respective essential service boards. Two sources of start-up power are now available for the gas turbine.

Document is valid for 14 days from 08/17/2005

Either diesel can be selected by the position of the changeover switch located in the gas turbine MCC room.

PROCEDURE

It should also be noted that the diesel fire pump will start and continue to run on loss of AC power. This should be left in service until AC power becomes available for the electric fire pump.

GAS TURBINE

Before starting the gas turbine, Operations should:

1. Select manual sync mode for the gas turbine on the WDPF system in the control room. The synchronizer should also be turned "off" in the gas turbine control room.

2. Ensure that the following 4160 V breakers are open (as shown on the WDPF screen) SSB-1, SSB-2, SSB-3, SSB-4, ST3/4, TB12, UT3, UB2-1, UB1-2, UB2-2, UB1-3, TB-3.

3. Ensure that the following 600 volt breakers are open (as shown on the WDPF screen) A-9, C-15, C-16, B-2, ATB-3, ATB-12, DB-3/4.

The gas turbine can now be started. If the start is successful, the generator will accelerate to and hold at a speed of 4600 R.P.M. The operator will then have to raise the speed to 4800 R.P.M. by use of the Raise/Lower control switch. At a speed of 4800 R.P.M. and 60 cycle frequency the operator can request breaker SSB-2 to close manually.

The manual sync switch must be held selected as breaker SSB-2 is requested to close. Approximately five (5) seconds after breaker SSB-2 closes, the gas turbine will switch from station service power to its own unit service. The station board for Unit 1 and Unit 2 is now re-powered.

Please ensure that whenever the Gas Turbine is Operated, that the Time (Start / Synchronized / Shutdown), Load, and other Pertinent Items Normally checked are entered in the Gas Turbine Log Book.

GAS TURBINE EXHAUST CONE TEMPERATURES 'ECT'

Please be advised that whenever the Gas Turbine is in operation, Channels 17 & 18, on the Temperature Monitor located in the Gas Turbine Control Room, are monitored closely to ensure that the temperatures do not decrease to 565°C. These temperatures are to be recorded, in the Gas Turbine Log Book, each time that the Unit is operated.

14. Push open.
15. Select Control Station 6.
16. Push start (one breaker operation is enabled.
17. When the shift supervisor and ECC determine the system is stable:
    a. Shut down the diesels,
    b. Re-energize the diesel boards, and
    c. Shut down the gas turbine.

Note:

1. Breaker SSB-1 will not close if breakers SSB-2 and ST34 are closed.

2. SSB-3 does not open on undervoltage.

3. If performing this test with Unit 3 synchronized, do not open UT-3 in step 2 of the gas turbine section and skip step 5 in the power restoration section. Ensure all auxiliaries are on unit service.

In the event that the temperatures fall below 600°C, it is essential that a Work Request be submitted to have the thermocouples checked.

Rolls-Royce has suggested that the above measures be taken as a means of detecting and monitoring combustion flame tube, discharge nozzle or burner distress to allow corrective action to be taken.

POWER RESTORATION

With the station board for Unit #1 and Unit #2 powered from the gas turbine, the following sequence should allow for a rapid, orderly restoration of power:

1. Select screen SB-1/2 Breakers/Sync.
2. Select Control Station 7.
3. Push start (two breaker operation is enabled).
4. Select screen SB-1/2 Breakers/Sync,
5. Select Control Station 2 (SSB-4).
6. Push close. Breaker SSB-4 should close and all other breakers should stay in the same position.
7. Select screen SB-3/4 Breakers/Sync.
8. Select Control Station 6.
9. Push start (one breaker operation is enabled).
10. Select Control Station 2 (TB12).
11. Select 'Manual OFF'.
12. Push close TB 12.
13. Select screen Bus UB-3.
14. Select Control Station 2 (TB-3).
15. Push close. TB-3 should close.

NOTE:

At this point both the 4160 V and 600 V boards on Unit #3 will be powered. Unit #3 lighting MCC's and compressors are now available.

16. Select screen - Bus SB-12 Breakers/Sync.
17. Select Control Station 3 (SSB-3).
18. Push close. Breakers SSB-3 and C-1 should close.
19. Select screen - Bus UB-2 Breakers/Sync.
20. Select Control Station 2 (UB2-12).
21. Push close if required. (This breaker should be closed already).
22. Select screen - Bus UB-1 Breakers/Sync.
23. Select Control Station 2 (UB1-1).
24. Push close if required. (This breaker should be closed already).
25. Select screen - Bus UB-1 Breakers/Sync.
26. Select Control Station 3 (UB1-3).
27. Push close. Breakers UB1-3 and A-1 should close.
28. Select screen - Bus UB-2 Breakers/Sync.
29. Select Control Station 3 (UB2-2).
30. Push close. Breakers UB2-2 and B-1 should close.

NOTE:

After this switching is complete, an operator has to go to Power Centres A, B, and C and manually reclose all feeder breakers with the exception of the electric fire pump breaker. This feeder breaker can be reclosed electrically from the control room.

The operator should reset all undervoltage (type 27) relays as well.

NOTE:

Provided all equipment operates normally, this sequence of events allows for an orderly restoration of 4160/600V power for all three units.

There are provisions for alternate power transfers in case of breaker or transformer failure. These should be covered off separately.

Emergency diesel shutdown and diesel fire pump shutdown should also be covered off separately.

Speed in implementing this sequence is essential but not critical. Top priority must be to get the gas turbine running using whatever diesel is available. The UPS battery banks must be prevented from running down.

When a unit is available to be placed on line serious consideration should be given to keeping station service supplied from the gas turbine until good system stability is achieved. The definition of good system stability is a decision which the plant would have to make in consultation with ECC.

Further information relative to POP #074:

The black start exercise has revealed that in the event of an extreme emergency one diesel generator can be used to power both diesel busses. This emergency would be defined as only one diesel generator running and the gas turbine unavailable for an extended period.

In this situation, battery banks would be rapidly discharged and vital plant equipment such as air heater drives, lube oil pumps and turning gear motors would be unavailable. To prevent this from happening the following procedure could be used:

SCENARIO (A)

Stage I diesel has started automatically on power failure after an unsuccessful transfer on breaker DBT, and has closed in breaker C-19 repowering stage I diesel bus. The gas turbine is not available. Stage II diesel didn't start.

1. D2 should be in manual, if not, manual should be selected.

2. Breaker DBT should be open and in manual.

3. Breaker DB-34 should be open, if not open DB-34.

4. Close breaker DBT from the WDPF station service console to re-power stage II diesel bus.

5. Critical loads on stage II diesel bus can now be re-started. Monitor kilowatt load on stage I as this is being done. Keep loading, to within diesel generator capability, only start loads that are critical.

SCENARIO (B)

Stage II diesel has started automatically on power failure after an unsuccessful transfer on breaker DBT, and has closed in breaker D-2 re-powering stage II diesel bus. The gas turbine is unavailable and stage I diesel generator did not start.

1. D-1 should be in manual. If not, select manual.

2. Breaker DBT should be open and in manual. If not, open DBT and put it in manual.

3. Breakers C-16 and C-19 should be open. If not, open C-16 and C-19.

4. Close breaker DBT from the WDPF station service console to re-power stage 1 diesel bus.

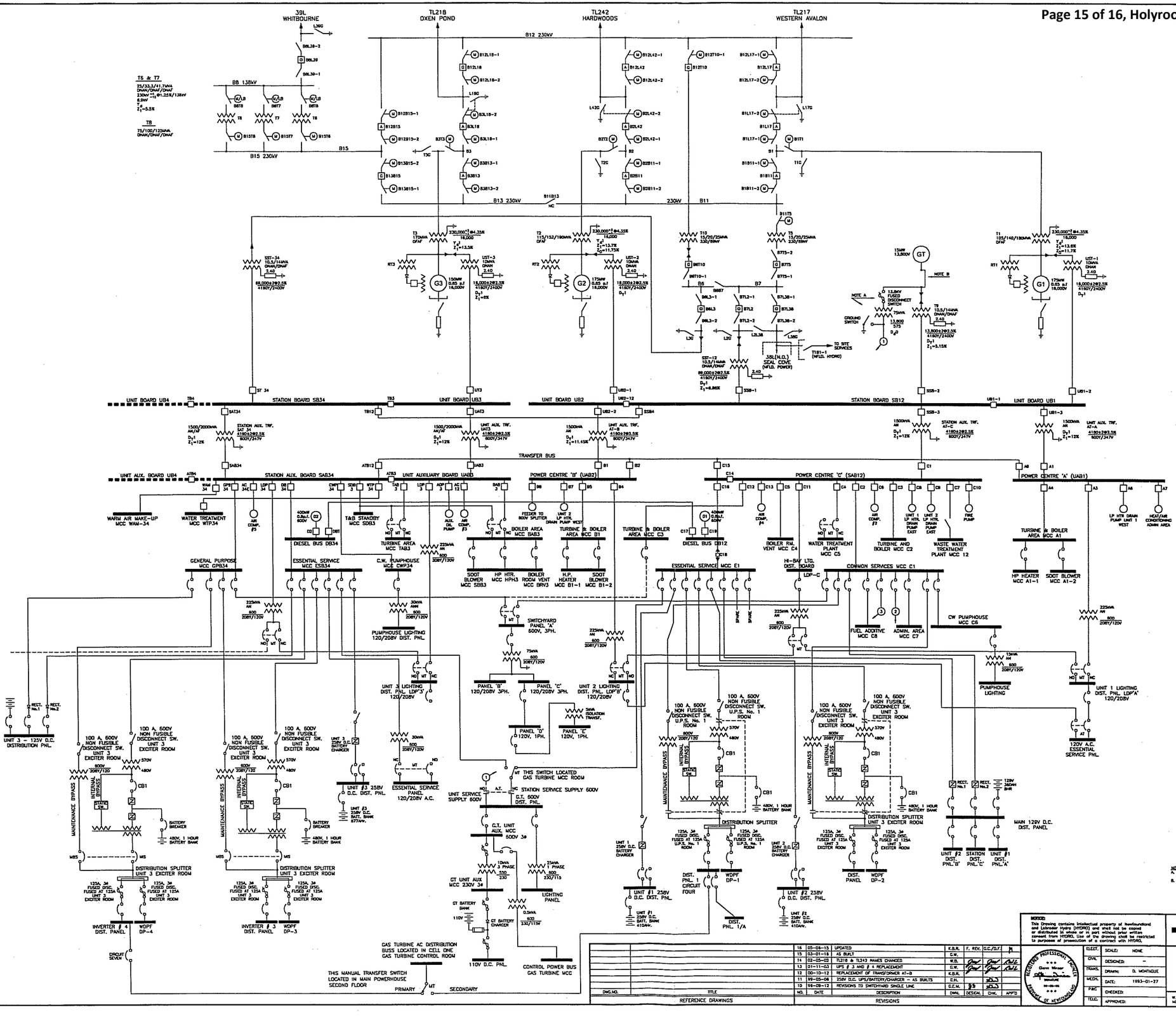
5. Critical loads on stage I diesel bus can now be re-started. Monitor kilowatt load on the stage II diesel as this is being done. Keep kilowatt loading within the diesel capability and only start what is critical.

After the gas turbine has been started and is online supplying station service power, restore the diesel busses to their normal operating condition i.e. being supplied by way of breakers DB-34 and C-16, respectively.

RESTORING STATION SERVICE FROM THE SWITCHYARD

After the Plant and ECC has decided that system stability is acceptable, restore station service from the switchyard:

1. Confirm B6L3 & B7L2 are closed.
2. Select screen SB-1/2 Breakers/sync.
3. Select Control Station 7.
4. Push start (two breaker operation is enabled).
5. Select Control Station 1 (SSB-1) and place in manual to enable scopes.
6. Check for synchronism, push close. SSB-1 should close and all other breakers should stay in the same position.
7. Select screen SB-3/4 Breakers/sync.
8. Select Control Station 6.
9. Push start (one breaker operation is enabled).
10. Select Control Station 1 (ST34) and place in manual to enable scopes.
11. Check for synchronism, push close. ST34 should close and TB12 should open.
12. Select screen SB-1/2 Breakers/sync.
13. Select Control Station 2 (SSB-4).



DWG.NO.	TITLE
REFERENCE DRAWINGS	

NO.	DATE	DESCRIPTION	DWN.	DESIGN.	CHK.	APP'D
16	05-08-15	UPDATED	K.B.R.	F. REV.	G.C./D.F.	
15	03-01-18	AS BUILT	C.W.			
14	02-05-03	TL218 & TL242 NAMES CHANGED	W.B.			
13	01-11-03	UPS # 3 AND # 4 REPLACEMENT	D.W.			
12	00-10-12	REPLACEMENT OF TRANSFORMER AT-B	K.B.R.			
11	99-05-06	250V D.C. UPS/BATTERY/CHARGER - AS BUILTS	C.H.			
10	98-09-12	REVISIONS TO SWITCHYARD SINGLE LINE	C.C.M.			

REVISIONS

HYDRO — NEWFOUNDLAND AND LABRADOR HYDRO

HOLYROOD GENERATING STATION
POWERHOUSE AND SWITCHYARD
SINGLE LINE DIAGRAM

ELECT.	SCALE: NONE
CIVIL	DESIGNED: —
TRANS.	DRAWN: D. MONTAGUE
MECH.	DATE: 1993-01-27
P&C	CHECKED:
TELE.	APPROVED:

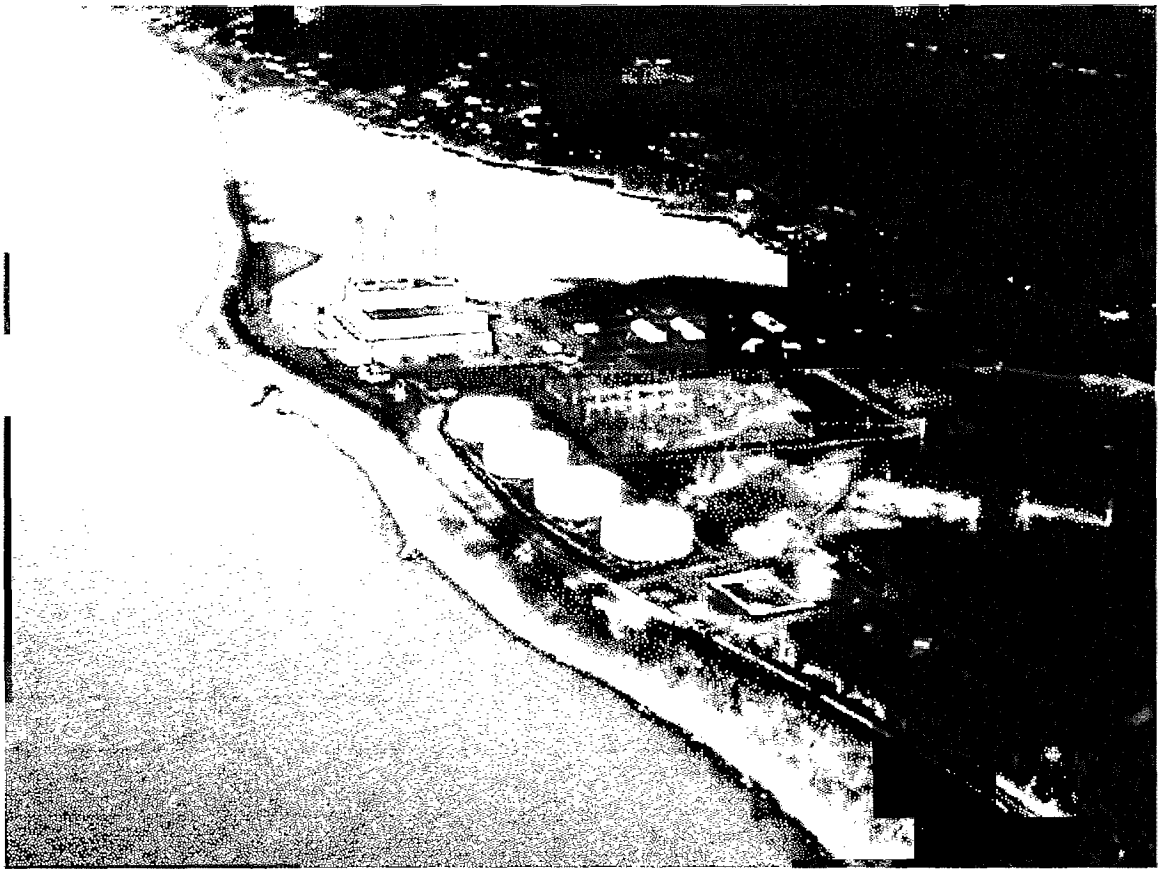
W.O. NO.

DWG. NO. A0 - 1403 - 500 - E - 001 REV. 18

PLOT SCALE 1:1 C.A.D.

HYDRO

Newfoundland & Labrador Hydro
Holyrood Thermal Generating Station



BLACK START ANNUAL TEST

2006

HYDRO

File No. 102.01.00/1

MEMO

TO: Terry LeDrew
Manager, Thermal Generation

FROM: Tom Jensen
Labour Manager Operations – Thermal

DATE: October 23, 2006

SUBJECT: **Annual Black Start Tests for 2006 - HTGS**

Annual Black Start Tests for 2006 were performed as follows:

- September 09, 2006 - Total Black Start Test
- September 11, 2006 - Partial Black Start Test - Stage 1

Please refer to the attachments for details of each Test.

T. Jensen
Labour Manager Operations – Thermal

/ms

HYDRO

File #102.01.00/1

Holyrood Thermal Generating Station
Black Start Test (Total)

Saturday, September 09, 2006

'C' Shift Personnel

Don Maloney (Shift Supervisor)
John Buglar (LTPO)
Glen Kennedy (LTPO)
Brian Cole (TPO)
Chris House (TPO)
Terry Barnable (TPO)

'Extra' Personnel (0600 hrs)
Kevin Burfitt (LTPO)
Kent Brophy (TPO)-Provided ERT Services for Gas Turbine.
Perry Peyton (TPO)
Tom Keats (TPO)
Dave Fifield (LTPO)
Chad Blackmore (TPO)-Provided ERT Services for Gas Turbine.
Gerard Cochrane (Training Coordinator-Operations)

'B' Shift Personnel-Starting at 0800 hrs

Evan Cabot (Shift Supervisor-arrived at 0800 hrs)
K Burfitt (LTPO)- Arrived at 0600 hrs
Kent Brophy (TPO)-Provided ERT Services for Gas Turbine-arrived at 0600 hrs
Perry Peyton (TPO- Arrived at 0600 hrs

Maintenance Personnel

Ron McDonald-Plant Electrician
Edward Flynn- Plant Electrician
Jim Gillingham-Plant Technician

The Procedure, POP-074 (Black Start Procedure), was used. This procedure had to be modified to reflect the new Foxboro DCS System for the Station System

Plant Status prior to the Black Start Test:

- **Unit No.1**: ABNO
- **Unit No.2**: Planned Outage 'P.O.'
- **Unit No.3**: Available but not Operating 'ABNO' – Synchronous Condenser Mode. Note! The synchronous condenser was shut down prior to Black Start Testing.

Events of Black Start Test

- E.C.C. was notified of Black Start Test several days in advance and just prior to Black Start Testing.
- Contractors were not on site at the time of Black Start Testing
- Plant Personnel were notified.
- The Black Start Test commenced when ECC Opened 4KV Breaker 'B6L3', which is located in the Plant Switchyard 'upstream' of Breaker 'ST34' which is located in the Plant, during a Black Start Test.
- -Breaker DBT was left in Auto mode and checked for Auto Operation to close on a loss of power on Diesel Bus DB 34. Therefore power was fed from Diesel Bus 12 to Diesel Bus DB 34.
- A Total Plant Outage was requested and commenced when ECC Opened 4KV Breaker 'B7L2', which is located in the Plant Switchyard 'upstream' of Breaker 'SSB1' which is located in the Plant, during a Black Start Test.
- Stage 1 and Stage 2 Emergency Diesel Generator started, in the 'Auto' mode and their respective breakers closed to a dead bus. Note! The new Stage 1 Diesel supplied power very shortly after the diesel had started. This is a notable improvement over the older retired Stage 1 Diesel
- All 4160 KV Breakers were checked and opened as stated in POP-074 (Black Start Procedure)
- The Gas Turbine was started and Breaker 'SSB2'was Closed to Stage 1 Station Service Board ' SB12' at 0657 hrs.
- Stage 1&2 4KV Station Boards 'SAB12 & 'SB34' 'Tie-Bus' Breaker 'SSB4' was 'Closed' as per a one (1) Normal Breaker operation.
- Stage 2 Unit Board 4KV 'Tie' Breaker 'TB3' was 'Opened'
- Stage 2 4KV Station Board SB34 was powered when Tie-Bus' Breaker 'TB12' was 'Closed' Note! 4 KV Breaker SAT 34 (feeding Auxiliary Transformer SAT 34) remains closed on a loss of power therefore as soon as TB 12 was closed power was supplied to 600V Station Auxiliary Board SAB 34.

- Stage 2 4KV Station Board UB3 was powered when Tie-Bus' Breaker TB 3 was closed. Note! 4 KV Breaker UAT 3 (feeding Auxiliary Transformer UAT 3) remains closed on a loss of power therefore as soon as TB 3 was closed power was supplied to 600V Unit Auxiliary Board UAB 3.

- Stage 1 4160 KV Breakers SSB3, UB2-2 and UB1-3 were closed thereby supplying power to their respective 600 V Boards (Power Center C, B and A respectively)

- All applicable MCC feeders breakers were closed.

- Plant Compressors were started along with the other necessary auxiliary equipment such as the Water Treatment Plant, General Service Cooling Water Pumps etc.

PLANT TEST LOADS

- Started Unit One East and West 4KV Forced Draft Fan and the Circ Water Pump West, to provide loading for the Gas Turbine. The GT load reading at that time was 1.8 MW.

Note: After all necessary equipment was returned to service the plant was in a position to return to regular power feed from the grid.

Other notes

1. The Gas Turbine tripped on the first attempt due to low air pressure. The air compressor was discovered tripped on overload. The Gas Turbine started on the second attempt using the nitrogen header. The overloads were reset on the air compressor and test ran acceptable.

2. There was a problem with Breaker C 2. It was found to be sticking and it reset.

3. The synchronous was not returned to service immediately because Holyrood Maintenance were approved outage time to work on a Foxboro Control/Card Cabinet.

4. With Unit 3 on Synchronous Condenser mode the 86 lockouts will trip on a loss of Diesel Bus. Therefore the unit will have to be placed in Generate Mode until the diesel bus is stabilized to allow the 86 lockouts to be reset (required for ring bus closure).

Restoring the Station Service from the Switchyard

0800 hrs

- Breakers B6L3 and B7L2 were closed by ECC

- Synchronized- Closed Breaker SSB1 with the Gas Turbine Breaker SS B2 already closed

- With Normal Operation selected Breaker Closed ST 34 and TB 12 Opened

- Selected Breaker SS B4 and Opened this breaker. At this point the Station Service Board was returned to Normal.

- Selected Synchronous Condenser mode on Unit 3 unit control board (low oil pressure will trip the ring bus-as designed)
- Stopped Stage One Diesel from the control room-(Diesel runs through a Cool Down before actually shutting down)
- Closed Breaker C 16 to energized Diesel Bus DB 12
- Stopped Stage Two Diesel
- Closed Breaker DB 34 to energize Diesel Bus DB 34
- Both Diesel place back into Auto Mode
- Gas Turbine Shut Down (Breaker SS B2 Opened at 0813 hrs)

Gerard Cochrane
Training Coordinator- Operations

/ms

HYDRO

HTGS Procedures

Procedure No: 0646 Entered By: Cheryl Oliver Date: Nov 27th, 2000 10:51 AM

Title **POP-074 Black Start Procedure**

Archive Information

Issue Date:	08/15/95 Aug 15th, 1995
Distribution:	Labour Manager Operations - Thermal, Lead Thermal Plant Operator, Shift Supervisor, Thermal Plant Operator, Training Co -ordinator - Operations
Manual/Group:	Plant Operating Procedures, Plant Operations
Revision No:	15
Revision Date:	10/25/2006 Oct 25th, 2006
Prepared By:	Jerry Goulding
Controller:	Tom Jensen
Reviewers:	Gerard Cochrane
Approved By:	Terry LeDrew /HO/NLHydro

Procedure Scope

To return the Plant to service from a Total Power Outage.

Reference Information

Procedure Details

NOTE: Confirm status of the following equipment prior to commencement of Black Start Testing. (1) Air Compressors and (2) Sample Cooling pumps.

PLANT DIESEL GENERATOR

On loss of plant service, breaker DBT will try to close to transfer station service. If this transfer is unsuccessful breaker DBT will open. Breakers DB3-4 and C-16 will also open to allow essential services boards to be powered by way of their respective diesel generators.

Diesel generators #1 and #2 should start automatically and when rated voltage is achieved, breakers D-2 and C-19 should close automatically, allowing the diesels to re-power their respective essential service boards. Two sources of start-up power are now available for the gas turbine.

Either diesel can be selected by the position of the changeover switch located in the gas turbine MCC room.

PROCEDURE

It should also be noted that the diesel fire pump will start and continue to run on loss of AC power. This should be left in service until AC power becomes available for the electric fire pump.

GAS TURBINE

Before starting the gas turbine, Operations should:

1. Select manual sync mode for the gas turbine on the DCS system in the control room. The synchronizer should also be turned "off" in the gas turbine control room.

2. Ensure that the following 4160 V breakers are open (as shown on the DCS screen) SSB-1, SSB-2, SSB-3, SSB-4, ST3/4, TB12, UT3, UB2-1, UB1-2, UB2-2, UB1-3, TB-3.

3. Ensure that the following 600 volt breakers are open (as shown on the DCS screen) A-9, C-15, C-16, B-2, ATB-3, ATB-12, DB-3/4.

The gas turbine can now be started. If the start is successful, the generator will accelerate to and hold at a speed of 4600 R.P.M. The operator will then have to raise the speed to 4800 R.P.M. by use of the Raise/Lower control switch. At a speed of 4800 R.P.M. and 60 cycle frequency the operator can request breaker SSB-2 to close manually.

The manual sync switch must be held selected as breaker SSB-2 is requested to close. Approximately five (5) seconds after breaker SSB-2 closes, the gas turbine will switch from station service power to its own unit service. The station board for Unit 1 and Unit 2 is now re-powered.

Please ensure that whenever the Gas Turbine is Operated, that the Time (Start / Synchronized / Shutdown), Load, and other Pertinent Items Normally checked are entered in the Gas Turbine Log Book.

GAS TURBINE EXHAUST CONE TEMPERATURES 'ECT'

Please be advised that whenever the Gas Turbine is in operation, Channels 17 & 18, on the Temperature Monitor located in the Gas Turbine Control Room, are monitored closely to ensure that the temperatures do not decrease to 565°C. These temperatures are to be recorded, in the Gas Turbine Log Book, each time that the Unit is operated.

In the event that the temperatures fall below 600°C, it is essential that a Work Request be submitted to have the thermocouples checked.

Rolls-Royce has suggested that the above measures be taken as a means of detecting and monitoring combustion flame tube, discharge nozzle or burner distress to allow corrective action to be taken.

POWER RESTORATION

With the station board for Unit #1 and Unit #2 powered from the gas turbine, the following sequence should allow for a rapid, orderly restoration of power:

1. Select screen SB-1/2 Control.
2. Select normal/abnormal operation.
3. Select abnormal operation control (two breaker operation is enabled).
4. Select screen SB-1/2 Control.
5. Select Breaker SSB-4.
6. Push close. Breaker SSB-4 should close and all other breakers should stay in the same position.
7. Select screen SB-3/4 Control..
8. Select normal/abnormal operation control.
9. Select normal/abnormal operation control (one breaker operation is enabled).
10. Select Breaker TB12.
11. Push Sync scope on.
12. Push close TB 12.
13. Select screen UB-3 Control.
14. Select Breaker TB-3.
15. Push close. TB-3 should close.

NOTE:

At this point both the 4160 V and 600 V boards on Unit #3 will be

powered. Unit #3 lighting MCC's and compressors are now available.

16. Select screen - SB-12 Control.

17. Select Breaker SSB-3.

18. Push close. Breakers SSB-3 and C-1 should close.

19. Select screen - UB-2 Control.

20. Select Breaker UB2-12.

21. Push close if required. (This breaker should be closed already).

22. Select screen - UB-1 Control.

23. Select Breaker UB1-1.

24. Push close if required. (This breaker should be closed already).

25. Select screen - UB-1 Control.

26. Select Breaker UB1-3.

27. Push close. Breakers UB1-3 and A-1 should close.

28. Select screen - UB-2 Control.

29. Select UB2-2.

30. Push close. Breakers UB2-2 and B-1 should close.

NOTE:

After this switching is complete, an operator has to go to Power Centres A, B, and C and manually reclose all feeder breakers with the exception of the electric fire pump breaker. This feeder breaker can be reclosed electrically from the control room.

The operator should reset all undervoltage (type 27) relays as well.

NOTE:

Provided all equipment operates normally, this sequence of events allows for an orderly restoration of 4160/600V power for all three units.

There are provisions for alternate power transfers in case of breaker or

transformer failure. These should be covered off separately. Emergency diesel shutdown and diesel fire pump shutdown should also be covered off separately.

Speed in implementing this sequence is essential but not critical. Top priority must be to get the gas turbine running using whatever diesel is available. The UPS battery banks must be prevented from running down.

When a unit is available to be placed on line serious consideration should be given to keeping station service supplied from the gas turbine until good system stability is achieved. The definition of good system stability is a decision which the plant would have to make in consultation with ECC.

Further information relative to POP #074:

The black start exercise has revealed that in the event of an extreme emergency one diesel generator can be used to power both diesel busses. This emergency would be defined as only one diesel generator running and the gas turbine unavailable for an extended period.

In this situation, battery banks would be rapidly discharged and vital plant equipment such as air heater drives, lube oil pumps and turning gear motors would be unavailable. To prevent this from happening the following procedure could be used:

SCENARIO (A)

Stage I diesel has started automatically on power failure after an unsuccessful transfer on breaker DBT, and has closed in breaker C-19 repowering stage I diesel bus. The gas turbine is not available. Stage II diesel didn't start.

1. D2 should be in manual, if not, manual should be selected.

2. Breaker DBT should be open and in manual.

3. Breaker DB-34 should be open, if not open DB-34.

4. Close breaker DBT from the **Foxboro** station service console to re-power stage II diesel bus.

5. Critical loads on stage II diesel bus can now be re-started. Monitor kilowatt load on stage I as this is being done. Keep loading, to within diesel generator capability, only start loads that are critical.

SCENARIO (B)

Stage II diesel has started automatically on power failure after an unsuccessful transfer on breaker DBT, and has closed in breaker D-2 re-powering stage II diesel bus. The gas turbine is unavailable and stage I diesel generator did not start.

1. D-1 should be in manual. If not, select manual.

2. Breaker DBT should be open and in manual. If not, open DBT and put it in manual.

3. Breakers C-16 and C-19 should be open. If not, open C-16 and C-19.

4. Close breaker DBT from the **Foxboro** station service console to re-power stage 1 diesel bus.

5. Critical loads on stage I diesel bus can now be re-started. Monitor kilowatt load on the stage II diesel as this is being done. Keep kilowatt loading within the diesel capability and only start what is critical.

After the gas turbine has been started and is online supplying station service power, restore the diesel busses to their normal operating condition i.e. being supplied by way of breakers DB-34 and C-16, respectively.

RESTORING STATION SERVICE FROM THE SWITCHYARD

After the Plant and ECC has decided that system stability is acceptable, restore station service from the switchyard:

1. Confirm B6L3 & B7L2 are closed.
2. Select screen SB-1/2 Control.
3. Select normal/abnormal operation control.
4. Select abnormal-two breaker operation.
5. Select Breaker SSB-1 and select sync scope on.
6. Check for synchronism, push close. SSB-1 should close and all other breakers should stay in the same position.
7. Select screen SB-3/4 Control.
8. Select normal/abnormal operation control.
9. Select normal-one breaker operation.
10. Select Breaker ST-34 and select sync scope on.
11. Check for synchronism, push close. ST34 should close and TB12 should open.
12. Select screen SB-1/2 Control.
13. Select Breaker SSB-4.

14. Push open.
15. Select normal/abnormal operation control.
16. Select normal-one breaker operation.
17. When the shift supervisor and ECC determine the system is stable:
    a. Shut down the diesels,
    b. Re-energize the diesel boards, and
    c. Shut down the gas turbine.

Note:

1. Breaker SSB-1 will not close if breakers SSB-2 and ST34 are closed.

2. SSB-3 (Stage 1) does not open on undervoltage. The same for Stage 2 Aux Transformer Breakers (SAT- 34 and UAB-34).

3. If performing this test with Unit 3 synchronized, do not open UT-3 in step 2 of the gas turbine section and skip step 5 in the power restoration section. Ensure all auxiliaries are on unit service.

HYDRO

File #102.01.00/1

Holyrood Thermal Generating Station
Black Start Test (Partial)

Monday, September 11, 2006

'A' Shift Personnel

Eldon Emberley (Shift Supervisor)
William Morris (LTPO)
Tom Keats (TPO)
Jim Senior (TPO) Provided ERT Services for Gas Turbine.
Baxter Pinsent (TPO)
Robert Pretty (TPO)

'Extra' Personnel -Operations
Jim McNeill-Provided ERT Services for Gas Turbine.
Dave Fifield (LTPO)
Gerard Cochrane (Training Coordinator-Operations)

Maintenance Personnel
Edward Flynn- Plant Electrician
Paul White-Plant Technician

The Procedure, POP-133 (Partial Stage 1 Black Start Procedure), was used. This procedure had to me modified to reflect the new Foxboro DCS System for the Station System

Plant Status prior to the Black Start Test;

- **Unit No.1**: ABNO
- **Unit No.2**: Planned Outage 'P.O.'
- **Unit No.3**: Available but not Operating 'ABNO' – Synchronous Condenser Mode.

Events of Black Start Test

- E.C.C. was notified of Black Start Test
- Contractors were not on site at the time of Black Start Testing
- Plant Personnel were notified.
- Breaker DBT was placed in manual and Opened so that Stage 1 would supply Diesel Bus DB 12
- The Partial Black Start Test commenced when ECC Opened 4KV Breaker 'B7L2', which is located in the Plant Switchyard 'upstream' of Breaker 'ST34' which is located in the Plant, during a Black Start Test.
- Stage 1 Emergency Diesel Generator started, in the 'Auto' mode and its respective breaker closed to a dead bus. Note! The new Stage 1 Diesel supplied power very shortly after the diesel had started. This is a notable improvement over the older retired Stage 1 Diesel
- All 4160 KV Breakers were checked and opened as stated in POP-133 (Partial Black Start Procedure)
- The Gas Turbine was started and Breaker 'SSB2'was Closed to Stage 1 Station Service Board ' SB12' at 1729 hrs.
- Stage 1 4160 KV Breakers SSB3, UB2-2 and UB1-1 were closed thereby supplying power to their respective 600 V Boards (Power Center C, B and A respectively)
- All applicable MCC feeders breakers were closed.

PLANT TEST LOADS

- Started Unit One East and West 4KV Forced Draft Fan and the Circ Water Pump West. Started Unit 2 Boiler Feed Pump East and Extraction Pump North. The GT load reading at that time was 2.72 MW. Plant Compressor # 4 was also started.

Note: After all necessary equipment was returned to service the plant was in a position to return to regular power feed from the grid.

Other notes:

- There was a problem with Breaker C 2. It was found to be sticking and it reset.

Restoring the Station Service from the Switchyard

Note: The restoration of Power has to be completed by Operating Breakers on Stage 2 (Open ST 34) because SS B1 will not close if Breakers SS B2 and ST 34 are closed at the same time even though SS B2 (Gas Turbine synchronized to system) is allowed to close while SS B1 and ST 34 are closed.

- Breakers B7L2 was closed by ECC
- With Normal Operation selected closed breaker SS B4
- With Normal Operation selected closed breaker TB 12 and ST 34 Opened
- (Note! Buses SB 34 and SB 12 were synchronized after GT speed was adjusted)
- With Abnormal Operation selected SS B1 was synchronized with GT Breaker SS B2.
- With Normal Operation selected ST 34 was closed and TB 12 opened
- Breaker SS B4 was Opened
- With Normal Operation selected on SS B1 –this was left in this positon
- At 1840 hrs the Gas Turbine was shut down (SS B2 opened)
- Shut down Unit One East and West 4KV Forced Draft Fan and the Circ Water Pump West. Shut down Unit 2 Boiler Feed Pump East and Extraction Pump North
- Stage 1 Diesel Shut Down and Closed Breaker C 16 to restored power to Diesel Bus DB 12
- Placed breaker DBT back in Auto mode
- Placed Stage One Diesel back in Auto

Gerard Cochrane
Training Coordinator- Operations

/ms

Document is valid for 14 days from 10/26/2006

HYDRO **HTGS Procedures**

Procedure No: 0864 Entered By: Mary Slaney Date: July 7th, 2003 11:49 AM

Title **POP-133 Partial Stage 1 Black Start Test Procedure**

Archive Information

Issue Date:	07/07/2003 July 7th, 2003
Distribution:	Labour Manager - Operations - Thermal, Lead Thermal Plant Operator, Shift Supervisor, Thermal Plant Operator, Training Co -ordinator - Operations
Manual/Group:	Plant Operating Procedures, Plant Operations
Revision No:	2
Revision Date:	10/25/2006 Oct 25th, 2006
Prepared By:	Bob Woodman
Controller:	Tom Jensen
Reviewers:	Gerard Cochrane, Gerard Cochrane
Approved By:	Terry LeDrew/HO/NLHydro

Procedure Scope

To return the Plant to service from a Stage 1 Power Outage by use of a 'Black Start Procedure', for testing purposes.

Reference Information

POP-074

Procedure Details

NOTE: Confirm status of the following equipment prior to commencement of Black Start Testing. (1) Air Compressors and (2) Sample Cooling pumps.

PLANT DIESEL GENERATOR

Place DBT on manual so that it will not try to close automatically. Request ECC to open B7L2. Breaker C-16 will open to allow the essential services board to be powered by the respective diesel generator.

Diesel generator #1 should start automatically and when rated voltage is achieved, breaker C-19 will close automatically, allowing the diesel to re-power the essential service board. Select Stage 1 diesel via the position of the changeover switch located in the Gas Turbine MCC Room.

PROCEDURE

It should also be noted that the diesel fire pump will start and continue to run on loss of AC power. This should be left in service until AC power becomes available for the electric fire pump.

GAS TURBINE

Before starting the Gas Turbine Operations should:

1. Select manual sync mode for the Gas Turbine on the DCS system in the Control Room. The Synchronizer should also be turned **"off"** in the Gas Turbine Control Room.

2. Ensure that the following 4160V breakers are open (as shown on the DCS screen) SSB-1, SSB-2, SSB-3, SSB-4, TB-12, UB2-1, UB1-2, UB2-2, UB1-3.

3. Ensure that the following 600 volt breakers are open (as shown on the DCS screen) A-1, A9, B1, B2, C1, C-15, & C-16.

The Gas Turbine can now be started. If the start is successful, the generator will accelerate to and hold at a speed of 4600 RPM. The Operator will then have to raise the speed to 4800 RPM by use of the Raise/Lower control switch. At a speed of 4800 RPM and 60 cycle frequency the Operator can request breaker SSB-2 to close manually.

The Manual Sync Switch must be held selected as breaker SSB-2 is requested to close. Approximately five (5) seconds after breaker SSB-2 closes, the Gas Turbine will switch from Station Service power to its own Unit Service. The Station Board for Unit #1 is now re-powered.

Please ensure that whenever the Gas Turbine is Operated, that the Time (Start / Synchronized / Shutdown), Load, and other Pertinent Items Normally checked are entered in the Gas Turbine Log Book .

GAS TURBINE EXHAUST CONE TEMPERATURES 'ECT'

Please be advised that whenever the Gas Turbine is in operation, Channels 17 & 18, on the Temperature Monitor located in the Gas Turbine Control Room, are monitored closely to ensure that the temperatures do not decrease to 565°C. These temperatures are to be recorded, in the Gas Turbine Log Book, each time that the Unit is operated. In the event that the temperatures fall below 600°C, it is essential that a Work Request be submitted to have the thermocouples checked.

Rolls-Royce has suggested that the above measures be taken as a means of detecting and monitoring combustion flame tube, discharge nozzle or burner distress to allow corrective action

to be taken.

POWER RESTORATION

If Unit #3 is operating in Generation mode, shutdown the Gas Turbine, open Breaker SSB-2, and close Breaker SSB-1 before restoring power. If Unit #3 is operating in Synchronous Condenser mode, ensure all auxiliaries are powered from Unit Service.

With the Station Board for Unit #1 powered from the Gas Turbine, the following sequence should allow for a rapid, orderly restoration of power.

1. Select screen - Bus UB-2 Control, close breaker UB2-12 if required. (This breaker should be closed already)

2. Selected screen - Bus UB-1 Control, close breaker UB1-1 if required. (This breaker should be closed already)

3. Select screen - Bus SB-12 Control, close and breaker SSB-3 and C-1 should close.

4. Select screen - Bus UB-1 Control, close breaker UB1-3 and A-1 should close.

5. Select screen - Bus UB-2 Control, close breaker UB2-2 and B-1 should close.

NOTE:

After this switching is complete an Operator has to go to Power Centres A, B, and C and manually reclose all feeder breakers with the exception of the Electric Fire Pump breaker. This feeder can be reclosed electrically from the Control Room.

The Operator should reset all undervoltage (type 27) relays as well.

NOTE:

This sequence of events allows for an orderlly restoration of 4160/600v power for Stage 1 units providing all equipment operates normally.

There are povisions for alternate power transfers in case of Breaker or Transformer failure. These should be covered off separately. Emergency Diesel shutdown and Diesel Fire Pump shutdown should also be covered off separately.

Speed in implementing this sequence is essential but not critical. Top priority must be to get the Gas Turbine running using whatever diesel is available. The UPS Battery Banks must be prevented from running down.

When a unit is available to be placed on-line serious consideration should be given to keeping Station Service supplied from the Gas Turbine until good system stability is achieved. The definition of system stability is a decision which the Plant would have to make in consultation with ECC.

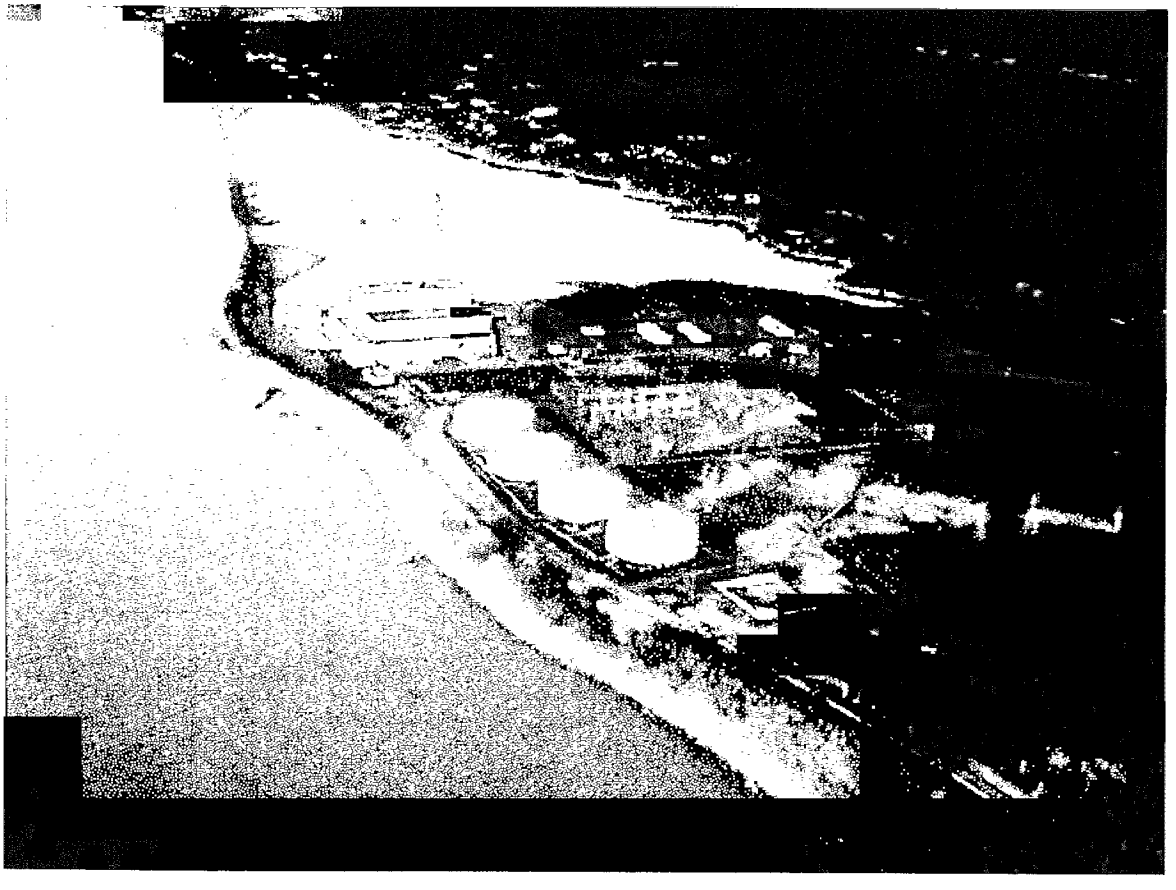
When Testing is complete: return to normal Station Service.

1. Verify SSB-1 open;
2. Request ECC to close B7L2;
3. Select screen SB-1/2 Control.
4. Enable abnormal operation.
5. Close. Breaker SSB-4.
6. Select screen SB-34 Control.
7. Enable normal operation.
8. Select (TB-12) and enable scopes.
9. Check for synchronism and push close. TB-12 should close and ST-34 should open.
10. Select screen SB-12 Contol.
11. Confirm abnormal operation is enabled.
12. Select (SSB-1) and enable scopes.
13. Check for synchronism and push close. SSB-1 should close and all other breakers should stay in the same state.
14. Select screen SB-34 Control.
15. Confirm normal operation is enabled.
16 Select (ST-34) and enable scope.
17. Push close, ST-34 should close and TB-12 should open.
18. Selct screen SB-12 Control.
19. Select (SSB-4).
20. Push open. SSB-4 should open and all other breakers should stay in the same state.
21. Enable normal operation.
22. Shut-off the Gas Turbine, Diesel Generator, and Diesel Fire Pumps.

Note: Breaker SSB-1 will not close if SSB-2 & ST-34 are closed.

HYDRO

Newfoundland & Labrador Hydro
Holyrood Thermal Generating Station



BLACK START ANNUAL TEST

2007

HYDRO

File No. 102.01.00/1

MEMO

TO: Terry LeDrew
Manager, Thermal Generation

FROM: Tom Jensen
Labour Manager Operations – Thermal

DATE: September 03, 2007

SUBJECT: **Annual Black Start Tests for 2007 - HTGS**

Annual Black Start Test for 2007 were performed as follows:

- Saturday, August 4, 2007- Total Black Start Test

Please refer to the attachments for details of each Test.

T. Jensen
Labour Manager Operations – Thermal

/ms

HYDRO

File #102.01.00/1

Holyrood Thermal Generating Station
Black Start Test (Total)

Saturday, August 4, 2007

'D' Shift Personnel

Ross Norris (Shift Supervisor)
Jim McNeill (LTPO)
Chad Blackmore (TPO)
Steve Scevior (TPO)

'Extra' Personnel -Operations
Dave Pollard (TPO)
Doug Gillard (TPO)
Scott Hudson (TPO)
Greg Burry (TPO)

Maintenance Personnel
Ron McDonald- Plant Electrician
Jim Gillingham-Plant Technician

The Procedure, POP-074 (Black Start Procedure), was used. This procedure had to be modified to reflect the new Foxboro DCS System for the Station System

Plant Status prior to the Black Start Test;

- **Unit #1**: Planned Outage 'P.O.'
- **Unit #2**: Available but not Operating 'ABNO'
- **Unit #3**: 'ABNO'

Events of Black Start Test

- E.C.C. was notified of Black Start Test several days in advance and just prior to Black Start testing.
- Contractors were not on site at the time of Black Start Testing
- Plant Personnel were notified.
- 0840 hrs the Black Start Test commenced when ECC opened 4KV Breakers 'B6L3' and 'B7L2' in the Plant Switchyard supplying Station Service.
- Breaker DBT was left in auto mode and checked for Auto Operation to close on a loss of power on Diesel Bus DB 34.
- Stage 1 and Stage 2 Emergency Diesel Generator started, in the 'Auto' mode and their respective breakers closed to a dead bus. Note: The new Stage 1 Diesel supplied power very shortly after the diesel had started. This is a notable improvement over the older retired Stage 1 Diesel.
- All 4160 KV Breakers were checked and opened as stated in POP-074 (Black Start Procedure)
- The Gas Turbine failed to start due to fuel system being air locked from fuel line replacement that had been completed the previous day. Power was restored to plant through 4KV Breakers 'B6L3' and 'B7L2' in the Plant Switchyard supplying Station Service.
- 0935 hrs the Gas Turbine was started after venting fuel oil lines and shutdown 0940 hrs.
- 0949 the Black Start Test commenced when ECC opened 4KV Breakers 'B6L3' and 'B7L2' in the Plant Switchyard supplying Station Service.
- All 4160KV Breakers were checked and opened as stated in POP-074 (Black Start Procedure).
- State 1 & 2 4KV Station Boards 'SAB12 and 'SB34' 'Tie-Bus' Breaker 'SSB4' was 'Closed' as per a one (1) Breaker operation but due to the present setup of Breakers, the 4KV Station Service Breaker 'SSB1' didn't 'Open' as normal.
- Stage 2 Unit Board 4KV 'Tie' Breaker 'TB3' was 'Opened'.
- Stage 2 4KV Station Board SB34 was powered when Tie-Bus Breaker 'TB12' was 'Closed' Note: 4KV Breaker SAT34 (Feeding Auxiliary Transformer SAT34) remains closed on a loss of power, therefore, as soon as TB12 was closed power was supplied to 600V Station Auxiliary Board SAB34.
- Stage 2 KV Station Board UB3 was powered when Tie-Bus Breaker TB3 2as closed. Note: 4KV Breaker UAT 3 (feeding Auxiliary Transformer UAT 3) remains closed on loss of power, therefore, as soon as TB3 was closed power was supplied to 600V Unit Auxiliary Board UAB3.

- Stage 1 4160KV Breakers SSB3, UBw-w and UB1-1 were closed, thereby supplying power to their respective 600V Boards (Power Center C, B and A respectively)
- All applicable MCC feeders breakers were closed.
- Plant Compressors were started along with the other necessary auxiliary equipment such as the Water Treatment Plant, General Service Cooling Water Pumps, etc.
- Started Unit 2 and 3 East and West 4KV forced Draft Fans to provide loading for the Gas Turbine. The Gas Turbine load reading at the time was 2.76MW.
- Note: After all necessary equipment was returned to service the plant was in a postion to return to regular power feed from the grid.

Restoring the Station Service from the Switchyard

- Breakers B6L3 and B7L2 were closed by ECC
- Synchronized the Gas Turbine with breaker SSB1
- With Normal Operation selected closed Breaker ST#$ and TB12 Opened
- Selected and opened SSB4. At this point the Station Service Board was returned to Normal.
- Stopped Stage 1 Diesel from the Control Room (Diesel runs through a Cool Down before actually shutting down)
- Closed Breaker C16 to energized Diesel Bus DB12
- Stopped Stage 2 Diesel
- Closed Breaker DB34 to energize Diesel Bus DB34
- Both Diesel placed back in Auto Mode
- Gas Turbine shutdown Breaker SSB2 opened at 1040 hrs.

Ron Tobin
Shift Supervior- Operations

/ms

HYDRO

HTGS Procedures

Procedure No : 0646	Entered By : Cheryl Oliver Date: Nov 27th, 2000 10:51 AM

Title	POP-074 Black Start Procedure

Archive Information

Issue Date :	08/15/95 Aug 15th, 1995
Distribution :	Labour Manager Operations - Thermal, Lead Thermal Plant Operator, Shift Supervisor, Thermal Plant Operator, Training Co -ordinator - Operations
Manual/Group:	Plant Operating Procedures, Plant Operations
Revision No :	16
Revision Date :	06/09/2008 June 9th, 2008
Prepared By :	Jerry Goulding
Controller :	Tom Jensen
Reviewers :	Ron Tobin, Gerard Cochrane
Approved By :	Terry LeDrew /HO/NLHydro

Procedure Scope

To return the Plant to Service from a Total Power Outage.

Reference Information

Procedure Details

NOTE: Confirm Status of the following Equipment prior to commencement of Black Start Testing. (1) Air Compressors and (2) Sample Cooling Pumps.

PLANT EMERGENCY DIESEL GENERATORS

On loss of Plant Service, Breaker DBT will try to close to transfer Station Service. If this transfer is unsuccessful, Breaker DBT will Open. Breakers C-16 and DB34 will also Open to allow 600V Essential Services Boards to be Powered by way of their respective Emergency Diesel Generators.

Stage I & II Emergency Diesel Generators should start automatically and when rated voltage is achieved, the associated Breakers C-19 and D2 should close automatically, allowing the Diesels to Re-Power their respective 600V Essential Service Boards. Two sources of start-up power are now available for the Gas Turbine. Either Diesel can be selected by the position of the

Change-Over Switch located in the Gas Turbine MCC Room.

Note: Extra information on Emergency Diesel Generators is located further on in the Procedure

PROCEDURE

It should also be noted that the Diesel Fire Pump will start and continue to run on loss of AC Power. This should be left in service until AC power becomes available for the Electric Fire Pump.

GAS TURBINE (*Impt. SSB1 & ST34*)

Before starting the Gas Turbine, Operations should: Ensure that Breakers SSB1 and ST34 are open prior to starting the Gas Turbine to prevent possible overloading if the Gas Turbine Breaker SSB2 is closed onto a Dead Bus.

1. Select 'Manual' Sync mode for the Gas Turbine on the Foxboro DCS system in the Plant Control Room. The synchronizer should also be turned 'OFF' in the Gas Turbine Control Room.

2. Ensure that the following 4160 V Breakers are Open (as shown on the Foxboro DCS screen) SSB-1, SSB-2, SSB-3, SSB-4, ST3/4, TB12, UT3, (See Note: #3 on the last page of the Procedure), UB2-1, UB1-2, UB2-2, UB1-3, TB-3.

3. Ensure that the following 600 volt Breakers are Open (as shown on the Foxboro DCS screen) A-9, C-15, C-16, B-2, ATB-3, ATB-12, DB-3/4.

The Gas Turbine can now be started. If the start is successful, the Generator will accelerate to and hold at a speed of 4600 R.P.M. The Operator will then have to raise the speed to 4800 R.P.M. by use of the Raise/Lower control switch. At a speed of 4800 R.P.M. and 60 Cycle Frequency the Operator can request Breaker SSB-2 to close 'Manually'.

The 'Manual' Sync Switch must be held selected as Breaker SSB-2 is requested to CLOSE. Approximately five (5) seconds after Breaker SSB-2 CLOSES, the Gas Turbine will switch from Station Service Power to its own Unit Service Power. The 4160V Station Board for Unit # 1 and 2 (Stage I) is now Re-Powered.

Please ensure that whenever the Gas Turbine is Operated, that the Time (Start / Synchronized / Shutdown), Load, and other Pertinent Items Normally checked are entered in the Gas Turbine Log Book.

GAS TURBINE EXHAUST CONE TEMPERATURES 'ECT'

Please be advised that whenever the Gas Turbine is in operation, Channels 17 & 18, on the Temperature Monitor located in the Gas Turbine Control Room, are monitored closely to ensure that the temperatures do not decrease to 565°C. These temperatures are to be recorded, in the Gas Turbine Log Book, each time that the Unit is operated. In the event that the temperatures fall below 600°C, it is essential that a Work Request be submitted to have the thermocouples checked.

Rolls-Royce has suggested that the above measures be taken as a means of detecting and monitoring combustion flame tube, discharge nozzle or burner distress to allow corrective action to be taken.

POWER RESTORATION

With the 4160V Station Board for Unit #1 and 2 (Stage I) Re-Powered from the Gas Turbine, the following sequence should allow for a rapid, orderly Restoration of Power:

1. Select screen SB-1/2 Control.
2. Select Normal/Abnormal Operation Control.
3. Select Abnormal - Two (2) Breaker Operation (two breaker operation is enabled).
4. Select screen SB-1/2 Control.
5. Select Breaker SSB-4. (See Note: #3 on the last page of the Procedure)
6. Push CLOSE. Breaker SSB-4 should CLOSE and all other breakers should stay in the same position.
7. Select screen SB-3/4 Control.
8. Select Normal/Abnormal Operation Control.
9. Select Abnormal - One (1) Breaker Operation (one breaker operation is enabled).
10. Select Breaker TB12.
11. Push Sync scope on.

12. Push CLOSE TB 12.

13. Select screen UB-3 Control.

14. Select Breaker TB-3.

15. Push CLOSE. TB-3 should CLOSE.

NOTE:

At this point both the 4160 V and 600 V Boards on Unit #3 will be Re-Powered. Unit #3 lighting MCC's and Air Compressors are now available.

16. Select screen - SB-12 Control.

17. Select Breaker SSB-3.

18. Push CLOSE. Breakers SSB-3 and C-1 should CLOSE.

19. Select screen - UB-2 Control.

20. Select Breaker UB2-12.

21. Push close if required. (This breaker should be closed already).

22. Select screen - UB-1 Control.

23. Select Breaker UB1-1.

24. Push CLOSE if required. (This Breaker should be closed already).

25. Select screen - UB-1 Control.

26. Select Breaker UB1-3.

27. Push CLOSE. Breakers UB1-3 and A-1 should CLOSE.

28. Select screen - UB-2 Control.

29. Select UB2-2.

30. Push CLOSE. Breakers UB2-2 and B-1 should CLOSE.

Notes:

After this switching is complete, an Operator has to go to Power

Centres A, B, and C and 'manually' Re-Close all Feeder Breakers with the exception of the Electric Fre Pump Breaker. This Feeder Breaker can be Re-Closed Electrically from the Control Room.

The Operator should Reset all Undervoltage (type 27) Relays as well.

Provided all equipment operates normally, this sequence of events allows for an Orderly Restoration of 4160/600V Power for All Three Units.

There are provisions for alternate power transfers in case of Breaker or Transformer failure. These should be covered off separately. Emergency Diesel Shutdown and Diesel Fire Pump shutdown should also be covered off separately.

Speed in implementing this sequence is essential but not critical. Top priority must be to get the Gas Turbine running using whatever Emergency Diesel Generator is available being aware of where the Gas Turbine Start-Up Supply is being fed from either Stage I or II. The UPS Battery Banks must be prevented from running down.

When a Unit is available to be placed on line serious consideration should be given to keeping Station Service supplied from the GasTurbine until Good System Stability is achieved. The definition of Good System Stability is a decision which the Plant would have to make in consultation with ECC.

Emergency Diesel Generators-Extra information relative to POP #074:

The Black Start Exercise has revealed that in the event of an extreme emergency one Emergency Diesel Generator can be used to Power Both Diesel Busses. This emergency would be defined as only one (1) Diesel Generator running and the GasTurbine beng unavailable for an extended period.

Also be aware that there are Local Control Push Buttons, with respective Operational Instructions, on each Diesel which will allow for the 'Manual' CLOSING of their respective Breakers.

In this situation, Battery Banks would be rapidly discharged and vital plant equipment such as Air Heater Drives, Turbine Lube Oil Pumps and Turning Gear Motors would be unavailable. To prevent this from happening the following Procedure Scenarios (A & B) could be used:

Scenario (A)

Stage I Emergency Diesel Generator has started automatically on Power Failure after an unsuccessful transfer on Breaker DBT, and has CLOSED-IN Breaker C-19 Re-Powering Stage I Diesel Bus. The gas turbine is not available. Stage II Diesel didn't start.

1. Stage II Diesel Generator D2 should be in manual, if not, manual should be selected.

2. Breaker DBT should be Open and in 'Manual'.

3. Breaker DB-34 and D2 should be OPEN, if not OPEN DB-34.and D2.

4. Close Breaker DBT from the **Foxboro** Station Service Console to Re-Power Stage II Diesel Bus.

5. Critical loads on Stage II Diesel Bus can now be re-started. Monitor kilowatt load on Stage I Diesel as this is being done. Keep kilowatt loading, to within Stage I Diesel Generator Capability, only start Loads that are Critical. **Note:** Diesel Generator Power Output not suffiecient to start the Air Compressors????

Scenario (B)

Stage II Emergency Diesel Generator has started automatically on Power Failure after an unsuccessful transfer on Breaker DBT, and has CLOSED-IN Breaker D-2 Re-Powering Stage II Diesel Bus. The Gas Turbine is unavailable and Stage I Diesel Generator did not start.

1. Stage I Diesel Generator D-1 should be in 'Manual' . If not, select 'Manual'.

2. Breaker DBT should be open and in 'Manual'. If not, OPEN DBT and put it in 'Manual'.

3. Breakers C-16 and C-19 should be OPEN. If not, OPEN C-16 and C-19.

4. Close Breaker DBT from the **Foxboro** Station Service Console to Re-Power Stage 1 Diesel Bus.

5. Critical loads on Stage I Diesel Bus can now be re-started. Monitor kilowatt load on the Stage II Diesel as this is being done. Keep kilowatt loading to within Stage II Diesel Capability and only start Loads that are Critical. **Note:** Diesel Generator Power Output not sufficient to start the Air Compressors.

After the Gas Turbine has been started and is online supplying Station Service Power, Restore Stage I & II Diesel Busses to their normal operating condition i.e. being supplied by way of Breakers C-16 and DB-34, respectively.

RESTORING STAGE 1 & ii 4160V STATION SERVICE FROM THE SWITCHYARD

After the Plant and ECC has decided that System Stability is acceptable, Restore Station Service from the Switchyard:

1. Confirm B6L3 & B7L2 are CLOSED.
2. Select screen SB-1/2 Control.
3. Select Normal/Abnormal Operation Control.
4. Select Abnormal-Two (2) Breaker Operation (two breaker operation is enabled).
5. Select Breaker SSB-1 and select sync scope on.
6. Check for synchronism, push CLOSE. SSB-1 should CLOSE and all other Breakers should stay in the same position.
7. Select screen SB-3/4 Control.
8. Select Normal/Abnormal Operation Control.
9. Select Normal-One Breaker Operation (one breaker operation is enabled).
10. Select Breaker ST-34 and select Sync scope on.
11. Check for Synchronism, push CLOSE. ST34 should CLOSE and TB12 should OPEN.
12. Select screen SB-1/2 Control.
13. Select Breaker SSB-4.
14. Push OPEN.
15. Select Normal/Abnormal Operation Control.
16. Select Normal-One Breaker Operation. (one breaker operation is enabled).
17. When the Shift Supervisor and ECC determine the system is stable:
    a. Shut down the diesels,
    b. Re-energize BOTH Diesel Bboards, and ensure that Both Diesels are returned to Auto Mode.
    c. Shut down the Gas Turbine.
18. The Operator should Reset all Undervoltage (type 27) Relays as well.

Notes:

1. Breaker SSB-1 will not close if breakers SSB-2 and ST34 are closed.

2. SSB-3 (Stage 1) does not open on undervoltage. The same for Stage 2 Aux Transformer Breakers (SAT- 34 and UAT-34).

3. If performing this test with Unit 3 synchronized, do not open UT-3 in step 2 of the gas turbine section and skip step 5 in the power restoration section. Ensure all auxiliaries are on unit service.

HYDRO

HTGS Procedures

Procedure No: 0864	Entered By: Mary Slaney Date: July 7th, 2003 11:49 AM

Title	POP-133 Partial Stage 1 Black Start Test Procedure

Archive Information

Issue Date:	07/07/2003 July 7th, 2003
Distribution:	Labour Manager Operations - Thermal, Lead Thermal Plant Operator, Shift Supervisor, Thermal Plant Operator, Training Co -ordinator - Operations
Manual/Group:	Plant Operating Procedures, Plant Operations
Revision No:	3
Revision Date:	06/09/2008 June 9th, 2008
Prepared By:	Bob Woodman
Controller:	Tom Jensen
Reviewers:	Ron Tobin, Gerard Cochrane
Approved By:	Terry LeDrew/HO/NLHydro

Procedure Scope

To return the Plant to Service from a Stage 1 Power Outage by use of a 'Black Start Procedure', for testing purposes.

Reference Information

POP-074

Procedure Details

NOTE: Confirm Status of the following Equipment prior to commencement of Black Start Testing. (1) Air Compressors and (2) Sample Cooling Pumps.

PLANT EMERGENCY DIESEL GENERATOR

Place DBT on manual so that it will not try to close automatically. Request ECC to open B7L2. Breaker C-16 will open to allow the essential services board to be powered by the respective diesel generator.

Stage I Diesel Generator #1 should start automatically and when rated voltage is achieved, breaker C-19 will close automatically, allowing the diesel to re-power the essential service board. Select Stage 1 diesel via the position of the changeover switch located in the Gas Turbine MCC Room.

PROCEDURE

It should also be noted that the Diesel Fire Pump will start and continue to run on loss of AC Power. This should be left in service until AC power becomes available for the electric fire pump.

GAS TURBINE

Before starting the Gas Turbine Operations should: Ensure that Breakers SSB1 and ST 34 are open prior to starting the Gas Turbine to prevent possible overloading if the Gas Turbine Breaker SSB2 is closed on a Dead Bus.

1. Select Manual Sync mode for the Gas Turbine on the Foxboro DCS system in the Plant Control Room. The Synchronizer should also be turned **"OFF"** in the Gas Turbine Control Room.

2. Ensure that the following 4160V breakers are open (as shown on the Foxboro DCS screen) SSB-1, SSB-2, SSB-3, SSB-4, TB-12, UB2-1, UB1-2, UB2-2, UB1-3.

3. Ensure that the following 600 volt breakers are open (as shown on the FoxboroDCS screen) A-1, A9, B1, B2, C1, C-15, & C-16.

The Gas Turbine can now be started. If the start is successful, the generator will accelerate to and hold at a speed of 4600 RPM. The Operator will then have to raise the speed to 4800 RPM by use of the Raise/Lower control switch. At a speed of 4800 RPM and 60 cycle frequency the Operator can request breaker SSB-2 to close manually.

The Manual Sync Switch must be held selected as breaker SSB-2 is requested to close. Approximately five (5) seconds after breaker SSB-2 closes, the Gas Turbine will switch from Station Service power to its own Unit Service. The Station Board for Unit #1 is now Re-Powered.

Please ensure that whenever the Gas Turbine is Operated, that the Time (Start / Synchronized / Shutdown), Load, and other Pertinent Items Normally checked are entered in the Gas Turbine Log Book .

GAS TURBINE EXHAUST CONE TEMPERATURES 'ECT'

Please be advised that whenever the Gas Turbine is in operation, Channels 17 & 18, on the Temperature Monitor located in the Gas Turbine Control Room, are monitored closely to ensure that the temperatures do not decrease to 565°C. These temperatures are to be recorded, in the Gas Turbine Log Book, each time that the Unit is operated. In the event that the temperatures fall below 600°C, it is essential that a Work Request be submitted to have the thermocouples checked.

Rolls-Royce has suggested that the above measures be taken as a means of detecting and monitoring combustion flame tube, discharge nozzle or burner distress to allow corrective action to be taken.

POWER RESTORATION

If Unit #3 is operating in Generation mode, shutdown the Gas Turbine, open Breaker SSB-2, and close Breaker SSB-1 before restoring power. If Unit #3 is operating in Synchronous Condenser mode, ensure all auxiliaries are powered from Unit Service.

With the Station Board for Unit #1 powered from the Gas Turbine, the following sequence should allow for a rapid, orderly restoration of power.

1. Select screen - Bus UB-2 Control, close breaker UB2-12 if required. (This breaker should be closed already)

2. Selected screen - Bus UB-1 Control, close breaker UB1-1 if required. (This breaker should be closed already)

3. Select screen - Bus SB-12 Control, close and breaker SSB-3 and C-1 should close.

4. Select screen - Bus UB-1 Control, close breaker UB1-3 and A-1 should close.

5. Select screen - Bus UB-2 Control, close breaker UB2-2 and B-1 should close.

NOTE:

After this switching is complete an Operator has to go to Power Centres A, B, and C and manually reclose all feeder breakers with the exception of the Electric Fire Pump breaker. This feeder can be reclosed electrically from the Plant Control Room.

The Operator should reset all undervoltage (type 27) relays as well.

NOTE:

This sequence of events allows for an orderlly restoration of 4160/600v power for Stage 1 units providing all equipment operates normally.

There are povisions for alternate power transfers in case of Breaker or Transformer failure. These should be covered off separately. Emergency Diesel shutdown and Diesel Fire Pump shutdown should also be covered off separately.

Speed in implementing this sequence is essential but not critical. Top priority must be to get the Gas Turbine running using whatever diesel is available. The UPS Battery Banks must be prevented from running down.

When a unit is available to be placed on-line serious consideration should be given to keeping Station Service supplied from the Gas Turbine until good system stability is achieved. The definition of system stability is a decision which the Plant would have to make in consultation with ECC.

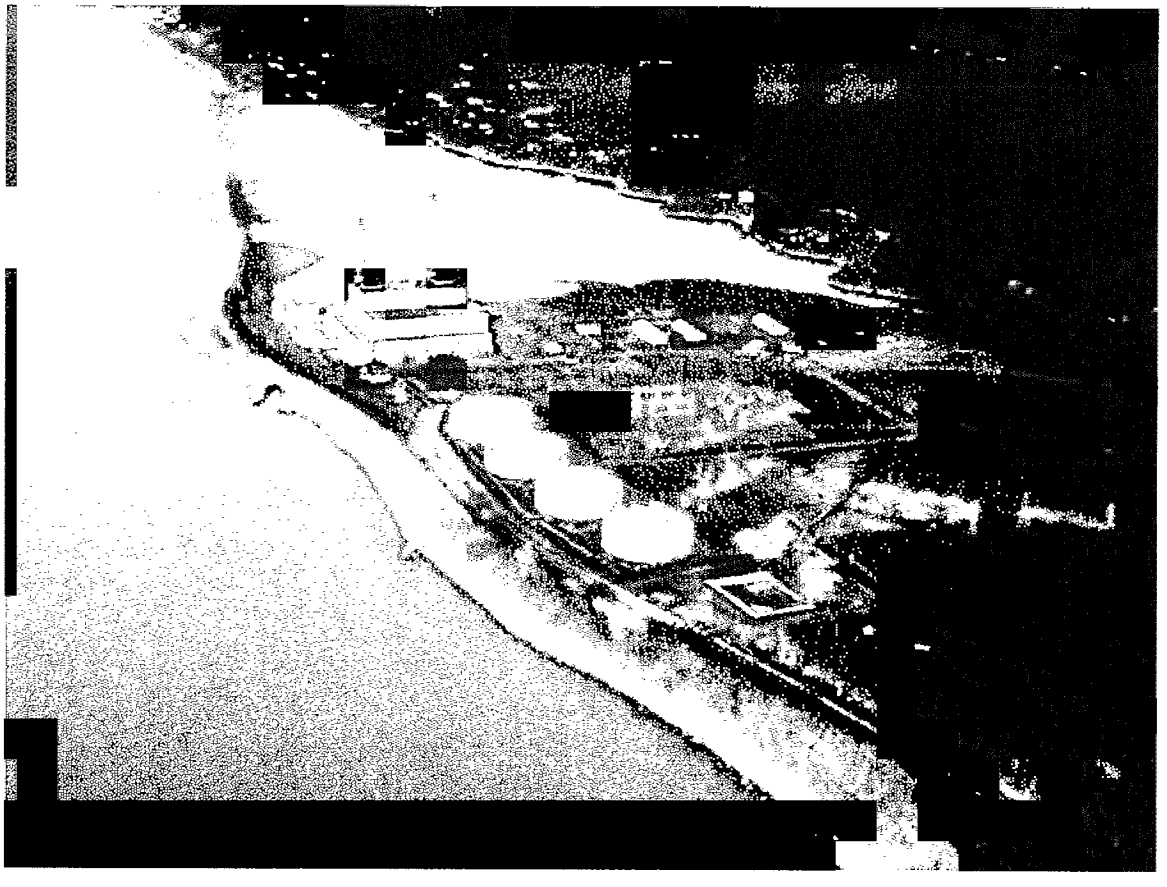
When Testing is complete: return to normal Station Service.

1. Verify SSB-1 open;
2. Request ECC to close B7L2;
3. Select screen SB-1/2 Control.
4. Enable abnormal operation.
5. Close. Breaker SSB-4.
6. Select screen SB-34 Control.
7. Enable normal operation.
8. Select (TB-12) and enable scopes.
9. Check for synchronism and push close. TB-12 should close and ST-34 should open.
10. Select screen SB-12 Contol.
11. Confirm abnormal operation is enabled.
12. Select (SSB-1) and enable scopes.
13. Check for synchronism and push close. SSB-1 should close and all other breakers should stay in the same state.
14. Select screen SB-34 Control.
15. Confirm normal operation is enabled.
16 Select (ST-34) and enable scope.
17. Push close, ST-34 should close and TB-12 should open.
18. Selct screen SB-12 Control.
19. Select (SSB-4).
20. Push open. SSB-4 should open and all other breakers should stay in the same state.
21. Enable normal operation.
22. Shut-off the Gas Turbine, Diesel Generator, and Diesel Fire Pumps. Ensure Diesel Generators and Fire Pump are placed in Auto.

Note: Breaker SSB-1 will not close if SSB-2 & ST-34 are closed.

HYDRO

Newfoundland & Labrador Hydro
Holyrood Thermal Generating Station



BLACK START ANNUAL TEST

2008

HYDRO

File #102.01.00/1

Tuesday, July 29, 2008

Black Start Testing - Total Black Start

'C' Shift Personnel Present:

Don Maloney – Shift Supervisor
Tom Compton –TPO
Tom Keats – TPO
Brian Cole – TPO

The procedure POP-074 Black Start Procedure was used

Plant status prior to the Black Start test:

- **Unit #1 PO Planned Outage**
- **Unit #2 PO Planned Outage**
- **Unit #3 FO Forced Outage**

Events of the Black Start Test:

- ✓ ECC were notified of Black Start Test several days in advance and just prior to Black Start testing.
- ✓ Contractors were at Lunch Break when procedure was being carried out.
- ✓ Plant personnel were notified.
- ✓ A Total Plant Outage was requested and commenced when ECC opened 4KV Breaker 'B7L2, which is located in the Plant Switchyard 'upstream' of Breaker 'SSB1' which is located in the Plant. ECC then opened 4KV Breaker 'B6L3 which is located in the Plant Switchyard 'upstream' of Breaker 'ST34" which is located in the Plant and thus both feeds into plant were shutdown at 1230 hours.
- ✓ Stage 1 and 2 Emergency Diesel Generator started, in the 'auto' mode and their respective breakers closed to a dead bus. **NOTE**: the new Stage 1 Diesel supplied power very shortly after the diesel had started. This a notable improvement of the older retired Stage 1 Diesel.

- ✓ All 4160 KV Breakers were checked and opened as stated in POP-074 Black Start Procedure.

- ✓ The Gas Turbine was started and Breaker 'SSB2' was closed to Stage 1 Station Service Board 'SB12' at 1245 hours.

- ✓ Stage 1 & 2 4KV Station Boards 'SAB12 & 'SB34' 'Tie-Bus' Breaker 'SSB4' was closed as per a one (1) Breaker operation but due to a present setup of Breakers, the 4 KV Station Service Breaker 'SSB1' didn't 'open' as normal.

- ✓ Stage 2 Unit Board 4KV 'Tie' Breaker 'TB3' was 'opened'.

- ✓ Stage 2 4KV Station Board SB34 was powered when 'Tie-Bus' Breaker 'TB12' was 'closed'. **NOTE:** 4KV Breaker SAT34 (feeding Auxiliary Transformer SAT34) remains 'closed' on a loss of power, therefore, as soon as TB12 was 'closed' power was supplied to 600V Station Auxiliary Board SAB34.

- ✓ Stage 2 4KV Station Board UB3 was powered when 'Tie-Bus' Breaker TB3 was 'closed'. **NOTE:** 4KV Breaker UAT 3 (feeding Auxiliary Transformer UAT3) remains 'closed' on a loss of power, therefore, as soon at TB3 was 'closed' power was supplied to 600V Unit Auxiliary Board UAB3.

- ✓ Stage 1 4160KV Breakers SSB3, UB2-2 and UB1-1 were 'closed' thereby, supplying power to their respective 600V Boards (Power Centre C, B and A respectively).

- ✓ All applicable MCC feeder Breakers were 'closed'.

- ✓ Plant Compressors were started alone with the other necessary auxiliary equipment such as the Water Treatment Plant, General Service Cooling Water Pumps, etc.

- ✓ Started Unit #3 East and West 4KV Forced Draft Fans to provide loading for the Gas Turbine. The Gas Turbine load reading at that time was 1.24MW's.

NOTE: After all necessary equipment was returned to service the plant was in a position to return to regular power feed from the grid.

Restoring the Station Service from the Switchyard

- ✓ Breakers B6L3 and B7L2 were closed by ECC.
  - Synchronized the Gas Turbine with Breaker SSB1
  - 1345 hours shutdown the Gas Turbine and then restored power to Stage 11though ST34 with one breaker operation and TB12 opened.
- ✓ Selected and opened SSB4. At this point the Station Service Board was returned to normal.
- ✓ Stopped Stage 1 Diesel from the Control Room (Diesel runs through a Cool Down before actually shutting down).
- ✓ Closed Breaker C 16 to energized Diesel Bus DB12.
- ✓ Stopped Stage 2 Diesel.
- ✓ Closed Breaker DB34 to energize Diesel Bus DB34.
- ✓ Both Diesels placed back into Auto Mode.

Ron Tobin
Shift Supervisor

/ms

Ron Tobin/HO/NLHydro
12/16/2008 02:20 AM

To Tom Jensen/HO/NLHydro@NLHydro, Gerard Cochrane/HO/NLHydro@NLHydro
cc
bcc
Subject BLACK START 2008

History: This message has been forwarded.

Tom,
Here is the report for Mary to do up into the folder same as last year. The required change is in red in procedure. I din't really get into the fact that this was discovered during the test!!!!!!!! Ok by you.

ron

Black Start 2008.doc
Please add comments on bottom of procedure that are in red .
---- Forwarded by Ron Tobin/HO/NLHydro on 12/16/2008 01:51 AM ----

HYDRO **HTGS Procedures**

Procedure No: 0646	Entered By: Cheryl Oliver Date: Nov 27th, 2000 10:51 AM

Title	**POP-074 Black Start Procedure**

Archive Information

Issue Date:	08/15/95 Aug 15th, 1995
Distribution:	Labour Manager Operations - Thermal, Lead Thermal Plant Operator, Shift Supervisor, Thermal Plant Operator, Training Co -ordinator - Operations
Manual/Group:	Plant Operating Procedures, Plant Operations
Revision No:	16
Revision Date:	06/09/2008 June 9th, 2008
Prepared By:	Jerry Goulding
Controller:	Tom Jensen
Reviewers:	Ron Tobin, Gerard Cochrane
Approved By:	Terry LeDrew /HO/NLHydro

Procedure Scope

To return the Plant to Service from a Total Power Outage.

Reference Information

Procedure Details

NOTE: Confirm Status of the following Equipment prior to commencement of Black Start Testing. (1) Air Compressors and (2) Sample Cooling

Pumps.

PLANT EMERGENCY DIESEL GENERATORS

On loss of Plant Service, Breaker DBT will try to close to transfer Station Service. If this transfer is unsuccessful, Breaker DBT will Open. Breakers C-16 and DB34 will also Open to allow 600V Essential Services Boards to be Powered by way of their respective Emergency Diesel Generators.

Stage I & II Emergency Diesel Generators should start automatically and when rated voltage is achieved, the associated Breakers C-19 and D2 should close automatically, allowing the Diesels to Re-Power their respective 600V Essential Service Boards. Two sources of start-up power are now available for the Gas Turbine. Either Diesel can be selected by the position of the Change-Over Switch located in the Gas Turbine MCC Room.

Note: Extra information on Emergency Diesel Generators is located further on in the Procedure

PROCEDURE

It should also be noted that the Diesel Fire Pump will start and continue to run on loss of AC Power. This should be left in service until AC power becomes available for the Electric Fire Pump.

GAS TURBINE (*Impt. SSB1 & ST34*)

Before starting the Gas Turbine, Operations should: Ensure that Breakers SSB1 and ST34 are open prior to starting the Gas Turbine to prevent possible overloading if the Gas Turbine Breaker SSB2 is closed onto a Dead Bus.

1. Select 'Manual' Sync mode for the Gas Turbine on the Foxboro DCS system in the Plant Control Room. The synchronizer should also be turned 'OFF' in the Gas Turbine Control Room.

2. Ensure that the following 4160 V Breakers are Open (as shown on the Foxboro DCS screen) SSB-1, SSB-2, SSB-3, SSB-4, ST3/4, TB12, UT3, (See Note: #3 on the last page of the Procedure), UB2-1, UB1-2, UB2-2, UB1-3, TB-3.

3. Ensure that the following 600 volt Breakers are Open (as shown on the Foxboro DCS screen) A-9, C-15, C-16, B-2, ATB-3, ATB-12, DB-3/4.

The Gas Turbine can now be started. If the start is successful, the Generator will accelerate to and hold at a speed of 4600 R.P.M. The Operator will then

have to raise the speed to 4800 R.P.M. by use of the Raise/Lower control switch. At a speed of 4800 R.P.M. and 60 Cycle Frequency the Operator can request Breaker SSB-2 to close 'Manually'.

The 'Manual' Sync Switch must be held selected as Breaker SSB-2 is requested to CLOSE. Approximately five (5) seconds after Breaker SSB-2 CLOSES, the Gas Turbine will switch from Station Service Power to its own Unit Service Power. The 4160V Station Board for Unit # 1 and 2 (Stage I) is now Re-Powered.

Please ensure that whenever the Gas Turbine is Operated, that the Time (Start / Synchronized / Shutdown), Load, and other Pertinent Items Normally checked are entered in the Gas Turbine Log Book.

GAS TURBINE EXHAUST CONE TEMPERATURES 'ECT'

Please be advised that whenever the Gas Turbine is in operation, Channels 17 & 18, on the Temperature Monitor located in the Gas Turbine Control Room, are monitored closely to ensure that the temperatures do not decrease to 565°C. These temperatures are to be recorded, in the Gas Turbine Log Book, each time that the Unit is operated. In the event that the temperatures fall below 600°C, it is essential that a Work Request be submitted to have the thermocouples checked.

Rolls-Royce has suggested that the above measures be taken as a means of detecting and monitoring combustion flame tube, discharge nozzle or burner distress to allow corrective action to be taken.

POWER RESTORATION

With the 4160V Station Board for Unit #1 and 2 (Stage I) Re-Powered from the Gas Turbine, the following sequence should allow for a rapid, orderly Restoration of Power:

1. Select screen SB-1/2 Control.

2. Select Normal/Abnormal Operation Control.

3. Select Abnormal - Two (2) Breaker Operation (two breaker operation is enabled).

4. Select screen SB-1/2 Control.

5. Select Breaker SSB-4. (See Note: #3 on the last page of the Procedure)

6. Push CLOSE. Breaker SSB-4 should CLOSE and all other breakers should stay in the same position.

7. Select screen SB-3/4 Control.

8. Select Normal/Abnormal Operation Control.

9. Select Abnormal - One (1) Breaker Operation (one breaker operation is enabled).

10. Select Breaker TB12.

11. Push Sync scope on.

12. Push CLOSE TB 12.

13. Select screen UB-3 Control.

14. Select Breaker TB-3.

15. Push CLOSE. TB-3 should CLOSE.

NOTE:

At this point both the 4160 V and 600 V Boards on Unit #3 will be Re-Powered. Unit #3 lighting MCC's and Air Compressors are now available.

16. Select screen - SB-12 Control.

17. Select Breaker SSB-3.

18. Push CLOSE. Breakers SSB-3 and C-1 should CLOSE.

19. Select screen - UB-2 Control.

20. Select Breaker UB2-12.

21. Push close if required. (This breaker should be closed already).

22. Select screen - UB-1 Control.

23. Select Breaker UB1-1.

24. Push CLOSE if required. (This Breaker should be closed already).

25. Select screen - UB-1 Control.

26. Select Breaker UB1-3.

27. Push CLOSE. Breakers UB1-3 and A-1 should CLOSE.

28. Select screen - UB-2 Control.

29. Select UB2-2.

30. Push CLOSE. Breakers UB2-2 and B-1 should CLOSE.

Notes:

After this switching is complete, an Operator has to go to Power Centres A, B, and C and 'manually' Re-Close all Feeder Breakers with the exception of the Electric Fre Pump Breaker. This Feeder Breaker can be Re-Closed Electrically from the Control Room.

The Operator should Reset all Undervoltage (type 27) Relays as well.

Provided all equipment operates normally, this sequence of events allows for an Orderly Restoration of 4160/600V Power for All Three Units.

There are provisions for alternate power transfers in case of Breaker or Transformer failure. These should be covered off separately. Emergency Diesel Shutdown and Diesel Fire Pump shutdown should also be covered off separately.

Speed in implementing this sequence is essential but not critical. Top priority must be to get the Gas Turbine running using whatever Emergency Diesel Generator is available being aware of where the Gas Turbine Start-Up Supply is being fed from either Stage I or II. The UPS Battery Banks must be prevented from running down.

When a Unit is available to be placed on line serious consideration should be given to keeping Station Service supplied from the GasTurbine until Good System Stability is achieved. The definition of Good System Stability is a decision which the Plant would have to make in consultation with ECC.

Emergency Diesel Generators-Extra information relative to POP #074:

The Black Start Exercise has revealed that in the event of an extreme emergency one Emergency Diesel Generator can be used to Power Both Diesel Busses. This emergency would be defined as only one (1) Diesel

Generator running and the GasTurbine beng unavailable for an extended period.

Also be aware that there are Local Control Push Buttons, with respective Operational Instructions, on each Diesel which will allow for the 'Manual' CLOSING of their respective Breakers.

In this situation, Battery Banks would be rapidly discharged and vital plant equipment such as Air Heater Drives, Turbine Lube Oil Pumps and Turning Gear Motors would be unavailable. To prevent this from happening the following Procedure Scenarios (A & B) could be used:

Scenario (A)

Stage I Emergency Diesel Generator has started automatically on Power Failure after an unsuccessful transfer on Breaker DBT, and has CLOSED-IN Breaker C-19 Re-Powering Stage I Diesel Bus. The gas turbine is not available. Stage II Diesel didn't start.

1. Stage II Diesel Generator D2 should be in manual, if not, manual should be selected.

2. Breaker DBT should be Open and in 'Manual'.

3. Breaker DB-34 and D2 should be OPEN, if not OPEN DB-34.and D2.

4. Close Breaker DBT from the **Foxboro** Station Service Console to Re-Power Stage II Diesel Bus.

5. Critical loads on Stage II Diesel Bus can now be re-started. Monitor kilowatt load on Stage I Diesel as this is being done. Keep kilowatt loading, to within Stage I Diesel Generator Capability, only start Loads that are Critical. **Note:** Diesel Generator Power Output not suffiecient to start the Air Compressors????

Scenario (B)

Stage II Emergency Diesel Generator has started automatically on Power Failure after an unsuccessful transfer on Breaker DBT, and has CLOSED-IN Breaker D-2 Re-Powering Stage II Diesel Bus. The Gas Turbine is unavailable and Stage I Diesel Generator did not start.

1. Stage I Diesel Generator D-1 should be in 'Manual' . If not, select 'Manual'.

2. Breaker DBT should be open and in 'Manual'. If not, OPEN DBT and

put it in 'Manual'.

3. Breakers C-16 and C-19 should be OPEN. If not, OPEN C-16 and C-19.

4. Close Breaker DBT from the **Foxboro** Station Service Console to Re-Power Stage 1 Diesel Bus.

5. Critical loads on Stage I Diesel Bus can now be re-started. Monitor kilowatt load on the Stage II Diesel as this is being done. Keep kilowatt loading to within Stage II Diesel Capability and only start Loads that are Critical. **Note:** Diesel Generator Power Output not sufficient to start the Air Compressors.

After the Gas Turbine has been started and is online supplying Station Service Power, Restore Stage I & II Diesel Busses to their normal operating condition i.e. being supplied by way of Breakers C-16 and DB-34, respectively.

RESTORING STAGE 1 & ii 4160V STATION SERVICE FROM THE SWITCHYARD

After the Plant and ECC has decided that System Stability is acceptable, Restore Station Service from the Switchyard:

1. Confirm B6L3 & B7L2 are CLOSED.
2. Select screen SB-1/2 Control.
3. Select Normal/Abnormal Operation Control.
4. Select Abnormal-Two (2) Breaker Operation (two breaker operation is enabled).
5. Select Breaker SSB-1 and select sync scope on.
6. Check for synchronism, push CLOSE. SSB-1 should CLOSE and all other Breakers should stay in the same position.

The Gas Turbine must now be shut down as St-34 cannot be closed if SSB-1 and SSB-2 are closed.

7. Select screen SB-3/4 Control.
8. Select Normal/Abnormal Operation Control.
9. Select Normal-One Breaker Operation (one breaker operation is enabled).
10. Select Breaker ST-34 and select Sync scope on.
11. Check for Synchronism, push CLOSE. ST34 should CLOSE and TB12 should OPEN.
12. Select screen SB-1/2 Control.
13. Select Breaker SSB-4.
14. Push OPEN.

15. Select Normal/Abnormal Operation Control.
16. Select Normal-One Breaker Operation. (one breaker operation is enabled).
17. When the Shift Supervisor and ECC determine the system is stable:
    a. Shut down the diesels,
    b. Re-energize BOTH Diesel Bboards, and ensure that Both Diesels are returned to Auto Mode.
    c. Shut down the Gas Turbine.
18. The Operator should Reset all Undervoltage (type 27) Relays as well.

Notes:

1. Breaker SSB-1 will not close if breakers SSB-2 and ST34 are closed.

2. SSB-3 (Stage 1) does not open on undervoltage. The same for Stage 2 Aux Transformer Breakers (SAT- 34 and UAT-34).

3. If performing this test with Unit 3 synchronized, do not open UT-3 in step 2 of the gas turbine section and skip step 5 in the power restoration section. Ensure all auxiliaries are on unit service.

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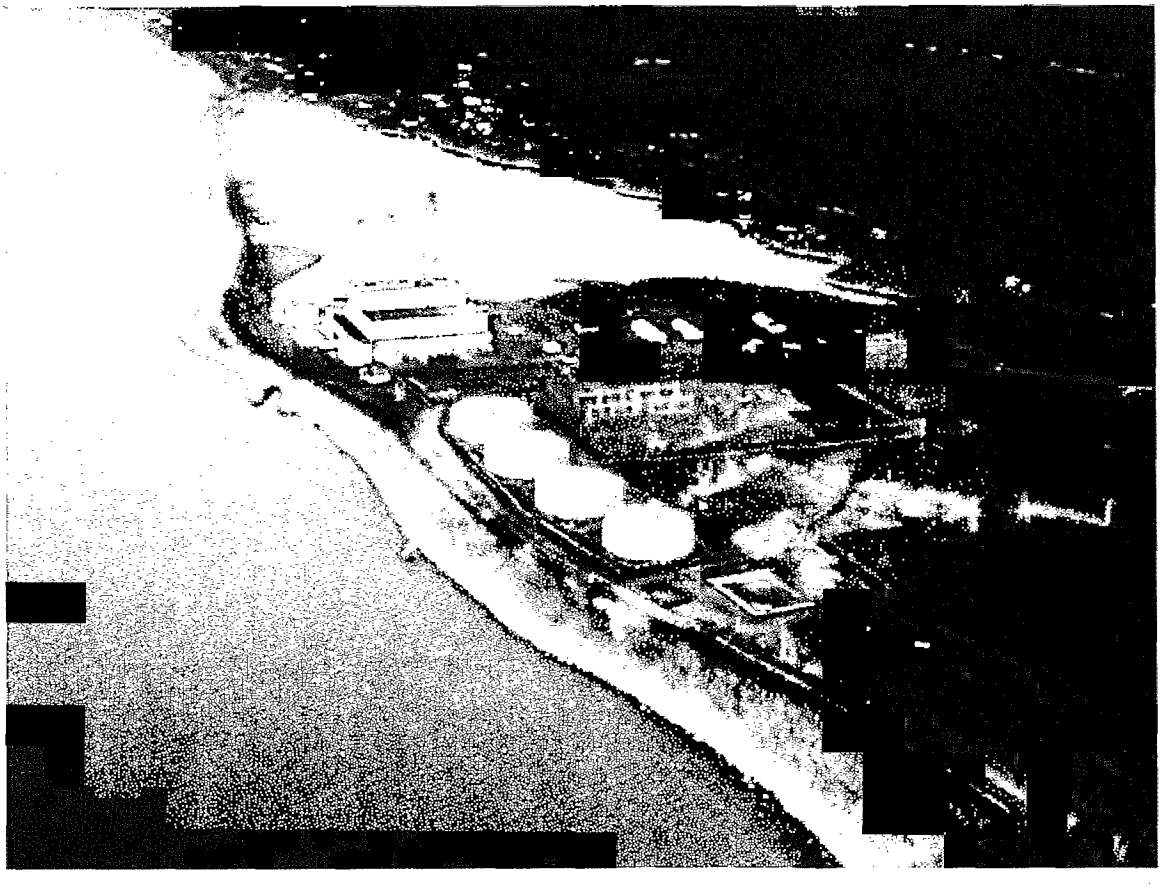
Newfoundland & Labrador Hydro
Holyrood Thermal Generating Station



BLACK START ANNUAL TEST

2009

newfoundland labrador hydro
a nalcor energy company

File No. 102.01.00/1

MEMO

TO: Terry LeDrew
Manager, Thermal Generation

FROM: Gerard Cochrane
Labour Manager Operations – Thermal

DATE: July 14, 2009

SUBJECT: **Annual Black Start Tests (Partial) for 2009 - HTGS**

Annual Black Start Test (Partial) for 2009 were performed as follows:

- Tuesday, July 14, 2009

Please refer to the attachments for details of each Test.

Gerard Cochrane
Labour Manager Operations – Thermal

/ms

newfoundland labrador hydro
a nalcor energy company

File #102.01.00/1

Holyrood Thermal Generating Station
Black Start Test (Partial)

Tuesday, July 14, 2009

'C' Shift Personnel

Don Maloney (Shift Supervisor)
Steve Sceviour (LTPO)
Scott Hudson (TPO)
Keith Emberly (TPO)
Gerard Molloy (Temp. LTPO)
Greg Burry (TPO)
Tom Compton (Issuing Authority)
Evan Cabot (Operation Specialist-Acting)

Maintenance Personnel
Ron McDonald – Plant Electrician
Bob Hobbs – Plant Electrician

The Procedure, POP-133 (Partial Stage 1 Black Start Procedure), was used.

Plant Status prior to the Black Start Test;

- **Unit No.1**: PO Planned Outage
- **Unit No.2**: ABNO
- **Unit No.3**: ABNO – Synchronous Condenser Mode.

Events of Black Start Test

- E.C.C. was notified of Black Start Test
- Contractors were not on site at the time of Black Start Testing
- Plant Personnel were notified.
- #3 Compressors were placed in lead which is power from Stage II.

- The Partial Black Start test commenced when ECC opened 4kv Breaker 'B7L2', which is located in the Plant Switchyard 'upstream' of Breaker 'SSB1' which is located in the Plant during a Black Test.

- Stage I Emergency Diesel Generator started in the 'Auto' mode and its respective Breaker C-19 closed to a dead bus re-powering the Essential Service Board.

- All 4150/600v Breakers were checked and opened as stated in POP-133 (Partial Black Start procedure).

- The Gas Turbine was started and Breaker 'SSB2' was closed to Stage I Station Service Board 'SB12' at 18:18 hrs.

- Started Unit 2 East and West 4kv Forced Draft Fans to provide loading for the Gas Turbine. The Gas Turbine loading at that time was 0.85MW's.

- Stage I 4160kv Breakers UB1-3, Ub2-2 and SSB3 were closed there by supplying power to their respective 600v Boards (Power Centers A, B and C).

- All Applicable MCC feeders' Breakers were closed.

- All under voltage (type 270 relays was reset).

NOTE: After all necessary equipment was returned to service the Plant was in a position to return to regular power supply from the grid.

Restoring the Station Service from the Switchyard 1904 hours

- Ron McDonald placed a jumper on ST34 to allow Stage I Breaker SSB1 to be synchronized to the system with Breakers SSB2 and ST34 already in the closed position.

- Breakers B7L2 were closed by ECC at 1904 hours.

- SSB1 was synchronized to Stage 1 Station Board at 1909 hours.

- Shut down Stage 1 Diesel from the Control Room and closed Breaker C-16 to energized Diesel Bus DB-12.

- Placed Breaker DBT back in Auto Mode.

- Placed Stage 1 Diesel back in Auto Mode.

- Shutdown Unit #2 West and East F.D. Fans.

- Shutdown Gas Turbine at 19:15 hours.

All equipment was placed in normal operation. Diesel fire shutdown, Unit #2 DC Oil Pump shutdown. Compressors sequence placed back in normal operation and Jumper removed from ST 34 by Ron McDonald.

NOTE: Breakers C3 and C11 was very difficult to reclose, mechanical trips sticking, also 600 volt Breaker B5 has a loose handle.

Evan Cabot
Operation Specialist

/ms

File No. 102.01.00/1

HTGS Procedures

Procedure No: 0864	Entered By: Mary Slaney Date: July 7th, 2003 11:49 AM

Title	POP-133 Partial Stage 1 Black Start Test Procedure

Archive Information

Issue Date:	07/07/2003 July 7th, 2003
Distribution:	Labour Manager Operations - Thermal, Lead Thermal Plant Operator, Shift Supervisor, Thermal Plant Operator, Training Co -ordinator - Operations
Manual/Group:	Plant Operating Procedures, Plant Operations
Revision No:	3
Revision Date:	06/09/2008 June 9th, 2008
Prepared By:	Bob Woodman
Controller:	Gerard Cochrane
Reviewers:	Ron Tobin, Gerard Cochrane
Approved By:	Terry LeDrew /HO/NLHydro

Procedure Scope

To return the Plant to Service from a Stage 1 Power Outage by use of a 'Black Start Procedure', for testing purposes.

Reference Information

POP-074

Procedure Details

NOTE: Confirm Status of the following Equipment prior to commencement of Black Start Testing. (1) Air Compressors and (2) Sample Cooling Pumps.

PLANT EMERGENCY DIESEL GENERATOR

Place DBT on manual so that it will not try to close automatically. Request ECC to open B7L2. Breaker C-16 will open to allow the essential services board to be powered by the respective diesel generator.

Stage I Diesel Generator #1 should start automatically and when rated voltage is achieved, breaker C-19 will close automatically, allowing the diesel to re-power the essential service board. Select Stage 1 diesel via the position of the changeover switch located in the Gas Turbine MCC Room.

PROCEDURE

It should also be noted that the Diesel Fire Pump will start and continue to run on loss of AC Power. This should be left in service until AC power becomes available for the electric fire pump.

GAS TURBINE

Before starting the Gas Turbine Operations should: Ensure that Breakers SSB1 and ST 34 are open prior to starting the Gas Turbine to prevent possible overloading if the Gas Turbine Breaker SSB2 is closed on a Dead Bus.

1. Select Manual Sync mode for the Gas Turbine on the Foxboro DCS system in the Plant Control Room. The Synchronizer should also be turned **"OFF"** in the Gas Turbine Control Room.

2. Ensure that the following 4160V breakers are open (as shown on the Foxboro DCS screen) SSB-1, SSB-2, SSB-3, SSB-4, TB-12, UB2-1, UB1-2, UB2-2, UB1-3.

3. Ensure that the following 600 volt breakers are open (as shown on the FoxboroDCS screen) A-1, A9, B1, B2, C1, C-15, & C-16.

The Gas Turbine can now be started. If the start is successful, the generator will accelerate to and hold at a speed of 4600 RPM. The Operator will then have to raise the speed to 4800 RPM by use of the Raise/Lower control switch. At a speed of 4800 RPM and 60 cycle frequency the Operator can request breaker SSB-2 to close manually.

The Manual Sync Switch must be held selected as breaker SSB-2 is requested to close. Approximately five (5) seconds after breaker SSB-2 closes, the Gas Turbine will switch from Station Service power to its own Unit Service. The Station Board for Unit #1 is now Re-Powered.

Please ensure that whenever the Gas Turbine is Operated, that the Time (Start / Synchronized / Shutdown), Load, and other Pertinent Items Normally checked are entered in the Gas Turbine Log Book .

GAS TURBINE EXHAUST CONE TEMPERATURES 'ECT'

Please be advised that whenever the Gas Turbine is in operation, Channels 17 & 18, on the Temperature Monitor located in the Gas Turbine Control Room, are monitored closely to ensure that the temperatures do not decrease to 565°C. These temperatures are to be recorded, in the Gas Turbine Log Book, each time that the Unit is operated. In the event that the temperatures fall below 600°C, it is essential that a Work Request be submitted to have the thermocouples checked.

Rolls-Royce has suggested that the above measures be taken as a means of detecting and monitoring combustion flame tube, discharge nozzle or burner distress to allow corrective action to be taken.

POWER RESTORATION

If Unit #3 is operating in Generation mode, shutdown the Gas Turbine, open Breaker SSB-2, and close Breaker SSB-1 before restoring power. If Unit #3 is operating in Synchronous Condenser mode, ensure all auxiliaries are powered from Unit Service.

With the Station Board for Unit #1 powered from the Gas Turbine, the following sequence should allow for a rapid, orderly restoration of power.

1. Select screen - Bus UB-2 Control, close breaker UB2-12 if required. (This breaker should be closed already)

2. Selected screen - Bus UB-1 Control, close breaker UB1-1 if required. (This breaker should be closed already)

3. Select screen - Bus SB-12 Control, close and breaker SSB-3 and C-1 should close.

4. Select screen - Bus UB-1 Control, close breaker UB1-3 and A-1 should close.

5. Select screen - Bus UB-2 Control, close breaker UB2-2 and B-1 should close.

NOTE:

After this switching is complete an Operator has to go to Power Centres A, B, and C and manually reclose all feeder breakers with the exception of the Electric Fire Pump breaker. This feeder can be reclosed electrically from the Plant Control Room.

The Operator should reset all undervoltage (type 27) relays as well.

NOTE:

This sequence of events allows for an orderlly restoration of 4160/600v power for Stage 1 units providing all equipment operates normally.

There are povisions for alternate power transfers in case of Breaker or Transformer failure. These should be covered off separately. Emergency Diesel shutdown and Diesel Fire Pump shutdown should also be covered off separately.

Speed in implementing this sequence is essential but not critical. Top priority must be to get the Gas Turbine running using whatever diesel is available. The UPS Battery Banks must be prevented from running down.

When a unit is available to be placed on-line serious consideration should be given to keeping Station Service supplied from the Gas Turbine until good system stability is achieved. The definition of system stability is a decision which the Plant would have to make in consultation with ECC.

When Testing is complete: return to normal Station Service.

1. Verify SSB-1 open;
2. Request ECC to close B7L2;
3. Select screen SB-1/2 Control.
4. Enable abnormal operation.
5. Close. Breaker SSB-4.
6. Select screen SB-34 Control.
7. Enable normal operation.
8. Select (TB-12) and enable scopes.
9. Check for synchronism and push close. TB-12 should close and ST-34 should open.
10. Select screen SB-12 Contol.
11. Confirm abnormal operation is enabled.
12. Select (SSB-1) and enable scopes.
13. Check for synchronism and push close. SSB-1 should close and all other breakers should stay in the same state.
14. Select screen SB-34 Control.
15. Confirm normal operation is enabled.
16 Select (ST-34) and enable scope.
17. Push close, ST-34 should close and TB-12 should open.
18. Selct screen SB-12 Control.
19. Select (SSB-4).
20. Push open. SSB-4 should open and all other breakers should stay in the same state.
21. Enable normal operation.
22. Shut-off the Gas Turbine, Diesel Generator, and Diesel Fire Pumps. Ensure Diesel Generators and Fire Pump are placed in Auto.

Note: Breaker SSB-1 will not close if SSB-2 & ST-34 are closed.