Q. Please provide a current copy of all preventative maintenance activities for both hydraulic and thermal production assets in summary form, identifying each by title.

A. For Hydraulic Generation preventive maintenance activities, specific check sheets have been developed for each asset classification and are divided by Operations, Mechanical, Electrical, and Protection & Control. On each check sheet there are specific checks and duties that have to be completed. Please refer to PUB-NLH-010, Attachment 1 for the activities that are planned and executed on the hydraulic turbine assets as part of the time-based preventive maintenance program, including PM6 (annual), PM9 (six year), and annual pre-winter Inspections. Please refer to PUB-NLH-009 which details additional operational checks completed on the hydraulic production assets.

Please refer to PUB-NLH-009, Attachment 2 for the preventive maintenance activities planned and scheduled for execution on Holyrood thermal assets. Thermal Generation activities with a frequency indicator of one year or less are completed annually, while those with a frequency indicator greater than one year are scheduled for completion when required. This includes online, shutdown, and total plant outage preventive maintenance activities.

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 3 Rev. No.: 2 Rev. Date: 14-05-22 Index No.: 2440 Binder No.: 67

PM Checksheet No.: PM6/PM8/PM9 – 59527 - OBDE
Item No. & Description: 59527 - Turbine/Generator Unit No. 5 – BDE – Pre-shutdown
Type of Inspection: PM6/PM8/PM9
Department: Operations — Asset Approval: Bob Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature and Date:
Reference Drawing and Manuals:

ACTIVITIES (Initial Box Upon Completion)	REMARKS

PRE-SHUTDOWN REQUIREMENTS

Prior to shutting down a Turbine/Generator Unit for an annual, minor or major outage, the following activities shall take place. Those activities shall take place sufficiently in advance of outage to permit activities to be properly planned and scheduled for outage.

1. A set of turbine/generator unit vibration readings shall be taken at SNL, field on, field off and at 10 MW increments up to full load. These readings shall be evaluated immediately by the plant mechanical engineer to determine if there is a requirement for bearing or runner seal clearances or any other action required as a result of the test results. ( )

2. A unit deceleration curve shall be done by Control Room Operators using established procedures. The results shall be evaluated by the Plant Mechanical Engineer to determine if wicket gate vertical and horizontal clearances are required or other actions required as a result of test results. ( )

3. Plant Operators shall do an evaluation of all unit cooling water flows, unit temperatures and oil level indications and report any abnormalities sufficiently in advance of outage to allow for proper planning and scheduling of corrective work. Devices inspected shall include thrust/guide bearing alarm/trip temp. meters, turbine guide bearing alarm/trip temp meters, generator and turbine bearing oil level indication systems. Abnormalities shall be reported as work orders in advance of outage so corrective work can be planned and scheduled. ( )

PM Checksheet No.: 59527-Turbine/Generator Unit #5 – BDE Pre-shutdown Type of Inspection: PM6/PM8/PM9 Department: Operations	Sheet: 2 of 3 Rev. No.: 2 Rev. Date: 14-05-22 Index No.: 2440 Binder No.: 67
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**

4. Plant operators shall also conduct a thorough visual inspection ( ) of turbine pit area for abnormal shaft seal leakage, excessive turbine pit water due to plugged drains, evidence of oil leakage from generator or turbine bearing, faulty instrumentation, cooling water, defects, and auto greasing issues.

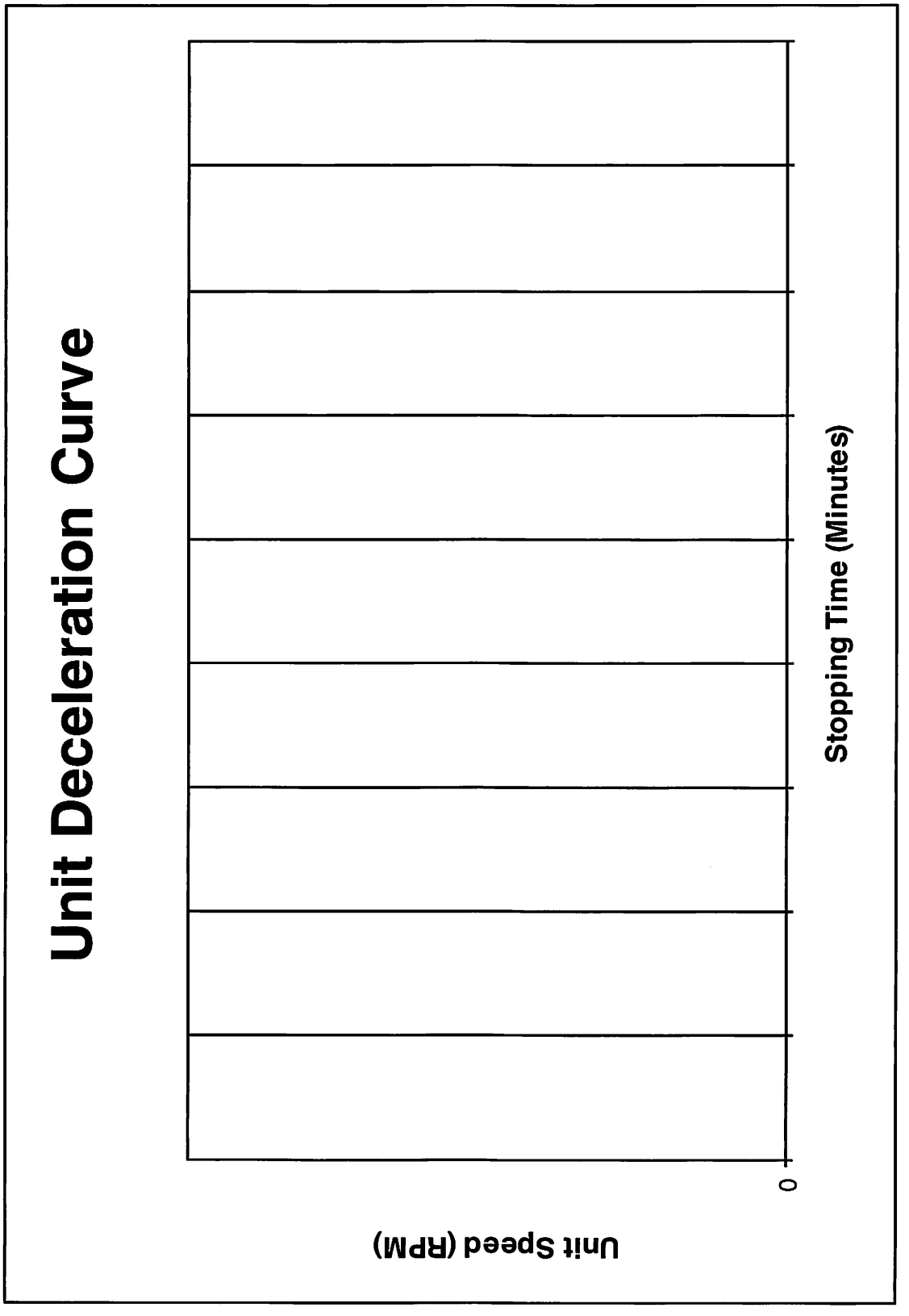
   NOTE:

   All documents to be included with annual inspection report :

   a) Vibration Readings
   b) Deceleration Curve
   c) Operations Evaluation of Unit Instrumentation Report

5. Record the following exciter values:

Parameter	Local ECT	Control Room ECT
Generator Volts		
Generator Amps		
Generator MW		
Generator MVARS		
Exciter Volts DC		
Exciter Amps DC		


Unit Deceleration Curve
Unit Speed (RPM)
0
Stopping Time (Minutes)

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 4 Rev. No.: 1 Rev. Date: 16-02-02 Index No.: 2450 Binder No.: 67

PM Checksheet No.: PM6/PM8/PM9-59527-BDE
Item No. & Description: 59527- BDE Turbine/Generator Unit No. 5 - Pre-Start-Up Inspection
Type of Inspection: PM6 (Annual)
Department: BDE Ops/Mech/Elect — Asset Approval: B. Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature and Date:
Reference Drawing and Manuals:

ACTIVITIES (Initial Box Upon Completion)	REMARKS

SCOPE:
This Inspection is required after all annual minor or major PM Outages or after any major work or inspection on turbine/generator equipment. Check only what is applicable to the inspection.

OBJECTIVE:
The objective of the inspection is to ensure that a thorough visual inspection is completed prior to placing unit back in service, to ensure any loose or forging material is removed, to ensure that areas of the machine worked on are free of hazards or debris that may cause damage during operation.

STANDARD:
Responsibility for ensuring that the start-up inspection is completed is the responsibility of the Operations Supervisor for the particular unit.

The inspection shall be completed by the Operations, Mechanical and Electrical Supervisor prior to unit start up. If no Supervisor is present, the Lead Hand in the particular discipline is responsible for this inspection. The Operations Supervisor responsible for start up can also request the service of plant engineering and in scope employees.

Prior to doing this inspection, all objects such as coins, keys wallets, pagers, pens, etc. must be removed from your pockets and boots should also be checked for foreign objects.

The unit will not be placed in operation until the inspection results have been reviewed and accepted by the supervisor responsible for the start up.

The attached inspections will be used as a guide for this inspection.

PRIOR TO INSTALLATION OF SHROUDS	CHECKED BY
1. Ensure no loose bolts or any foreign material is in the unit that may be covered once the shrouds are in place.	_____
2. Ensure no foreign material or tools is left anywhere around top of stator frame area.	_____
3. Ensure all pole key retainers are securely in place.	_____

PM Checksheet No.: BDE Turbine/Generator # 5 Pre-Start-Up Inspection Type of Inspection: PM6 (Annual) Department: BDE Ops/Mech/Elect	Sheet: 2 of 4 Rev. No.: 1 Rev. Date: 16-02-02 Index No.: 2450 Binder No.: 67
ACTIVITIES (Initial Box Upon Completion)	REMARKS

PRIOR TO INSTALLATION OF SHROUDS (Cont'd)	CHECKED BY
4. Ensure top of poles are free from foreign objects.	
5. Visually inspect v-bolts between poles for nay foreign objects or abnormalities.	
6. Check the back area of the poles where material can be conveniently placed.	
7. Thoroughly inspect top end windings.	
8. Thoroughly inspect bottom end windings.	
9. Check the air gap between the riser and stator, for any sign of abnormalities.	
PRIOR TO UNIT START-UP	
Inspect the following areas:	
1. Brush gear assembly.	
2. Upper bracket.	
3. Main bracket.	
4. Top covers of thrust/guide bearing assembly.	
5. Top of upper shrouds.	
6. Top of stator.	
7. Check the security of the shroud locking plates, angle iron supports and bolts.	
8. Between upper shrouds and rotor.	
9. Stub shaft bolts.	
10. Security of sprinkler system piping.	
11. Rotor ventilation slots.	
12. Rotor spider for tools, welding slag, etc. Note: Do not move/remove any weights that may be present.	

PM Checksheet No.: BDE Turbine/Generator # 5 Pre-Start-Up Inspection Type of Inspection: PM6 (Annual) Department: BDE Ops/Mech/Elect	Sheet: 3 of 4 Rev. No.: 1 Rev. Date: 16-02-02 Index No.: 2450 Binder No.: 67
ACTIVITIES (Initial Box Upon Completion)	REMARKS

PRIOR TO UNIT START-UP (Cont'd)	CHECKED BY
13. Between rotor and lower shrouds.	_____
14. Security of lower shrouds.	_____
15. Check drain cocks, valve positions, piping connections, etc.	_____
16. Check all bearing oil levels, governor sump levels and accumulator tank oil levels.	_____
17. Check for foreign matter between wicket gates.	_____
18. Check spiral case area for cleanliness.	_____
19. Check draft tube scaffold removal, door closed and bolted.	_____
20. Check spiral case door closed and bolted.	_____
21. Ensure rotor has been jacked.	_____
22. Check position of creep detector and grounding brush.	_____
23. Check duplex panels in Control Room for reminder notes.	_____
24. Check to ensure links, valves, etc. that were worked on have been returned to normal position.	_____
25. Thoroughly inspect turbine pit area.	_____
26. Thoroughly inspect spherical valve pit area.	_____
27. Thoroughly inspect duplex and TG panels.	_____
28. List all deficiencies that must be corrected prior to running of unit.	_____
29. Check surface air coolers i.e.: positions of valves, air relief valves, plugs, etc.	_____
30. Check valve on H.P. lift pump to ensure it is open.	_____
31. Check positions of all valves in brake circuit to ensure all is in correct position.	_____

PM Checksheet No.: BDE Turbine/Generator # 5 Pre-Start-Up Inspection Type of Inspection: PM6/PM8/PM9 Department: BDE Ops/Mech/Elect	Sheet: 4 of 4 Rev. No.: 1 Rev. Date: 16-02-02 Index No.: 2450 Binder No.: 67
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**

PRIOR TO UNIT START-UP (Cont'd) **CHECKED BY**

32. Verify oil level in turbine bearing and generator guide bearing. _____

33. Check to ensure all penstock hatches are closed. _____

34. Check to ensure all temporary grounds are removed. _____

35. Check to ensure all external work is completed. _____

HOUSEKEEPING

1. Conduct inspection on generator floor and turbine floor. _____

2. Remove tools, equipment, excess materials and place in appropriate location. _____

3. Prior to surrendering the Work Protection, discuss with work crew any deficiencies or outstanding items to ensure they are identified. _____

DESCRIPITON	RESPONSIBILITY	DATE/TIME
Sign Off Signatures		
Electrical Supervisor/Designate	_____	_____
Mechanical Supervisor/Designate	_____	_____
Operations Supervisor/Designate	_____	_____

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 2 Rev. No.: 1 Rev. Date: 13-10-07 Index No.: 2445 Binder No.: 67

PM Checksheet No.: PM6/PM8/PM9 – 59527 - ENGBDE
Item No. & Description: 59527 - Turbine/Generator Unit No. 5 - Visual Inspection
Type of Inspection: PM6/PM8/PM9
Department: Engineering — Asset Approval: Bob Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature and Date:
Reference Drawing and Manuals:

VISUAL INSPECTION PRIOR TO START OF PHYSICAL WORK.

Prior to start of physical maintenance work on turbine/generator unit, a comprehensive visual inspection will be conducted by a team of employees consisting of engineers, tradesperson, and frontline supervisors. These inspections shall be conducted as soon a s unit is shutdown and prior to any cleaning activity. All items inspected shall require a remark of some nature. Any abnormalities found will be reported and prioritized using JDE work order system.

NOTE: Rotor is not removed for this inspection.

ACTIVITIES (Initial Box Upon Completion)		REMARKS
1. STATOR COILS		
a) Check coils for end distortion, cracked insulation or any other mechanical damage.	( )	
b) Check for signs of corona discharge.	( )	
c) Check for dirt, contamination and identify all areas requiring cleaning.	( )	
d) Check for signs of coil movement.	( )	
e) Check stator frame sole plates for signs of movement.	( )	
f) Check lashings and ties for looseness, movement or or deterioration.	( )	
g) Check slot packing for tightness, signs of migration of slot fillers.	( )	
h) Check punchings at fingers for looseness or fretting corrosion.	( )	
i) Check generator neutral lead insulation.	( )	

PM Checksheet No.: 59527-Turbine/Generator Unit No. 5 Visual Insp. Type of Inspection: PM6/PM8/PM9 Department: Engineering	Sheet: 2 of 2 Rev. No.: 1 Rev. Date: 13-10-07 Index No.: 2445 Binder No.: 67
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
2. GENERATOR SLIP RING ASSEMBLY	
a) Check slip rings for pitting, discoloration or scouring. ( )	
b) Check condition of slip ring insulation. ( )	
c) Check all mounting hardware for tightness. ( )	
d) Check wear on slip ring and determine if machining is required. ( )	
3. ROTOR	
a) Check rotor for cleanliness and recommend cleaning if required. ( )	
b) Check all fasteners such as bolts, pole keys, etc. for all connections. ( )	
c) Check field pole connection; taping and insulation on all coil connections. ( )	
d) Check rotor carefully for distress at welds including rim supports. ( )	
e) Check ventilation duct and spaces for foreign materials or obstruction. ( )	
f) Check rotor bus leads. ( )	
g) Check brake plates for signs of movement distortion or scouring. ( )	
4. GENERATOR BEARING ASSEMBLY	
a) Check exterior bearing assembly for oil leaks. ( )	
b) Check main bracket securing bolts to ensure they are tight. ( )	

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 6 Rev. No.: 12 Rev. Date: 17-03-06 Index No.: 473 Binder No.: 26

PM Checksheet No.: PM6-299206
Item No. & Description: 299206 - Spherical Valve - Unit No. 5 - BDE
Type of Inspection: PM6 (Annual)
Department: Electrical/Mechanical — Asset Approval: B. Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature & Date:
Reference Drawing and Manuals: Operating and Maintenance Units 1 – 6, 107-E-149

ACTIVITIES (Initial Box Upon Completion)	REMARKS

CHECK PRIOR TO OPERATING & TESTING VALVES

Note: 1) Mechanical & Electrical Power-off checks to be conducted in parallel.

2) Don't adjust settings without authorization.

3) Requires operations to operate valve.

POWER-ON TESTING

1. Valve Indications

a) With the spherical valve closed, upstream seal off and the downstream seal applied, check that the following indication lamps are lit: ( )

Automatic mode, bypass valve closed, upstream seal off, spherical valve closed, downstream seal on, spiral depressurized, 600 volts AC on, power supply (PSI and PS2) on. Yes _____ No _____

If no, reason for failure:

b) The pressure gauges located on the upstream wall ( )

PG1 _____ KPA Normal 1793 KPA - penstock pressure
PG2 _____ KPA Normal 0KPA - U/S seal
PG3 _____ KPA Normal 1793 KPA - D/S seal
PG4 _____ KPA Normal 0 KPA - Spiral case

2. Valve opening locally at the PLC control panel. ( )

a) Time the bypass valve opening using the indicating lights – open/in motion/close.

Standard - 14 seconds Actual _____

b) Check the bypass motor current. ( )

Standard 0.5 Amps - A~~0~~ _____ B~~0~~ _____ C~~0~~

PM Checksheet No.: 299206 Spherical Valve - Unit No. 5 - BDE Type of Inspection: PM6 Department: Electrical/Mechanical	Sheet: 2 of 6 Rev. No.: 12 Rev. Date: 17-03-06 Index No.: 473 Binder No.: 26
ACTIVITIES (Initial Box Upon Completion)	REMARKS
POWER-ON TESTING (Cont'd)	
3. Spiral Case Indication	
a) Record the time from valve given open pulse until spiral full indication is lit _____ normal 50 secs. ( )	
b) Record pressure on PG4 _____ KPA normal 690 KPA.	
Note: Spiral light will come on when level switch, pressure Switch and pressure transmitted conditions have been met.	
4. Downstream Seal	
a) Record time from spiral full light on until downstream seal is off _____ seconds. Normal 45 seconds. ( )	
b) Verify the change of seal indication. ( )	
c) Record downstream seal pressure gauge PG3 _____ kpa. Normal 1793 kpa. ( )	
5. Spherical Valve Servo Valve	
a) Verify that the in motion light is on. ( )	
b) Record time that the main valve is opening _____ seconds. Normal time 65 seconds. ( )	
c) Verify that the valve open light is on. ( )	
d) Verify that the bypass valve indication in motion to close is lit. ( )	
e) Record the timing of the bypass valve closing _____ seconds. Normal 14 seconds. ( )	
f) Record spiral case pressure PG4 _____ KPA. Normal 1793. ( )	
g) Record differential on downstream filters while servo valve is operating _____ KPA. If greater than 90 KPA for 10 seconds filter is clogged. ( )	
h) Operate supply ball valve on in service filter to cause a blockage alarm. ( )	

PM Checksheet No.: 299206 - Spherical Valve - Unit No. 5 - BDE Type of Inspection: PM6 Department: Electrical/Mechanical	Sheet: 3 of 6 Rev. No.: 12 Rev. Date: 17-03-06 Index No.: 473 Binder No.: 26
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**

POWER-ON TESTING (Cont'd)

5. Spherical valve servo valve (Cont'd)

   i) While the valve is opening, initiate an automatic closing from the PLC control panel. ( )

6. Spherical Valve Piping

   a) Check all piping and connections for leaks. ( )

   b) Check all piping mounting hardware. ( )

7. Automatic Valve Closing

   a) Close the spherical valve. ( )

   b) Record the closing time _____. Normal time is 62 seconds. ( )

   c) Check indication for in motion and closed lights. ( )

   d) Record time for downstream seal to operate _____. Normally approximately 10 seconds. ( )

   e) Record PG3 pressure _____. Normal 1730± 50 KPA. ( )

   f) Spiral case full light has changed to depressurized. ( )

8. Upstream Seal

   a) Ensure spherical valve is closed. ( )

   b) Check off status of U/S seal indicating light. ( )

   c) Apply upstream seal. ( )

   d) Check on status of U/S seal indicating light. ( )

   e) Record differential on in service U/S filter while seal is being applied. _____ KPA. ( )

   f) Operate supply ball valve to filters to create a differential alarm. ( )

PM Checksheet No.: 299206 - Spherical Valve - Unit No. 5 - BDE Type of Inspection: PM6 Department: Electrical/Mechanical	Sheet: 4 of 6 Rev. No.: 12 Rev. Date: 17-03-06 Index No.: 473 Binder No.: 26
ACTIVITIES (Initial Box Upon Completion)	REMARKS
POWER-ON TESTING (Cont'd)	
8. Upstream Seal (Cont'd)	
g) With upstream seal applied, open body drain valve and drain body to verify seal is applied and effective. Standard is 10 minutes. Actual _____ minutes. ( )	
Note: Close body drain valve before removing U/S seal.	
h) Remove upstream seal. ( )	
9. Alarms	
a) Test the following alarms	
1) PLC fault, CPU failure, timer failure, I/O module failure. ( )	
Change battery in PLC (size ½ AA) ( )	
2) Valve pit high water magnetrol	
a) Operate manually and verify the alarm. ( )	
3) Bypass valve AC failure. ( )	
POWER-OFF	
MECHANICAL	
1. Inspect and clean upstream duplex filters. ( )	
2. Inspect and clean downstream duplex filters. ( )	
3. Grease the following components:	
a) Main trunions. ( )	
b) Connecting rod pins on piston. ( )	
c) Operating cylinder pivot pin bearing. ( )	
d) Upstream bypass valve. ( )	

PM Checksheet No.: 299206 - Spherical Valve - Unit No. 5 - BDE Type of Inspection: PM6 Department: Electrical/Mechanical	Sheet: 5 of 6 Rev. No.: 12 Rev. Date: 17-03-06 Index No.: 473 Binder No.: 26
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
POWER-OFF (Cont'd) **MECHANICAL (Cont'd)** e) Downstream bypass valve. ( ) NOTE: Ensure Rockwell grease is applied to downstream bypass valve. 4. Remove debris from spherical valve pit drains. ( ) **ELECTRICAL** 1. Meggar bypass motor (1000 volts) _____ ( ) 2. Record torque switch settings on bypass motor. ( ) Standard 2.5 for open and close. _____ Open _____ Close. 3. Check 600 volt cable terminations. ( ) **P&C** 1. Measure Power Supplies ( ) a) PS1 _____ Vdc b) PS2 _____ Vdc 2. With laptop, verify CP1 limit switches. ( ) a) LS5A (10023) _____With Valve Closed b) LS5B (10024) _____ With Valve Open ( ) 3. Monitor scroll case/vent chamber instrumentation ( ) a) PT1 Set Point (40 100) Found _____ Left at _____ b) L1 Vent Chamber Switch (10 001) Found _____ Left at _____ c) PS4 Scroll Case Pressure (10 005) Found _____ Left at _____kpa Normal 1435 kpa.	

PM Checksheet No.: 299206 - Spherical Valve - Unit No. 5 – BDE Type of Inspection: PM6 Department: Electrical/Mechanical	Sheet: 6 of 6 Rev. No.: 12 Rev. Date: 17-03-06 Index No.: 473 Binder No.: 26
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
4. With laptop verify PLC switches from auto to manual on operation of the following valves manual control levers. Follow current procedure. NOTE: Valve P applies maintenance seal; to be done only with main valve closed. Valve D-E, S-R, N and P3-M to be checked only during a proper manual operating sequence. a) Valve D-E (10021) (LS3) ( ) b) Valve S-R (10022) (LS4) ( ) c) Valve P (10006) (LS7) ( ) d) Valve N (10007) (LS9) ( ) e) Valve P3-M (10031) (LS10) ( ) 5. a) Open 600 volt disconnect for bypass valve (with valve in closed position). ( ) b) Close the U/S manual bypass valve. (This will make the auto valve easier to operate manually). ( ) c) Check calibration of the valve position feedback by operating the manual handle and reading the indication on the DPI. ( ) d) Verify that the 0% and 100% positions correspond to the Mechanical closed (0%) and open (100%) positions. ( ) <u>TOOLS</u> 1. Grease gun 2. Stop watch 3. AC/DC clip on ammeter 4. Multimeter 5. 1000 volt meggar 6. Standard tools	

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 1 Rev. No.: 4 Rev. Date: 15-05-22 Index No.: 479 Binder No.: 26

PM Checksheet No.: PM6-59540-EBDE
Item No. & Description: 59540 - Isolated Phase Bus - Unit No. 5 - BDE
Type of Inspection: PM6 (Annual)
Department: ELECTRICAL — Asset Approval: B. Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature & Date:
Reference Drawing and Manuals: 2107-E-43, BDE-15 & ITE Dwg. #: N-13902

ACTIVITIES (Initial Box Upon Completion)		REMARKS
CRITICAL PARTS INSPECTION		
1. <u>13.8 KV Metering & Voltage Regulator P.T. Cubicle</u>		
a. Check all connections and wiring.	( )	
b. Check fuses and holders.	( )	
c. Clean out cubicle.	( )	
d. Check for signs of moisture.	( )	
e. Check insulators for signs of cracks or tracking.	( )	
f. Inspect surge protection.	( )	

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 1 Rev. No.: 4 Rev. Date: 15-05-07 Index No.: 500 Binder No.: 26

PM Checksheet No.: PM6-59556-EBDE
Item No. & Description: 59556 - Turbine - Unit No. 5 - BDE
Type of Inspection: PM6 (Annual)
Department: ELECTRICAL — Asset Approval: B. Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature & Date:
Reference Drawing and Manuals: 107-E-131, 2107-E, Trabon Maxi-Monitor Mark III M216185

ACTIVITIES (Initial Box Upon Completion)	REMARKS
CRITICAL PARTS INSPECTION	
1. **AUTOGREASER**	
a. Check all wiring connections for looseness and mechanical damage. ( )	
b. Check operation of micro on distribution block. ( )	
c. Check failure alarm on annunciator. ( )	
d. Record shots on primary to verify shots since last inspection. ( )	
_____ 1 shot per 12 hours.	
2. **SHEARPIN PLUG**	
a. Check wiring on each of the plugs for looseness or mechanical damage. ( )	
b. Check condition of plug for proper fitting in shearpin. ( )	
c. Check operation of 95X relay for shearpin ground alarm. ( )	
d. Check operation of relay 95A for shearpin failure alarm. ( )	

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 1 Rev. No.: 5 Rev. Date: 16-02-25 Index No.: 521 Binder No.: 26

PM Checksheet No.: PM6-109924-EBDE
Item No. & Description: 109924 - Exciter - Unit No. 5 - BDE
Type of Inspection: PM6 (Annual)
Department: ELECTRICAL — Asset Approval: B. Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature & Date:
Reference Drawing and Manuals: ABB Ref. 502-799, 2107-E-130

ACTIVITIES (Initial Box Upon Completion)	REMARKS
CRITICAL PARTS INSPECTION	
1. Field Flashing Contactor	
a) Check if contacts are clean as per Operating Instruction FPTC401-773. ( )	
2. Air Filters	
a) Check or replace air filters. ( )	
3. Bus	
a) Inspect bus connections. ( )	

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 5 Rev. No.: 11 Rev. Date: 15-05-21 Index No.: 528 Binder No.: 26

PM Checksheet No.: PM6-59527
Item No. & Description: 59527 - Generator - Unit No. 5 - BDE
Type of Inspection: PM6 (Annual)
Department: Electrical — Asset Approval: B. Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature & Date:
Reference Drawing and Manuals: 2107-E-43, 2107-E-45, 2107-E-130, ED-019, ED-022

ACTIVITIES (Initial Box Upon Completion)	REMARKS

1. Generator Slip Ring Assembly

NOTE: TORQUE SETTINGS FOR ELECTRICAL CONNECTORS:

Bolts ½" – 41ft/lbs – Silicon Bronze
Bolts 3/8" – 27+/-3 Ft/Lbs Medium Carbon Steel
Bolts ½" – 67+/-7 Ft/Lbs Medium Carbon Steel
Bolts 3/8" – 20ft/lbs Silicon Bronze

a) Check brushes for cracks, uneven surfaces, etc. Replace any brush projecting from a brush box 1/8" or less, before pigtail contact brush box. ( )

b) Measure and record lengths of carbon brushes. ( )

c) Inspect and clean all slip ring insulators. ( )

d) Check slip rings for pitting, discoloration or scouring. ( )

e) Check all mounting hardware for tightness. ( )

f) Measure and record wear on lower slip ring. ( )

g) Measure and record wear on upper slip ring. ( )

h) Reverse polarity on slip rings by reversing leads at exciter cubicle. ( )

i) Check and clean all brush holders, springs and pigtail connections. ( )

j) Meggar slip rings. 500volt DC _____ Normal >1000mohms. ( )

k) Check brush force and freedom of movement, normal force at 3 lbs. If significantly less, spring should be replaced, sticky brushes should be cleaned. ( )

PM Checksheet No.: 59527 - Generator - Unit No. 5 - BDE Type of Inspection: PM6 Department: Electrical	Sheet: 2 of 5 Rev. No.: 11 Rev. Date: 15-05-21 Index No.: 528 Binder No.: 26
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**

1. Generator Slip Ring Assembly (Cont'd)

   l) Check the clearance between the brush boxes and the collection. Minimum of clearance between brush boxes and collection rings. Clearance of 2.0 to 2.5 MM between brush box and collector ring. ( )

   m) Clean the collector. Surface of collector rings shall be clean and free of rust at all times. Take the following precautions: ( )

      i. Avoid finger marks. Skin acids and/or moisture promotes the development of rust on the polished steel surface. ( )

      ii. If a collector is to be out of service for some long periods of time, completely envelope it in rust inhibiting grease to prevent the condensation of moisture. ( )

      iii. Clean the ring surfaces with industrial alcohol prior to returning the collection to service. ( )

2. Rotor

   a) Check rotor bus leads (flexible jumpers) to slip rings:

      i. Check tightness of bolts torque at 67 +/-7 Ft-Lbs. ( )

      ii. Visually inspect for abnormal wear and cracks. ( )

      iii. Check laminate layers for peeling. ( )

   b) Inspect rotor ventilation ducts. Clean if there is excess material. ( )

3. Current Transformer Split Phase and Neutral

   a) Check mounting hardware and connections. ( )

   b) Wipe down all accessible areas with clean dry cloths. ( )

   c) Visually inspect cablings for cracks or mechanical damage. ( )

PM Checksheet No.: 59527 - Generator - Unit No. 5 - BDE Type of Inspection: PM6 Department: Electrical	Sheet: 3 of 5 Rev. No.: 11 Rev. Date: 15-05-21 Index No.: 528 Binder No.: 26
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
4. Generator Shaft Grounding Brush	
a) Check brush for cracks, uneven wear. ( )	
b) Check brush for good contact with shaft. ( )	
c) Check shaft grounding brush grounding circuit. ( )	
5. Generator Brake Switches	
a) Check mounting hardware. ( )	
b) Check wiring for loose connections, broken connections and mechanical damage. ( )	
c) Check operation of switches. ( )	
d) Check brake circuits BG1 - BG8. ( )	
e) Check brake solenoid wiring for loose connections. ( )	
f) Check operation of brake solenoid for free movement. ( )	
g) Monitor and record braking solenoid coil resistance. ( )	
h) Check timing of brake application. ( )	
Standard 7 Sec. Record Actual: _____	
6. Partial Discharge Equipment	
a) Check coupler mounting hardware for looseness insulation cracking. 15 couplers. ( )	
b) Check coaxial cable for mechanical damage. ( )	
7. Generator Creep Detector	
a) Check connections on contacts and operation coils. ( )	
b) Clean creep detector. ( )	
c) Check operation of contacts. ( )	
d) Inspect pins and linkage movement. ( )	

PM Checksheet No.: 59527 - Generator - Unit No. 5 - BDE Type of Inspection: PM6 Department: Electrical	Sheet: 4 of 5 Rev. No.: 11 Rev. Date: 15-05-21 Index No.: 528 Binder No.: 26
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
7. Generator Creep Detector (Cont'd)	
e) Check condition of textolite brush. ( )	
f) Check air gap to shaft .003". ( )	
8. Generator Stator	
a) Inspect stator RTD wiring and connections in RTD box. ( )	
b) Check coils for end distortion, cracked insulation or any mechanical damage. ( )	
c) Check for swelling, puffiness, discolouration or tape delamination. This will reveal white powder or yellow marks. ( )	
d) Check for signs of corona discharge. This will reveal white powder at top of slots or around wedges or around lashings. ( )	
e) Check for signs of fretting corrosion. This will appear as red dust around bolts, edges of steel laminations, etc. ( )	
f) Check for dirt contamination by carbon, oil, dust, moisture. Identify any area that requires cleaning. ( )	
g) Check coil lashing to support rings for signs of movement. Check support ring brackets to stator finger plates. ( )	
h) Check for signs of packing migrating out of stator slots. This would be an indication of loose wedges. ( )	
i) Check that rubber cover up booths are in place over neutral connections and split phase CT connections from stator leads. ( )	

PM Checksheet No.: 59527 - Generator - Unit No. 5 - BDE Type of Inspection: PM6 Department: Electrical	Sheet: 5 of 5 Rev. No.: 11 Rev. Date: 15-05-21 Index No.: 528 Binder No.: 26

Date of Check: _____ Checked By: _____

BRUSH MEASUREMENT (CLOCKWISE)

Unit hour meter reading: _____ Hours accumulated since last inspection: _____

	Top Ring		Bottom Ring	
	Top	Bottom	Top	Bottom
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				

Comments:

_____

_____

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 6 Rev. No.: 6 Rev. Date: 17-03-07 Index No.: 535 Binder No.: 26

PM Checksheet No.: PM6-59532-EBDE
Item No. & Description: 59532 - Governor - Unit No. 5 - BDE
Type of Inspection: PM6
Department: ELECTRICAL — Asset Approval: B. Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature & Date:
Reference Drawing and Manuals: 2107-E-45, 2107-E-126, 2107-E-44, 2107-E-141, 2107-E-42, Woodward Governor Manual 07004 & PMG 11002

ACTIVITIES (Initial Box Upon Completion)	REMARKS
CRITICAL PARTS INSPECTION	
1. Governor Oil Pump Motor	
a. Inspect magnetic starter and disconnect for loose/frayed wiring. ( )	
b. Meggar governor oil pump motor. _____ with 1000volt meggar. ( )	
c. Record operating hours of motor. _____ If in excess of 10,000 hours, replace bearings. ( )	
d. Check bearing ends for excessive heat. ( )	
e. Verify operation of the oil pump motor control switches. ( )	
f. Record amperage. A_____ B_____ C_____ Normal 20 amps. ( )	
2. Ball Head Motor Governor	
a. Visual inspection to check cleanliness of stator. ( )	
b. Check suppression springs on ball head motor. ( )	
3. PMG Upper Drive Pins	
a. Check that bolt is not worn or mechanical cracks. ( )	
b. Check condition of insulating washer under bolt for cracks or carbon buildup. Replace if worn. ( )	
c. Check condition of locking wire spaghetti insulation. ( )	
d. Check condition of brass lockwire for mechanical damage. ( )	

PM Checksheet No.: 59532-Governor - Unit No. 5 - BDE Type of Inspection: PM6 Department: ELECTRICAL	Sheet: 2 of 6 Rev. No.: 6 Rev. Date: 17-03-07 Index No.: 535 Binder No.: 26
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
CRITICAL PARTS INSPECTION (Cont'd)	
4. PMG Lower Drive Pins	
a. Check that pins are not mechanically worn. ( )	
b. Check that pins are not loose in drive plate. ( )	
5. PMG Urethane Upper Bushing	
a. Check that bushings are not worn. Replace if worn. ( )	
b. Check that fastening device holds bushing in place. ( )	
c. Clean bushing to prevent carbon tracking. ( )	
6. PMG Urethane Lower Bushing	
a. Check that bushings are not worn. Replace if worn. ( )	
b. Check that fastening device holds bushing in place. ( )	
c. Clean bushing to prevent carbon tracking. ( )	
7. PMG Speed Switches	
Note: Testing of the speed switches after the PMG has been re-installed into the unit shall be performed by manually moving the ballarms.	
a. Check all mounting hardware. ( )	
b. Check all wiring for chafing, loose connections, etc. ( )	
c. Oil all linkages with light lubricating oil. ( )	
d. Check condition of teflon drive gears for cracks. Check condition of bearings. Replace if necessary. ( )	
e. Check all pins for obstruction in free movements. ( )	
f. Check and record speed switch setting as per speed switch support sheet. EM Standard #8. ( )	
g. Check wiring with PMG installed on unit - 75 rpm and below. ( )	
BB10 & BB9 (20 AB CCT) BB11 & BB12 (14X CCT)	

PM Checksheet No.: 59532-Governor - Unit No. 5 - BDE Type of Inspection: PM6 Department: ELECTRICAL	Sheet: 3 of 6 Rev. No.: 6 Rev. Date: 17-03-07 Index No.: 535 Binder No.: 26
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
7. PMG Speed Switches (Cont'd)	
h. Check wiring with PMG installed 450 rpm and above. ( ) BC21 & BC22 (20CR) BC23 & BC24 (alarm) Input to spherical valve PLC	
i. Check wiring with PMG installed 270rpm and above. ( ) BB7 & BB8 (14EX CCT) BB5 & BB6 (25X-1, 25X-2, 25X-3, 25X-4)	
j. Check wiring with PMG installed 390 rpm and above. ( ) BC17 & BC18 (86 CCT) BC19 & BC20 (C.W. bypass solenoid)	
k. Check hold-down bolts and measure for correct clearance 0.75". ( )	
l. Meggar PMG to ground. _____ ( )	
m. Check main leads from PMG to governor cabinet. ~~AØ~~, ~~BØ~~, ~~CØ~~ to ensure links closed. ( )	
8. PMG Stator	
a. Check condition of PMG stator leads for looseness or mechanical damage. ( )	
b. Check condition of PMG stator for mechanical damage, insulation cracking and cleanliness. ( )	
c. Check and record voltage reading of three phases as per Maintenance Standard settings with unit at: ( ) S.N.L. A-B_____ B-C_____ C-A_____	
9. PMG Drive Plate	
a. Check the hold-down bolts for tightness. Normal 17ft/lbs ( )	
b. Check drive pin holds for tightness. ( )	
10. Power-On Checks	
a. Verify correct rotation of ballhead motor. ( )	

PM Checksheet No.: 59532 - Governor - Unit No. 5 - BDE Type of Inspection: PM6 Department: ELECTRICAL	Sheet: 4 of 6 Rev. No.: 6 Rev. Date: 17-03-07 Index No.: 535 Binder No.: 26

Date of Check: _____ Checked by: _____

PMG TESTING

* Check all switch operations

	Found at	Adjusted to	Normal
Brake Switch	_____ rpm	_____ rpm	75 +/- 2%
Field Flashing	_____ rpm	_____ rpm	270 +/- 2%
Overspeed Switch	_____ rpm	_____ rpm	390 +/- 1%
Runaway Switch	_____ rpm	_____ rpm	450 +/- 1 %

Voltage at rated speed A - B _____ volts Normal at S.N. Load 85

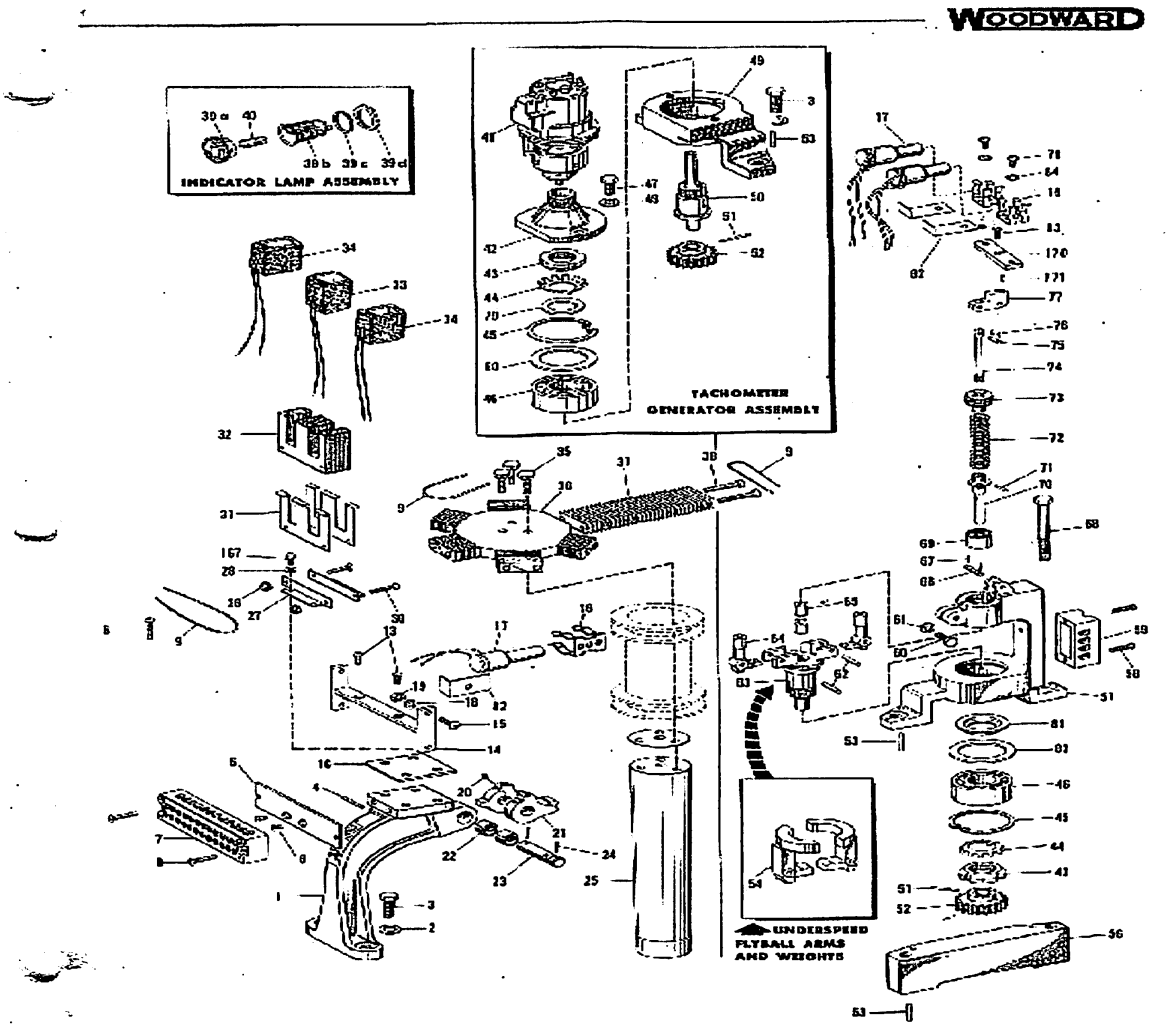
Voltage at rated speed B - C _____ volts Normal at No Load 95 Test Stand

Voltage at rated speed A - C _____ volts Normal Full Load Current 1.9 amps

Voltage can be 10% higher or as much as 20% below.

Comments:

PM Checksheet No.:	**59532 - Governor - Unit No. 5 - BDE**	**Sheet:**	**5 of 6**
Type of Inspection:	**PM6**	**Rev. No.:**	**6**
Department:	**ELECTRICAL**	**Rev. Date:**	**17-03-07**
		Index No.:	**535 Binder No.: 26**



PM Checksheet No.:	59532 - Governor - Unit No. 5 - BDE	Sheet:	6 of 6
Type of Inspection:	PM6	Rev. No.:	6
Department:	ELECTRICAL	Rev. Date:	17-03-07
		Index No.: 535	Binder No.: 26

WOODWARD

INFORMATION AND PARTS REPLACEMENT: When requesting information concerning Permanent Magnet Generator operation, or when ordering replacement parts, it is essential that the following information accompany the request.

1. Permanent Magnet Generator serial number (shown on nameplate).
2. The part reference number as shown in this manual.
3. A description, or name of the part.

Parts List for Permanent Magnet Generator Auxiliary Parts.

REF. NO.	PART NAME	NO. REQD.
11002-1	Pole	1
11002-2	⅜" Shakeproof Washer	As Reqd.
11002-3	⅜"-16x1" Hex. Head Cap Screw	As Reqd.
11002-4	⅛"x⅜" Straight Pin	1
11002-5	Terminal Block Mounting Plate	1
11002-6	8-32x⅜" Phillips Flat Head Screw	2
11002-7	12 Pole Terminal Block	1
11002-8	8-32x1" Phillips Round Head Screw	6
11002-9	Brass Lockwire	As Reqd.
11002-10	Laminated Shim	As Reqd.
11002-13	10-32x½" Phillips Flat Head Screw	2
11002-14	Mercury Switch Mounting Plate	1
11002-15	8-32x½" Phillips Round Head Screw	As Reqd.
11002-16	Switch Clip	As Reqd.
11002-17	Mercury Switch	As Reqd.
11002-18	#8 Shakeproof Washer	As Reqd.
11002-19	8-32 Hex. Nut	As Reqd.
11002-20	10-32 Socket Head Set Screw	1
11002-21	Trip Arm	1
11002-22	Oilite Bushing	2
11002-23	Trip Pin	1
11002-24	Cotter Pin	2
11002-25	Rotating Sleeve	1
11002-26	Elastic Stop Nut	2
11002-27	Transformer Mounting Bracket	2
11002-28	5/16" Lockwasher	4
11002-30	10-32x1¾" Fillister Head Screw	2
11002-31	Coil Retainer Lamination	2
11002-32	"E" Lamination	42
11002-33	Secondary Coil	1
11002-34	Primary Coil	2
11002-35	¼"-20x¾" Drilled Hex. Head Cap Screw	5
11002-36	Lamination Rotor Plate	1
11002-37	"I" Lamination	168
11002-38	10-32x1¾" Cad. Fillister Head Screw	8
11002-39a	Indicator Lamp Head Assembly	As Reqd.
11002-39b	Indicator Lamp Body	As Reqd.
11002-39c	Indicator Lamp Lockwasher	As Reqd.
11002-39d	Indicator Lamp Nut	As Reqd.
11002-40	Indicator Lamp Bulb	As Reqd.
11002-41	Tachometer Generator	1
11002-42	Bracket Cover	1

REF. NO.	PART NAME	NO. REQD.
11002-43	Bearing Locknut	As Reqd.
11002-44	Bearing Lockwasher	As Reqd.
11002-45	Snap Ring	As Reqd.
11002-46	Bearing	As Reqd.
11002-47	5/16"-18x¾" Hex. Head Cap Screw	2
11002-48	5/16" Shakeproof Washer	2
11002-49	Tachometer Generator Bracket	1
11002-50	Tachometer Generator Pinion Shaft	1
11002-51	4/0-5/16" Taper Pin	As Reqd.
11002-52	Micarta Drive Gear	As Reqd.
11002-53	Dowel Pin	As Reqd.
11002-54	Ball arm	As Reqd.
11002-56	Adapter Block	As Reqd.
11002-57	Speed Switch Bracket	As Reqd.
11002-58	10-32x⅝" Phillips Round Head Screw	As Reqd.
11002-59	4 Pole Terminal Block	As Reqd.
11002-60	¼"-20x¾" Hex. Head Cap Screw	As Reqd.
11002-61	¼" Shakeproof Washer	As Reqd.
11002-62	Ballarm Pin	As Reqd.
11002-63	Ballhead	As Reqd.
11002-64	Ballarm	As Reqd.
11002-65	Oilite Bushing	As Reqd.
11002-66	Rocker Arm Pin	As Reqd.
11002-67	Cotter Pin	As Reqd.
11002-68	⅜"-16 Hex. Head Cap Screw	As Reqd.
11002-69	Thrust Bearing Assembly	As Reqd.
11002-70	Lower Speeder Rod	As Reqd.
11002-71	Lower Speeder Rod Pin	As Reqd.
11002-72	Speed Switch Spring	As Reqd.
11002-73	Speed Setting Plug	As Reqd.
11002-74	Upper Speeder Rod	As Reqd.
11002-75	Upper Speeder Rod Pin	As Reqd.
11002-76	Cotter Pin	As Reqd.
11002-77	Rocker Arm	As Reqd.
11002-78	8-32x⅜" Round Head Screw	As Reqd.
11002-79	Bearing Shield Washer (Plain)	As Reqd.
11002-80	Bearing Shield Washer (Plain)	As Reqd.
11002-81	Bearing Shield Washer (Stepped)	As Reqd.
11002-82	Switch Retainer	As Reqd.
11002-83	8-32x3/8 Phillips Flat Head Screw	As Reqd.
11002-84	No. 8 Shakeproof Washer	As Reqd.
11002-85	Drive Pin	1
11002-86	Lower Dowel Pin	2

W/O _____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 1 Rev. No.: 0 Rev. Date: 17-08-16 Index No.: 2932 Binder No.: 26

PM Checksheet No.: PM6 – 393241 - EBDE
Item No. & Description: 393241 – Excitation Transformer – Unit #5 - BDE
PM Type: PM6
Department: Electrical — Asset Approval: Bob Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature and Date:
Reference Drawing and Manuals:

ACTIVITIES (Initial Box Upon Completion)	REMARKS
1. Oil Checks	
a. Check oil levels in main tank and record. _____ ( )	
b. Check for oil leaks and clean up any stains or spills. Report any event through SWOP. ( )	
2. Gas Relay check. ( )	
3. Vacuum pressure gauge KPA: _____ ( )	
4. Inspect exciter leads connections to the transformer. Report abnormalities. ( )	
5. Inspect all oil and winding temperature devices and record findings. ( )	
6. Check explosion vent diaphragm for signs of damage or deterioration. ( )	
7. Check that all equipment grounds are in place and all connections are sound. ( )	
8. Check main tank, radiators and other metal parts for signs of rust penetration. ( )	
9. Control Cabinets and Devices.	
a. Inspect control wiring and terminations for breaks, corrosion, overheating or damage. ( )	
b. Check all cabinet doors for ease of operation. Lubricate as required. ( )	

W/O _____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 1 Rev. No.: 0 Rev. Date: 18-01-29 Index No.: 3063 Binder No.: 5

PM Checksheet No.: PM6 – 59523 – BDEMECH
Item No. & Description: 59523 – Turbine/Generator Unit #5 – Pre-Winter Checks-Bay d'Espoir
PM Type: PM6 (Annual)
Department: Mechanical — Asset Approval: Bob Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature and Date:
Reference Drawing and Manuals:

ACTIVITIES (Initial Box Upon Completion)	REMARKS
1. Check all brakes. Replace if below ¼". ( )	
2. Visually check both generator and turbine for oil leaks. (Governor and bearings.) ( )	
3. Visually check unit cooling water system for water leaks. (Lines and coolers.) ( )	
4. Top up the governor dashpot oil. ( )	
5. Visually check governor for any abnormalities. ( )	
6. Lubricate the governor linkages; ensure there is no binding in links. ( )	
7. Inspect turbine pit drains for debris. Remove if necessary. ( )	

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 4 Rev. No.: 10 Rev. Date: 15-05-22 Index No.: 853 Binder No.: 5

PM Checksheet No.: PM6-59527-MBDE
Item No. & Description: 59527 - Generator - Unit No. 5 - BDE
Type of Inspection: PM6 (Annual)
Department: Mechanical — Asset Approval: B. Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature & Date:
Reference Drawing and Manuals: G.E. Dwg. #599B112CF, Dwg. #606B820, Torque Table for Grade 2 Medium Carbon Steel, ED-059

ACTIVITIES (Initial Box Upon Completion)		REMARKS
1. <u>Generator Brakes</u>		
a) Check brake pads thickness and record: _____ Minimum wear surface is ¼".	( )	
b) Check brake pads for cracks. Report to supervisor immediately if pads need replacement.	( )	
c) Check brake track for excessive scouring or warpage and check plate bolts for proper torque. _____ 320 Normal (Dry grade 2 medium carbon steel)	( )	
d) Check spring retaining nuts for looseness, missing set screws. Re-torque.	( )	
e) Grease brake cylinders. Check for excessive leakage.	( )	
f) Monitor and record timing of brake release. Normal 7 seconds. Actual_____.	( )	
2. <u>Thrust/Guide Bearing Assembly</u>		
a) Clean external bearing assembly. Check for leaks, loose bolts.	( )	
b) Check water inlet to bearing coolers for leaks.	( )	
c) Clean orifice on generator cooling water Rosemount Transducer.	( )	
d) Check Rosemount in Control Room or T/G panel. Normal <u>454 LPM</u> Actual _____	( )	
e) Check normal oil level on sight glass. Norma 14mm below top of oil pit. ED-059	( )	
3. <u>Main Bracket</u>		
Inspect main bracket assembly for loose bolts and visible cracks. Inspect welding by wiping down welds with rags to remove excess dirt.	( )	

PM Checksheet No.: 59527 – Generator – Unit No. 5 – BDE Type of Inspection: PM6 Department: Mechanical	Sheet: 2 of 4 Rev. No.: 10 Rev. Date: 15-05-22 Index No.: 853 Binder No.: 5
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
ROUTINE PM INSPECTION **1. Clean orifices on coolers - North & South. ( )**	

Sheet: 3 of 4
Rev. No.: 10
Rev. Date: 15-05-22
Index No.: 853 Binder No.: 5

BOLTS AND TORQUE SPECS

U.S. BOLT TORQUE SPECIFICATIONS
Torque in pounds-foot

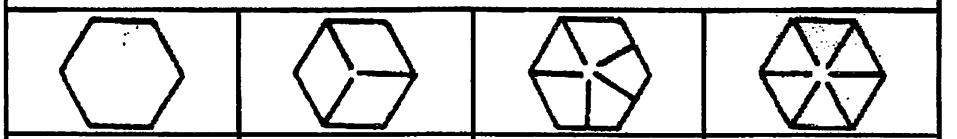
		2	2	5	5	7	7	8	8	Socket head cap screw	Socket head cap screw
Bolt Dia.	Thread per inch	Dry	Oiled	Dry	Oiled	Dry	Oiled	Dry	Oiled	Dry	Oiled
1/4	20	4	3	8	6	10	8	12	9	14	11
1/4	28	6	4	10	7	12	9	14	10	16	13
5/16	18	9	7	17	13	21	16	25	18	29	23
5/16	24	12	9	19	14	24	18	29	20	33	26
3/8	16	16	12	30	23	40	30	45	35	49	39
3/8	24	22	16	35	25	45	35	50	40	54	44
7/16	14	24	17	50	35	60	45	70	55	76	61
7/16	20	34	26	55	40	70	50	80	60	85	68
1/2	13	38	31	75	55	95	70	110	80	113	90
1/2	20	52	42	90	65	100	80	120	90	126	100
9/16	12	52	42	110	80	135	100	150	110	163	130
9/16	18	71	57	120	90	150	110	170	130	181	144
5/8	11	98	78	150	110	190	140	220	170	230	184
5/8	18	115	93	180	130	210	160	240	180	255	204
3/4	10	157	121	260	200	320	240	380	280	400	320
3/4	16	180	133	300	220	360	280	420	320	440	350
7/8	9	210	160	430	320	520	400	600	460	640	510
7/8	14	230	177	470	360	580	440	660	500	700	560
1	8	320	240	640	480	800	600	900	680	980	780
1	12	350	265	710	530	860	666	990	740	1060	845

BOLT TORQUE FACTORS

LUBRICANT OR PLATING	TORQUE CHANGES
Oil	Reduce torque 15% to 25%
Dry Film (Teflon or moly based)	Reduce torque 50%
Dry Wax (Cetyl alcohol)	Reduce torque 50%
Chrome plating	No change
Cadmium plating	Reduce torque 25%
Zinc plating	Reduce torque 15%

Sheet: 4 of 4
Rev. No.: 10
Rev. Date: 15-05-22
Index No.: 853 Binder No.: 5

U.S. BOLT GRADES



SAE 2	SAE 5	SAE 7	SAE 8

	2	5	7	8	SOCKET HEAD CAP SCREW
I.D. Marks	No markings	3 lines	5 lines	6 lines	Allen head
Material	Low carbon	Medium-carbon, tempered	Medium-carbon, quenched & tempered	Medium-carbon, quenched & tempered	High-carbon, quenched & tempered
Tensile strength (Minimum)	74,000 psi	120,000 psi	133,000 psi	150,000 psi	160,000 psi

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 3 Rev. No.: 13 Rev. Date: 16-02-29 Index No.: 864 Binder No.: 5

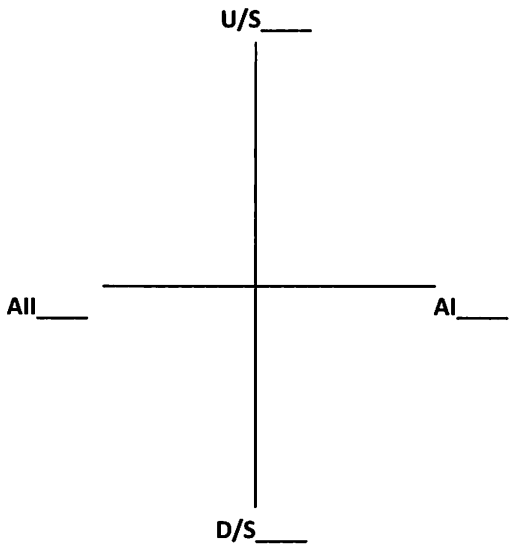
PM Checksheet No.: PM6-59556-MBDE
Item No. & Description: 59556 - Turbine - Unit No. 5 - BDE
Type of Inspection: PM6 (Annual)
Department: Mechanical — Asset Approval: B. Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature & Date:
Reference Drawing and Manuals: ED-003

ACTIVITIES (Initial Box Upon Completion)	REMARKS
CRITICAL PARTS INSPECTION	
1. Turbine Guide Bearing	
a) Check for oil leaks. ( )	
2. Cooling Coils	
a) Check condition of supply and drain lines - visual. ( )	
b) Clean orifice. Check readings on Rosemount in Control Room. Record normal and actual. ( )	
Normal: 15LPM Actual: _____	
Note: PC-14 required if supply water is off.	
c) Clean cooling water Y-strainer, duplex strainer and regulator. ( )	
NOTE: Pressure testing of cooling coils will begin when coils are 20 years old. Separate PM's will be initiated to hydrostatic pressure test turbine bearing cooling coils.	
3. Operating Ring / Linkages	
a) Inspect wicket gate linkages for signs of mechanical damage and wear. ( )	
b) Inspect wicket gate packing glands and studs. ( )	
c) Inspect wicket gate shearpins to ensure all are properly in place. ( )	
d) Re-torque eccentric pin locking screws. ( )	
e) Inspect shaft seal piping for leaks and damage. ( )	

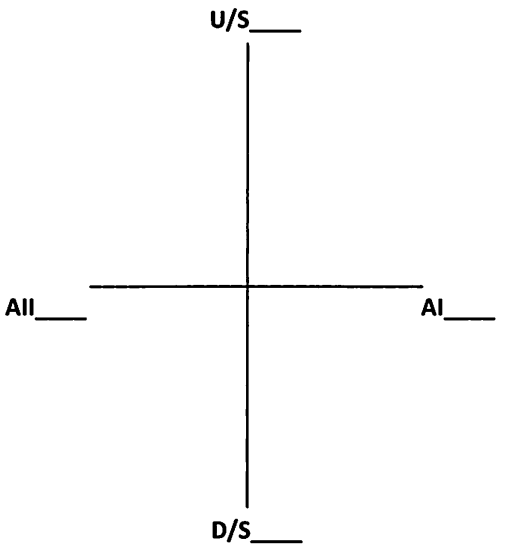
JDE Item No. & Description:	59556 - Turbine - Unit No. 5 - BDE	Sheet: 2 of 3 Rev. No.: 13 Rev. Date: 16-02-29 Index No.: 864 Binder No.: 5
Type of Inspection:	PM6	
Department:	Mechanical	
ACTIVITIES (Initial Box Upon Completion)		**REMARKS**
4. <u>Spiral Case Door</u> Inspect spiral case door for signs of leakage, cracks and bolt tightness. Replace door gasket if door is opened.	( )	
5. <u>Spiral Case Drain</u> a) Lubricate valve and check for leaks.	( )	
b) Check operation of the valve.	( )	
6. <u>Draft Tube Door</u> Inspect draft tube door for signs of leakage, cracks and bolt tightness. Replace door gasket if door is removed.	( )	
7. <u>Auto Greaser</u> a) Check for broken or disconnected lines. Repair if necessary.	( )	
b) Clean strainer.	( )	
c) Check operation and build up pressure.	( )	
d) Check Auto Greaser lubricator oil level.	( )	
e) Drain moisture trap.	( )	
f) Check grease level. Add if necessary.	( )	
g) Check regulator pressure. Set to 50psi.	( )	
8. Check upper and lower primary seal clearances through head cover plugs as per attached form. Plant Mechanical Engineer to evaluate.	( )	

JDE Item No. & Description:	**59556 - Turbine - Unit No. 5 - BDE**	**Sheet: 3 of 3**
Type of Inspection:	**PM6**	**Rev. No.: 13**
Department:	**Mechanical**	**Rev. Date: 16-02-29**
		Index No.: 864 Binder No.: 5

Upper Primary Seal Clearances



Lower Primary Seal Clearances



W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 4 Rev. No.: 10 Rev. Date: 15-05-22 Index No.: 871 Binder No.: 5

PM Checksheet No.: PM6-59532-MBDE
Item No. & Description: 59532 - Governor - Unit No. 5 – BDE
Type of Inspection: PM6
Department: Mechanical — Asset Approval: B. Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature & Date:
Reference Drawing and Manuals: Woodward – Operation & Maintenance – 07079B, ED-009, ED-005 & Dwg. No.: 9980-075 – Schematic Diagram

ACTIVITIES (Initial Box Upon Completion)	REMARKS
USE ONLY LINT-FREE RAGS S/N 99200027 **ACTUATOR DEPRESSURIZED** Before starting any work, do a visual inspection of the actuator for oil leaks, any unusual signs of wear, or misalignment of cables, levers, or gears. 1. Governor Oil Pump a) Replace filters. ( ) S/N: 58602404 Part No.: 07079-664 2. Dismantle Echelon controls and check for worn parts. Re-assemble and test operation. ( ) 3. Dual Oil Filters a) Replace in-service filter. ( ) S/N: 58601669 Part No.: 07079-556 4. Remove and clean flow control regulator screen. ( ) 5. Inspect all moveable linkages for worn pivot pins, any binding in the slots. This can be done without any dismantle, by visual and moving the links to check for free play. ( ) 6. Lubricate all moveable linkages with Teresso 46. ( ) 7. Grease all restoring cable bearings. ( )	

JDE Item No. & Description: 59532 - Governor - Unit No. 5 - BDE Type of Inspection: PM6 Department: Mechanical	Sheet: 2 of 4 Rev. No.: 10 Rev. Date: 15-05-22 Index No.: 871 Binder No.: 5
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**

ACTUATOR DEPRESSURIZED (Cont'd)

8. Sump

   a) Take oil sample. ( )

9. Main Valve

   a) Remove pilot valve bushings and spring. Clean and inspect. ( )

   b) Check condition of pilot valve restoring pivot lever. ( )

   c) Check stop nuts for looseness or any unusual movement. ( )

WARNING:

The gate timing adjustments should not be changed without approval of authorized personnel.

   d) Condition of pilot valve restoring lever. ( )

   _____

   e) Move valve servomotor plunger up and down, check for binding. ( )

10. Unloader/Relief Valve

    Visually inspect the mechanical unloader/relief valve combo. Check for oil leakage and seal condition. ( )

11. Dashpot

    a) Check oil level and general condition of dashpot. ( )

    b) Visual check small dashpot plunger spring for any change in setting. ( )

       NOTE: All needle settings on dashpot to remain as before the shutdown.

JDE Item No. & Description: 59532 - Governor - Unit No. 5 - BDE Type of Inspection: PM6 Department: Mechanical	Sheet: 3 of 4 Rev. No.: 10 Rev. Date: 15-05-22 Index No.: 871 Binder No.: 5
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**

ACTUATOR DEPRESSURIZED (Cont'd)

12. Check run out of the ball head dashpot plunger. ( )

    Max. run out - .002 Found at: _____ Left at: _____

ACTUATOR PRESSURIZED

1. Check all gauges for proper pressure readings. ( )
2. Check high pressure pump for noise and vibrations. ( )
3. Check and record speed of vibration motor. ( )

    Normal speed – 540 RPM Found at: _____ Left at: _____

4. Check oscillation of distributing valve plunger. ( )

    Normal - .006 - .007 Found at: _____ Left at: _____

5. Check zero position of gate position indicator. ( )

    Found at: _____ Left at: _____

6. Record wicket gate squeeze. ( )

    Normal squeeze - .125" Found at: _____ Left at: _____

7. Record wicket gate closing time. ( )

    From 80% - 30% = 6 Seconds Found at: _____ Left at: _____

    From 30% - 80% = 6 Seconds Found at: _____ Left at: _____

    From 100% - 0% Found at: _____ Left at: _____

    Cushion: Yes _____ No _____

8. Check the gate position pointer at fifty percent for proper alignment. Use Standard Procedure as per Woodward instructions. ( )

JDE Item No. & Description: 59532 - Governor - Unit No. 5 - BDE Type of Inspection: PM6 Department: Mechanical	Sheet: 4 of 4 Rev. No.: 10 Rev. Date: 15-05-22 Index No.: 871 Binder No.: 5
ACTIVITIES (Initial Box Upon Completion)	REMARKS

ACTUATOR PRESSURIZED (Cont'd)

9. Record partial gate setting. ( )

   a) Using Power Supply, check partial gate. Coordinate with P&C crew. ( )

      Normal setting: 25% Found at: _____ Left at: _____

10. Check shutdown solenoid. With gates open, latch up solenoid and observe gate position. This will be done after P&C/Electrical have done their electric al checks and both parties should observe the operation. ( )

11. Lubricate internal dashpot of ballhead motor with dashpot oil. ( )

12. Observe system pressure when governor pump starts and stops. ( )

    Normal = Start – 310 PSI; Stop = 360 PSI

    Start – 310 PSI – Found at: _____ Left at: _____

    Stop – 360 PSI – Found at: _____ Left at:_____

13. Check alignment of restoring cable where it enters the ferrule, there should not be any wear on cable entering ferrule. ( )

14. Auxiliary Valve

    a) After the gate operation is completed in the dry, using the Main Valve, transfer to Auxiliary Valve and operate gates to check valve for proper operation. ( )

       i) Transfer valve

          Free _____ Tight _____ ( )

NOTE: As per Engineering Directive, when the checks and adjustments on this sheet are completed, the person responsible must be assured that the actuator will function in the same condition with respect to on-line settings as it was before the PM Inspection was done. This is accomplished by operating the gates in the dry and checking frequency and unit response at SNL.

If we do governor work that has the potential to affect governor response, post testing must be done to verify the governor response is still within acceptable limits as per curves established and accepted by System Planning in 2005/2006.

W/O _____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 2 Rev. No.: 0 Rev. Date: 18-01-29 Index No.: 3069 Binder No.: 26

PM Checksheet No.: PM6 – 59523 - BDEELEC
Item No. & Description: 59523 - Turbine/Generator Unit #5 – Pre-Winter Checks-Bay d'Espoir
PM Type: PM6 (Annual)
Department: Electrical — Asset Approval: Bob Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature and Date:
Reference Drawing and Manuals:

ACTIVITIES (Initial Box Upon Completion)	REMARKS
1. Check slip ring brushes for cracks and any other abnormalities. Measure and record all slip ring brushes. Replace if there is .500" or less from the brush box back to the end of the carbon brush. Record how many brushes were replaced. ( )	
2. Visually check slip ring hardware and insulators. ( )	
3. Visually check slip ring for pitting or discolouration. ( )	
4. Visually check all brush holders, springs and pigtail connections. Ensure there is enough clearance between the brush box and slip ring. ( )	
5. Visually check flex leads. ( )	
6. Remove SSG cover. Visually check all speed switches. Lubricate links and pivot points. Check drive pins and ensure they are not loose. ( )	
7. Check water in oil detector. Drain if oil is discoloured and there is a small amount of water present. ( )	

JDE Item No. & Description: 59523 – Generator – Unit #5 – Pre-Winter Type of Inspection: PM6 Department: Electrical	Sheet: 2 of 2 Rev. No.: 0 Rev. Date: 18-01-29 Index No.: 3069 Binder No.: 26

Date of Check: _____ Checked By: _____

BRUSH MEASUREMENT (CLOCKWISE)

Unit hour meter reading: _____ Hours accumulated since last inspection: _____

Number of brushes replaced: _____

	Top Ring		Bottom Ring	
#	Top	Bottom	Top	Bottom
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 6 Rev. No.: 12 Rev. Date: 17-03-08 Index No.: 343 Binder No.: 41

PM Checksheet No.: PM6-59532-P&CBDE
Item No. & Description: 59532 - Governor - Unit No. 5 - BDE
Type of Inspection: PM6 (Annual)
Department: Protection and Control — Asset Approval: B. Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature & Date:
Reference Drawing and Manuals: 2107-E-44, 2107-E-45, 2107-E-141, 2107-E-149, ED-064 & ED-065

ACTIVITIES (Initial Box Upon Completion)	REMARKS

CRITICAL PARTS INSPECTION

1. Shutdown Solenoid Operate Coil

   a. Check that operate lever latches when operated manually. ( )

   b. Remove cover and check connections on operate solenoid. ( )

   c. Check the operate solenoid contacts. Clean and burnish if necessary. ( )

   d. Check spring adjustment screw. Tighten if necessary, using a lockwasher or loctite. ( )

   e. Check resistance of operate coil when latched and unlatched. ( )

NT Links: BB 52 and 53	Bench	Field
Latched 1.09 Kohms Actual		
Unlatched 18.7 Ohms Actual		

   f. Check operation of solenoid electrically. ( )

2. Shutdown Solenoid Reset Coil

   a. Check that reset lever resets the operate lever when operated manually. ( )

   b. Remove cover and check connections on reset solenoid. ( )

   c. Check the reset solenoid contacts. Clean and burnish if necessary. ( )

   d. Check spring adjustment screw. Tighten if necessary using a lockwasher or loctite. ( )

JDE Item No. & Description: 59532 - Governor - Unit No. 5 - BDE Type of Inspection: PM6 Department: Protection & Control	Sheet: 2 of 6 Rev. No: 12 Rev. Date: 17-03-08 Index No.: 343 Binder No.: 41
ACTIVITIES (Initial Box Upon Completion)	REMARKS

2. Shutdown Solenoid Reset Coil (Cont'd)

   e. Check resistance of reset coil when latched and unlatched. ( )

NT Links: BB 50 and 51	Bench	Field
Latched 1.6 Kohms Actual		
Unlatched 35.2 Ohms Actual		

   f. Check operation of solenoid electrically. ( )

3. Partial Shutdown Solenoid Operate Coil

   a. Check that operate lever latches when operated manually. ( )

   b. Remove cover and check connections on operate solenoid. ( )

   c. Check the operate solenoid contacts. Clean and burnish if necessary. ( )

   d. Check spring adjustment screw. Tighten if necessary using a lockwasher or loctite. ( )

   e. Check resistance of operate coil when latched and unlatched. ( )

NT Links: BB 38 and 40	Bench	Field
Latched 1.08 Kohms Actual		
Unlatched 18.8 Ohms Actual		

   f. Using power supply check partial gate setting. Coordinate with Mechanical Crew. ( )

   Normal 25% Actual _____

   g. Check operation of solenoid electrically. ( )

4. Partial Shutdown Solenoid Reset Coil

   a. Check that reset lever resets the operate lever when operated manually. ( )

   b. Remove cover and check connections on reset solenoid. ( )

   c. Check the reset solenoid contacts. Clean and burnish if necessary. ( )

JDE Item No. & Description: 59532 - Governor - Unit No. 5 - BDE Type of Inspection: PM6 Department: Protection & Control	Sheet: 3 of 6 Rev. No.: 12 Rev. Date: 17-03-08 Index No.: 343 Binder No.: 41
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**

4. Partial Shutdown Solenoid Reset Coil (Cont'd)

   d. Check spring adjustment screw. Tighten if necessary using a lockwasher or loctite. ( )

   e. Check resistance of reset coil when latched and unlatched. ( )

NT Links: BB 38 and 39	Bench	Field
Latched 1.57 Kohms Actual		
Unlatched 34.9 Ohms Actual		

   f. Check operation of solenoid electrically. ( )

5. Gate Limit Motor, Shaft and Friction Gear Assembly

   a. Check clutch assembly, move gate limit from 0 - 100%; operation should be smooth. ( )

   b. Check variable resistor connections. ( )

   c. Check resistance of the resistor used in motor circuit. ( )

   Resistance 243 Ohms Actual _____

   d. Check condition of motor gears; assembly should be free of grease and dirt. ( )

6. Speed Adjustment Motor, Shaft and Friction Gear Assembly

   a. Check clutch assembly, move speed adjustment from 0-100%; operation should be smooth. ( )

   b. Check variable resistor connections. ( )

   c. Check resistance of the resistor used in motor circuit. ( )

   Resistance 162 Ohms Actual _____

   d Check condition of motor gears; assembly should be free of grease and dirt. ( )

JDE Item No. & Description: 59532 - Governor - Unit No. 5 - BDE Type of Inspection: PM6 Department: Protection & Control	Sheet: 4 of 6 Rev. No.: 12 Rev. Date: 17-03-08 Index No.: 343 Binder No.: 41
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
ROUTINE PM INSPECTIONS – Power On	
1. Check operation of the following gate position switches. **Note: Refer to drawing to verify check points.**	
a. 0 gate - SW1; set to close at 1.5% and below points AA14, AA15. ( ) **Closed at _____ % and down**	
b. Partial gate - SW2; set to close at 25% and up points AA20, AA21. ( ) **Closed at _____ % and up**	
c. 0 gate - SW3; set to close at 1.5% and down Points AA22, AA23. ( ) **Closed at _____ % and down**	
2. Check the following instrumentation on the actuator cabinet:	
a. Tachometer. Also check tachometer in control room at the same time. Check and adjust frequency. ( ) **_____RPM _____RPM**	
b. Gate limit/gate position indicator on actuator and in the control room. As per attached sheet. ( )	
c. Open current loop for gate position and measure feedback transducer current. Open positive to transducer. ( )	
3. Check governor accumulator tank oil level switches. **Check drawing to verify points (T.G. panel).**	
a. 71 GO high alarm (points AD1, AD2). ( )	
b. 71 GO low alarm (points AD3, AD4). ( )	
c. 71 GL low trip (points AD5, AD6). ( )	
4. Check governor accumulator tank oil pressure switches. Check drawing to verify points (T.G. panel).	
a. 63 GAP low alarm (points AD7, AD8). ( ) **Closes at 2000 (290 psi) kpa and down. Actual _____**	

JDE Item No. & Description: 59532 - Governor - Unit No. 5 - BDE Type of Inspection: PM6 Department: Protection & Control	Sheet: 5 of 6 Rev. No.: 12 Rev. Date: 17-03-08 Index No.: 343 Binder No.: 41
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
ROUTINE PM INSPECTIONS (Cont'd) **4. Check governor accumulator tank oil pressure switches. Check drawing to verify points (T.G. panel). (Cont'd)** **b. 63 GT trip (points AD9, AD10). ( )** **Closes at 1850 (268 psi) kpa and down. Actual _____** **c. 63 GI CIX-CCT (points AD11, AD12). ( )** **Closes at 1960 (284 psi) kpa and up. Actual _____** **5. Check all wiring and connections. ( )** **6. Speed Droop Indicator ( )** **Normal 2% Actual _____%**	

JDE Item No. & Description: 59532 - Governor - Unit No. 5 - BDE Type of Inspection: PM6 Department: Protection & Control	Sheet: 6 of 6 Rev. No.: 12 Rev. Date: 17-03-08 Index No.: 343 Binder No.: 41

GOVERNOR GATE LIMIT/GATE POSITION CHECKS

Drawing #: _____

Tested By: _____ Date: _____

Governor				Control Room				ECC			
Gate Limit		Gate Position		Gate Limit		Gate Position		Gate Limit		Gate Position	
	Ma Signal		Ma Signal	Found	Left	Found	Left	Found	Left	Found	Left
0											
10											
20											
30											
40											
50											
60											
70											
80											
90											
100											

*Note: Open the +(Positive) to each of the transducers to obtain Ma currents.

Comments:

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 1 Rev. No.: 8 Rev. Date: 17-09-11 Index No.: 367 Binder No.: 41

PM Checksheet No.: PM6 - 59556 - P&CBDE
JDE Item No. & Description: 59556 - Turbine - Unit No. 5 - BDE
Type of Inspection: PM6 (Annual)
Department: Protection & Control
Inspection Start Date: Asset Approval: B. Woodman
Supervisor's Review Signature & Date: Insp. Comp. Date:
Reference Drawing and Manuals: 2107-E-141, 2107-E-154, ED-002 & ED-009

ACTIVITIES (Initial Box Upon Completion)	REMARKS
CRITICAL PARTS INSPECTION	
1. Turbine Bearing Temperature Trip Meter #1	
a. Inspect wiring and connections. ( )	
2. Turbine Bearing Temperature Trip Meter #2	
a. Inspect wiring and connections. ( )	
3. Turbine Bearing Temperature Alarm Meter	
a. Inspect wiring and connections. ( )	
4. Check vibration pickups for turbine and generator. Inspect cables, signal conditioners and set up gap to read -12 VDC. ( )	
5. a. Check calibration of turbine oil level. ( )	
Verify alarms:	
Low: 238 mm Actual: _____	
High: 377 mm Actual: _____	
Verify Indication: _____	
b. Remove probe cover and check wiring. Note: Ensure the signal wire from probe is securely connected to circuit board. ( )	

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 6 Rev. No.: 12 Rev. Date: 15-05-21 Index No.: 373 Binder No.: 41

PM Checksheet No.: PM6-59527 - P&CBDE
JDE Item No. & Description: 59527 - Generator - Unit No. 5 - BDE
Type of Inspection: PM6 (Annual)
Department: Protection & Control
Inspection Start Date: Asset Approval: B. Woodman
Supervisor's Review Signature & Date: Insp. Comp. Date:
Reference Drawing and Manuals: 2107-E-155, 2107-E-141, 2107-E-43, 2107-E-44, 2107-E-45, 2107-E-149 & ED-059

ACTIVITIES (Initial Box Upon Completion)	REMARKS
CRITICAL PARTS INSPECTION	
1. Thrust Bearing Temperature Alarm Meter	
a. Inspect wiring and connections. ( )	
2. Thrust Bearing Temperature Trip Meter	
a. Inspect wiring and connections. ( )	
3. Guide Bearing Temperature Trip Meter #1	
a. Inspect wiring and connections. ( )	
4. Guide Bearing Temperature Trip Meter #2	
a. Inspect wiring and connections. ( )	
5. Guide Bearing Temperature Alarm Meter	
a. Inspect wiring and connections. ( )	
6. Generator Bearing	
a. Check calibration of generator oil level. Verify alarms. ( )	
Normal Low - 60mm Actual - _____	
Normal High – 120mm Actual - _____	
Verify Indication	
ROUTINE PM INSPECTIONS	
1. Inspect and clean all relays. ( )	
2. Check unit KV meter. ( )	

PM Checksheet No.: 59527 - Generator - Unit No. 5 - BDE Type of Inspection: PM6 Department: Protection & Control	Sheet: 2 of 6 Rev. No.: 12 Rev. Date: 15-05-21 Index No.: 373 Binder No.: 41

GENERATOR PRIMARY PROTECTION FUNCTION TEST

Tested by: _____ **Date:** _____

BDE Powerhouse Unit Protection and Unit Breaker and Modifications Control DC Schematic Diagrams.

BDE Powerhouse Unit 3-Phase AC Drawings.

ACTIVITIES (Initial Box Upon Completion)

Note: Any block accompanied by an * must have a completed checksheet.

FUNCTION TEST SHEETS (UNIT)

Notes:

1. **Work on units and related equipment must be completed and all personnel must be away from the unit and related equipment before function tests are carried out.**
2. **Tape off adjacent panels so as not to work on wrong units.**
3. **Note that all primary protection initiates lockout (86). Also, note that 86 trips the main breaker and field breaker and operates the shutdown solenoid. After initial tripping of breaker, leave breaker tripped until all primary protection is checked. Then close breaker to check standby protection. Check voltage on the shutdown solenoid across links BB52 and BB53.**
4. **Note that standby protection initiates lockout (86S) and 86S trips main breaker and field breaker and operates the shutdown solenoid. Leave breaker tripped until all standby protection is checked, then leave breaker tripped to check mechanical protection. Mechanical protection operates 5 and 5 operates partial shutdown solenoid and trips 86 through 33X contact.**
5. **Note that for unit #1 and unit #3, lockouts (86) and (86S) also trip station service breaker 52AT-1 and 52AT-2, respectively.**
6. **Open links to disable oscillograph and close after completion of testing.**
7. **Note all alarms and/or targets associated with the trips and reset upon completion of testing (control room and exciter).**

PM Checksheet No.: 59527 - Generator - Unit No. 5 - BDE Type of Inspection: PM6 Department: Protection & Control	Sheet: 3 of 6 Rev. No.: 12 Rev. Date: 15-05-21 Index No.: 373 Binder No.: 41
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
1. Loss of Field (40G). ( ) Note: Loss of field (40G) just gives alarm.	
2. Split Phase (87SP) Unit. ( )	
Phase A _____ Timed _____ Inst.	
Phase B _____ Timed _____ Inst.	
Phase C _____ Timed _____ Inst.	
3. Differential (87G). ( )	
Phase A _____ Inst.	
Phase B _____ Inst.	
Phase C _____ Inst.	
4. Overvoltage (59G). ( )	
5. Generator Ground. ( )	
64G/I. ( )	
64G/I. ( )	
6. Out of Step (78). ( )	
7. Overspeed (12A/390 rpm). ( )	
8. Excitation System Failure (K-95). ( )	
9. Rectifier Transformer Protection	
a. Gas pressure (63RT). ( )	
b. Overcurrent (50-51RT). ( )	
Phase A _____ Timed _____ Inst.	
Phase B _____ Timed _____ Inst.	
Phase C _____ Timed _____ Inst.	

PM Checksheet No.: 59527 - Generator - Unit No. 5 - BDE Type of Inspection: PM6 Department: Protection & Control	Sheet: 4 of 6 Rev. No.: 12 Rev. Date: 15-05-21 Index No.: 373 Binder No.: 41
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
UNIT STANDBY PROTECTION 1. Voltage Restraint (51V). ( ) Phase A_____ Timed Phase B_____ Timed Phase C_____ Timed 2. Negative Phase Sequence (46G). ( ) **MECHANICAL PROTECTION** 1. Turbine Bearing Temperature Trip a. 38BT-1. ( ) b. 38BT-2. ( ) 2. Generator Guide Bearing Temperature Trip a. 38BT-1. ( ) b. 38BT-2. ( ) 3. Generator Thrust Bearing Temperature Trip (38BT-1). ( ) 4. Governor Accumulator Tank Low Air Pressure Trip (63GT). ( ) 5. Governor Accumulator Tank Low Oil Level Trip (71GL). ( )	

PM Checksheet No.:	59527 - Generator - Unit No. 5 - BDE	Sheet: 5 of 6
Type of Inspection:	PM6	Rev. No.: 12
Department:	Protection & Control	Rev. Date: 15-05-21
		Index No.: 373 Binder No.: 41

Tested By: _____ Date: _____

Instrument Checked: KV Meter

Standard Source	Calculated	Recorded	Final Adjustment
0 volts	0 kv		
50 volts	6 kv		
100 volts	12 kv		
150 volts	18 kv		

Meter Type: Type AB-18 Scale: 0 – 150 volts Manufacturer: General Electric

Comments: _____

PM Checksheet No.:	59527 - Generator - Unit No. 5 - BDE	Sheet: 6 of 6
Type of Inspection:	PM6	Rev. No.: 12
Department:	Protection & Control	Rev. Date: 15-05-21
		Index No.: 373 Binder No.: 41

Protection & Control Devices - Generator #5

Device No.	Device Function	Recommended Setting	Actual Setting
62	Creep detector time delay relay	3 Minutes	
62X	Shutoff valve closing time delay auxiliary relay	10 Seconds	

W/O #_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 2 Rev. No.: 7 Rev. Date: 17-11-20 Index No.: 1968 Binder No.: 41

PM Checksheet No.: PM6-199924-P&CBDE
JDE Item No. & Description: 199924 - Exciter - Unit No. 5 - BDE
Type of Inspection: PM6 (Annual)
Department: P&C — Asset Approval: B. Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature & Date:
Reference Drawing and Manuals: 2107-E-130, 2107-E-131, 107-E-132 & ABB Ref. 502-799

ACTIVITIES (Initial Box Upon Completion)	REMARKS
CRITICAL PARTS INSPECTION **Step #1** **The following checks to be done with power off/unit isolated for inspection:** **a. Inspect heatsinks for contamination. ( )** **b. Inspect printed circuit boards for component discolouration, dirt and dust accumulation, etc. ( )** **c. Inspect wiring and connections on terminal blocks. ( )** **d. Check all ribbon cables for damage and proper connection. ( )** **e. Visual inspection of field flashing contactor. ( )** **f. Visual inspection of internal distribution breakers. ( )** **g. Visual inspection of crowbar assembly. ( )** **h. Check calibration of timer 14EX: ( )** **Setting value - 1.0 Sec. Measured value - _____ Sec.** **i. Check operation of 14x relay. ( )** **j. Inspect 24V AC/DC power supply (G05) for dust and dirt accumulation. Also check all associated wiring and connections. ( )** **k. Inspect 24V DC/DC power supply (G15) for dust and dirt accumulation. Also check all associated wiring and connections. ( )** **l. Inspect all cubicles for any foreign material and clean and vacuum if necessary. ( )**	

JDE Item No. & Description: 199924 - Exciter - Unit No. 5 - BDE Type of Inspection: PM6 Department: PROTECTION & CONTROL	Sheet: 2 of 2 Rev. No.: 7 Rev. Date: 17-11-20 Index No.: 1968 Binder No.: 41
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**

Step #2

"Power On" checks:

a. With power on check output voltage of 24V AC/DC power supply (G05). _____ ( )

Measure on W5:1 and W4:1

b. With power on check output voltage of 24 V DC/DC power supply (G15). _____ ( )

Measure on W1:1 and W2:1

c. Check field flashing timer setting. Normal 8.0 seconds ( )

Measured _____

d. With unit at speed no load, perform all the steps previously done in Step #2, i.e.: ( )

i. Change over from Auto to Manual. ( )

ii. Change over from Manual to Auto. ( )

iii. Transfer of bridges. ( )

iv. Verification of thyristor firing. ( )

v. Check alarm screen. ( )

vi. Check voltage raise/lower from Control Room. ( )

Note: Take all necessary precautions as mentioned in each section of Step #2.

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 5 Rev. No.: 5 Rev. Date: 15-04-15 Index No.: 915 Binder No.: 6

PM Checksheet No.: PM9 – 109924 - EBDE
JDE Item No. & Description: 109924 - Exciter #5 - BDE
Type of Inspection: PM9
Department: Electrical — Asset Approval: B. Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature & Date:
Reference Drawing and Manuals: ABB Ref. 502-799, 2107-E-130, 2107-E-131

ACTIVITIES (Initial Box Upon Completion)		REMARKS
CRITICAL PARTS INSPECTION		
1. Cooling Fan #1		
a) Record cooling fan hours. _____	( )	
b) Replace cooling fan assembly 25,000 service hours and reset hour meter to zero.	( )	
c) Check wiring for loose connections, etc.	( )	
2. Cooling Fan #2		
a) Record cooling fan hours. _____	( )	
b) Replace cooling fan assembly 25,000 service hours and reset hour meter to zero.	( )	
c) Check wiring for loose connections, etc.	( )	
3. Field Breaker		
a) Inspect main fixed contacts.	( )	
b) Inspect main moving contacts.	( )	
c) Inspect arcing chamber.	( )	
d) Inspect closing and opening operating mechanism.	( )	
e) Inspect protective releases.	( )	
f) Check charging motor.	( )	
g) Inspect moving arc breaking contacts.	( )	
h) Inspect fixed arc breaking contacts.	( )	
i) Check all connections for tightness and lubrication.	( )	

JDE Item No. & Description: 109924 - Exciter #5 - BDE Type of Inspection: PM9 Department: Electrical	Sheet: 2 of 5 Rev. No.: 5 Rev. Date: 15-04-15 Index No.: 915 Binder No.: 6
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
3. Field Breaker (Cont'd)	
j) Operate breaker in racked out position. ( )	
k) Record operation counter. ( )	
l) Check clearance between arcing and main contacts. ( )	
4. Field Flashing Contactor	
a) Check if contacts are clean as per Operating Instruction FPTC401-773. ( )	
5. Air Filters	
a) Check or replace air filters. ( )	
6. Field Cables Panel ER	
a) Check connections as per attached Torque Table for Metric Bolts. ( )	
7. Field Cables Panel EE	
a) Check wiring connections. ( )	
b) Check bus connections. ( )	
8. Field Cables Panel EG1	
a) Check bus connections. ( )	
9. Transformer - Rectifier	
a) Check all connections and wiring. ( )	
b) Check and inspect bushings. ( )	
c) Check Pyranol level. ( )	
d) Check operation of gas detector. ( )	
e) Check for leaks. ( )	

JDE Item No. & Description: 109924 - Exciter #5 - BDE PM Type of Inspection: PM9 Department: Electrical	Sheet: 3 of 5 Rev. No.: 5 Rev. Date: 15-04-15 Index No.: 915 Binder No.: 6
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
9. <u>Transformer – Rectifier</u> (Cont'd) <u>Temperature Gauge</u> a) Check pointer indication to ensure that meter is not reading zero degrees. ( ) b) Check glass faceplate for cracks. ( ) c) Clean glass faceplate. ( ) d) Check calibration of meter. ( ) e) Check point movement for smoothness. ( ) f) Check alarm point. Alarm 85°. ( ) Found at _____ Adjusted to _____ g) Check contacts - clean if necessary. ( ) h) Check wiring and connections. ( ) i) Check condition of bulb. ( ) j) Check calibration. ( ) 10. <u>13.8 KV Metering & Voltage PT's</u> a) Check connections on the six potential transformers. ( ) b) Check fuse holders. ( ) c) Check grounding connection on PT's. ( ) d) Check connection between PT and bus. ( )	

JDE Item No. & Description: 109924 - Exciter #5 - BDE Type of Inspection: PM9 Department: Electrical	Sheet: 4 of 5 Rev. No.: 5 Rev. Date: 15-04-15 Index No.: 915 Binder No.: 6

Manufacturer: Marshall Town Serial No.: _____ Model No.: _____

Location: Unit #5 Rectifier Transformer

Face Diameter: 4" Tube Length: 6" Scale: 0° – 120°C

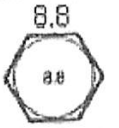
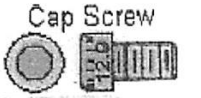
Alarm Point	Temp. Meter Reading	Thermometer Reading	Comments
	20^0 C		
	30^0 C		
	40^0 C		
	50^0 C		
	60^0 C		
	70^0 C		
	80^0 C		
	90^0 C		

JDE Item No. & Description:	109924 - Exciter #5 - BDE	Sheet:	5 of 5
PM Type of Inspection:	PM9	Rev. No.:	5
Department:	Electrical	Rev. Date:	15-04-15
		Index No.:	915 Binder No.: 6

ACTIVITIES (Initial Box Upon Completion)	REMARKS

Metric Bolt Torque Table

Estimated with clamp load as 75% of proof load as specified in ISO 898-1

Property Class	8.8 	10.9 	12.9 Socket Head Cap Screw 	
Minimum Tensile Strength MPa	M6 - M16: 800 M20 - M30: 830	1040	1220	
Nominal Size and Thread Pitch	Bolt Torque Specs in Foot Pounds or (Inch Pounds)			
	Dry	Lubed	Dry	Lubed	Dry	Lubed
M5 x 0.80	(54)	(41)	(78)	(59)	(91)	(68)
M6 x 1.00	(92)	(69)	(133)	(99)	(156)	(116)
M7 x 1.00	(156)	(116)	(222)	(167)	(260)	(195)
M8 x 1.25	(225)	(169)	(333)	(242)	(377)	(284)
M10 x 1.50	37	28	53	40	62	47
M12 x 1.75	65	49	93	69	108	81
M14 x 2.00	104	78	148	111	173	130
M16 x 2.00	161	121	230	172	269	202
M18 x 2.50	222	167	318	238	372	279
M20 x 2.50	314	235	449	337	525	394
M22 x 2.50	428	321	613	460	716	537
M24 x 3.00	543	407	776	582	908	681
M27 x 3.00	796	597	1139	854	1331	998
M30 x 3.50	1079	809	1543	1158	1804	1353
M33 x 3.50	1468	1101	2101	1576	2455	1842
M36 x 4.00	1886	1415	2699	2024	3154	2366

Lubed means cleaned dry bolts lubricated with a standard medium viscosity machine oil. Lubricate all contact areas of the bolts and washers. Lubricating the bolts is the suggested method. Thread Engagement

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 22 Rev. No.: 10 Rev. Date: 15-04-07 Index No.: 929 Binder No.: 6

PM Checksheet No.: PM9 - 59527 - EBDE
JDE Item No. & Description: 59527 - Generator #5 - BDE
Type of Inspection: PM9 (Major - Every Five Years)
Department: Electrical — Asset Approval: B. Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature & Date:
Reference Drawing and Manuals: 107-E-19, 2107-E-43, 2107-E-131, 2107-E-44, 2107-E-130, ED-014, ED-021, ED-022, ED-024 & ED-047

ACTIVITIES (Initial Box Upon Completion)		REMARKS
CRITICAL PARTS INSPECTION		
1. <u>Stator Coils</u>		
a) Check coils for end distortion, cracked insulation or any other mechanical damage.	( )	
b) Check for signs of corona discharge.	( )	
c) Check for dirt, contamination, etc.	( )	
d) Check for signs of coil movement.	( )	
e) Check stator frame sole plates for signs of movement.	( )	
f) Check end caps for puffing, swelling, cracks, contamination, etc.	( )	
g) Check lashings and ties for looseness, movement or deterioration.	( )	
h) Check slot packing for tightness, signs of migration of slot fillers.	( )	
i) Check punchings at fingers for looseness or fretting corrosion.	( )	
j) Clean generator stator.	( )	
k) Conduct polarization index test and record results on PI form prior to and after cleaning.	( )	
l) Conduct Hypot test. Ground all RTDs and PDA cables. Email results in Excel format to Plant Electrical Engineer. Note: If graph changes from linear to exponential, abort test and inform Engineer.	( )	
m) Conduct radial wedge tightness checks.	( )	
n) Conduct doble test.	( )	

JDE Item No. & Description: 59527 - Generator #5 - BDE Type of Inspection: PM9 Department: Electrical	Sheet: 2 of 22 Rev. No.: 10 Rev. Date: 15-04-07 Index No.: 929 Binder No.: 6
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**

1. Stator Coils (Cont'd)

   o) Conduct air gap readings. ( )

   p) Check stator core studs. _____ Normal 400ft/lbs ( )

2. Water in Bearing Oil Detector

   a) Verify operation. ( )

   b) Clean cup and probes. ( )

   c) Check wiring for damage. ( )

3. Generator Slip Ring Assembly

   NOTE: TORQUE SETTINGS FOR ELECTRICAL CONNECTORS:
   BOLTS 3/8" – 20ft/lbs – silicon bronze
   BOLTS 3/8" – 27+/-3 ft/lbs – Grade 5 medium carbon
   BOLTS ½" – 67+/-7 ft/lbs – Grade 5 medium carbon
   BOLTS ½" – 41ft/lbs – Silicon bronze

   a) Check brushes for cracks, uneven surfaces, etc. ( )

   b) Measure and record lengths of carbon brushes. ( )

   c) Replace all worn brushes less than 1/8". Number of brushes replaced. _____ 1/8" before pigtail contacts brush box. ( )

   d) Inspect and clean all slip ring insulators. ( )

   e) Check slip rings for pitting, discoloration or scouring. ( )

   f) Check all mounting hardware for tightness. ( )

   g) Measure and record wear on lower slip ring. ( )

   h) Measure and record wear on upper slip ring. ( )

   i) Reverse polarity on slip rings by reversing leads at exciter cubicle. ( )

   j) Check and clean all brush holders, springs and pigtail connections. ( )

   k) Meggar slip rings. 500 volt meggar. Normal 1000m+ ( )

JDE Item No. & Description: 59527 - Generator #5 - BDE Type of Inspection: PM9 Department: Electrical	Sheet: 3 of 22 Rev. No.: 10 Rev. Date: 15-04-07 Index No.: 929 Binder No.: 6
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
4. <u>Rotor</u>	
a) Clean rotor and varnish touchup. ( )	
b) Check all fasteners, such as bolts, pole keys, rim keys, etc. for tightness. Cooling fan bolts ¾" are 100 ft/lbs. 1" bolts are 220 ft/lbs torque. ( )	
c) Check field pole connections, taping and insulation and all coil connections. ( )	
d) Conduct 500 volt meggar test and record result. ( )	
Meggar result _____ Normal is 100m ohms.	
e) Check spider for cracks. ( )	
f) Check ventilation ducts for foreign material or obstruction. ( )	
g) Check rotor bus leads (flexible jumpers) to slip rings:	
i. Check tightness of bolts torque at 67 +/- 7 Ft-Lb.s ( )	
ii. Visually inspect for abnormal wear and cracks. ( )	
iii. Check laminate layers for peeling. ( )	
h) Obtain pole drop test. ( )	
5. <u>Current Transformer Split Phase and Neutral</u>	
a) Check mounting hardware and connections. ( )	
b) Clean transformer and mounting hardware. ( )	
c) Visually inspect cablings for cracks or mechanical damage. ( )	
6. <u>Generator Shaft Grounding brush</u>	
a) Spray clean grounding bracket. ( )	
b) Check brush for cracks, uneven wear. ( )	
c) Check brush for good contact with shaft. ( )	

JDE Item No. & Description: 59527 - Generator #5 - BDE Type of Inspection: PM9 Department: Electrical	Sheet: 4 of 22 Rev. No.: 10 Rev. Date: 15-04-07 Index No.: 929 Binder No.: 6
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
7. Partial Discharge Equipment a) Check coupler mounting hardware for looseness, insulation cracking. ( ) b) Check co-axial cable for mechanical damage. ( ) **8. Generator Smoke Detectors** a) Check mounting hardware. ( ) b) Check wiring connections for defects. ( ) c) Conduct and record sensitivity readings for each of the four detectors. ( ) _____ _____ _____ _____ d) Conduct operation check with 24-volt power supply. ( ) **9. Generator Bearing RTD** a) Check connections. ( ) b) Measure and record resistance. ( ) Thrust _____ohms. Guide _____ohms. **10. Generator Stator RTD's** G.E. Drawing # 767D205AL a) Check connections. ( ) b) Record resistances of RTD's in use. ( ) Resistance RTD #1 _____ohms Temp Auto Control _____ Resistance RTD #2 _____ohms Temp Auto Control _____ c) Record resistances of RTD's in use. (Cont'd) Resistance RTD #3 _____ohms Meter in Auto Control Panel _____ Resistance RTD #4 _____ohms Meter in Auto Control Panel _____ Resistance RTD #5 _____ohms Meter in Auto Control Panel _____	

JDE Item No. & Description: 59527 - Generator #5 - BDE Type of Inspection: PM9 Department: Electrical	Sheet: 5 of 22 Rev. No.: 10 Rev. Date: 15-04-07 Index No.: 929 Binder No.: 6
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
11. Generator Brake Switches	
a) Clean all switches and mounting hardware. ( )	
b) Check mounting hardware. ( )	
c) Check wiring for loose connections, broken connectors and mechanical damage. ( )	
d) Check operation of switches. ( )	
e) Check brake circuits BG1-BG8. ( )	
12. Generator Creep Detector	
a) Check connections on contacts and operation coils. ( )	
b) Clean creep detectors. ( )	
c) Check operation of contacts. ( )	
d) Inspect pins and linkage movement. ( )	
e) Check condition of textolite brush. ( )	
f) Check air gap to shaft .003". ( )	
13. Generator Neutral Grounding Cubicle	
a) Check and clean transformer bushings. ( )	
b) Check all wiring connections. ( )	
c) Check resistor and switch conditions. Resistor ohms _____ ( )	
d) Vacuum out cubicle. ( )	
ROUTINE PM INSPECTION	
1. Check all runs of wiring for fraying, mechanical damage, etc. ( )	
2. Check all cable clamps. ( )	
3. Check lighting fixtures and outlets. ( )	

JDE Item No. & Description: 59527 - Generator #5 - BDE Type of Inspection: PM9 Department: Electrical	Sheet: 6 of 22 Rev. No.: 10 Rev. Date: 15-04-07 Index No.: 929 Binder No.: 6
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
ROUTINE PM INSPECTION (Cont'd) **4. Check operation of GFI's.** ( ) **5. Check all wiring in generator terminal boxes. (main bracket & top bracket)** ( ) **6. Check cable tray, supports, etc.** ( ) **7. Check inside of generator housing for dirt, foreign objects, carbon buildup on 13.8 kv leads.** ( ) **8. Inspect condition of insulating material on main leads to isolated phase bus inside of generator housing.** ( )	

JDE Item No. & Description: 59527 - Generator #5 - BDE Type of Inspection: PM9 Department: Electrical	Sheet: 7 of 22 Rev. No.: 10 Rev. Date: 15-04-07 Index No.: 929 Binder No.: 6

Date of Check: _____ Checked By: _____

BRUSH MEASUREMENT (CLOCKWISE)

Unit hour meter reading: _____ Hours accumulated since last inspection: _____

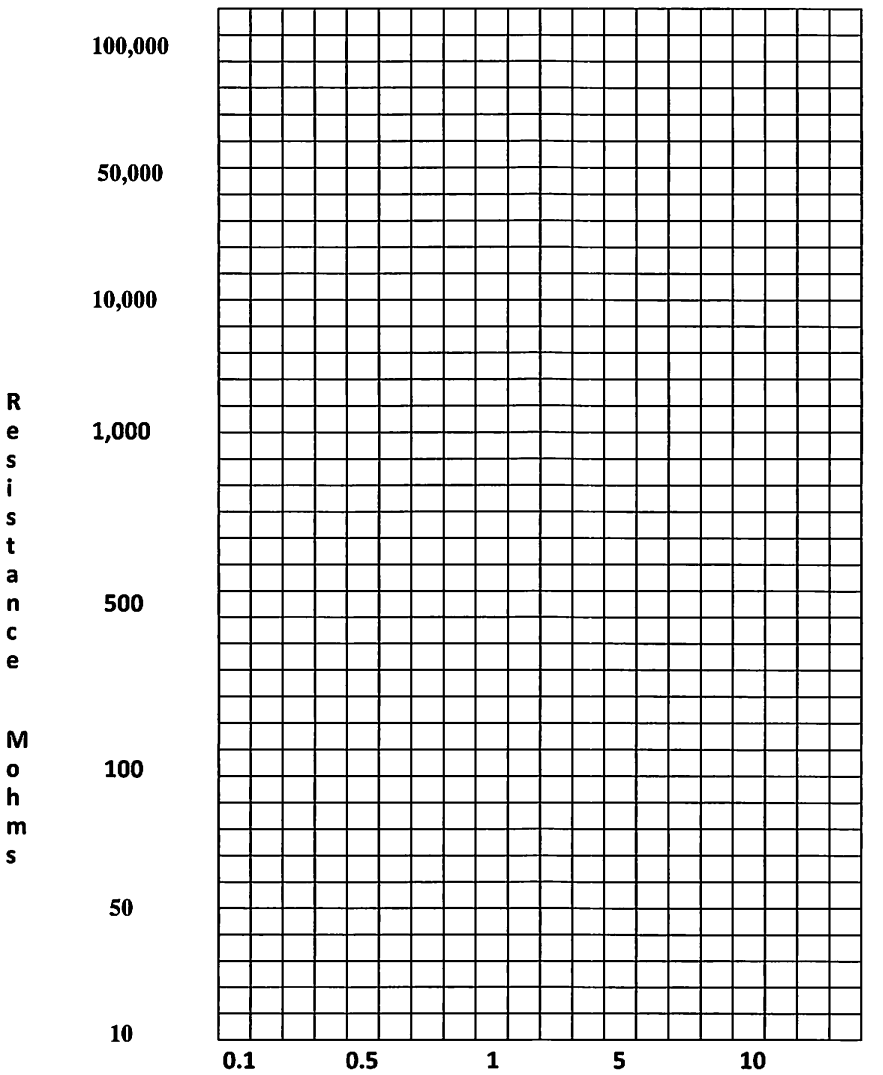
	Top Ring		Bottom Ring	
	Top	Bottom	Top	Bottom
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				

Comments:

JDE Item No. & Description: 59527 - Generator #5 - BDE Type of Inspection: PM9 Department: Electrical	Sheet: 8 of 22 Rev. No.: 10 Rev. Date: 15-04-07 Index No.: 929 Binder No.: 6

Checked By: _____ Date: _____

POLARIZATION INDEX TEST



Time	Mohms
15 Sec.	
30 Sec.	
45 Sec.	
1 Min.	
2 Min.	
3 Min.	
4 Min.	
5 Min.	
6 Min.	
7 Min.	
8 Min.	
9 Min.	
10 Min.	

Polarization Index: Time, Minutes

Comments: _____

_____

JDE Item No. & Description: 59527-Generator #5 - BDE Type of Inspection: PM9 Department: Electrical	Sheet 9 of 22 Rev. No.: 10 Rev. Date: 15-04-07 Index No.: 929 Binder No.: 6

Date of Check: _____ Checked By: _____

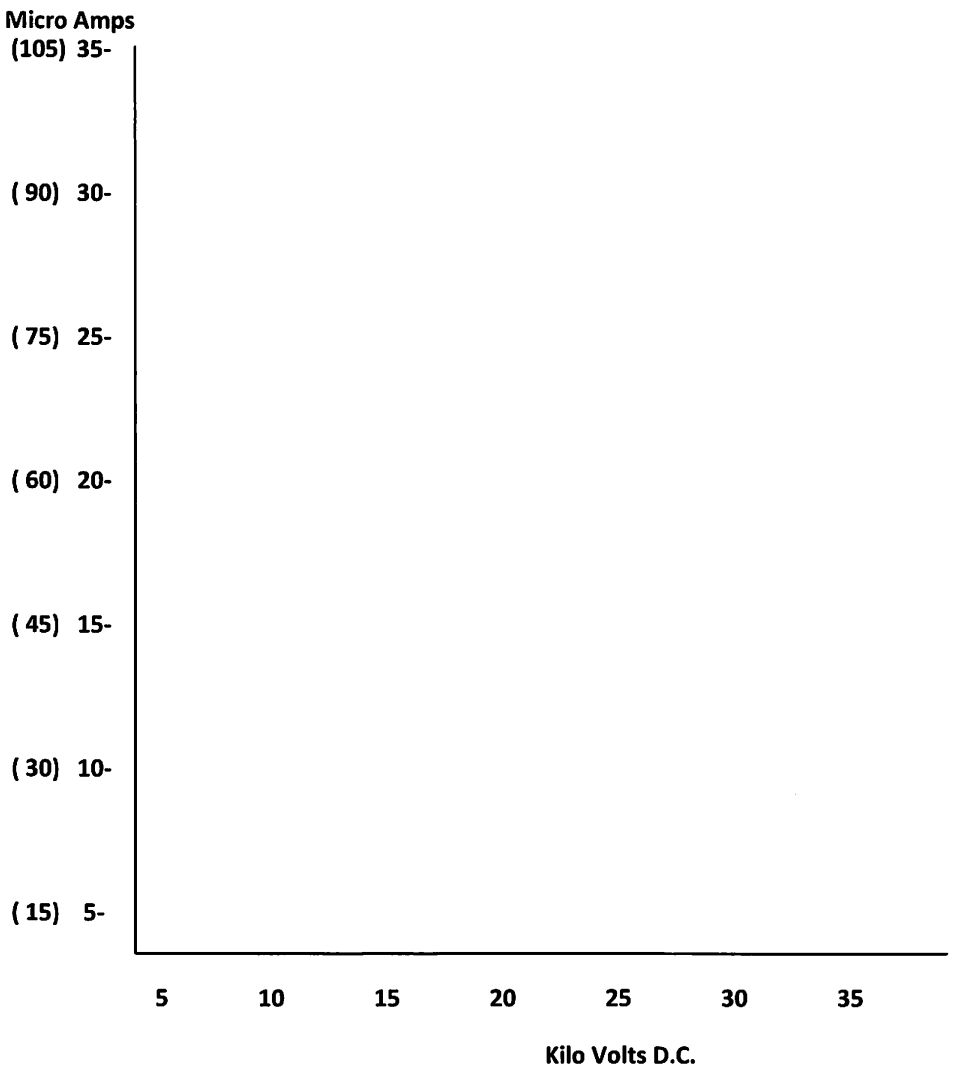
POLE DROP TEST - PRIOR TO CLEANING

Applied Voltage _____ volts.

	Pole	Voltage
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		

JDE Item No. & Description: 59527 - Generator #5 - BDE Type of Inspection: PM9 Department: Electrical	Sheet 10 of 22 Rev. No.: 10 Rev. Date: 15-04-07 Index No.: 929 Binder No.: 6

HYPOT TEST CURVE GRAPHS



Unit was hypotted with _____ winding.

Comments:

JDE Item No. & Description: 59527 - Generator #5 - BDE Type of Inspection: PM9 Department: Electrical	Sheet: 11 of 22 Rev. No.: 10 Rev. Date: 15-04-07 Index No.: 929 Binder No.: 6

GEN. AIR GAP READINGS

Unit #: _____ Position: 180 degs. Bottom Date: _____

Pole No.	Value	Pole No.	Value	Difference
1		13		
2		14		
3		15		
4		16		
5		17		
6		18		
7		19		
8		20		
9		21		
10		22		
11		23		
12		24		

Remarks: _____

_____

_____

_____

_____

_____

Readings taken by: _____

JDE Item No. & Description:	59527 - Generator #5 - BDE	Sheet:	12 of 22
Type of Inspection:	PM9	Rev. No.:	10
Department:	Electrical	Rev. Date:	15-04-07
		Index No.:	929 Binder No.: 6

GEN. AIR GAP READINGS

Unit #: _____ Position: 0 degs. Bottom Date: _____

Pole No.	Value	Pole No.	Value	Difference
1		13		
2		14		
3		15		
4		16		
5		17		
6		18		
7		19		
8		20		
9		21		
10		22		
11		23		
12		24		

Remarks: _____

_____

_____

_____

_____

_____

Readings taken by: _____

JDE Item No. & Description: 59527 - Generator #5 - BDE Type of Inspection: PM9 Department: Electrical	Sheet: 13 of 22 Rev. No.: 10 Rev. Date: 15-04-07 Index No.: 929 Binder No.: 6

GEN. AIR GAP READINGS

Unit #: _____ Position: 180 degs. Top Date: _____

Pole No.	Value	Pole No.	Value	Difference
1		13		
2		14		
3		15		
4		16		
5		17		
6		18		
7		19		
8		20		
9		21		
10		22		
11		23		
12		24		

Remarks: _____

_____

_____

_____

_____

_____

Readings taken by: _____

JDE Item No. & Description: 59527 - Generator #5 - BDE Type of Inspection: PM9 Department: Electrical	Sheet: 14 of 22 Rev. No.: 10 Rev. Date: 15-04-07 Index No.: 929 Binder No.: 6

GEN. AIR GAP READINGS

Unit #: _____ Position: 0 degs. Top Date: _____

Pole No.	Value	Pole No.	Value	Difference
1		13		
2		14		
3		15		
4		16		
5		17		
6		18		
7		19		
8		20		
9		21		
10		22		
11		23		
12		24		

Remarks: _____

_____

_____

_____

_____

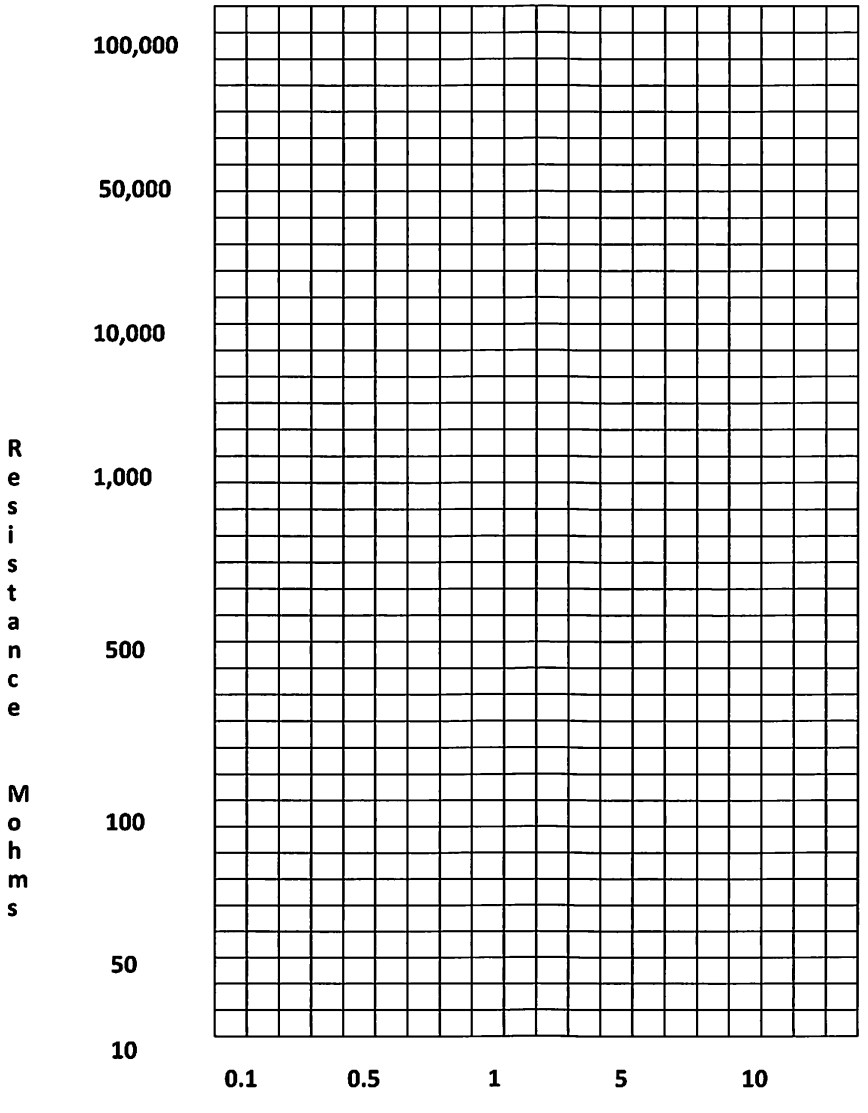
_____

Readings taken by: _____

JDE Item No. & Description: 59527 - Generator #5 - BDE Type of Inspection: PM9 Department: Electrical			Sheet: 15 of 22 Rev. No.: 10 Rev. Date: 15-04-07 Index No.: 929 Binder No.: 6
GENERATOR	Readings Taken by: Verified by: Reviewed by: Approved by:	Date: Date: Date: Date:	

Check: _____ Checked By: _____

POLARIZATION INDEX TEST



Time	Mohms
15 Sec.	
30 Sec.	
45 Sec.	
1 Min.	
2 Min.	
3 Min.	
4 Min.	
5 Min.	
6 Min.	
7 Min.	
8 Min.	
9 Min.	
10 Min.	

Polarization Index: Time, Minutes

Submit to Engineering day of test.

Comments: _____

JDE Item No. & Description: 59527- Generator #5 - BDE Type of Inspection: PM9 Department: Electrical		Sheet: 16 of 22 Rev. No.: 10 Rev. Date: 15-04-07 Index No.: 929 Binder No.: 6
Generator:	Readings taken by: Verified by: Reviewed by: Approved by:	Date: Date: Date: Date:

POLE DROP TEST

Applied Voltage _____ volts.

	Pole	Voltage
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		

Remarks: _____

_____

_____

Submit copy to Engineering the day of inspection.

JDE Item No. & Description: 59527 - Generator #5 - BDE Type of Inspection: PM9 Department: Electrical	Sheet: 17 of 22 Rev. No.: 10 Rev. Date: 15-04-07 Index No.: 929 Binder No.: 6

GENERATOR: _____

STATOR WINDING SLOT WEDGING INSPECTION

Slot No. ® Wedge No.¯																											
Top	1																										
	2																										
	3																										
	4																										
	5																										
	6																										
	7																										
	8																										
	9																										
	10																										
	11																										
Bottom	12																										

Instrument Used: _____

Readings taken by: _____ Date: _____

Verified by: _____ Date: _____

Reviewed by: _____ Date: _____

Approved by: _____ Date: _____

L - Loose
C - Cracked
M - Missing

Submit to Engineering upon completion of this inspection.

JDE Item No. & Description: 59527 - Generator #5 - BDE Type of Inspection: PM9 Department: Electrical	Sheet: 18 of 22 Rev. No.: 10 Rev. Date: 15-04-07 Index No.: 929 Binder No.: 6

Generator: _____	Readings taken by: _____ Verified by: _____ Reviewed by: _____ Approved by: _____	Date: _____ Date: _____ Date: _____ Date: _____

AFTER CLEANING
HYPOT TEST

Air Temperature _____ °C Winding Temperature _____ °C

Voltage Steps	Current (UA) 1st Min.					Current (UA) 3rd Min.				
3 KV										
6 KV										
9 KV										
12 KV										
15 KV										
18 KV										
21 KV										
24 KV										
27 KV	1 Min.	2 Min.	3 Min.	4 Min.	5 Min.	6 Min.	7 Min.	8 Min.	9 Min.	10Min

2016 to 2020 rated voltage will be 24kv max and from 2021 rated voltage will be 21kv as per Engineering Directive.

Comments:

Submit to Engineering upon completion of test.

JDE Item No. & Description: 59527- Generator #5-BDE Type of Inspection: PM9 Department: Electrical	Sheet: 19 of 22 Rev. No.: 10 Rev. Date: 15-04-07 Index No.: 929 Binder No.: 6

GENERATOR AIR GAP READINGS

GENERATOR: _____

READINGS TAKEN BY: _____ DATE: _____

VERIFIED BY: _____ DATE: _____

REVIEWED BY: _____ DATE: _____

APPROVED BY: _____ DATE: _____

ROTOR PROFILE			STATOR PROFILE		
Pole #	Top Reading	Bottom Reading	Position	Top Reading	Bottom Reading
1			0°		
2			15		
3			30		
4			45		
5			60		
6			75		
7			90		
8			105		
9			120		
10			135		
11			150		
12			165		
13			180		
14			195		
15			210		
16			225		
17			240		
18			255		
19			270		
20			285		
21			300		
22			315		
23			330		
24			345		

Remarks:

Notes:
1. Record units of measurements.
2. Submit to Engineering upon completion of this task.

JDE Item No. & Description:	59527 - Generator #5 - BDE	Sheet:	20 of 22
Type of Inspection:	PM9	Rev. No.:	10
Department:	Electrical	Rev. Date:	15-04-07
		Index No.:	929 Binder No.: 6

STATOR CORE FLANGE BOLT CHECK

GENERATOR: _____

Cleaned by:	Date:
Verified by:	Date:
Reviewed by:	Date:
Approved by:	Date:

Note location of bolts which are less than 300 ft. lbs.

Note: G.E. recommends 400 ft. lbs.

Submit to Engineering upon completion of this task.

JDE Item No. & Description: 59527-Generator #5 - BDE Type of Inspection: PM9 Department: Electrical	Sheet: 21 of 22 Rev. No.: 10 Rev. Date: 15-04-07 Index No.: 929 Binder No.: 6

ROTOR MAGNETIC CENTER READINGS

REQUIRED IF MAIN BRACKET HAS BEEN REMOVED

GENERATOR: _____

Readings taken by:	Date:
Verified by:	Date:
Reviewed by:	Date:
Approved by:	Date:

POLE #	TOP READING	BOTTOM READING	DIFFERENCE (TOP-BOTTOM)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			

Remarks:

Notes: **Record units of measurements.**

Submit to Engineering upon completion of this task.

JDE Item No. & Description: 59527 - Generator #5 - BDE Type of Inspection: PM9 Department: Electrical	Sheet: 22 of 22 Rev. No.: 10 Rev. Date: 15-04-07 Index No.: 929 Binder No.: 6

CHECKLIST

GENERATOR: _____

ITEM	DATE COMPLETED	DATE SUBMITTED TO ENGINEERING	CHECKED BY
PI Test after unit comes down.			
Pole drop test after unit comes down			
Stator cleaning			
Rotor cleaning			
Wedge inspection			
Stator core flange bolt torque check			
Generator lead insulation			
Neutral lead insulation			
Rotor pole jumper insulation			
PI test prior to rotor installation			
Pole drop test prior to rotor installation			
DC highpot test prior to rotor installation			
Air gap readings			
Rotor magnetic centre readings			

Remarks:

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 7 Rev. No.: 6 Rev. Date: 17-03-07 Index No.: 936 Binder No.: 6

PM Checksheet No.: PM9 - 59532 - EBDE
JDE Item No. & Description: 59532 - Governor #5 - BDE
Type of Inspection: PM9
Department: Electrical — Asset Approval: B. Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature & Date:
Reference Drawing and Manuals: 2107—42, 2107-E-44, 2107-E-45, 2107-E-126, 2107-E-141

ACTIVITIES (Initial Box Upon Completion)	REMARKS
CRITICAL PARTS INSPECTION	
1. Governor Oil Pump Motor	
a) Check connections on magnetic starter for looseness. ( )	
b) Meggar governor oil pump motor with 1000 volt meggar. ( ) _____	
c) Record amperage of motor. ( ) A _____ B _____ C _____	
d) Record operating hours of motor. _____ ( )	
e) Replace bearings and clean motor if in excess of 10,000 hours and reset to zero. ( )	
f) Check motor connections and taping. ( )	
g) Check connection in 100 amp disconnect. ( )	
h) Verify operation of the oil pump motor controls and switch. ( ) In at _____ Normal 310 psi Out at _____ Normal 350 psi	
2. Ball Head Motor Governor	
a) Visual inspection to check cleanliness of stator. ( )	
b) Check suppression springs on ball head motor. ( )	
c) Replace ball head motor bearings. ( )	
d) Verify correct rotation. ( )	

JDE Item No. & Description: 59532 - Governor #5 - BDE Type of Inspection: PM9 Department: Electrical	Sheet: 2 of 7 Rev. No.: 6 Rev. Date: 17-03-07 Index No.: 936 Binder No.: 6
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
3. Governor Oil Pressure Switch	
a) Check wiring for loose connections. ( )	
b) Calibrate set point that it closes at 80 - 100 psi. ( )	
c) Calibrate differential that it opens at 255 - 260 psi. ( )	
4. Brake Solenoid	
a) Check wiring for loose connections. ( )	
b) Check operation of solenoid for free movement. ( )	
5. PMG Upper Drive Pins	
a) Check that bolt is not worn or mechanical cracks. ( )	
b) Check condition of insulating washer under bolt for cracks or carbon buildup. ( )	
c) Check condition of locking wire spaghetti insulation. ( )	
d) Replace brass lockwire. ( )	
6. PMG Lower Drive Pins	
a) Check that pins are not mechanically worn. ( )	
b) Check that pins are not loose in drive plate. ( )	
7. PMG Urethane Upper Bushing	
a) Check that bushings are not worn. ( )	
b) Check that fastening device holds bushing in place. ( )	
c) Clean bushing to prevent carbon tracking. ( )	
8. PMG Urethane Lower Bushing	
a) Check that bushings are not worn. ( )	
b) Check that fastening device holds bushing in place. ( )	
c) Clean bushing to prevent carbon tracking. ( )	

JDE Item. No. & Description: 59532 - Governor #5 - BDE Type of Inspection: PM9 Department: Electrical	Sheet: 3 of 7 Rev. No.: 6 Rev. Date: 17-03-07 Index No.: 936 Binder No.: 6
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**

9. PMG Speed Switches

Note: Testing of the speed switch after the PMG has been re-installed into the unit shall be performed by manually moving the ballarms.

a) Change all bearings in speed switches. ( )

b) Check all mounting hardware. ( )

c) Check all wiring for chafing, loose connections, etc. ( )

d) Oil all linkages with light lubricating oil. ( )

e) Check condition of teflon drive gears for cracks. ( )

f) Check all pins for obstruction in free movements. ( )

g) Check and record speed switch setting as per speed switch support sheet. ( )

h) Check wiring with PMG installed on unit - 75 rpm and below. ( )

BB10 & BB9 (20 AB CCT) BB11 & BB12 (14X CCT)

i) Check wiring with PMG installed 450 rpm and above. ( )

BC21 & BC22 (20CR) BC23 & BC34 (alarm)

j) Check wiring with PMG installed 270 rpm and above. ( )

BB7 & BB8 (14EX CCT) BB5 & BB6 (25X-1, 25X-2, 25X-3, 25X-4)

k) Check wiring with PMG installed 390 rpm and above. ( )

BC17 & BC18 (86 CCT) BC19 & BC20 (C.W. bypass solenoid)

l) Check hold-down bolts and measure for correct clearance 0.75". ( )

m) Meggar PMG to ground. _____ ( )

JDE Item No. & Description: 59532-Governor #4 - BDE Type of Inspection: PM9 Department: Electrical	Sheet: 4 of 7 Rev. No.: 6 Rev. Date: 17-03-07 Index No.: 936 Binder No.: 6
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
10. PMG Stator	
a) Clean stator. ( )	
b) Check condition of PMG stator leads for looseness or mechanical damage. ( )	
c) Check condition of PMG stator for mechanical damage, insulation cracking and cleanliness. ( )	
d) Check and record voltage reading of three phases as per Maintenance Standard settings. ( )	
A-B _____ B-C _____ C-A _____	
11. PMG Drive Plate	
a) Check the hold-down bolts for tightness. Normal 17 ft/lbs. ( )	
b) Check drive pin holds for tightness. ( )	
12. PMG Main Bearings	
a) Replace bearings. ( )	

JDE Item No. & Description: 59532 - Governor #5 - BDE Type of Inspection: PM9 Department: Electrical	Sheet: 5 of 7 Rev. No.: 6 Rev. Date: 17-03-07 Index No.: 936 Binder No.: 6

Date of Check: _____ Checked by: _____

PMG TESTING

* Check all switch operations as per Maintenance Standard #EM-8

	Found at	Adjusted to	Normal
Brake Switch	_____ rpm	_____ rpm	75 rpm ± 2%
Field Flashing	_____ rpm	_____ rpm	270 rpm ± 2%
Overspeed Switch	_____ rpm	_____ rpm	390 rpm ± 1%
Runaway Switch	_____ rpm	_____ rpm	450 rpm ± 1%

Voltage at rated speed A – B _____ volts

Voltage at rated speed B – C _____ volts

Voltage at rated speed A – C _____ volts

Voltage can be 10% above or as much as 20% below.

Normal at S.N. Load 85 volts

Normal at No Load 95 volts Test Stand

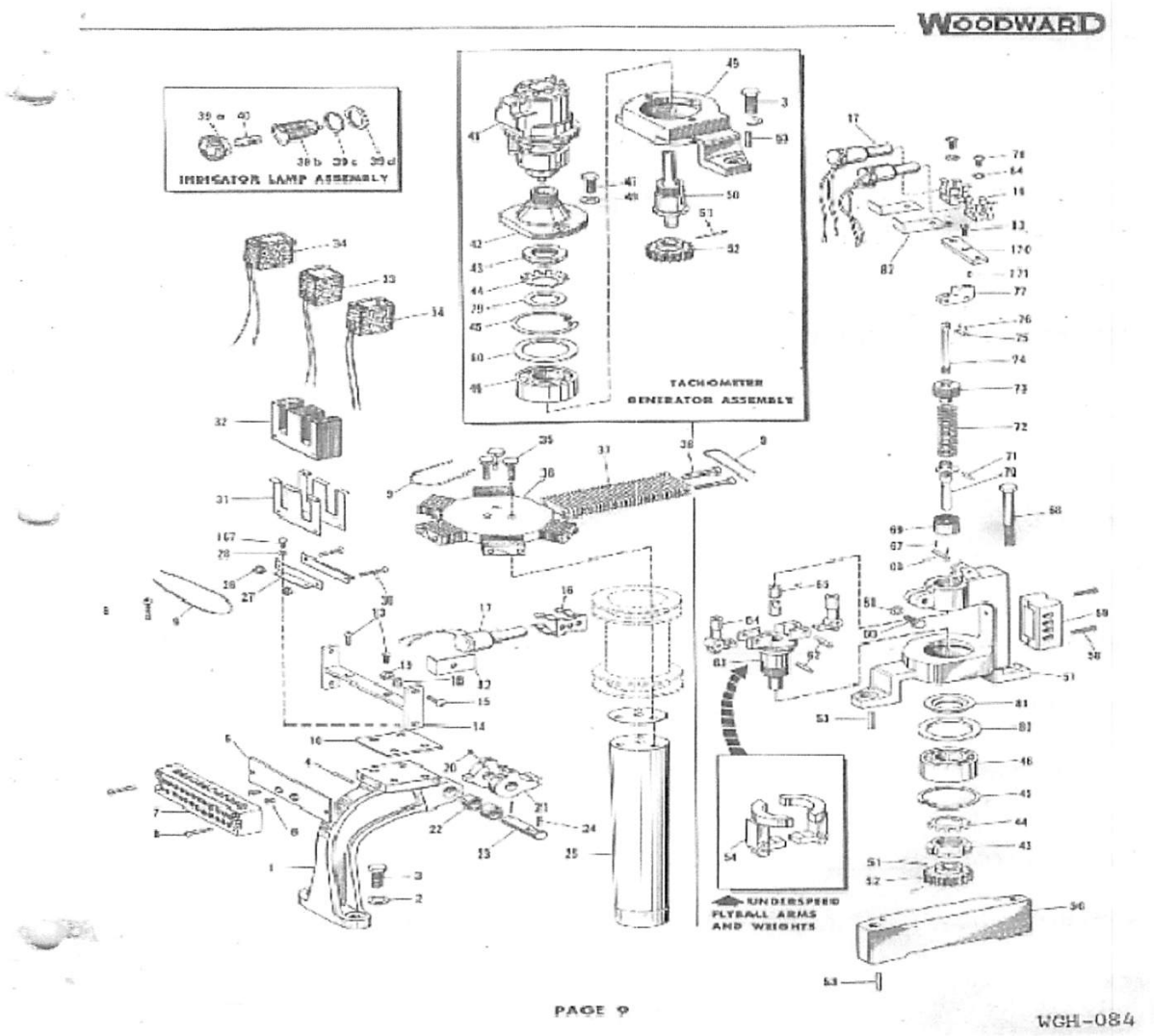
Normal Full Load Current 1.9 amps

Comments: _____

_____

_____

JDE Item No. & Description: 59532 - Governor #5 - BDE Type of Inspection: PM9 Department: Electrical	Sheet: 6 of 7 Rev. No.: 6 Rev. Date: 17-03-07 Index No.: 936 Binder No.: 6



JDE Item No. & Description: 59532 - Governor #5 - BDE	Sheet: 7 of 7
Type of Inspection: PM9	Rev. No.: 6
Department: Electrical	Rev. Date: 17-03-07
	Index No.: 936 Binder No.: 6

WOODWARD

INFORMATION AND PARTS REPLACEMENT: When requesting information concerning Permanent Magnet Generator operation, or when ordering replacement parts, it is essential that the following information accompany the request.

1. Permanent Magnet Generator serial number (shown on nameplate).
2. The part reference number as shown in this manual.
3. A description, or name of the part.

Parts List for Permanent Magnet Generator Auxiliary Parts.

REF. NO.	PART NAME	NO. REQD.
11002-1	Post	1
11002-2	⅜" Shakeproof Washer	As Reqd.
11002-3	⅜"-16x1" Hex. Head Cap Screw	As Reqd.
11002-4	⅛"x¾" Straight Pin	1
11002-5	Terminal Block Mounting Plate	1
11002-6	8-32x⅜" Phillips Flat Head Screw	2
11002-7	12 Pole Terminal Block	1
11002-8	8-32x1" Phillips Round Head Screw	6
11002-9	Brass Lockwire	As Reqd.
11002-10	Laminated Shim	As Reqd.
11002-13	10-32x½" Phillips Flat Head Screw	2
11002-14	Mercury Switch Mounting Plate	1
11002-15	8-32x¼" Phillips Round Head Screw	As Reqd.
11002-16	Switch Clip	As Reqd.
11002-17	Mercury Switch	As Reqd.
11002-18	#8 Shakeproof Washer	As Reqd.
11002-19	8-32 Hex. Nut	As Reqd.
11002-20	10-32 Socket Head Set Screw	1
11002-21	Trip Arm	1
11002-22	Oilite Bushing	2
11002-23	Trip Pin	1
11002-24	Cotter Pin	2
11002-25	Retaining Sleeve	1
11002-26	Elastic Stop Nut	2
11002-27	Transformer Mounting Bracket	2
11002-28	5/16" Lockwasher	4
11002-30	10-32x1¾" Fillister Head Screw	2
11002-31	Coil Retainer Lamination	2
11002-32	"E" Lamination	42
11002-33	Secondary Coil	1
11002-34	Primary Coil	2
11002-35	¼"-20x⅝" Drilled Hex. Head Cap Screw	5
11002-36	Lamination Rotor Plate	1
11002-37	"I" Lamination	168
11002-38	10-32x1⅜" Cad. Fillister Head Screw	8
11002-39a	Indicator Lamp Head Assembly	As Reqd.
11002-39b	Indicator Lamp Body	As Reqd.
11002-39c	Indicator Lamp Lockwasher	As Reqd.
11002-39d	Indicator Lamp Nut	As Reqd.
11002-40	Indicator Lamp Bulb	As Reqd.
11002-41	Tachometer Generator	1
11002-42	Bracket Cover	1
11002-43	Bearing Locknut	As Reqd.
11002-44	Bearing Lockwasher	As Reqd.
11002-45	Snap Ring	As Reqd.
11002-46	Bearing	As Reqd.
11002-47	5/16"-18x¾" Hex. Head Cap Screw	2
11002-48	5/16" Shakeproof Washer	2
11002-49	Tachometer Generator Bracket	1
11002-50	Tachometer Generator Pinion Shaft	1
11002-51	4/0-5/16" Taper Pin	As Reqd.
11002-52	Mizarra Drive Gear	As Reqd.
11002-53	Dowel Pin	As Reqd.
11002-54	Ball #10	As Reqd.
11002-56	Adapter Block	As Reqd.
11002-57	Speed Switch Bracket	As Reqd.
11002-58	10-32x1" Phillips Round Head Screw	As Reqd.
11002-59	4 Pole Terminal Block	As Reqd.
11002-60	¼"-20x1¼" Hex. Head Cap Screw	As Reqd.
11002-61	¼" Shakeproof Washer	As Reqd.
11002-62	Ballarm Pin	As Reqd.
11002-63	Ballhead	As Reqd.
11002-64	Ballarm	As Reqd.
11002-65	Oilite Bushing	As Reqd.
11002-66	Rocker Arm Pin	As Reqd.
11002-67	Cotter Pin	As Reqd.
11002-68	¼"-16 Hex. Head Cap Screw	As Reqd.
11002-69	Thrust Bearing Assembly	As Reqd.
11002-70	Lower Speeder Rod	As Reqd.
11002-71	Lower Speeder Rod Pin	As Reqd.
11002-72	Speed Switch Spring	As Reqd.
11002-73	Speed Setting Plug	As Reqd.
11002-74	Upper Speeder Rod	As Reqd.
11002-75	Upper Speeder Rod Pin	As Reqd.
11002-76	Cotter Pin	As Reqd.
11002-77	Rocker Arm	As Reqd.
11002-78	8-32x⅜" Round Head Screw	As Reqd.
11002-79	Bearing Shield Washer (Plain)	As Reqd.
11002-80	Bearing Shield Washer (Plain)	As Reqd.
11002-81	Bearing Shield Washer (Stepped)	As Reqd.
11002-82	Switch Retainer	As Reqd.
11002-83	8-32x3/8 Phillips Flat Head Screw	As Reqd.
11002-84	No. 0 Shakeproof Washer	As Reqd.
11002-85	Drive Plate	1
11002-86	Lower Ball Pin	2

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 2 Rev. No.: 4 Rev. Date: 15-04-15 Index No.: 950 Binder No.: 6

PM Checksheet No.: PM9 - 59540 - EBDE
JDE Item No. & Description: 59540 - Isolated Phase Bus #5 - BDE
Type of Inspection: PM9 (Major - Every Five Years)
Department: Electrical — Asset Approval: B. Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature & Date:
Reference Drawing and Manuals: 2107-E-43

ACTIVITIES (Initial Box Upon Completion)		REMARKS
CRITICAL PARTS INSPECTION		
1. Insulators		
a) Check insulators for cracks.	( )	
b) Check insulators for tracking.	( )	
c) Clean insulators with dry rags.	( )	
2. Jaw Assembly		
a) Check for burns.	( )	
b) Grease joints.	( )	
c) Check connections.	( )	
d) Check switch operation and alignment.	( )	
3. Flexible Joints (10 sets of three inside plant and 4 sets of three outside plant.)		
a) Check all connections for looseness. Silicon Bronze ½" Bolt 41 ft/lbs torque. Do not mix different types of bolts.	( )	
4. Gaskets		
a) Check condition of all gaskets for leaks, environment damage.	( )	
b) Check conductivity test between unit and fir joint of cover to prove gasket is not grounded.	( )	
c) Check for any indication of moisture inside of bus duct.	( )	

JDE Item No. & Description: 59540 - Isolated Phase Bus #5 - BDE Type of Inspection: PM9 Department: Electrical	Sheet: 2 of 2 Rev. No.: 4 Rev. Date: 15-04-15 Index No.: 950 Binder No.: 6
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
5. <u>Ground Cubicle/Surge Protection</u> a) Clean insulators. ( ) b) Check wiring connections. ( ) c) Check lighting. ( ) **6. <u>13.8 KV Metering and Voltage Regulator P.T. Cubicle</u>** a) Check all connections and wiring. ( ) b) Check fuses and holders. ( ) c) Clean out cubicle. ( ) d) Check for signs of moisture. ( ) e) Check insulators for signs of cracks or tracking. ( ) **ROUTINE PM INSPECTIONS** 1. Check all clamps, grounding straps, etc. ( ) 2. Check all bus duct conduction and cover supports. ( ) 3. Clean out gen. ground and surge protection cubicle. ( ) 4. Clean 13.8 kv metering PT's. ( ) 5. Check ventilation caps outdoors on bus covers to prevent water entering bus duct. ( )	

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 1 Rev. No.: 4 Rev. Date: 15-04-07 Index No.: 977 Binder No.: 6

PM Checksheet No.: PM9 - 59556 - EBDE
JDE Item No. & Description: 59556 - Turbine #5 - BDE
Type of Inspection: PM9 - Major – (Every Five Years)
Department: Electrical — Asset Approval: B. Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature & Date:
Reference Drawing and Manuals: 107-E-131, Trabon Maxi-Monitor Mark III Dwg. #: M21618S

ACTIVITIES (Initial Box Upon Completion)	REMARKS
CRITICAL PARTS INSPECTION	
1. <u>Autogreaser</u>	
a) Check all wiring connections for looseness and mechanical damage. ( )	
b) Check operation of micro switch on distribution block. ( )	
c) Check failure alarm on annunciator. ( )	
d) Record shots on primary to verify correct shots since last inspection. _____ 1 shot per 12 hours. ( )	
2. <u>Shearpin Plug</u>	
a) Check wiring on each of the plugs for looseness or mechanical damage. ( )	
b) Check condition of plug for proper fitting in shearpin. ( )	
c) Check operation of 95X relay to give alarm annunciation. ( )	
d) Check operation of 95A relay to give alarm annunciation. ( )	
3. <u>Turbine Bearing</u>	
a) Record resistance of RTD _____ Ohms. ( )	

W/O #:_____

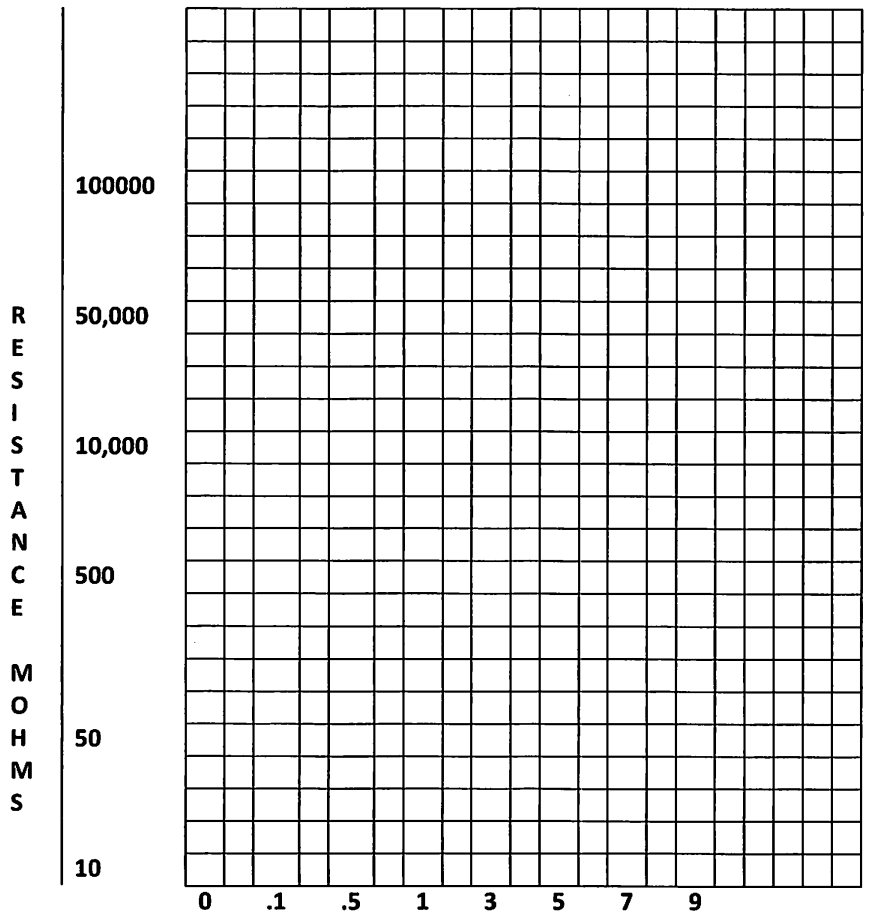
NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 2 Rev. No.: 2 Rev. Date: 13-03-29 Index No.: 2455 Binder No.: 26

PM Checksheet No.: 59527
Item No. & Description: 59527 – Turbine/Generator Unit No. 5 - BDE
Type of Inspection: PM9 (Major)
Department: Electrical/P&C
Asset Approval:
Inspection Start Date:
Insp. Comp. Date:
Supervisor's Review Signature and Date:
Reference Drawing and Manuals:

ACTIVITIES (Initial Box Upon Completion)	REMARKS
<u>Electrical Tests</u> Electrical tests, when practical, shall be conducted as early as possible into the outage in order that the results can be analyzed and acted on. Forward test results to Plat Electrical Engineer for analysis as soon as test are completed. a) Conduct polarization index test prior to beginning of any physical work and again at the end of outage. Record results on proper P1 form and forward to Plant Electrical Engineer for analysis as soon as tests are completed. ( ) b) Conduct 500 volt meggar test and record result. ( ) Meggar result: _____	

PM Checksheet No.: 59527 – Generator – Unit No. 5 - BDE Type of Inspection: PM9 Department: Electrical		Sheet: 2 of 2 Rev. No: 2 Rev. Date: 13-03-29 Index No.: 2455 Binder No.: 26
GENERATOR	Readings Taken by: Verified by: Reviewed by: Approved by:	Date: Date: Date: Date:
ACTIVITIES (Initial Box Upon Completion)		REMARKS

POLARIZATION INDEX TEST



Time	Mohms
15 sec.	
30 Sec.	
45 sec.	
1 min.	
2 min.	
3 min.	
4 min.	
5 min.	
6 min.	
7 min.	
8 min.	
9 min.	
10 min.	

Polarization Index: Time, Minutes

Comments:

Submit to Engineering day of test.

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 3 Rev. No.: 7 Rev. Date: 16-02-29 Index No.: 886 Binder No.: 1

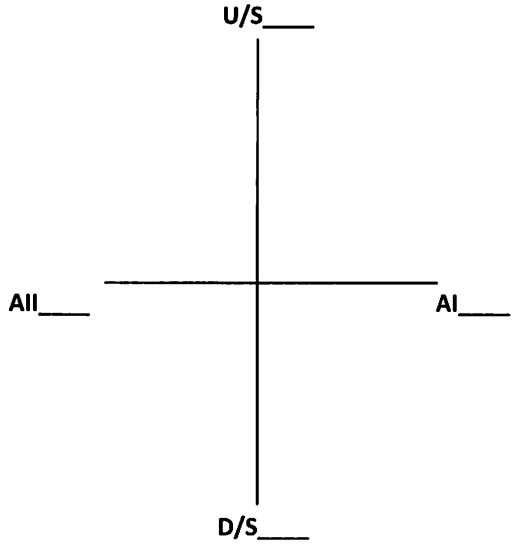
PM Checksheet No.: PM9-59556 – MBDE
Equip. No. & Description: 59556 – Turbine #5 – BDE
Type of Inspection: PM9
Department: Mechanical — Asset Approval: B. Woodman
Inspection Start Date: — Insp. Completion Date:
Supervisor's Review Signature & Date:
Reference Drawing and Manuals: Howard Martin M216185, ED-003, ED-005 & ED-009

ACTIVITIES (Initial Box Upon Completion)	Remarks
1. Runner Turbine	
a) Measure and record on attached sheet;	
i) Upper primary seal on four axis. ( )	
ii) Upper secondary seal on four axis. ( )	
iii) Lower secondary seal on four axis. ( )	
iv) Lower primary seal on four axis. ( )	
b) Replace gasket on draft tube door. ( )	
2. Turbine Guide Bearing	
a) Remove bearing covers and record bearing clearances. Plant Mechanical Engineer to evaluate. ( )	
b) Remove temperature probes and calibrate. ( )	
c) Remove bearing oil and circulate if oil analysis indicates oil is dirty. ( )	
3. Cooling Coils	
a) Check condition of supply and drain lines. ( )	
b) Clean orifice. Verify flow at turbine generator panel. ( )	
Normal 15 lpm. Actual _____	
NOTE: Turbine bearing cooling coils will only be pressure tested tested when they reach 20 years of age.	
4. Wicket Gate	
a) Break wicket gate links on four gates on UIS, DIS, A x I, A x II and measure. Record torque to move gates using hydraulic jack. Submit to Plant Mechanical Engineer for evaluation and trending. ( )	
b) Check for broken studs and leakage around wicket gate stems. ( )	

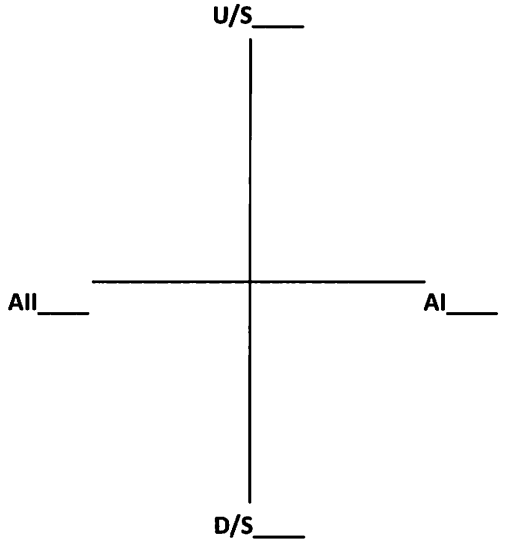
JDE Item No. & Description: 59556 - Turbine #5 - BDE Type of Inspection: PM9 Department: Mechanical	Sheet: 2 of 3 Rev. No.: 7 Rev. Date: 16-02-29 Index No.: 886 Binder No.: 1
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
4. Wicket Gate (Cont'd)	
c) Check for broken shear pins. ( )	
d) Re-torque eccentric pin lock screws. ( )	
e) Re-torque link pin lock screws. ( )	
f) When governor is pressurized, check vertical seals and record. ( )	
5. Spiral Case Door	
a) Replace O-ring on scroll case door. ( )	
b) Check bolts for elongation and cracks. Replace if necessary. ( )	
c) Check drain valve, located below door. ( )	
6. Spiral Case Drain	
a) Check drain pipe for deterioration or cracks. ( )	
b) Lubricate valve and check for leaks. ( )	
c) Torque bracket bolts. ( )	
7. Auto Greaser	
a) Check for broken or disconnected lines. Repair if necessary. ( )	
b) Drain moisture trap. ( )	
c) Fill auto greaser with grease. ( )	
d) Check regulator pressure. Set to 50psi. ( )	
e) Check operation and build up pressure. Normal 1700psi. ( )	
f) Clean strainer. ( )	
8. Vent Chamber	
a) Remove and inspect vent vale float ball. Replace if necessary. ( )	
b) Check chamber for cracks or leaks. ( )	

JDE Item No. & Description: 59556 - Turbine #5 - BDE Type of Inspection: PM9 Department: Mechanical	Sheet: 3 of 3 Rev. No.: 7 Rev. Date: 16-02-29 Index No.: 886 Binder No.: 1
ACTIVITIES (Initial Box Upon Completion)	REMARKS

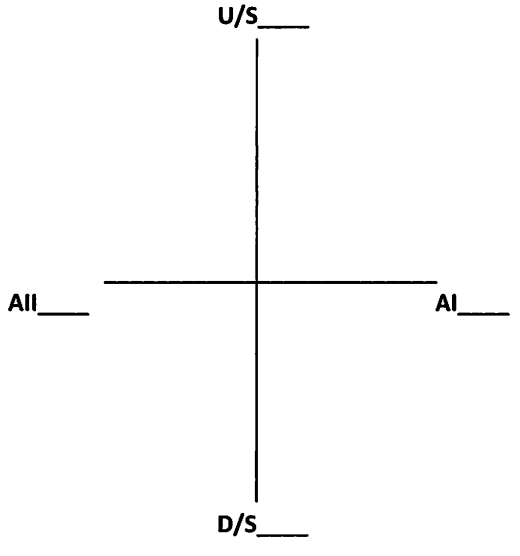
Upper Primary Seal Clearances



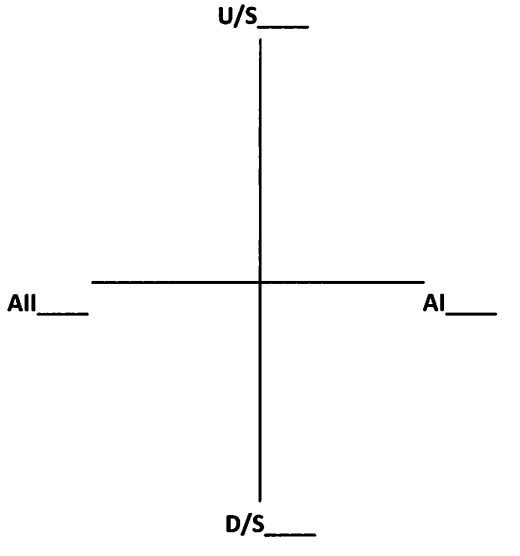
Upper Secondary Clearances



Lower Secondary Clearances



Lower Primary Clearances



W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 4 Rev. No.: 3 Rev. Date: 15-05-05 Index No.: 898 Binder No.: 1

PM Checksheet No.: PM9 - 59527 - MBDE
JDE Item No. & Description: 59527 - Generator #5 - BDE
Type of Inspection: PM9
Department: Mechanical — Dept. Approval: B. Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature & Date:
Reference Drawing and Manuals: G.E. Dwg. #599B112CF, Dwg. #606B820, Torque Table for Grade 2 Medium Carbon Steel & ED-059

ACTIVITIES (Initial Box Upon Completion)	REMARKS
CRITICAL PARTS INSPECTION	
1. Generator Brakes	
a) Check brake pads thickness and record: _____ ( ) Minimum wear surface is ¼".	
b) Check brake pads for cracks. Replace if cracks are unacceptable. ( )	
c) Check brake track for excessive scouring or warpage and check brake plate bolts for proper torque. _____ Normal 320. (Dry for Grade 2 Medium Carbon Steel) ( )	
d) Check spring retaining nuts for looseness, missing set screws. ( )	
e) Grease brake cylinders. Check for excessive leakage. ( )	
f) Check air pipes for leaks. ( )	
g) Check and record timing of brake release. Approximately 7 seconds travel _____. ( )	
2. Guide Bearing	
a) Remove oil from bearing and circulate if oil sample analysis indicates centrifuging is required. ( )	
b) Remove thrust bearing segment. ( ) **This task is only required if there are symptoms of problems with the thrust bearing and the plant Mechanical Engineer or designer has requested an inspection of the thrust bearing segments.	
c) Remove all thrust and guide bearing temp probes and check calibration. ( )	

JDE Item No. & Description: 59527 - Generator #5 - BDE Type of Inspection: PM9 Department: Mechanical	Sheet: 2 of 4 Rev. No.: 3 Rev. Date: 15-05-05 Index No.: 898 Binder No.: 1
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
2. Guide Bearing (Cont'd) d) Remove four guide bearing segments and check for discolouration. ( ) e) Measure and record generator guide bearing clearance. Plant Mechanical Engineer shall evaluate and determine if action is required. ( ) f) Check felt strip assuring clearances between shaft. ( ) g) Check bearing for oil leaks and make necessary repairs. ( ) h) Clean orifice – generator cooling water discharge. Check flow on T.G. panel. ( ) 3. Surface Air Coolers a) Remove one SAC and check for dirt accumulation. ( ) b) Pressure test SAC to 100 PSI, only if SAC is twenty years of age. A separate PM Master will be set up for SAC testing when life expectancy is due. ( ) c) Clean orifice on cooler supply; check flow on T.G. panel. ( ) 4. Main Bracket Assembly a) Check main bracket securing bolt for tightness on all four arms. This is a critical inspection. Notify plant Mechanical Engineer if Bolts are found loose. Torque 310 ft/lbs ± 30 lbs. ( ) 5. Head Cover/Bottom Rim Assembly a) Measure and record vertical distance between head cover and bottom ring face plate using an inside micrometer. ( )	

JDE Item No. & Description:	59527 - Generator #5 - BDE	Sheet: 3 of 4
Type of Inspection:	PM9	Rev. No.: 3
Department:	Mechanical	Rev. Date: 15-05-05
		Index No.: 898 Binder No.: 1

1	8	320
1	12	350

BOLTS AND TORQUE SPECS

U.S. BOLT TORQUE SPECIFICATIONS

Torque in pounds-foot

		2	3	5	5	7	7	8	8	Socket head cap screw	Socket head cap screw
Bolt Dia.	Thread per inch	Dry	Oiled	Dry	Oiled	Dry	Oiled	Dry	Oiled	Dry	Oiled
1/4	20	4	3	8	6	10	8	12	9	14	11
1/4	28	6	4	10	7	12	9	14	10	16	13
5/16	18	9	7	17	13	21	16	25	18	29	23
5/16	24	12	9	19	14	24	18	29	20	33	26
3/8	16	16	12	30	23	40	30	45	35	49	39
3/8	24	22	16	35	25	45	35	50	40	54	44
7/16	14	24	17	50	35	60	45	70	55	76	61
7/16	20	34	26	55	40	70	50	80	60	85	68
1/2	13	38	31	75	55	95	70	110	80	113	90
1/2	20	52	42	90	65	100	80	120	90	126	100
9/16	12	52	42	110	80	135	100	150	110	163	130
9/16	18	71	57	120	90	150	110	170	130	181	144
5/8	11	98	78	150	110	190	140	220	170	230	184
5/8	18	115	93	180	130	210	160	240	180	255	204
3/4	10	157	121	260	200	320	240	380	280	400	320
3/4	16	180	133	300	220	360	280	420	320	440	350
7/8	9	210	160	430	320	520	400	600	460	640	510
7/8	14	230	177	470	360	580	440	660	500	700	560
1	8	320	240	640	480	800	600	900	680	980	780
1	12	350	265	710	530	860	666	990	740	1060	845

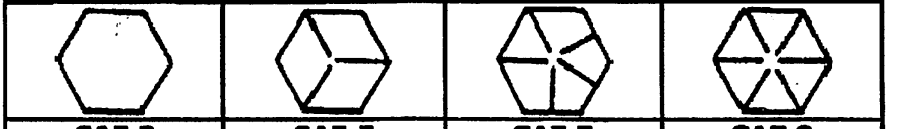
BOLT TORQUE FACTORS

LUBRICANT OR PLATING	TORQUE CHANGES
Oil	Reduce torque 15% to 25%
Dry Film (Teflon or moly based)	Reduce torque 50%
Dry Wax (Cetyl alcohol)	Reduce torque 50%
Chrome plating	No change
Cadmium plating	Reduce torque 25%
Zinc plating	Reduce torque 15%

JDE Item No. & Description:	59527 - Generator #5 - BDE
Type of Inspection:	PM9
Department:	Mechanical

Sheet: 4 of 4
Rev. No.: 3
Rev. Date: 15-05-05
Index No.: 898 Binder No.: 1

U.S. BOLT GRADES



SAE 2	SAE 5	SAE 7	SAE 8

	2	5	7	8	SOCKET HEAD CAP SCREW
I.D. Marks	No markings	3 lines	5 lines	6 lines	Allen head
Material	Low carbon	Medium-carbon, tempered	Medium-carbon, quenched & tempered	Medium-carbon, quenched & tempered	High-carbon, quenched & tempered
Tensile strength (Minimum)	74,000 psi	120,000 psi	133,000 psi	150,000 psi	160,000 psi

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 5 Rev. No.: 6 Rev. Date: 15-05-05 Index No.: 908 Binder No.: 1

PM Checksheet No.: PM9-59532-MBDE
Item No. & Description: 59532 - Governor - Unit No. 5 – BDE
Type of Inspection: PM9
Department: Mechanical — Asset Approval: B. Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature & Date:
Reference Drawing and Manuals: Woodward – Operation & Maintenance–07079B, 9980-075–Schematic Diagram, ED-005 & ED-009

ACTIVITIES (Initial Box Upon Completion)	REMARKS
USE ONLY LINT-FREE RAGS S/N 99200027 ACTUATOR DEPRESSURIZED Before starting any work, do a visual inspection of the actuator for oil leaks, any unusual signs of wear, or misalignment of cables, levers, or gears. 1. Governor Oil Pump a) Replace filters. ( ) S/N: 58602404 Part No.: 07079-664 2. Dismantle Echelon controls and check for worn parts. ( ) 3. Dual Oil Filters a) Replace in-service filter. ( ) S/N: 58601669 Part No.: 07079-556 4. Remove and clean flow control regulator screen. ( ) 5. Inspect all moveable linkages for worn pivot pins, any binding in the slots. This can be done without any dismantle, by visual and moving the links to check for free play. ( ) 6. Lubricate all moveable linkages with Teresso 46. ( ) 7. Grease all restoring cable bearings. ( ) 8. Sump a) Take oil sample. ( )	

JDE Item No. & Description: 59532 - Governor - Unit No. 5 - BDE Type of Inspection: PM9 Department: Mechanical	Sheet: 2 of 5 Rev. No.: 6 Rev. Date: 15-05-05 Index No.: 908 Binder No.: 1
ACTIVITIES (Initial Box Upon Completion)	REMARKS

ACTUATOR DEPRESSURIZED (Cont'd)

9. Main Valve

a) Remove pilot valve bushings and spring. Clean and inspect. ( )

b) Check condition of pilot valve restoring pivot lever. ( )

c) Check stop nuts for looseness or any unusual movement. ( )

W A R N I N G:

The gate timing adjustments should not be changed without approval of authorized personnel.

d) Condition of pilot valve restoring lever. ( )

_____

_____

e) Move valve servomotor plunger up and down, check for binding. ( )

10. Dashpot

a) Check oil level and general condition of dashpot. ( )

b) Visual check small dashpot plunger spring for any change in setting. ( )

NOTE: All needle settings on dashpot to remain as before the shutdown.

11. Check run out of the ball head dashpot plunger. ( )

Maximum runout - .002

Found at: _____ Left at: _____

JDE Item No. & Description: 59532 - Governor - Unit No. 5- BDE Type of Inspection: PM9 Department: Mechanical	Sheet: 3 of 5 Rev. No.: 6 Rev. Date: 15-05-05 Index No.: 908 Binder No.: 1
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**

ACTUATOR PRESSURIZED

1. Check all gauges for proper pressure readings. ( )
2. Check high pressure pump for noise and vibrations. ( )
3. Check and record speed of vibration motor. ( )

   Normal speed – 540 RPM.

   Found at: _____ Left at: _____
4. Check oscillation of distributing valve plunger. ( )

   Normal - .006 - .007

   Found at: _____ Left at: _____
5. Check zero position of gate position indicator. ( )

   Found at: _____ Left at: _____
6. Record wicket gate squeeze. ( )

   Normal squeeze - .125"

   Found at: _____ Left at: _____
7. Record wicket gate closing time.

   From 80% - 30% = 6 Seconds.

   Found at: _____ Left at: _____

   From 30% - 80% = 6 Seconds. ( )

   Found at: _____ Left at: _____

   From 100% - 0% ( )

   Found at: _____ Left at: _____

   Cushion: Yes _____ No _____

JDE Item No. & Description: 59532 - Governor - Unit No. 5 - BDE Type of Inspection: PM9 Department: Mechanical	Sheet: 4 of 5 Rev. No.: 6 Rev. Date: 15-05-05 Index No.: 908 Binder No.: 1
ACTIVITIES (Initial Box Upon Completion)	REMARKS

ACTUATOR PRESSURIZED (Cont'd)

8. Check the gate position pointer at fifty percent for proper alignment. Use Standard Procedure as per Woodward instructions. ( )

9. Record partial gate setting. ( )

   a) Using Power Supply, check partial gate. Coordinate with P&C Crew. ( )

   Normal setting: 25%.

   Found at: _____ Left at: _____

10. Check shutdown solenoid. With gates open, latch up solenoid and observe gate position. This will be done after the P&C/ Elect have done their electrical checks, and both parties should observe the operation. ( )

11. Unloader/Relief Valve

    Visually inspect the mechanical unloader/relief valve combo. ( )

12. Lubricate internal dashpot of ballhead motor with dashpot oil. ( )

13. Observe system pressure when governor pump starts and stops. ( )

    Normal = Start – 310 PSI; Stop = 360 PSI

    Start – 310 PSI – Found at: _____ Left at: _____

    Stop – 360 PSI – Found at: _____ Left at: _____

14. Check alignment of restoring cable where it enters the ferrule, there should not be any wear on cable entering ferrule. ( )

15. Auxiliary Valve

    a) After the gate operation is completed in the dry, using the Main Valve, transfer to Auxiliary Valve and operate gates to check valve for proper operation. ( )

       i) Transfer valve

       Free _____ Tight _____ ( )

JDE Item No. & Description: 59532 - Governor - Unit No. 5 - BDE Type of Inspection: PM9 Department: Mechanical	Sheet: 5 of 5 Rev. No.: 6 Rev. Date: 15-05-05 Index No.: 908 Binder No.: 1
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
ACTUATOR PRESSURIZED (Cont'd) **NOTE: As per Engineering Directive, when the checks and adjustments on this sheet are completed, the person responsible must be assured that the actuator will function in the same condition with respect to on-line settings as it was before the PM Inspection was done. This is accomplished by operating the gates in the dry and checking frequency and unit response at SNL.** **If we do governor work that has the potential to affect governor response, post testing must be done to verify the governor response is still within acceptable limits as per curves established and accepted by System Planning in 2005/2006.**	

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 6 Rev. No.: 5 Rev. Date: 15-04-14 Index No.: 221 Binder No.: 39

PM Checksheet No.: PM9 - 59532 - P&CBDE
JDE Item No. & Description: 59532 - Governor #5 - BDE
Type of Inspection: PM9
Department: Protection & Control — Dept. Approval: B. Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature & Date:
Reference Drawing and Manuals: 2107-E-44, 2107-E-45, 2107-E-141, 2107-E-149, 2107-E-042

ACTIVITIES (Initial Box Upon Completion)	REMARKS
CRITICAL PARTS INSPECTION	
1. <u>Shutdown Solenoid Operate Coil</u>	
a) Check that operate lever latches when operated manually. ( )	
b) Remove cover and check connections on operate solenoid. ( )	
c) Check the operate solenoid contacts. Clean and burnish if necessary. ( )	
d) Check spring adjustment screw. Tighten if necessary, using a lockwasher or Loctite. ( )	
e) Check resistance of operate coil when latched and unlatched. ( )	
NT links BB52 and 53	
Normal 1.09k ohms Normal 18.5 ohms	
_____ Latched _____ Unlatched	
f) Check operation of solenoid electrically. ( )	
2. <u>Shutdown Solenoid Reset Coil</u>	
a) Check that reset lever reset the operate lever when operated manually. ( )	
b) Remove cover and check connections on reset solenoid. ( )	
c) Check the reset solenoid contacts. Clean and burnish if necessary. ( )	
d) Check spring adjustment screw. Tighten if necessary, using a lockwasher or Loctite. ( )	

JDE Item No. & Description: PM9 - 59532 - Governor #5 - BDE Type of Inspection: PM9 Department: Protection & Control	Sheet: 2 of 6 Rev. No.: 5 Rev. Date: 15-04-14 Index No.: 221 Binder No.: 39
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
2. Shutdown Solenoid Reset Coil (Cont'd) **e) Check resistance of reset coil when latched and unlatched. ( )** **NT links BB50 and 51** **Normal 1.6k ohms Normal 35 ohms** **_____ latched _____ unlatched** **3. Partial Shutdown Solenoid Operate Coil** **a) Check that operate lever latches when operated manually. ( )** **b) Remove cover and check connections on operate solenoid. ( )** **c) Check the operate solenoid contacts. Clean and burnish if necessary. ( )** **d) Check spring adjustment screw. Tighten if necessary, using a lockwasher or Loctite. ( )** **e) Check resistance of operate coil when latched and unlatched. ( )** **NT links BB38 and 40** **Normal 1.08k ohms Normal 8.5 ohms** **_____ latched _____ unlatched** **f) Using Power Supply, check partial gate setting. Coordinate with Mechanical Crew. ( )** **Normal 26% Actual _____** **4. Partial Shutdown Solenoid Reset Coil** **a) Check that reset lever resets the operate lever when operated manually. ( )** **b) Remove cover and check connections on reset solenoid. ( )** **c) Check the reset solenoid contacts. Clean and burnish if necessary. ( )**	

JDE Item No. & Description: PM9 - 59532 - Governor #5 - BDE Type of Inspection: PM9 Department: Protection & Control	Sheet 3 of 6 Rev. No.: 5 Rev. Date: 14-04-14 Index No.: 221 Binder No.:39
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
4. <u>Partial Shutdown Solenoid Reset Coil</u> (Cont'd)	
d) Check spring adjustment screw. Tighten if necessary, using a a lockwasher or Loctite. ( )	
e) Check resistance of reset coil when latched and unlatched. ( )	
NT links BB38 and 39	
Normal 1.5k ohms Normal 35 ohms	
_____ Latched _____ Unlatched	
f) Check operation of solenoid electrically. ( )	
5. <u>Gate Limit Motor, Shaft and Friction Gear Assembly</u>	
a) Check clutch assembly. Move gate limit from 0 - 100%. Operation should be smooth. ( )	
b) Check variable resistor connections used in motor circuit. ( )	
c) Check resistance of the resistor used in motor circuit. _____ ( )	
d) Check condition of motor gears. Assembly should be free of grease and dirt. ( )	
6. <u>Speed Adjustment Motor, Shaft and Friction Gear Assembly</u>	
a) Check clutch assembly. Move speed adjustment from 0-100%. Operation should be smooth. ( )	
b) Check variable resistor connections. ( )	
c) Check resistance of the resistor used in motor circuit. Normal 243 ohms. Actual _____ ( )	
d) Check condition of motor gears. Assembly should be free of grease and dirt. ( )	

JDE Item No. & Description: PM9 - 59532 - Governor #5 - BDE Type of Inspection: PM9 Department: Protection & Control	Sheet: 4 of 6 Rev. No.: 5 Rev. Date: 15-04-14 Index No.: 221 Binder No.: 39
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
ROUTINE PM INSPECTIONS **1. Check operation of the following gate position switches.** **Note: Refer to drawing to verify check points:** **a) 0 gate - SW1. Set to close at 1.5% and below points AA14, AA15. ( )** **Closed at _____ % and down.** **b) 0 gate - SW2. Set to close at 25% and up points AA20, AA21. ( )** **Closed at _____ % and up.** **c) 0 gate - SW3. Set to close at 1.5% and down points AA22, AS23. ( )** **Closed at _____ % and down.** **2. Check the following instrumentation on the actuator cabinet:** **a) Tachometer. Also check tachometer in control room at the same time. ( )** **b) Gate limit/gate position indicator on actuator in the Control Room as per sheet 6. ( )** **c) Speed droop indicator. Normal 2%.** **Speed droop setting: _____** **d) Air brake indicator. ( )** **e) Oil pressure gauge. ( )** **Normal 310 psi Normal 350 psi** **_____ cut in _____ cut out** **f) Transfer valve indicator. ( )** **g) Speed adjustment indicator. ( )**	

JDE Item No. & Description: PM9 - 59532 - Governor #5 - BDE Type of Inspection: PM9 Department: Protection & Control	Sheet: 5 of 6 Rev. No.: 5 Rev. Date: 15-04-14 Index No.: 221 Binder No.: 39
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
3. Check governor accumulator tank oil level switches. Check drawing to verify points (TG panel). a) 71 GO high alarm (points AD1, AD2). ( ) b) 71 GO low alarm (points AD3, AD4). ( ) c) 71 GL low trip (points AD5, AD6). ( ) 4. Check governor accumulator tank oil pressure switches. Check drawing to verify points (TG panel). a) 63 GAP low alarm (points AD7, AD8). ( ) Closes at 2000 (290 psi) kpa and down. Actual _____ b) 63 GT trip (points AD9, AD10). ( ) Closes at 1850 (268 psi) kpa and down. Actual _____ c) 63 GI CIX-CCT (points AD11, AD12). ( ) Closes at 1960 (284 psi) kpa and up. Actual _____ 5. Check all wiring and connections. ( )	

JDE Item No. & Description: 59532 - Governor #5 - BDE Type of Inspection: PM9 Department: Protection & Control	Sheet: 6 of 6 Rev. No: 5 Rev. Date: 15-04-14 Index No.: 221 Binder No.: 39

GOVERNOR GATE LIMIT/GATE POSITION CHECKS

Tested by: _____ **Date:** _____

GOVERNOR				CONTROL ROOM				ECC	
Gate Limit		Gate Position		Gate Limit		Gate Position		Gate Limit	Gate Position
	Ma Signal		Ma Signal	Found	Left	Found	Left		
0%		0%							
10%		10%							
20%		20%							
30%		30%							
40%		40%							
50%		50%							
60%		60%							
70%		70%							
80%		80%							
90%		90%							
100%		100%							

Note: Open the positive to each of the transducers to obtain current readings.

Comments:

_____

_____

_____

_____

_____

_____

_____

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 1 Rev. No.: 0 Rev. Date: 00-01-18 Index No.: 237 Binder No.: 39

PM Checksheet No.: PM9 - 58616 - P&CBDE
JDE Item No. & Description: 58616 - TG Panel #5 - BDE
Type of Inspection: PM9 (Five Years)
Department: Protection & Control — Dept. Approval: R. Bartlett
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature & Date:
Reference Drawing and Manuals:

ACTIVITIES (Initial Box Upon Completion)	REMARKS
CRITICAL PARTS INSPECTION	
1. Check all wiring and connections. ( )	
2. Vacuum out panel. ( )	

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 1 Rev. No.: 0 Rev. Date: 00-01-18 Index No.: 238 Binder No.: 39

PM Checksheet No.: PM9 - 59544 - P&CBDE
JDE Item No. & Description: 59544 - Auto Control Panel #5 - BDE
Type of Inspection: PM9 (Five Years)
Department: Protection & Control — Dept. Approval: R. Bartlett
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature & Date:
Reference Drawing and Manuals:

ACTIVITIES (Initial Box Upon Completion)	REMARKS
CRITICAL PARTS INSPECTION	
1. Check all wiring and connections. ( )	
2. Vacuum out panel. ( )	

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 6 Rev. No.: 7 Rev. Date: 17-09-08 Index No.: 245 Binder No.: 39

PM Checksheet No.: PM9 - 59556 - P&CBDE
JDE Item No. & Description: 59556 - Turbine #5 - BDE
Type of Inspection: PM9 (Five Years)
Department: Protection & Control — Asset Approval: B. Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature & Date:
Reference Drawing and Manuals: 2107-E-141, 2107-E-154, 2107-E-45, 2107-E-149

ACTIVITIES (Initial Box Upon Completion)	REMARKS
CRITICAL PARTS INSPECTION	
1. <u>Turbine Bearing Temperature Trip Meter #1</u>	
a) Check/clean meter glass face plate. ( )	
b) Remove face plate and remove inside cover. Check/tighten all meter internal connections. ( )	
c) Check meter contacts with decade box. ( )	
2. <u>Turbine Bearing Temperature Trip Meter #2</u>	
a) Check/clean meter glass face plate. ( )	
b) Remove face plate and remove inside cover. Check/tighten all meter internal connections. ( )	
c) Check meter contacts with decade box. ( )	
3. <u>Turbine Bearing Temperature Alarm Meter</u>	
a) Check/clean meter glass face plate. ( )	
b) Remove face plate and remove inside cover. Check/tighten all meter internal connections. ( )	
c) Check meter contacts with decade box. ( )	
4. Check vibration pickups for turbine and generator. Inspect cables, signal conditioners and set up gap to read -12 VDC. ( )	

JDE Item No. & Description:	59556 - Turbine #5 - BDE	Sheet: 2 of 6
Type of Inspection:	PM9	Rev. No.: 7
Department:	Protection & Control	Rev. Date: 17-09-08
		Index No.: 245 Binder No.: 39

5. Check calibration of turbine oil level. Do in conjunction with Mechanics. Oil will need to be added and removed.

   a) Verify alarms. Low - 238 mm High - 377 mm Normal - 308 mm ( )

      Actual Low _____ Actual High _____

   b) Remove probe cover and check wiring. Note: Ensure the wire from probe is securely connected to circuit board. ( )

6. Check calibration of turbine bearing flow transducer. ( )

JDE Item No. & Description:	59556 - Turbine #5 - BDE	Sheet:	3 of 6
Type of Inspection:	PM9	Rev. No.:	7
Department:	Protection & Control	Rev. Date:	17-09-08
		Index No.: 245	Binder No.: 39

Tested by: _____ Date tested: _____

Meter Purpose: Turbine Cooling Water Flow Manufacturer: Bailey

Serial No.: 96W014369 Diff. Pressure Range: 0 – 30" H_2O = 0 – 12.98 psi

Safe Working Pressure: 3625 Location: Turbine Downstream Wall

Alarm: 10 lpm -20MA = 100 lpm

PSI	MA/Cal.	MA/Meas.	lpm
0	4.00		
1	8.44		
2	10.28		
3	11.69		
4	12.88		
5	13.93		
6	14.87		
7	15.75		
8	16.56		
9	17.32		
10	18.04		
11	18.73		
12	19.35		
12.98	20.00		

Comments:

JDE Item No. & Description: 59556 - Turbine #5 - BDE Type of Inspection: PM9 Department: Protection & Control	Sheet 4 of 6 Rev. No.: 7 Rev. Date: 17-09-08 Index No.: 245 Binder No.: 39

Meter Purpose: TURBINE TEMP. TRIP METER #1 Manufacturer: UE (100 ohm Platinum 4 Wire RTD)

Serial No.: _____ Model No.: 2XLP43

Location: _____ Diameter: _____

Tube Length: _____ Scale: _____

Calibrated for _____ inches immersion with bulb Level _____ case

Date	Trip Point	Alarm Point	Temp. Meter Reading	Thermometer Reading	Comments

JDE Item No. & Description: 59556 - Turbine #5 - BDE Type of Inspection: PM9 Department: Protection & Control	Sheet: 5 of 6 Rev. No.: 7 Rev. Date: 17-09-08 Index No.: 245 Binder No.: 39

Meter Purpose: TURBINE TEMP. TRIP METER #2 Manufacturer: UE

Serial No.: _____ Model No.: 2XLP43

Location: _____ Diameter: _____

Tube Length: _____ Scale: _____

Calibrated for _____ inches immersion with bulb Level _____ case

Date	Trip Point	Alarm Point	Temp. Meter Reading	Thermometer Reading	Comments

JDE Item No. & Description: 59556 - Turbine #5 - BDE Type of Inspection: PM9 Department: Protection & Control	Sheet: 6 of 6 Rev. No.: 7 Rev. Date: 17-09-08 Index No.: 245 Binder No.: 39

Meter Purpose: TURBINE TEMP. ALARM METER Manufacturer: UE (100 ohm Platinum 4 Wire RTD)

Serial No.: _____ Model No.: 2XLP43

Location: _____ Diameter: _____

Tube Length: _____ Scale: _____

Note: Verify RTD temp for Data Acquisition System and RTD reading is the same as the temperature bath.

Calibrated for _____ inches immersion with bulb Level _____ case

Date	Trip Point	Alarm Point	Temp. Meter Reading	Thermometer Reading	Comments

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 13 Rev. No.: 7 Rev. Date: 15-04-14 Index No.: 251 Binder No.: 39

PM Checksheet No.: PM9 - 59527 - P&CBDE
JDE Item No. & Description: 59527 - Generator #5 - BDE
Type of Inspection: PM9 (Five Years)
Department: Protection & Control — Asset Approval: B. Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature & Date:
Reference Drawing and Manuals: 2107-E-43, 2107-E-44, 2107-E-45, 2107-E-141, 2107-E-149, 2107-E-155

ACTIVITIES (Initial Box Upon Completion)		REMARKS
CRITICAL PARTS INSPECTION		
1. Thrust Bearing Temperature Alarm Meter		
a) Check/clean meter glass face plate.	( )	
b) Remove faceplate and remove inside cover. Check/tighten all meter internal connections.	( )	
c) Check meter contact with decade box.	( )	
2. Thrust Bearing Temperature Trip Meter		
a) Check/clean meter glass face plate.	( )	
b) Remove faceplate and remove inside cover. Check/tighten all meter internal connections.	( )	
c) Check meter contact with decade box.	( )	
3. Guide Bearing Temperature Trip Meter #1		
a) Check/clean meter glass face plate.	( )	
b) Remove faceplate and remove inside cover. Check/tighten all meter internal connections.	( )	
c) Check meter contact with decade box.	( )	
4. Guide Bearing Temperature Trip Meter #2		
a) Check/clean meter glass face plate.	( )	
b) Remove faceplate and remove inside cover. Check/tighten all meter internal connections.	( )	
c) Check meter contact with decade box.	( )	

JDE Item No. & Description: 59527 - Generator #5- BDE Type of Inspection: PM9 Department: Protection & Control	Sheet: 2 of 13 Rev. No.: 7 Rev. Date: 15-04-14 Index No.: 251 Binder No.: 39
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
5. <u>Guide Bearing Temperature Alarm Meter</u>	
a) Check/clean meter glass face plate. ( )	
b) Remove faceplate and remove inside cover. Check/tighten all meter internal connections. ( )	
c) Check meter contact with decade box. ( )	
6. Generator Bearing Oil Level. (Check in conjunction with Mechanics. Oil needs to be removed and added.)	
a) Verify alarms. ( )	
Low oil level alarm - 60 mm High oil level alarm - 120 mm Normal level 90 mm	
7. Check calibration of north bank surface air coolers flow transducer. ( )	
8. Check calibration of south bank surface air coolers flow transducer. ( )	
9. Check calibration of generator bearing flow transducer. ( )	
10. Check calibration of generator bearing flow meter. ( )	
ROUTINE PM INSPECTIONS	
1. Visually inspect all relays and clean if necessary. ( )	
2. Check calibration of unit KV meter. ( )	
3. Function test generator protection. (Should be done in conjunction with P&C Central. ( )	

JDE Item No. & Description:	59527 - Generator #5- BDE	Sheet:	3 of 13
Type of Inspection:	PM9	Rev. No.:	7
Department:	Protection & Control	Rev. Date:	15-04-14
		Index No.:	251 Binder No.: 39

GENERATOR PRIMARY PROTECTION FUNCTION TEST

Tested by: _____ **Date:** _____

BDE Powerhouse Unit Protection and Unit Breaker and Modifications Control DC Schematic Diagrams.

BDE Powerhouse Unit 1-Phas AC Drawings.

ACTIVITIES (Initial Box Upon Completion)

Note: Any block accompanied by an * must have a completed checksheet.

FUNCTION TEST SHEETS (UNIT)

Notes:

1. **Work on units and related equipment must be completed and all personnel must be away from the unit and related equipment before function tests are carried out.**
2. **Tape off adjacent panels so as not to work on wrong units.**
3. **Note that all primary protection initiates lockout (86). Also, note that 86 trips the main breaker and field breaker and operates the shutdown solenoid. After initial tripping of breaker, leave breaker tripped until all primary protection is checked. Then close breaker to check standby protection. Check voltage on the shutdown solenoid across links BB52 and BB53.**
4. **Note that standby protection initiates lockout (86S) and 86S trips main breaker and field breaker and operates the shutdown solenoid. Leave breaker tripped until all standby protection is checked, then leave breaker tripped to check mechanical protection. Mechanical protection operates 5 and 5 operates partial shutdown solenoid and trips 86 through 33X contact.**
5. **Note that for Unit #1 and Unit #3, lockouts (86) and (86S) also trip station service breaker 52AT-1 and 52AT-2, respectively.**
6. **Open links to disable oscillograph and close after completion of testing.**
7. **Note all alarms and/or targets associated with the trips and reset upon completion of testing (Control Room and Exciter).**

JDE Item No. & Description: 59527 - Generator #5- BDE Type of Inspection: PM9 Department: Protection & Control	Sheet: 4 of 13 Rev. No.: 7 Rev. Date: 15-04-14 Index No.: 251 Binder No.: 39
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
1. <u>Loss of Field</u> 40G. ( ) Note: Loss of field (40G) just gives alarm. ( ) 2. <u>Split Phase (87SP) Unit</u> ( ) Phase A _____ Timed _____ Inst. Phase B _____ Timed _____ Inst. Phase C _____ Timed _____ Inst. 3. <u>Differential (87G)</u> ( ) Phase A _____ Inst. Phase B _____ Inst. Phase C _____ Inst. 4. <u>Overvoltage</u> 59G. ( ) 5. <u>Generator Ground</u> ( ) a) 64G/I. ( ) b) 64G/I. ( ) 6. <u>Out of Step</u> 78. ( ) 7. <u>Overspeed</u> 12A/390 rpm. ( ) 8. <u>Excitation System Failure</u> a) Excitation DC overcurrent (76C). ( ) b) Positive excitation DC short circuit (50ER). ( ) Phase A _____ Inst. Phase B _____ Inst. Phase C _____ Inst.	

JDE Item No. & Description: 59527 - Generator #5- BDE Type of Inspection: PM9 Department: Protection & Control	Sheet: 5 of 13 Rev. No.: 7 Rev. Date: 15-04-14 Index No.: 251 Binder No.: 39
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
8. Excitation System Failure (Cont'd)	
c) Excitation system auxiliary power failure (30T/B). ( )	
d) Exciter DC overcurrent (95EX). ( )	
9. Rectifier Transformer Protection	
a) Gas pressure (63RT). ( )	
b) Overcurrent (50-51RT). ( )	
Phase A _____ Timed _____ Inst.	
Phase B _____ Timed _____ Inst.	
Phase C _____ Timed _____ Inst.	
UNIT STANDBY PROTECTION	
1. Voltage Restraint (51V) ( )	
Phase A _____ Timed	
Phase B _____ Timed	
Phase C _____ Timed	
2. Negative Phase Sequence	
46G. ( )	
MECHANICAL PROTECTION	
1. Turbine Bearing Temperature Trip	
a) 38BT-1. ( )	
b) 38BT-2. ( )	

JDE Item No. & Description: 59527 - Generator #5- BDE Type of Inspection: PM9 Department: Protection & Control	Sheet: 6 of 13 Rev. No.: 7 Rev. Date: 15-04-14 Index No.: 251 Binder No.: 39
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
2. <u>Generator Guide Bearing Temperature Trip</u> a) 38BT-1. ( ) b) 38BT-2. ( ) 3. <u>Generator Thrust Bearing Temperature Trip</u> 38BT-1. ( ) 4. <u>Governor Accumulator Tank Low Air Pressure Trip</u> 63GT. ( ) 5. <u>Governor Accumulator Tank Low Oil Level Trip</u> 71GL. ( )	

JDE Item No. & Description: 59527 - Generator #5- BDE Type of Inspection: PM9 Department: Protection & Control	Sheet: 7 of 13 Rev. No.: 7 Rev. Date: 15-04-14 Index No.: 251 Binder No.: 39

Meter Purpose: _____ Manufacturer: UE (100OHM Platinum 4 Wire RTD)

Serial No.: _____ Model No.: 2XLP43

Location: _____ Face Diameter: _____

Tube Length: _____ Scale: _____

Calibrated for _____ inches immersion with bulb _____ Level _____ case

Date	Trip Point	Alarm Point	Temp. Meter Reading	Thermometer Reading	Comments

JDE Item No. & Description: 59527 - Generator #5- BDE Type of Inspection: PM9 Department: Protection & Control	Sheet: 8 of 13 Rev. No.: 7 Rev. Date: 15-04-14 Index No.: 251 Binder No.: 39

TURBINE/GENERATOR TEMPERATURE METER CHECKS

Temp. Meter for Generator Cooler — Location: Generator Cooler

Manufacturer: U/E Model 2XLP43 (100 OHM Platinum 4 WIRE RTD) — Scale: 0 - 100 ^{0} C.

Date	Zero	Mid Range	Full Scale	Comments

JDE Item No. & Description:	59527 - Generator #5- BDE	Sheet:	9 of 13
Type of Inspection:	PM9	Rev. No.:	7
Department:	Protection & Control	Rev. Date:	15-04-14
		Index No.:	251 Binder No.: 39

Protection & Control Devices - Generator #5

Device No.	Device Function	Recommended Setting	Actual Setting
62	Creep detector time delay relay	180 Secs.	
62X	Shutoff valve closing time delay auxiliary relay	10 Secs.	

JDE Item No. & Description: 59527 - Generator #5- BDE Type of Inspection: PM9 Department: Protection & Control	Sheet: 10 of 13 Rev. No.: 7 Rev. Date: 15-04-14 Index No.: 251 Binder No.: 39

SOUTH SAC FLOW TRANSDUCER CALIBRATION SHEET

Tested By: _____ Date Tested: _____

Meter Purpose: South Surface Air Coolers Flow Manufacturer: Rosemount

Serial No.: C68878 Diff. Pressure Range: 0 – 150" H_2O

Location: Generator Housing South Side Alarm: Low Flow 500 lpm High Flow 300 lpm

Alarm: _____

HG (Inches)	Meter LPM	Comments

JDE Item No. & Description: 59527 - Generator #5- BDE Type of Inspection: PM9 Department: Protection & Control	Sheet: 11 of 13 Rev. No.: 7 Rev. Date: 15-04-14 Index No.: 251 Binder No.: 39

NORTH SAC FLOW TRANSDUCER CALIBRATION SHEET

Tested By: _____ **Date Tested:** _____

Meter Purpose: North Surface Air Coolers Flow **Manufacturer:** Rosemount

Serial No.: C68878 **Diff. Pressure Range:** 0 – 150" H_2O

Location: Generator Housing D/S North Side **Alarm:** Low Flow 500lpm High Flow 3000lpm

HG (Inches)	Meter LPM	Comments

JDE Item No. & Description: 59527 - Generator #5- BDE Type of Inspection: PM9 Department: Protection & Control	Sheet: 12 of 13 Rev. No.: 7 Rev. Date: 15-04-14 Index No.: 251 Binder No.: 39

GENERATOR FLOW TRANSDUCER CALIBRATION SHEET BEARING

Tested By: _____ Date Tested: _____

Manufacturer: Bailey Serial No.: 126219

Diff. Pressure Range: 0 – 75psi Safe Working Pressure: 3625psi

Location: Turbine Pit Alarm: 216 lpm

PSI	MA CAL	MA MEAS.	COMMENTS
0	4.00		Operating range 4.00 mA to 8.86 mA.
0.8656	5.72		0 PSI to 6.9248 PSI.
1.7312	6.43		
2.5968	6.97		
3.4624	7.44		
4.3280	7.84		
5.1936	8.21		
6.0592	8.55		
6.9248	8.86		
7.7904	9.16		
8.6560	9.44		
9.5216	9.70		
10.3872	9.95		
11.2528	10.20		
75.0000	20.00		

Comments:

JDE Item No. & Description: 59527 - Generator #5- BDE Type of Inspection: PM9 Department: Protection & Control	Sheet: 13 of 13 Rev. No.: 7 Rev. Date: 15-04-14 Index No.: 251 Binder No.: 39

Tested By: _____ Date: _____

Instrument Checked: KV Meter

Standard Source	Calculated	Recorded	Final Adjustment
0 Volts	0 KV		
50 Volts	6 KV		
100 Volts	12 KV		
150 Volts	18 KV		

Meter Type: Type AB-18 Scale: 0-150 volts Manufacturer: General Electric

Comments: _____

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 6 Rev. No.: 5 Rev. Date: 17-11-20 Index No.: 1972 Binder No.: 39

PM Checksheet No.: PM9 - 109924 - P&CBDE
JDE Item No. & Description: 109924 - Exciter #5 - BDE
Type of Inspection: PM9 (Six Years)
Department: Protection & Control — Dept. Approval: B. Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature & Date:
Reference Drawing and Manuals: 2107-E-130, 2107-E-131, 2107-E-132

ACTIVITIES (Initial Box Upon Completion)	REMARKS
CRITICAL PARTS INSPECTION **Step #1** **The following checks to be done with power off/unit isolated for inspection:** **a. Visually inspect heatsinks for contamination. ( )** **b. Visually inspect printed circuit boards for component discolouration, dirt and dust accumulation, etc. ( )** **c. Visually inspect wiring and connections on terminal blocks. ( )** **d. Visually inspect all ribbon cables for damage and proper connection. ( )** **e. Visual inspection of field flashing contactor. ( )** **f. Visual inspection of internal distribution breakers. ( )** **g. Visual inspection of crowbar assembly. ( )** **h. Measure resistance of field flashing resistor and check resistor and check associated wiring and connections. ( )** **R03 setting - 0.5 ohms.** **R03 measured _____ ohms.** **i. Measure and record resistance using an ohmmeter from AC "R", "S", "T" leads to "+ and "-" DC bus for each converter bridge. (See attached table)** ***Note: If resistance is low, isolate AC leads on each bridge and repeat measurements.** **Isolate the 3 phase bus from each excitation transformer. Record findings on attached sheet.**	

JDE Item No. & Description: 109924 - Exciter #5 - BDE Type of Inspection: PM9 Department: Protection & Control	Sheet: 2 of 6 Rev. No.: 5 Rev. Date: 17-11-20 Index No.: 1972 Binder No.: 39
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**
Step #1 (Cont'd) **The following checks to be done with power off/unit isolated for inspection:** **j. Check calibration of DC voltmeter in control room. Inject current signal on exciter links X3 - 37 (+), X3 - 38 (-). Check drawing to verify links. Calculated value is 4 - 20 MA = 0 - 250 VDC, 4MA = 0 volts, 12MA = 125 volts, 20MA = 250 VDE. ( )** **Measured: 4MA_____, 12MA_____, 20MA_____** **k. Check calibration of DC ammeter in Control Room. Inject current signal on exciter links X3 - 1 (+), X3 - 2 (-). Check drawing to verify links. Calculated value is 4 - 20 MA = 0 - 2,000 amps. 4MA – 0 amps, 12MA = 1000 amps, 20MA = 2000 amps. ( )** **Measured: 4MA_____, 12MA_____, 20MA_____** **l. Visually inspect 24V AC/DC power supply (G05) for dust and dirt accumulation. Also check all associated wiring and connections. ( )** **m. Visually inspect 24V DC/DC power supply (G15) for dust and dirt accumulation. Also check all associated wiring and connections. ( )** **n. Visually inspect all cubicles for any foreign material and clean and vacuum if necessary. ( )** **o. Check operation of 14x relay. ( )** ***Clean power supplies if necessary.** **Step #2** **"Power On" checks:** **a. With power on check output voltage of 24V AC/DC power supply (G05). ( )** **Expected: 24v Actual: _____** **Measure on W5:1 and W4:1. _____** **b. With power on check output voltage of 24 V DC/DC power supply (G15). ( )** **Expected: 24v Actual: _____** **Measure on W1:1 and W2:1. _____**	

JDE Item No. & Description: 109924 - Exciter #5 - BDE Type of Inspection: PM9 Department: Protection & Control	Sheet: 3 of 6 Rev. No.: 5 Rev. Date: 17-11-20 Index No.: 1972 Binder No.: :39
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**

Step #2 (Cont'd)

"Power On" checks:

c. Check field flashing timer setting. ( )

Expected: 6-8 sec Actual: _____

d. Check field flashing from both AC and DC sources. ( )

e. With unit at speed no load, perform the following steps:

i. Change over from Auto to Manual. ( )

ii. Change over from Manual to Auto. ( )

iii. Transfer of bridges. ( )

iv. Verification of thyristor firing. ( )

v. Check alarm screen. ( )

vi. Check voltage raise/lower from control room. ( )

Note: Take all necessary precautions as mentioned in each section of Step #2.

f. With unit on line obtain readings taken by Operators during pre-outage checks and compare the following: ( )

Parameter	Exciter	Control Room
Gen. Volts		
Gen. Amps		
Gen. MW		
Gen. MVAR		
Exc. Volts DC		
Exc. Amps DC		

JDE Item No. & Description: 109924 - Exciter #5 - BDE Type of Inspection: PM9 Department: Protection & Control	Sheet: 4 of 6 Rev. No.: 5 Rev. Date: 17-11-20 Index No.: 1972 Binder No.: 39
ACTIVITIES (Initial Box Upon Completion)	**REMARKS**

Step 3

a. Check operation of ground fault relay. ( )

Test Procedure for Ground Fault Relay

1. Remove relay from case. ( )

2. Remove resistor (50K, 50 Watt) from back of case (1, 9). ( )

3. Hook up for test on bench.

   a) 120V AC control power on 7, 8. ( )

   b) 50K, 50W resistor on terminals 1,9. ( )

   c) Set decade box (RT) to approximately 5999 ohms and hook up between terminals 2 and 4. RT should be minimum of 5 watts. Our decade box has a 10 watt rating. ( )

   d) Turn on control power. Note green light should be on and red light off. ( )

   e) Verify control voltage monitor contact (13, 14) and trip contact (11, 12) are both open. ( )

   f) Reset target if orange. Should be black when relay not tripped. ( )

   g) Gradually reduce RT until relay trips. Note red light on and target is orange. ( )

      Record this value of resistance. _____

      Also verify trip contact (11, 12) is closed.

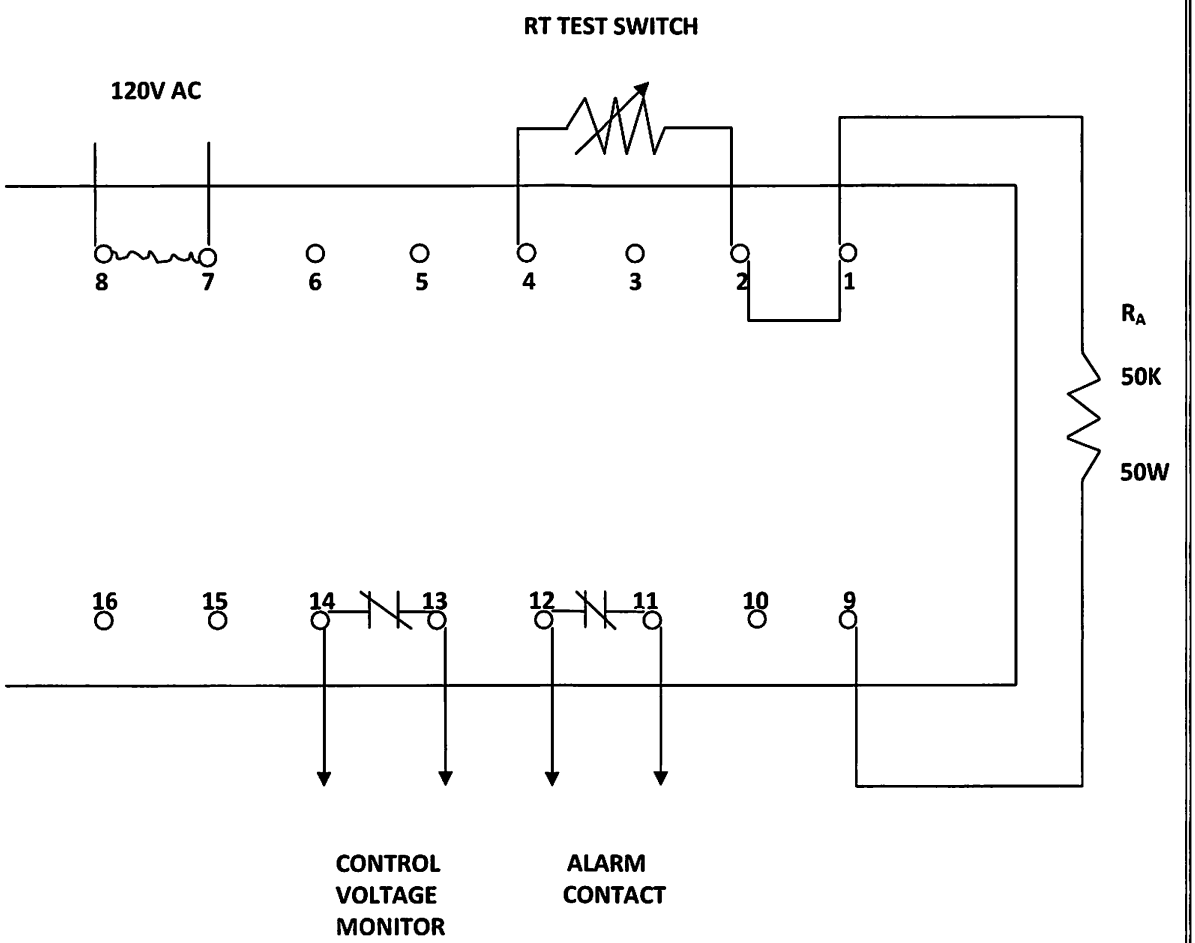
   h) Remove test resistance and reset relay. ( )

   i) Return relay to case at the unit. Be sure to re-connect the resistor to the back of the case; terminal 1, 9. ( )

JDE Item No. & Description: 109924 - Exciter #5 - BDE Type of Inspection: PM9 Department: Protection & Control	Sheet: 5 of 6 Rev. No.: 5 Rev. Date: 17-11-20 Index No.: 1972 Binder No.: 39
ACTIVITIES (Initial Box Upon Completion)	REMARKS

RT MIN. 5 WATT
BETWEEN 5 & 6 K

RELAY SHOULD OPERATE CLOSE TO 5K



JDE Item No. & Description: 109924 - Exciter #5 - BDE **Type of Inspection:** PM9 **Department:** Protection & Control	**Sheet:** 6 of 6 **Rev. No.:** 5 **Rev. Date:** 17-11-20 **Index No.:** 1972 **Binder No.:** 39

Measurements of Resistance between R, S, and T w.r.t. (+) and (-)

3-Ph. AC Bridge #1 - EG1 (Before Isolations)		3-Ph. AC Bridge #2 - EG2 (Before Isolations)	
R to (+) =	____Ω	R to (+) =	____Ω
R to (-) =	____Ω	R to (-) =	____Ω
S to (+) =	____Ω	S to (+) =	____Ω
S to (-) =	____Ω	S to (-) =	____Ω
T to (+) =	____Ω	T to (+) =	____Ω
T to (-) =	____Ω	T to (-) =	____Ω

3-Ph. AC Bridge #1 - EG1 (After Isolations)		3-Ph. AC Bridge #2 - EG2 (After Isolations)	
R to (+) =	____Ω	R to (+) =	____Ω
R to (-) =	____Ω	R to (-) =	____Ω
S to (+) =	____Ω	S to (+) =	____Ω
S to (-) =	____Ω	S to (-) =	____Ω
T to (+) =	____Ω	T to (+) =	____Ω
T to (-) =	____Ω	T to (-) =	____Ω

*All plugs to individual SCRs were checked ( )
*Wiring to Unitrol 3670 checked. ( )
*Fuses on R, S, and T are good. ( )
*All fuse blown indicating switches are good. ( )
*Measured _____Ω on all Gate/Cathode Leads

Measurements of Resistance between R, S, and T Phases

3-Ph. AC Bridge #1 - EG1 (Before Isolations)		3-Ph. AC Bridge #2 - EG2 (Before Isolations)	
R to S =	____Ω	R to S =	____Ω
S to T=	____Ω	S to T=	____Ω
R to T=	____Ω	R to T=	____Ω

3-Ph. AC Bridge #1 - EG1 (After Isolations)		3-Ph. AC Bridge #2 - EG2 (After Isolations)	
R to S =	____Ω	R to S =	____Ω
S to T=	____Ω	S to T=	____Ω
R to T=	____Ω	R to T=	____Ω

Hours of Use on Bridges

3-Ph. AC Bridge #1 - EG1 =	Hrs.	3-Ph. AC Bridge #2 - EG2 =	Hrs.

W/O #:_____

NEWFOUNDLAND & LABRADOR HYDRO HYDRO GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 5 Rev. No.: 4 Rev. Date: 15-04-15 Index No.: 2023 Binder No.: 39

PM Checksheet No.: PM9 - 59637 - P&CBDE
JDE Item No. & Description: 59637 - Annunciator #5 - BDE
Type of Inspection: PM9 (Major)
Department: Protection & Control — Dept. Approval: B. Woodman
Inspection Start Date: — Insp. Comp. Date:
Supervisor's Review Signature & Date:
Reference Drawing and Manuals: 2107-E-141

ACTIVITIES (Initial Box Upon Completion)	REMARKS
CRITICAL PARTS INSPECTION 1. Complete as per attached sheets. ( ) Note: Check points from field devices or field links where possible.	

JDE Item No. & Description: 59637 - Annunciator #5 - BDE Type of Inspection: PM9 Department: Protection & Control								Sheet: 2 of 5 Rev. No.: 4 Rev. Date: 15-04-15 Index No.: 2023 Binder No.: 39
Alarm Points	**Title**	**Field Device**	**Field Contacts**	**FC Links**	**Annunciator Panel Links**	**Control Room Links**	**Received at BDE Control**	**Remarks**
1	Station Alarm							Not Used
2	Unit Protection Trip	86 86S 94SA	1, 1C 1, 1C 1, 2	11RYF7	501A2	501UK1	Unit 5 Alarm	
				11RYF8	501C10	501UK2		
3	Excitation Failure	445/R16	161, 164	X4-47	501C2	501UK1	Unit 5 Alarm	
				X4-48	501A3	501UK2		
4	Generator Creep	38CX	7, 8	502UG5	501A4	501UK1	Unit 5 Alarm	
5	Brakes Off Auto	20AB-CS/Off	7, 7C	Gov. BB71, BB72	501A5	501UK1	Unit 5 Alarm	
		4	1C, 10	502UG11	501C3	501UK2		
6	Brakes On	20TD 20X 4	3, 4 3, 4 4G, 4H	502UF11	501AG	501UK1	Unit 5 Alarm	
				502UG11	501C3	501UK2		
7	Bearing Temperature	38BA Guide Turbine, 38BA Guide Generator, 38BA Thrust Generator		AH1 & AH2 AH3 & AH4 AH5 & AH6	501C4	501UK1	Unit 5 Alarm	
					501A7	501UK2		

JDE Item No. & Description: 59637 - Annunciator #5 - BDE Type of Inspection: PM9 Department: Protection & Control								Sheet: 3 of 5 Rev. No.: 4 Rev. Date: 15-04-15 Index No.: 2023 Binder No.: 39
Alarm Points	**Title**	**Field Device**	**Field Contacts**	**FC Links**	**Annunciator Panel Links**	**Control Room Links**	**Received at BDE Control**	**Remarks**
8	Bearing Oil Level	71TL 71TH 71GBX 71GBX	3, 7 4, 8	AC3 & AC4 AC1 & AC2 AN11 & AN12 AN11 & AN12	501C4	501UK1	Unit 5 Alarm	
					501A8	501UK2		
9	Bearing Coolant Low Flow	80TX 80GX 4	1, 2 1, 2 1C, 1D	502UF12(?)	501C3	501UK1	Unit 5 Alarm	
				502UG11	501A9	501UK2		
10	Water in Bearing	96		AJ11	501C4	501UK1	Unit 5 Alarm	
				AJ12	501A9	501UK2		
11	Gen Brg Oil Level	71GHX(B1)	1,2	AJ-1	501C11	501UK1	Unit 5 Alarm	Not Used
		71GLX(R2)	4,5	AJ-2	501A11	501UK2		
12	Unit Runaway Speed	14/450 RPM		BC23	501C6	501UK1	Unit 5 Alarm	
				BC24	501A12	501UK2		
13	Shearpin Failure	95X	1, 2	502UG1	501C3	501UK1	Unit 5 Alarm	
				502UG11	501A13	501UK2		
14	Shearpin Failure Circuit Ground	95A	1, 7	502UG2	501C3	501UK1	Unit 5 Alarm	
				502UG11	501A14	501UK2		
15	Governor Accumulator Tank Low Pressure	63GAP		AD7, AD8	501C4	501UK1		
					501A15	501UK2		

JDE Item No. & Description: 59637 - Annunciator #5 – BDE Type of Inspection: PM9 Department: Protection & Control								Sheet: 4 of 5 Rev. No.: 4 Rev. Date: 15-04-15 Index No.: 2023 Binder No.: 39
Alarm Points	**Title**	**Field Device**	**Field Contacts**	**FC Links**	**Annunciator Pnl. Links**	**Control Room Links**	**Received at BDE Control**	**Remarks**
16	Governor Accumulator Tank Oil Level	71G0/High		AD1, AD2	501C4	501UK1	Unit 5 Alarm	
		71G0/Low		AD3, AD4	501A16	501UK2		
17	Turbine Pit High Water	71THL		AC7, AC8	501C9	501UK1	Unit 5 Alarm	
					501A17	501UK2		
18	Exciter Volts/HZ Limiter Active	445	141, 144	X4-43	501C11	501UK1	Unit 5 Alarm	
		/R14			501A18	501UK2		
19	Auto Greasing Failure	74AG	15, 16		501C5	501UK1	Unit 5 Alarm	
					501A19	501UK2		
20	Air Coolers Coolant Flow Abnormal	80ACX/Low 80AC/High 80AC/High 4	1, 3 1C, 1D	AK7, AK8 AJ1, AJ2 AJ5 AJ6	501C30	501UK1	Unit 5 Alarm	
					501A20	501UK2		
21	Main Transformer Oil & Winding Temperature	49WT		OT8, OT4	501C8	501UK1	Unit 5 Alarm	
		260T		OT9, OT10	501A21	501UK2		
22	Main Transformer Oil Level and Gas Accumulation	710L		OL1, OL2	501C8	501UK1	Unit 5 Alarm	
		63GA		GA1, GA2	501A22	501UK2		

JDE Item No. & Description: 59637 - Annunciator #5 - BDE Type of Inspection: PM9 Department: Protection & Control								Sheet: 5 of 5 Rev. No.: 4 Rev. Date: 15-04-15 Index No.: 2023 Binder No.: 39
Alarm Points	**Title**	**Field Device**	**Field Contacts**	**FC Links**	**Annunciator Panel Links**	**Control Room Links**	**Received at BDE Control**	**Remarks**
23	DC Breaker Off	8/B 8/B 8/B 8/B 8/B 8/B 8/B			501C7	501UK1	Unit 5 Alarm	
					501A23	501UK2		
24	Bypass AC Failure		1, 4		501C10	501UK1	Unit 5 Alarm	
					501A24	501UK2		
25	Unit Loss of DC							Not Used
26	Turbine Brg Oil Level	71THX		AJ-3	501C9	501UK1	Unit 5 Alarm	
		71TLX		AJ-4	501A26	501UK2		
27	Spherical Valve Alarm	SVPLC 00037		SV-TB3-7	501C9	501UK1	Unit 5 Alarm	
		27PSI, 27PS2	11, 12	SV-TB3-8	501A27	501UK2	Unit 5 Alarm	
28								
29	Rectifier/Transformer Oil/Temp.	26T		8, 9	501C1		Unit 5 Alarm	
					501A29			
30	Rectifier/Transformer Oil/Level	71T		1, 2	501C1		Unit 5 Alarm	
					501A30			

NL HYDRO EXPLOITS GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 3 Rev. No.: 1 Rev. Date: 3/25/2016

BISHOP'S FALLS POST-OUTAGE OPERATIONAL CHECKSHEET

Inspection Date: _____ **BF Unit #:** _____

Inspection Time: _____ **Outage Reference #:** _____

Completed By: _____ **Outage Completion Date:** _____

COMPLETE THE FOLLOWING INSPECTION WITHIN 5 DAYS OF UNIT BEING PLACED BACK IN SERVICE.

1. General ( )

a) What was the date and time the unit was put back online? _____

b) What was the duration of the outage (# days)? _____

2. Operational Checks ( )

a) Generator Power: _____ kW

b) Reactive Power: _____ kVAR

c) Frequency: _____ HZ

d) Generator Voltage: _____ V

e) Excitation Voltage: _____ V

f) Excitation Amps: _____ A

g) Unit Speed: _____ RPM

h) RPM SP: _____ RPM

i) WG Position: _____ %

j) WG Limit: _____ %

k) Chamber Water Level: _____ FT

l) Tailrace Water Level: _____ FT

Comments:

3. Vibration Levels (Panelview) ( )

a) Turbine Bearing: _____ mil

b) Roller Bearing Drive End: _____ mil

c) Gen Bearing Drive End: _____ mil

d) Gen Bearing Non-Drive End: _____ mil

e) Axial (Thrust Bearing): _____ mil

4. Bearing Temperatures (Panelview) ( )

a) Roller Bearing Drive End: _____ Deg. C

b) Gen Bearing Drive End: _____ Deg. C

c) Gen Bearing Non-Drive End: _____ Deg. C

d) Thrust Bearing Non-Drive End: _____ Deg. C

NALCOR ENERGY EXPLOITS GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 2 of 3 Rev. No.: 1 Rev. Date: 3/25/2016

BISHOP'S FALLS POST-OUTAGE OPERATIONAL CHECKSHEET

5. Generator Stator RTD Readings (Panelview) ( )

Stator RTD 1 = _____ Deg. C Stator RTD 4 = _____ Deg. C

Stator RTD 2 = _____ Deg. C Stator RTD 5 = _____ Deg. C

Stator RTD 3 = _____ Deg. C Stator RTD 6 = _____ Deg. C

6. Bearing Inspections

a) Generator Tail End Bearing ( )

i) Oil Rings Rotating? YES / NO

ii) Oil Level in Sight Glass: _____ inches

iii) Bearing Temperature using Temp. Gun: _____ Deg. C

b) Generator Drive End Bearing ( )

i) Oil Rings Rotating? YES / NO

ii) Oil Level in Sight Glass: _____ inches

iii) Bearing Temperature using Temp. Gun: _____ Deg. C

c) Generator Thrust Bearing ( )

i) Oil Circulation Pump Running? YES / NO

ii) Oil Level in Sight Glass: _____ inches

iii) Oil Flow reading on Flowmeter: _____ GPM

iv) Visible signs of oil leakage? YES / NO If YES, comment below on location.

Comments:

7. Shaft Seal ( )

a) Shaft Seal flow reading on Flowmeter: _____ GPM

b) Signs of water leakage from Shaft Seal & piping? YES / NO If YES, comment below.

Comments:

NALCOR ENERGY EXPLOITS GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 3 of 3 Rev. No.: 1 Rev. Date: 3/25/2016

BISHOP'S FALLS POST-OUTAGE OPERATIONAL CHECKSHEET

8. Turbine Bearing Cooling Water Supply ( )

a) Turbine Bearing water flow reading on Flowmeter: _____ GPM

b) Signs of water leakage from Turbine Bearing Water Supply piping? YES / NO

If YES, comment on location below.

Comments:

9. CMHP and Brakes ( )

a) At indicated Gate Position, what are the hydraulic pressure readings on the CMHP pressure gauges?

i) 'A' Port (Closing) = _____ psi ii) 'B' Port (Opening) = _____ psi

b) Visible signs of leakage from CMHP and Braking hydraulic piping? YES / NO

If YES, comment on location below.

Comments:

10. Unit Alarms - List Alarms showing on Panelview: ( )

11. General - General Comments / Concerns: ( )

NL HYDRO EXPLOITS GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 3 Rev. No.: 1 Rev. Date: 3/25/2016

BISHOP'S FALLS PRE-OUTAGE OPERATIONAL CHECKSHEET

Inspection Date: _____ **BF Unit #:** _____

Inspection Time: _____ **Outage Request #:** _____

Completed By: _____ **Outage Start Date:** _____

1. General ( )

a) Last time Unit was Off-line? _____

b) Reason Unit was Off-line? Maintenance / Unit Trip / Low Water / Other

Comments:

2. Operational Checks ( )

a) Generator Power: _____ kW
b) Reactive Power: _____ kVAR
c) Frequency: _____ HZ
d) Generator Voltage: _____ V
e) Excitation Voltage: _____ V
f) Excitation Amps: _____ A
g) Unit Speed: _____ RPM
h) RPM SP: _____ RPM
i) WG Position: _____ %
j) WG Limit: _____ %
k) Chamber Water Level: _____ FT
l) Tailrace Water Level: _____ FT

3. Vibration Levels (Panelview)

a) Turbine Bearing: _____ mil
b) Roller Bearing Drive End: _____ mil
c) Gen Bearing Drive End: _____ mil
d) Gen Bearing Non-Drive End: _____ mil
e) Axial (Thrust Bearing): _____ mil

4. Stator Temperatures (Panelview) ( )

a) Stator RTD 1 = _____ Deg. C
b) Stator RTD 2 = _____ Deg. C
c) Stator RTD 3 = _____ Deg. C
d) Stator RTD 4 = _____ Deg. C
e) Stator RTD 5 = _____ Deg. C
f) Stator RTD 6 = _____ Deg. C

EXPLOITS GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Rev. No.: 1 Rev. Date: 3/25/2016

BISHOP'S FALLS PRE-OUTAGE OPERATIONAL CHECKSHEET

5. Bearing Temperatures (Panelview) ( )

a) Roller Bearing Drive End: _____ Deg. C

b) Gen Bearing Drive End: _____ Deg. C

c) Gen Bearing Non-Drive End: _____ Deg. C

d) Thrust Bearing Non-Drive End: _____ Deg. C

6. Bearing Inspections

a) Generator Tail End Bearing ( )

i) Oil Rings Rotating? YES / NO

ii) Oil Level in Sight Glass: _____ inches

iii) Bearing Temperature using Temp. Gun: _____ Deg. C

b) Generator Drive End Bearing ( )

i) Oil Rings Rotating? YES / NO

ii) Oil Level in Sight Glass: _____ inches

iii) Bearing Temperature using Temp. Gun: _____ Deg. C

c) Generator Thrust Bearing ( )

i) Oil Circulation Pump Running? YES / NO

ii) Oil Level in Sight Glass: _____ inches

iii) Oil Flow reading on Flowmeter: _____ GPM

iv) Visible signs of oil leakage? YES / NO If YES, comment below on location.

Comments:

7. Shaft Seal ( )

a) Shaft Seal flow reading on Flowmeter: _____ GPM

b) Signs of water leakage from Shaft Seal & piping? YES / NO If YES, comment below.

Comments:

EXPLOITS GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Rev. No.: 1 Rev. Date: 3/25/2016

BISHOP'S FALLS PRE-OUTAGE OPERATIONAL CHECKSHEET

8. Turbine Bearing Cooling Water Supply ( )

a) Turbine Bearing water flow reading on Flowmeter: _____ GPM

b) Signs of water leakage from Turbine Bearing Water Supply piping? YES / NO

If YES, comment on location below.

Comments:

9. CMHP and Brakes ( )

a) At indicated Gate Position, what are the hydraulic pressure readings on the CMHP pressure gauges?

i) 'A' Port (Closing) = _____ psi ii) 'B' Port (Opening) = _____ psi

b) Visible signs of leakage from CMHP and Braking hydraulic piping? YES / NO

If YES, comment on location below.

Comments:

10. Unit Alarms - List Alarms showing on Panelview: ( )

11. General - General Comments / Concerns: ( )

NL HYDRO EXPLOITS GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 4 Rev. No.: 1 Rev. Date: 3/25/2016

BISHOP'S FALLS PRE-START OPERATIONAL CHECKSHEET

Inspection Date: _____

Inspection Time: _____ **BF Unit #:** _____

Completed By: _____

COMPLETE THE FOLLOWING CHECKS PRIOR TO START-UP OF UNIT. DO NOT START UNIT UNTIL ITEMS 1-4 ARE CONFIRMED.

1. General ( )

a) How long has the unit been shut-down (# days)? _____

b) Reason Unit was Off-line? Maintenance / Unit Trip / Low Water / Other

c) Complete a walk-around of the unit and visually check to ensure there are no parts, tools, debris, or other obstructions in the area that could cause damage to the unit during start-up. Ensure all handrailing and machine guards are secure. ( )

d) Complete an inspection of the Forebay area to confirm chamber gates are completely removed, dogged, and secured and chamber covers are installed and secured. Inspect trash racks for signs of material / debris build-up and damage. ( )

Comments:

2. Generator

a) Complete a visual inspection of the Generator air-gap to ensure there are no obstructions within the air gap. All items of concern are to be reported to Operations Supervisor for further evaluation. ( )

b) Record Stator RTD Readings from Panelview: ( )

Stator 1 = _____ Deg. C Stator 4 = _____ Deg. C

Stator 2 = _____ Deg. C Stator 5 = _____ Deg. C

Stator 3 = _____ Deg. C Stator 6 = _____ Deg. C

c) Complete a visual inspection of the brush-rigging to ensure there are no obstructions, all brushes are seated in brush holders, and all wiring is secure. ( )

Comments:

NL HYDRO EXPLOITS GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 2 of 4 Rev. No.: 1 Rev. Date: 3/25/2016

BISHOP'S FALLS PRE-START OPERATIONAL CHECKSHEET

3. Bearings

a) Complete a visual inspection of the bearings, checking for signs of oil leakage. Report all findings. ( )

Comments:

b) Record oil levels on bearing sight glasses. Top up as required. ( )

i) Tail End Generator Bearing: _____ inches

ii) Drive End Generator Bearing: _____ inches

iii) Thrust Bearing sump level: _____ inches

c) Bearing Temperatures (Panelview). ( )

i) Roller Bearing Drive End: _____ Deg. C

ii) Gen Bearing Drive End: _____ Deg. C

iii) Gen Bearing Non-Drive End: _____ Deg. C

iv) Thrust Bearing Non-Drive End: _____ Deg. C

d) Generator Thrust Bearing. *Ensure pump is running prior to start-up.* ( )

i) Oil Circulation Pump Running? YES / NO

ii) Oil Flow reading on Flowmeter: _____ GPM

4. Turbine Bearing & Shaft Seal Water Supply

a) Turbine Bearing water flow reading on Flowmeter: _____ GPM ( )

Trip setpoint is 23 GPM. Adjust flow to 28 GPM min.

b) Shaft Seal flow reading on Flowmeter: _____ GPM ( )

Trip setpoint is 1.5 GPM. Adjust flow to 2.5 GPM min.

c) Signs of water leakage from Turbine Bearing Water Supply piping or Shaft Seal piping? YES / NO ( )

If YES, comment on location below. Do not start unit if risk of loss of water supply to components or water spray onto electrical equip.

Comments:

NL HYDRO EXPLOITS GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 3 of 4 Rev. No.: 1 Rev. Date: 3/25/2016

BISHOP'S FALLS PRE-START OPERATIONAL CHECKSHEET

COMPLETE THE FOLLOWING CHECKS ONCE UNIT HAS BEEN GIVEN START COMMAND.

5. Synchronizing Sequence

a) Record below the time it takes for unit to synchronize and close main breaker. Start timing once start command has been given. ( )

Timing = _____ min.

b) Record the wicket gate position (% Gate) that unit requires to reach synchronous speed. ( )

Synch. WG Position = _____ %

Comments:

6. Bearing Oil Rings

Note: Inspect Generator bearings to ensure oil rings are rotating. Immediately shut-down if oil rings are not rotating.

a) Generator Tail End Bearing - Oil Rings Rotating? YES / NO ( )

b) Generator Drive End Bearing - Oil Rings Rotating? YES / NO ( )

7. Operational Checks (Unit Load Stabilized) ( )

a)	Generator Power: _____	kW	g)	Unit Speed: _____	RPM
b)	Reactive Power: _____	kVAR	h)	RPM SP: _____	RPM
c)	Frequency: _____	HZ	i)	WG Position: _____	%
d)	Generator Voltage: _____	V	j)	WG Limit: _____	%
e)	Excitation Voltage: _____	V	k)	Chamber Water Level: _____	FT
f)	Excitation Amps: _____	A	l)	Tailrace Water Level: _____	FT

8. Bearing Temperatures (Panelview) ( )

Note: Normal run-up temperature of babbitt bearing is 1 Deg. C / min. Immediately shut-down if spike in temp. is observed.

a) Roller Bearing Drive End: _____ Deg. C

b) Gen Bearing Drive End: _____ Deg. C

c) Gen Bearing Non-Drive End: _____ Deg. C

d) Thrust Bearing Non-Drive End: _____ Deg. C

Record time that temps are recorded after Unit start-up.

Time = _____ mins.

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PREVENTIVE MAINTENANCE CHECKSHEETS	Rev. Date: 3/25/2016

BISHOP'S FALLS PRE-START OPERATIONAL CHECKSHEET

9. Vibration Levels (Panelview) ( )

a) Turbine Bearing: _____ mil

b) Roller Bearing Drive End: _____ mil

c) Gen Bearing Drive End: _____ mil

d) Gen Bearing Non-Drive End: _____ mil

e) Axial (Thrust Bearing): _____ mil

10. Bearing Temperatures (Temp. Gun) ( )

Check Bearing Temperatures using Temp. Gun.

a) Roller Bearing Drive End: _____ Deg. C

b) Gen Bearing Drive End: _____ Deg. C

c) Gen Bearing Non-Drive End: _____ Deg. C

d) Thrust Bearing Non-Drive End: _____ Deg. C

11. CMHP & Brakes ( )

a) At indicated Gate Position, what are the hydraulic pressure readings on the CMHP pressure gauges?

i) 'A' Port (Closing) = _____ psi ii) 'B' Port (Opening) = _____ psi

b) Inspect hydraulic piping and components for signs of leakage. Immediately report issues found and shut down unit. ( )

12. Unit Alarms - List Alarms showing on Panelview: ( )

13. General - General Comments / Concerns: ( )

NL HYDRO EXPLOITS GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 5 Rev. No.: 5 Rev. Date: 15/11/2018 Index No. GF9-010 Folder No.: GF9

Asset No. & Description: 720116 - GF9 GOVERNOR
Type of Inspection: PM6 (ANNUAL) **Work Order:** _____
Department: ELECTRICAL
Inspection Start Date: _____ **Supervisor's Review Signature:** _____
Inspection Completion Date: _____ **Planner's Review Signature:** _____
Reference Drawing and Manuals:

ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
1. Governor Oil Pumps and Motors a) Inspect wiring and connections on pump starter. **Comments:**	( )
b) Inspect pump motor wiring and connections for Pump 1, Pump 2, and Backup DC Pump. Comment on overall condition of motors. **Comments:**	( )
c) Meggar HPU Motors at 500 VDC for one minute. Record results below: **Comments:**	( )
2. Governor PLC a) Inspect for corrosion on screws, electrical terminations, and electrical components. Repair/replace as required. **Comments:**	( )
b) Check all wiring terminations to ensure they are tight. **Comments:**	( )
c) Replace battery inside CPU module. Open the CPU enclosure located on the PLC rack. Remove battery from it's holder and replace. Verify BAT light on the front of the PLC is extinguished **Comments:**	( )

HPU Pumps	Meggar Reading
Pump 1	
Pump 2	
Backup DC Pump	

Asset No. & Description:	**720116 - GF9 GOVERNOR**	**Sheet:**	2 of 5
Type of Inspection:	PM6 (ANNUAL)	**Rev. #:**	5
Department:	ELECTRICAL	**Rev. Date:**	15/11/2018
		Index No.	GF9-010 **Folder No.: GF9**

ACTIVITIES (Initial Box Upon Completion) **CHECKED BY**

3. HPU Pressure Transmitter Alarm & Trip (PQTXDR1)

Viewed on Factory Talk: Beeton **Governor HPU** screen
Ref: Technical Data Sheets **Section "Item 215"** in Alstom Operation & Maint. Manual 2.1 PLC Tag: ACcHPUPQTXDR1_1
Manual Section in Alstom Operation & Maint. Manual 2.1
Dwgs.: 603020-6-M67DA-001 (sht. 1 of 5) in Alstom Operation & Maint. Manual 2.1
603020-6-M67EF-001 (sht. 2 of 5) in Alstom Operation & Maint. Manual 2.1
603020-6-M67EF-001 (sht. 3 of 5) in Alstom Operation & Maint. Manual 2.1
Type: Endress & Hauser PMP-731 Scale: 4 - 20 mA = 0 to 41,368 kPa /0 to 6000 PSI
(model PMP-731-3-5-32-8-8-1-10) High Alarm at: 16,000 kPa /2320 PSI
Low Alarm at: 12,200kPa / 1769 PSI
Low Low Alarm & Trip at: 12,000 kPa / 1740 PSI

This is a 5-part test, completed in several stages and in a specific order. Each part is identified, and as each part is completed, initial each section. All results are to be entered in the table(s). Please read each part carefully and follow all instructions.

***Note: Operations personnel are required to assist in this test.**
If the HPU is locked out during a shutdown, a PC14 test will have to be issued to energize the HPU.
The test will require an AWPP to be able to open/close the hand valves on the servo lines at the HPU location as required. It is preferred that the wicket gates be stroked to remove any air and left in the closed position.

Prior to starting this test, the following should be in place. Check each item listed below with a checkmark (√):
( ) Ensure that the penstock is dewatered.
( ) Ensure that there is no wicket gate lock in place.
( ) Ensure system is placed in "Maintenance Mode" at the Governor HMI
( ) The AWPP should be in place with locks and tags on the hand valves on the servo lines.
( ) In "Maintenance Mode", the HPU pressure should be around 12,500 kPa/ 1812 PSI
Observe the readings on the pressure transmitter PQTXDR1, and the HMI. Note them in the boxes below.

PQTXDR1 is : _____/_____(kPa/PSI)	HMI is : _____kpa

The pressure observed on PQTXDR1, in kPa, should be equivalent to the kPa observed in Factory Talk

Part 1 - Checking the High Pressure Alarm (H Alarm) at 16,000 kPa: ( )
(1) With the AWPP in place, ensure that the hand valves on the servo lines are in the **closed** position.
(2) Place the No.1 Pump in **Manual,** on the front of the MCC bucket.
(3) At the HPU, at the Pump No.1 solenoid valve, press in and hold the manual operator in the "in" position.
The pressure will increase while holding the manual operator in.
Observe the pressure at the local pressure gauge. At around 16,000 kPa/2320 PSI, the High Alarm should be activated. Note the pressure observed on the HMI at the High Alarm in the table on page 3.
After the alarm is triggered, release the manual operator.

(4) At this point, Place the No.1 Pump and the No.2 Pump in the **OFF** position on the front of the MCC buckets
The pumps will be left in the off position in preparation for the Low and Low Low presure checks.

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Type of Inspection:	PM6 (ANNUAL)	**Rev. #:**	5
Department:	ELECTRICAL	**Rev. Date:**	15/11/2018
		Index No.	GF9-010 **Folder No.: GF9**

ACTIVITIES (Initial Box Upon Completion) **CHECKED BY**

3.

mA	Pressure Tx. (kPa) / (PSI)	HMI Pressure (kPa)	*Note - PLC Alarm Tag
4	0		
8	10342 / 1500		
8.64	**12,000 / 1740** (LL Alarm & Trip)		BTcHPUPQTXDR_LLow
8.72	**12,200 / 1769** (L Alarm)		BAcHPUPQTXDR1_Low
10.19	**16,000 / 2320** (H Alarm)		BAcHPUPQTXDR1_High
12	20684 / 3000		
16	23269 / 3375		
	The HH Alarm & Trip will not be checked due to the extreme pressure setpoint required		
19.47	**40,000 / 5802** (HH Alarm & Trip)		

Part 2 - Checking the Low Pressure Alarm (L Alarm) at 12,200 kPa: ( )

(1) With the AWPP in place, ensure that the hand valves on the servo lines are still in the **opened** position.
(2) Pump No.1 and No.2 should be in the **Off** position**,** on the front of the MCC buckets.
(3) Observe the pressure at the HMI. Have the operator swing the wicket gates from 0% to 100%. and back to 0%. This will cause the pressure to drop at the HPU. Do this until the pressure drops to around 13,000 kPa. Then have the operator swing the gates from 100% to 80% and back to 100%. Do this repeatedly to get the pressure down to 12,200 kPa/1769 PSI, then the Low Alarm should be activated. Note the pressure observed on the HMI at the Low Alarm in the table on page 3.

Part 3 - Checking the Low Low Pressure Alarm (LL Alarm & Trip) at 12,000 kPa: ( )

(1) Continue with the hand valves on the servo lines in the **opened** position.
(2) Pump No.1 and No.2 should be in the **Off** position**,** on the front of the MCC buckets.
(3) Have the operator swing the gates from 100% to 90% and back to 100%. Do this repeatedly to get the pressure down to 12,000 kPa/1740 PSI, then the Low Low Alarm & Trip should be activated. Note the pressure observed on the HMI at the Low Alarm in the table on page 3.

Part 4 - Low Oil Pressure Shutdown Switch Alarm & Trip (63QHT1-1) ( )

Viewed on Factory Talk: Beeton **Governor HPU** screen
Ref: Technical Data Sheets **Section "Item 220"** in Alstom Operation & Maint. Manual 2.1 PLC Tag: BCxHPU_63QHT1_1
Dwgs.: 603020-6-M67DA-001 (sht. 1 of 5) in Alstom Operation & Maint. Manual 2.1
603020-6-M67EF-001 (sht. 2 of 5) in Alstom Operation & Maint. Manual 2.1
603020-6-M67EF-001 (sht. 3 of 5) in Alstom Operation & Maint. Manual 2.1
Type: MP Filtri Model IPH-160 Alarm and Trip at: 12,000 kPa / 1740 PSI falling

At a pressure of approximately 12,000 kPa/1740 PSI falling, the Low Oil Pressure Switch Alarm & Trip 63QHT1-1 will activate. This pressure switch will work in tandem with the pressure transmitter to provide a separate discrete input to provide alarming and tripping of the unit. It should be noted at this time that the alarm screen in the HMI indicated that this alarm was also triggered.

63QHT1-1	LL Alarm & Trip activated? _____ (√)	*Note - PLC Alarm Tag: BTcHPU_63QHT1_1

Part 5 - Checking the closure of the wicket gates in a LL Alarm & Trip condition: ( )

At this point the LL Alarm & Trip has occurred, and the gates should be at the 100% open position. Have the operator manually stroke the wicket gates back to 0%. After the 0% is reached, have the operator move the gates to 50% open. If the gates are successfully moved to the 50% open position, this satisfies the 1.5 stroke requirement that the gates must be able to travel in a Low Low Oil Pressure & Trip condition.

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Type of Inspection:	PM6 (ANNUAL)	**Rev. #:**	5
Department:	ELECTRICAL	**Rev. Date:**	15/11/2018
		Index No.	GF9-010 **Folder No.: GF9**

ACTIVITIES (Initial Box Upon Completion) **CHECKED BY**

3. Part 5 - (cont'd)

Record the number of strokes on the wicket gate: _____ (should be 1.5 minimum)
Record the pressure remaining at the HPU following the test: _____ kPa

After completing this test, the following should be in place. Check each item listed below with a checkmark (√):
( ) Ensure system is taken out of "Maintenance Mode" at the Governor HMI
( ) The AWPP with locks and tags should be reomoved from the servo lines.
( ) In "Maintenance Mode", the HPU pressure should be around 12,500 kPa/ 1812 PSI
( ) Pump No.1 and No.2 should be placed into the **Auto** position on the front of the MCC buckets

Comments:

4. HPU Low Oil Level Alarm & Trip (71QHT1-1 and 71QHT1-2) ( )

Viewed on Factory Talk: Beeton **Governor HPU** screen
Ref: Technical Data Sheets **Section "Item 280"** in Alstom Operation & Maint. Manual 2.1 PLC Tag: BCxHPU71QHT1_1
Dwgs.: 603020-6-M67DA-001 (sht. 1 of 5) in Alstom Operation & Maint. Manual 2.1 BCxHPU_71QHT1_2
603020-6-M67EF-001 (sht. 2 of 5) in Alstom Operation & Maint. Manual 2.1
603020-6-M67EF-001 (sht. 3 of 5) in Alstom Operation & Maint. Manual 2.1
Type: MP Filtri Model RL/G2 Alarm at: under 8 IN. Alarm & Trip at: under 4 IN.
(model RL-G2-R-F3-S1A-S1-A1000-B900)

There are two rods within the level switch. Each rod has its own float. The control rod and float move as one piece into the head assembly to actuate a switch. There is one rod/float/switch for the Low Level Alarm, and one rod/float/switch for the Low Level Alarm & Trip.
The switch arrangement is: if oil is present to raise the float, the switch will be in a "closed" state, otherwise, the state wil be "open".
With the connector and signal wires attached, remove the three screws at the mounting flange. Slowly lift complete assembly up to actuate the Low Level Alarm 71QHT1-1 (Under 8 IN.), then proceed to lift the assembly to actuate the Low Low Level Alarm & Trip 71QHT1-2 (Under 4 IN.) Note the results below.

Level in HPU Sump	Level Switch Setpoint	HMI in alarm?
Under 8 IN.	**Under 8 IN.** (L Alarm)	
Under 4 IN.	**Under 4 IN.** (LL Alarm & Trip)	

After completing the test, place the switch assembly in the flange mounting and re-install the screws.

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Type of Inspection:	PM6 (ANNUAL)	**Rev. #:**	5
Department:	ELECTRICAL	**Rev. Date:**	15/11/2018
		Index No.	GF9-010 **Folder No.: GF9**

ACTIVITIES (Initial Box Upon Completion) **CHECKED BY**

5. HPU Temperature Switch High Alarm & Trip (26QHT1-1) ( )

Viewed on Factory Talk: Beeton **Governor HPU** screen

Ref: Technical Data Sheets **Section "Item 120"** in Alstom Operation & Maint. Manual 2.1 PLC Tag: BCxHPU_26QHT1_1

Manual Section in Alstom Operation & Maint. Manual 2.1

Dwgs.: 603020-6-M67DA-001 (sht. 1 of 5) in Alstom Operation & Maint. Manual 2.1
603020-6-M67EF-001 (sht. 2 of 5) in Alstom Operation & Maint. Manual 2.1
603020-6-M67EF-001 (sht. 3 of 5) in Alstom Operation & Maint. Manual 2.1

Type: UE United Electric Series 100 Alarm and Trip at: 65 °C rising
(model E100-3BS-8S-4S-W48C)

Remove the temperature switch bulb from the thermo well. Place the bulb in warm water and slowly and carefully add boiling water boiling water to raise the temperature to the switching point (65 °C rising). Verify the temperature with a thermometer. Note the results below.

Temperature in HPU Sump	Temperature Switch Setpoint	HMI in alarm?
65 °C rising	**65 °C rising** (H Alarm & Trip)	

6. HPU Temperature Controller (26QHT1-2) ( )

Ref: Technical Data Sheets **Section "Item 285"** in Alstom Operation & Maint. Manual 2.1

Manual Section in Alstom Operation & Maint. Manual 2.1

Dwgs.: 603020-6-M67DA-001 (sht. 1 of 5) in Alstom Operation & Maint. Manual 2.1
603020-6-M67EF-001 (sht. 2 of 5) in Alstom Operation & Maint. Manual 2.1
603020-6-M67EF-001 (sht. 3 of 5) in Alstom Operation & Maint. Manual 2.1

Type: Fenwall Series 400 Controller contacts close at: 20 °C falling
(model 40-702014-406)

Note the both the present temperature reading and setpoint of the controller in the table below.
(The present temperature setpoint should be set to 20 °C, if it is not, set it to 20 °C)

HPU Sump Temperature Setpoint on Fenwall Controller:	20 °C
HPU Sump "As Found" Temperature Reading on Fenwall Controller:	°C

Note: The contacts in the controller are switching 208 VAC to the heater. Use appropiate PPE.
While monitoring the contact status with a mutimeter, use the control knob to raise the setpoint of the temperature controller to a point above the present temperature noted above.
Verify that the contacts changed state, and that the heater circuit was energized.

HPU Heater Contacts changed state:	(V)
HPU Heater was energized:	(V)

After the test is completed, return the setpoint to the 20°C setting and note it as "As Left"

HPU Sump "As Left" Temperature Setpoint on Fenwall Controller:	°C

NL HYDRO EXPLOITS GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 4 Rev. No.: 2 Rev. Date: 9/11/2015 Index No. GF9-030 Folder No.: GF9

Asset No. & Description: 720141 - GF9 EXCITER
Type of Inspection: PM6 (ANNUAL) **Work Order:** _____
Department: ELECTRICAL
Inspection Start Date: _____ **Supervisor's Review Signature:** _____
Inspection Completion Date: _____ **Planner's Review Signature:** _____
Reference Drawing and Manuals:

ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
1. Exciter Field Breaker	
a) Inspect and verify operation of the Exciter Field breaker.	( )
Comments:	
b) Inspect and clean the opening and closing mechanism of the field breaker. Lubricate all bearing points and sliding surfaces with appropriate lubricant. (Bearing points and sliding surfaces)	( )
Comments:	
c) Inspect the main fixed contacts.	( )
Comments:	
d) Inspect the main moving contacts.	( )
Comments:	
e) Inspect the main contacts resistance with a micro-ohm meter.	( )
Comments:	
f) Inspect the clearances between the main and the arcing contacts.	( )
Comments:	
g) Inspect all auxiliary relay contacts and closing/tripping coil for pitting.	( )
Comments:	

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ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
h) Inspect wiring and connections to ensure all are tight and in good condition.	( )
Comments:	
2. Exciter Field Flashing	
a) Inspect and clean field flashing contactors.	( )
Comments:	
b) Inspect field flashing resistor wiring and connections.	( )
Comments:	
c) Inspect Field Flashing from AC and DC Sources.	( )
Comments:	
3. Transformer	
a) Inspect transformer cubicles for any foreign material. Clean and vacuum.	( )
Comments:	
b) Inspect the physical, electrical, and mechanical condition of the transformer	( )
Comments:	
c) Verify that the core, frame, and enclosure are properly grounded.	( )
Comments:	

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ACTIVITIES (Initial Box Upon Completion)	**CHECKED BY**
d) Verify tightness of accessible bolted electrical connections. **Comments:**	( )
e) Verify that resilient mounts are free and that shipping brackets have been **Comments:**	( )
f) Verify surge arrestors. **Comments:**	( )
g) Verify that as-left tap connections are as specified or as found. **Comments:**	( )
h) Perform insulation resistance tests winding-to-winding and each winding-to-ground. **Comments:**	( )
i) Perform resistance measurements through exposed bolted connections with a low resistance ohmmeter. **Comments:**	( )
j) Verify operation of all Exciter alarms and trips. **Comments:**	( )
With the Power "ON", check the following:	
k) Verify field flashing from both AC and DC sources. [Test Required] **Comments:**	( )

Asset No. & Description: 720141 - GF9 EXCITER	**Sheet:** 4 of 4
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ACTIVITIES (Initial Box Upon Completion)	**CHECKED BY**

ADDITIONAL REMARKS:

NL HYDRO EXPLOITS GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 2 Rev. No.: 2 Rev. Date: 9/11/2015 Index No. GF9-040 Folder #: GF9

Asset No. & Description: 700009 - GF9 UNIT BREAKER (52-G9)
Type of Inspection: PM6 (ANNUAL) **Work Order:** _____
Department: ELECTRICAL
Inspection Start Date: _____ **Supervisor's Review Signature:** _____
Inspection Completion Date: _____ **Planner's Review Signature:** _____
Reference Drawing and Manuals:

ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
1. G9 UNIT BREAKER	
a) Inspect all wiring and connections to ensure all are tight and secure. Inspect all bolts and mounting hardware.	( )
Comments:	
b) Inspect and lubricate linkages beneath breaker. Also lubricate all moving parts. (Note: Clean out old Lubricant before applying fresh lubricant.)	( )
Comments:	
c) Monitor and record HiPot test on breaker. Record results.	( )
Comments:	
d) Clean all breaker insulation with dry lint-free cloth.	( )
Comments:	
e) Inspect breaker contacts, auxiliary contacts and record micro-ohm test on breaker main contacts.	( )
Comments:	
f) Inspect close and open indications for proper operation.	( )
Comments:	
g) Inspect operation of closing and tripping device of breaker.	( )
Comments:	

Asset No. & Desc.: 700009 - GF9 UNIT BREAKER (11-1)	Sheet: 2 of 2
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ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
h) Inspect breaker interlocks. **Comments:**	( )
i) Inspect operation of motor and motor brushes. **Comments:**	( )
j) Inspect operation of rack-in and rack-out indication. **Comments:**	( )
k) Monitor and record Breaker Resistance. **Resistance =** _____ **Comments:**	( )
l) Record counter operations. **Operations =** _____ **Comments:**	( )
Comments:	

NL HYDRO EXPLOITS GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 1 Rev. No.: 1 Rev. Date: 1/31/2019 Index No. GF9-070 Folder No.: GF9

Asset No. & Description: 720141 - GF9 STATIC EXCITER
Type of Inspection: PM6(ANNUAL) **Work Order:** _____
Department: ELECTRICAL
Inspection Start Date: _____ **Supervisor's Review Signature:** _____
Inspection Completion Date: _____ **Planner's Review Signature:** _____
Reference Drawing and Manuals: see drawing below.

ACTIVITIES (Initial Box Upon Completion) **CHECKED BY**

Manufacturer's Note:

Storage

Stored units should be kept in the original shipping package in a moisture- and dust-free environment.

This device contains long-life aluminum electrolytic capacitors. For devices that are not in service (spares in storage), the life of these capacitors can be maximized by energizing the device for 30 minutes once per year.

1. DECS-400 Power up.

a) Remove the DECS-400 from the storage carton. ( )

Comments:

b) Connect a surge-protected power supply of 120 Vac to terminal C1, C2, and C3 as shown below: ( )
Connect each wire to its respective terminal: 120 Vac (L) to (L3), 120 Vac (N) to (N2), and Ground (G) to (GND1)

Turn "ON" the power supply.
*Note: The 120 Vac supply is to be left connected for a minimum of 30 minutes.

c) After a minimum of 30 minutes with power on, turn "OFF" the power supply.
Disconnect all wires from terminals.

d) Carefully place the DECS-400 back into its plastic bag, and then into its box.
Seal the box and store it for safekeeping.

Comments:

NL HYDRO EXPLOITS GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 12 Rev. No.: 4 Rev. Date: 15/11/2018 Index No. GF9-002 Folder No.: GF9

Asset No. & Description: 720125 - GF9 GENERATOR
Type of Inspection: PM6 (ANNUAL) **Work Order:** _____
Department: ELECTRICAL
Inspection Start Date: _____ **Supervisor's Review Signature:** _____

Inspection Completion Date: _____ **Planner's Review Signature:** _____
Reference Drawing and Manuals:

ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
CRITICAL PARTS INSPECTION 1. Generator Slip Ring Assembly a) Check brushes for cracks, uneven surfaces, etc. Replace any brush projecting from a brush box 1/8" or less, before pig tail contact brush box. **Comments:**	( )
b) Measure and record length of carbon brushes. (See table on next pg. for recording results) c) Inspect and clean all slip ring insulators. **Comments:**	( ) ( )
d) Check slip rings for pitting, discoloration or scouring. **Comments:**	( )
e) Check all mounting hardware for tightness. **Comments:**	( )
f) Measure and record wear on lower slip ring. Base Reading _____. **Comments:**	( )

Asset No. & Description:	**720125 - GF9 GENERATOR**	**Sheet:**	2 of 12
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Date of Check: _____ Checked By: _____

BRUSH MEASUREMENT (CLOCKWISE)

Unit mwhour meter reading: _____

mwhours accumulated since last inspection: _____

	Top Ring			Bottom Ring		
	Top	**Bottom**	**Replaced ? (√)**	**Top**	**Bottom**	**Replaced ? (√)**
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						

Comments: _____

Asset No. & Description: 720125 - GF9 GENERATOR	Sheet: 3 of 12	
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ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
g) Measure and record wear on upper slip ring. **Comments:**	( )
h) Check and clean all brush holders, springs and pigtail connections. **Comments:**	( )
i) Check brush force and freedom of movement. **Comments:**	( )
j) Check clearance between the brush boxes and the collection rings. **Comments:**	( )
k) Clean the collector. Surface of collector rings shall be clean and free of rust at all times. Take following precautions: **Comments:**	( )
l) Meggar slip rings @250V for 1 minute. Record Results here. [Test Required] **Comments:**	( )

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ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
2. Generator Rotor	
a) Clean accessible parts of the rotor. Clean rotor ventilation ducts if excess build-up of material is present.	( )
Comments:	
b) Check rotor bus lead to slip rings:	
i) Check tightness of bolts.	( )
Comments:	
ii) Visually inspect for abnormal wear and cracks.	( )
Comments:	
iii) Check laminate layers for peeling.	( )
Comments:	
c) Inspect Rotor field cable supports and mounting clamps and ensure all bolting is tight and cables are secure.	( )
Comments:	
3. Current Transformers	
a) Check mounting hardware and connections.	( )
Comments:	
b) Wipe down all accessible areas with clean dry cloths.	( )
Comments:	
c) Visually inspect cablings for cracks or mechanical damage.	( )
Comments:	

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ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
4. Generator Stator **** Remove covers from lower stator in turbine pit. Inspect what can be seen through the opening.**	
a) Inspect Generator Main leads and Neutral leads. Inspect insulators and taping for signs of break-down or other damage. **Comments:**	( )
b) Inspect Stator RTD's wiring and connections. Ensure all connections are tight and wiring is not damaged. Verify operation if found faulted. **Comments:**	( )
c) Inspect stator coils for signs of corona discharge, end distortion, cracked insulation or other mechanical damage. **Comments:**	( )
d) Inspect for signs of coil movement. Check slot packing for tightness and signs of migration of slot fillers. **Comments:**	( )
e) Inspect stator frame sole plates for signs of movement and evidence of fretting. **Comments:**	( )
f) Inspect lashings and ties for looseness, movement, and deterioration. **Comments:**	( )
g) Inspect punchings at fingers for looseness and signs of fretting. **Comments:**	( )
h) Inspect & complete Load Test on Stator Heaters. **Comments:**	( )

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ACTIVITIES (Initial Box Upon Completion) **CHECKED BY**

5. Generator Stator and Rotor IR, PI, and DAR Test. ( )

Unit #:_____ **Unit kV:**_____

Date:_____ **Time of Test:**_____

Ambient Temp:_____ **Winding Temp:**_____

Ambient Humidity:_____ **Tested By:**_____

ROTOR INSULATION RESISTANCE (IR)

***Test Voltage: 250 VDC**

IR @ 1 min = _____

Corrected IR @ 1 min = _____

(To correct the measure value to 40°C, multiply the measured value by the correction factor, KT, found below.)

STATOR POLARIZATION INDEX & DIELECTRIC ABSORPTION TEST

TIME	IR (Mohms)
15 sec	
30 sec	
45 sec	
1 min	
2 min	
3 min	
4 min	
5 min	
6 min	
7 min	
8 min	
9 min	
10 min	

***Test Voltage: 5000 VDC**

IR @ 1 min = _____

Corrected IR @ 1 min = _____

(To correct the measure value to 40°C, multiply the measured value by the correction factor, K_T, found below.)

PI = _____

DAR = _____

REFERENCE INFORMATION

$$Polarization\ Index\ (PI) = \frac{IR_{10\ min}}{IR_{1\ min}}$$

$$Dielectric\ Absorption\ Ratio\ (DAR) = \frac{IR_{60\ sec}}{IR_{30\ sec}}$$

Guidelines for Acceptable Values (as per IEEE 43-2013)

Minimum Insulation Resistance		
$IR_{min\ Corrected\ to\ 40°C}$	100 MΩ	
	PI	**DAR**
Danger	< 1.0	-
Questionable	1.0 - 2.0	1.0 - 1.25
Good	2.0 - 4.0	1.4 - 1.6
Excellent	> 4.0	> 1.6

Approximate Temperature Correction Factor (K_T)

Winding Temp (°C)	Approx K_T	Winding Temp (°C)	Approx K_T
17	0.729	24	0.807
18	0.74	25	0.819
19	0.751	26	0.83
20	0.762	27	0.842
21	0.773	28	0.853
22	0.785	29	0.865
23	0.796	30	0.878

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ACTIVITIES (Initial Box Upon Completion) **CHECKED BY**

6. Generator Thrust Bearing Pad Temperature Sensor Alarm & Trip (TE-500) ( )

Viewed on HMI: Factory Talk

Ref: Technical Data Sheets **Section 1** in Alstom Operation & Maint. Manual 3.2 PLC Tag: ACxTE500

Technical Information **Section 4** (pg. 14-26) in Alstom Operation & Maint. Manual 3.1

Dwgs. (Alstom #) 2-50800-001 (sht. 3) in "Beeton Field Devices" dwgs.

(Hydro #) 730D-20288 or (Alstom #) E62DE-100 (sht 10) in Alstom Operation & Maint. Manual 6.1, Vol. 1 of 2

(Hydro #) 730D-19950 or (Alstom #) 2-55000-001 (sht. 1)

(Hydro #) 730D-19955 or (Alstom #) 2-55801-001 (sht. 1 & 2)

(Hydro #) 730D-19980 or (Alstom #) 2-58261-001 (sht. 1)

(Hydro #) 730D-19985 or (Alstom #) 2-58281-001 (sht. 1)

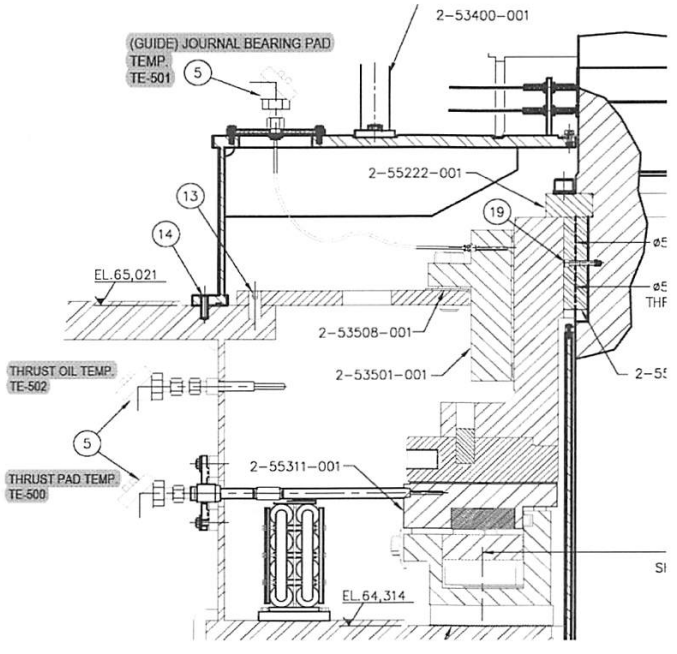
Alarm & Trip List in Alstom Operation & Maint. Manual 4.1

Interconnection List in Alstom Operation & Maint. Manual 4.1

Type : Thermo-Kinectics, 100 Ω Platinum RTD (3-wire) Scale: 0 to 250 °C Alarm at: 50 °C Trip at: 60 °C

Pt. Table (Ω)	Simulator (Ω)	Theo. Temp (°C)	HMI Temp (°C)	Comments
100	100	0		
107.79	107.8	20		
115.54	115.5	40		
119.4	119.4	50 (H Alarm)		
123.24	123.2	**60** (HH Alarm & Trip)		

**Note: Highlighted below are the locations for RTD's in activities # 6, #7, and #8.



Comments:

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ACTIVITIES (Initial Box Upon Completion) **CHECKED BY**

7. Generator Journal (Guide) Bearing Temperature Sensor Alarm & Trip (TE-501) ( )

Viewed on HMI: Factory Talk

Ref: Technical Data Sheets Section 1 in Alstom Operation & Maint. Manual 3.2 PLC Tag: ACxTE501

Technical Information Section 4 (pg. 14-26) in Alstom Operation & Maint. Manual 3.1

Dwgs. (Alstom #) 2-50800-001 (sht. 3) in "Beeton Field Devices" dwgs.

(Hydro #) 730D-20288 or (Alstom #) E62DE-100 (sht 10) in Alstom Operation & Maint. Manual 6.1, Vol. 1 of 2

(Hydro #) 730D-19950 or (Alstom #) 2-55000-001 (sht. 1)

(Hydro #) 730D-19955 or (Alstom #) 2-55801-001 (sht. 1 & 2)

(Hydro #) 730D-19980 or (Alstom #) 2-58261-001 (sht. 1)

(Hydro #) 730D-19985 or (Alstom #) 2-58281-001 (sht. 1)

Alarm & Trip List in Alstom Operation & Maint. Manual 4.1

Interconnection List in Alstom Operation & Maint. Manual 4.1

Type : Thermo-Kinectics, 100 Ω Platinum RTD (3-wire) Scale: 0 to 250 °C Alarm at: 50 °C Trip at: 60 °C

Pt. Table (Ω)	Simulator (Ω)	Theo. Temp (°C)	HMI Temp (°C)	Comments
100	100	0		
107.79	107.8	20		
115.54	115.5	40		
119.4	119.4	50 (H Alarm)		
123.24	123.2	60 (HH Alarm & Trip)		

**Note: see drawing in activity #6 for RTD placement.

Comments:

8. Generator Thrust Bearing Oil Temperature Sensor Alarm & Trip (TE-502) ( )

Viewed on HMI: Factory Talk

Ref: Technical Data Sheets Section 1 in Alstom Operation & Maint. Manual 3.2 PLC Tag: ACxTE502

Technical Information Section 4 (pg. 14-26) in Alstom Operation & Maint. Manual 3.1

Dwgs. (Alstom #) 2-50800-001 (sht. 3) in "Beeton Field Devices" dwgs.

(Hydro #) 730D-20288 or (Alstom #) E62DE-100 (sht 10) in Alstom Operation & Maint. Manual 6.1, Vol. 1 of 2

(Hydro #) 730D-19950 or (Alstom #) 2-55000-001 (sht. 1)

(Hydro #) 730D-19955 or (Alstom #) 2-55801-001 (sht. 1 & 2)

(Hydro #) 730D-19980 or (Alstom #) 2-58261-001 (sht. 1)

(Hydro #) 730D-19985 or (Alstom #) 2-58281-001 (sht. 1)

Alarm & Trip List in Alstom Operation & Maint. Manual 4.1

Interconnection List in Alstom Operation & Maint. Manual 4.1

Type : Thermo-Kinectics, 100 Ω Platinum RTD (3-wire) Scale: 0 to 250 °C Alarm at: 50 °C Trip at: 60 °C

Pt. Table (Ω)	Simulator (Ω)	Theo. Temp (°C)	HMI Temp (°C)	Comments
100	100	0		
107.79	107.8	20		
115.54	115.5	40		
119.4	119.4	50 (H Alarm)		
123.24	123.2	60 (HH Alarm & Trip)		

**Note: see drawing in activity #6 for RTD placement.

Comments:

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ACTIVITIES (Initial Box Upon Completion) **CHECKED BY**

9. Generator Thrust Bearing Cooling Water Temperature Sensor Alarm & Trip (TE-503) ( )

Viewed on HMI: Factory Talk

Ref: Technical Data Sheets Section 1 in Alstom Operation & Maint. Manual 3.2 PLC Tag: ACxTE503

Technical Information Section 4 (pg. 14-26) in Alstom Operation & Maint. Manual 3.1

Dwgs. (Alstom #) 2-50800-001 (sht. 3) in "Beeton Field Devices" dwgs.

(Hydro #) 730D-20288 or (Alstom #) E62DE-100 (sht 10) in Alstom Operation & Maint. Manual 6.1, Vol. 1 of 2

(Hydro #) 730D-19966 or (Alstom #) 2-57500-001 (sht. 1)

(Hydro #) 730D-19955 or (Alstom #) 2-55801-001 (sht. 1 & 2)

(Hydro #) 730D-19980 or (Alstom #) 2-58261-001 (sht. 1)

(Hydro #) 730D-19985 or (Alstom #) 2-58281-001 (sht. 1)

Alarm & Trip List in Alstom Operation & Maint. Manual 4.1

Interconnection List in Alstom Operation & Maint. Manual 4.1

Type : Thermo-Kinectics, 100 Ω Platinum RTD (3-wire) Scale: 0 to 250 °C Alarm at: 50 °C Trip at: 60 °C

Pt. Table (Ω)	Simulator (Ω)	Theo. Temp (°C)	HMI Temp (°C)	Comments
100	100	0		
107.79	107.8	20		
115.54	115.5	40		
119.4	119.4	50 (H Alarm)		
123.24	123.2	**60** (HH Alarm & Trip)		

Comments:

10. Generator Thrust Bearing Oil Level Switch Alarm & Trip (LIS-500) ( )

Viewed on HMI: Factory Talk

Ref: Technical Data Sheets Section 1 in Alstom Operation & Maint. Manual 3.2 PLC Tag: BCxLIS500 (Low Level)

Dwgs. (Alstom #) 2-50800-001 (sht. 3) in "Beeton Field Devices" dwgs. BCxLIS500_1 (High Level)

(Hydro #) 730D-20288 or (Alstom #) E62DE-100 (sht. 4 & sht. 7) in Alstom Operation & Maint. Manual 6.1, Vol. 1 of 2

(Hydro #) 730D-19950 or (Alstom #) 2-55000-001 (sht. 1)

(Hydro #) 730D-19955 or (Alstom #) 2-55801-001 (sht. 1 & 2)

(Hydro #) 730D-19980 or (Alstom #) 2-58261-001 (sht. 1)

(Hydro #) 730D-19984 or (Alstom #) 2-58280-001 (sht. 1)

Alarm & Trip List in Alstom Operation & Maint. Manual 4.1

Interconnection List in Alstom Operation & Maint. Manual 4.1

Type : Solartron Mobrey - Type 811S Scale: 0 - 100 mm High Alarm and Trip at: NO4 and C4 (Terminals 1 & 2)

Low Alarm and Trip at: NC1 and C1 (Terminals 7 & 8)

**Note: The terminals below are found in the intermediate junction box mounted directly on the level switch.
Place a jumper across the designated terminals to simulate the alarm condition for each signal in the table.
In a "non-alarm" state, the contacts will be open.

Terminals	Alarm & Trip - Level Switch	Alarm & Trip - HMI (Yes/No)	Comments
1 & 2	H Alarm & Trip		The alarm banner says "High High"
7 & 8	L Alarm & Trip		The alarm banner says "Low Low"

Comments:

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ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
11. Generator Neutral Grounding Cabinet	
a) Check all wiring and connections.	( )
Comments:	
b) Check resistor.	( )
Comments:	
c) Vacuum cubicle inside and out.	( )
Comments:	
d) Record resistance of resistor.	( )
Comments:	
12. Generator Brake Switches {Coordinate with mechanical crew}	
a) Check mounting hardware.	( )
Comments:	
b) Check wiring for loose connections, broken connections, and mechanical damage.	( )
Comments:	
c) Check operation of switches.	( )
Comments:	
d) Check brake solenoid wiring for loose connections.	( )
Comments:	
e) Check operation of brake solenoid for free movement. **(This needs to be done when mechanics do their checks)	( )
Comments:	
f) Check timing of brake application. Standard: ____ Secs. Actual: ____ Secs. **(This needs to be done when mechanics do their checks)	( )
Comments:	

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ACTIVITIES (Initial Box Upon Completion) — **CHECKED BY**

Power On Check - Checking Overspeed Alarm and Trip of Generator. ( )

*Note: Operations personnel and are required to assist in this test.

13. Generator/Turbine Overspeed Alarm & Trip (SE-500) PLC Tag: ACxSE500 and ACcTurbineSpeed

Ref:

Scale: 0 to 2800 RPM — Alarm at 154.3 RPM

Dwgs. (Alstom #) 2-50800-001 (sht. 6) in "Beeton Field Devices" dwgs. — 4-20mA DC — Alarm and Trip at 200 RPM

(Hydro #) 730D-20288 or (Alstom #) E62DE-100 (sht. 4, 5, 9 & 16) in Alstom Operation & Maint. Manual 6.1, Vol. 1 of 2

(Hydro #) 730D-19980 or (Alstom #) 2-58261-001 (sht. 1)

(Hydro #) 730D-19984 or (Alstom #) 2-58280-001 (sht. 1)

(Hydro #) 730D-19985 or (Alstom #) 2-58281-001 (sht. 1)

(Hydro #) 730D-19869 or (Alstom #) 2-51821-001 (sht. 1)

(Hydro #) 730D-19986 or (Alstom #) 2-58282-001 (sht. 1)

Note: 128 RPM is the nominal speed. This test is carried out under a full-speed, no-load, no-synch exercise with operations involved. The normal overspeed alarm & trip setpoint of 200 rpm, will be temporarily set to 125 rpm.

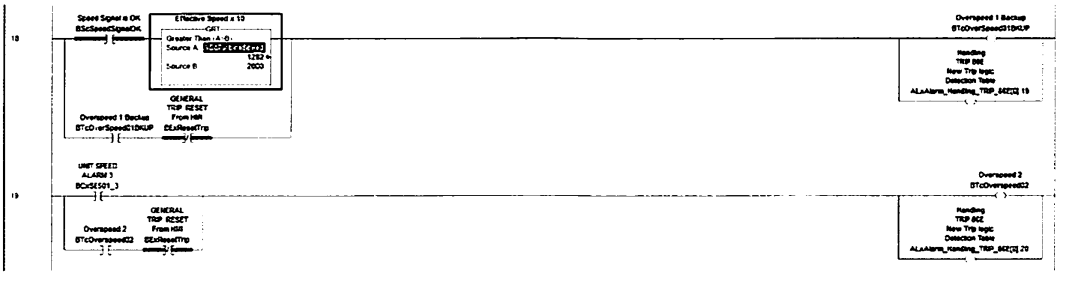
This test involves using the process laptop and going online with the unit.

The IP address of the unit is: 192.168.1.50

The program name is GF_G9_Nov_02_17.ACD

Set the process laptop IP address to 192.168.1.99 (this address will be free to use on the network for this purpose)
Connect to the process laptop to the network via the ethernet switch in the Beeton Governor Enclosure
Open the Studio 5000 software and go online with the unit.

Temporarily set the over speed High Alarm & Trip to 125 RPM from 200 in the 'Source B' value of the GRT instruction, located in rung 18 of the ladder named "TripUnitElec86E", under the Main Program section.
Note: You must enter 1250, because this number is divided by 10 in the program



After the edit is complete, the operations personnel will be involved in the next several steps.

(1). After setting the new temporary overspeed trip setpoint, the operator will start the unit.

(2). After starting, the unit will ramp up towards the synchronous speed setpont of 128 rpm.
With the unit ramping up to synchronous speed it will pass by the temporary ovespeed setpoint.

(3). The unit will trip at the speed of 125 rpm, and will not get a chance to synchronize.
The alarm will be triggered, and the Trip 86E will occur.

Asset No. & Description:	**720125 - GF9 GENERATOR**	**Sheet:**	12 of 12
Type of Inspection:	PM6 (ANNUAL)	**Rev. #:**	4
Department:	ELECTRICAL	**Rev. Date:**	15/11/2018
		Index No.	GF9-002 **Folder No.: GF9**

ACTIVITIES (Initial Box Upon Completion) **CHECKED BY**

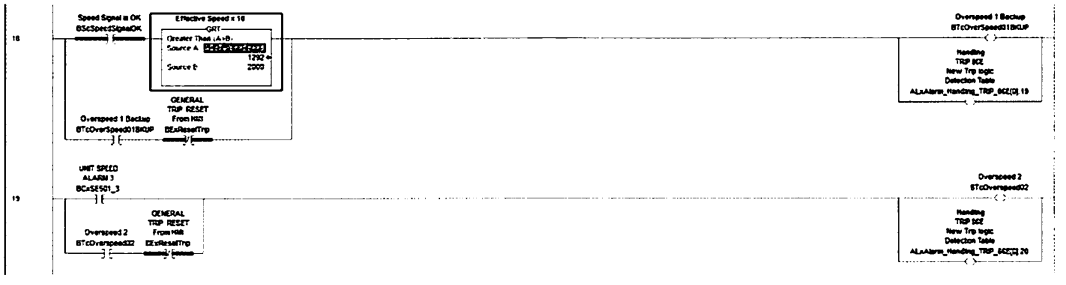
13. Generator/Turbine Overspeed Alarm & Trip (SE-500) (cont'd)

(4). The unit, after tripping, will ramp down and eventually stop.

Note that the overspeed alarm and trip took place below:

HMI Screen High (H) Alarm & Trip: _____(V)

(5). Set the over speed High Alarm & Trip from 125 RPM back to 200 in the 'Source B' value of the GRT instruction, located in rung 18 of the ladder named "TripUnitElec86E", under the Main Program section.
Note: You must enter 2000, because this number is divided by 10 in the program



(6). The operator may acknowledge and reset any outstanding alarms and unit protection flags. This concludes the test.

(7). Save the program. Go offline. Disconnect from the ethernet switch.

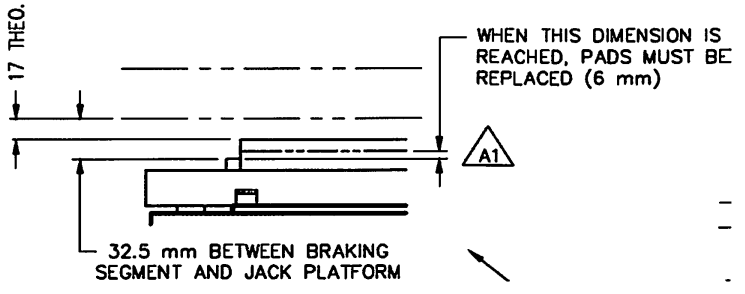
Comments:

NL HYDRO EXPLOITS GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 4 Rev. No.: 3 Rev. Date: 9/7/2018 Index No. GF9-001 Folder No.: GF9

Asset No. & Description: 720125 - GF9 GENERATOR
Type of Inspection: PM6 (ANNUAL) **Work Order:** _____
Department: MECHANICAL
Inspection Start Date: _____ **Supervisor's Review Signature:** _____

Inspection Completion Date: _____ **Planner's Review Signature:** _____
Reference Drawing and Manuals:

ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
1. Generator Brakes / Jacking System	
a) Check brake pad thickness and record. See diagram below:	( )



Brake Pad 1 =		Brake Pad 5 =	
Brake Pad 2 =		Brake Pad 6 =	
Brake Pad 3 =		Brake Pad 7 =	
Brake Pad 4 =		Brake Pad 8 =	

b)	Check brake pads for cracks. Report to supervisor immediately if brake pads require replacement.	( )
Comments:		
c)	Inspect brake track for excessive scouring or warpage and check brake plate bolts for looseness. Check that brake cylinders are fully retracted and not rubbing on track.	( )
Comments:		
d)	Inspect Reservoir Pump	( )
Comments:		

Asset No. & Description: 720125 - GF9 GENERATOR	Sheet: 2 of 4
Type of Inspection: PM6 (ANNUAL)	Rev. No.: 3
Department: MECHANICAL	Rev. Date: 9/7/2018
	Index No. GF9-001 Folder No.: GF9

ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
e) Inspect and grease brake cylinders. Check for excessive leakage and sticking	( )
Comments:	
f) Inspect air piping for damage and pressure test brakes for air leaks.	( )
Comments:	
2. Thrust/Guide Bearing Assembly	
a) Clean external bearing assembly. Check for leaks and loose bolts.	( )
Comments:	
b) Take oil sample. Comment on oil condition.	( )
Comments:	
c) Inspect cooling water piping to bearing coolers for leaks. Disassemble piping at inlet and outlet to cooling coils and inspect visiable portions of both piping and coils for signs of fouling.	( )
Comments:	
d) Reassemble piping to cooling coils and inspect for water leakage.	( )
Comments:	
3. Thrust Bearing Oil Lift System (High Lift Pump)	
a) Visually inspect oil lift pump and piping for oil leaks and condition of equipment. Take an oil sample and comment on oil condition.	( )
Comments:	

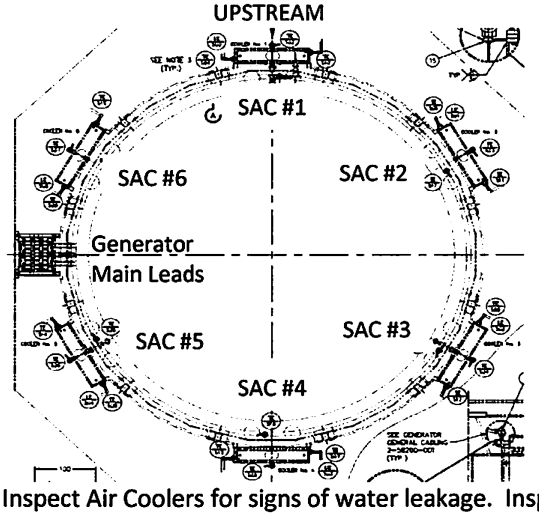
Asset No. & Description: 720125 - GF9 GENERATOR	Sheet: 3 of 4	
Type of Inspection: PM6 (ANNUAL)	Rev. No.: 3	
Department: MECHANICAL	Rev. Date: 9/7/2018	
	Index No. GF9-001	Folder No.: GF9

ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
b) Replace inline oil filter cartridge. Comment on condition of removed filter. **Comments:**	( )
c) Verify operation of oil lift system. Attach dial indicator on turbine shaft and take reading of lift (0.005" min.) and maximum pressure reached. **Comments:**	( )
4. Generator Rotor ** Remove ALL covers a) Inspect generator rotor for mechanical damage and stress cracks at welds. Inspect bolts to ensure they are tight. Wipe down welds with a rag to get a good visual. Pay particular attention to welds near coupling hub and fan blade welds. **Comments:**	( )
b) Inspect the rotor balancing weights to ensure they are properly seated and secure. **Comments:**	( )
c) Inspect coupling bolts and bolt locking devices for signs of damage and looseness. **Comments:**	( )
5. Generator Main Bracket ** Remove ALL covers a) Inspect generator main bracket for mechanical damage and stress cracks at welds. Wipe down welds with a rag to get a good visual. Report all findings. **Comments:**	( )

Asset No. & Description: 720125 - GF9 GENERATOR	**Sheet:** 4 of 4
Type of Inspection: PM6 (ANNUAL)	**Rev. No.:** 3
Department: MECHANICAL	**Rev. Date:** 9/7/2018
	Index No. GF9-001 **Folder No.:** GF9

ACTIVITIES (Initial Box Upon Completion)	**CHECKED BY**

6. Stator Surface Air Coolers (6)



a) Inspect Air Coolers for signs of water leakage. Inspect cleanliness of finned tubes. Remove cooler and clean if found dirty. Inspect tubes for looseness. ( )
If tube is found loose, report immediately.

SAC#:	Inspection Results:
1	
2	
3	
4	
5	
6	

b) Inspect air vent valves on each cooler to ensure proper operation. ( )

SAC#:	Inspection Results:
1	
2	
3	
4	
5	
6	

NL HYDRO EXPLOITS GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 3 Rev. No.: 3 Rev. Date: 9/6/2018 Index No.: GF9-010 Folder No.: GF9

Asset No. & Description: 710186 - GF9 GOVERNOR
Type of Inspection: PM6 (ANNUAL) **Work Order:** _____
Department: MECHANICAL
Inspection Start Date: _____ **Supervisor's Review Signature:** _____
Inspection Completion Date: _____ **Planner's Review Signature:** _____
Reference Drawing and Manuals:

ACTIVITIES (Initial Box Upon Completion)	Completed By
1. Oil Pump	
a) Visually inspect pumps and HPU unit for leaks. Check for pump noise and vibration. Inspect piping connections for signs of leakage and looseness. **Comments:**	( )
b) Replace oil filters and take an oil sample. Comment on cleanliness of filters removed. **Comments:**	( )
c) Verify operation of (3) unloader valves. **Comments:**	( )
d) Inspect & Test DC Pump **Comments:**	( )
2. Governor Accumulators	
a) Inspect nitrogen pre-charged accumulators and piping . Record accumulator pressures and add nitrogen as required as per operating instructions. Record final pressure. Serial no. _____ Found at: _____ Left at: _____	( )
Serial no. _____ Found at: _____ Left at: _____	
Serial no. _____ Found at: _____ Left at: _____	
Comments:	

Asset No. & Description: 710186 - GF9 GOVERNOR	**Sheet:** 2 of 3
Type of Inspection: PM6 (ANNUAL)	**Rev. #:** 2
Department: MECHANICAL	**Rev. Date:** 9/11/2015
	Index No.: GF9-010 **Folder No.:** GF9

ACTIVITIES (Initial Box Upon Completion)	Completed By
3. Governor Gate System ***(Complete work with Unit Pressurized)***	
a) Check the gate position pointer at 50% for proper alignment. [Test Req'd] Found at: _____ Left at: _____ **Comments:**	( )
b) Monitor and record zero position of gate position indicator. [Test Req'd] Found at: _____ Left at: _____ **Comments:**	( )
c) Monitor and record wicket gate opening time from 0 – 100%.[Test Req'd] Found at: _____ Left at: _____ **Comments:**	( )
d) Monitor and record wicket gate closing time from 100% – 0%.[Test Req'd] Found at: _____ Left at: _____ **Comments:**	( )

Asset No. & Description: 710186 - GF9 GOVERNOR	**Sheet:** 3 of 3
Type of Inspection: PM6 (ANNUAL)	**Rev. #:** 2
Department: MECHANICAL	**Rev. Date:** 9/11/2015
	Index No.: GF9-010 **Folder No.: GF9**

e) Monitor and record wicket gate squeeze. [Test Req'd] ( )

Found at: _____

Left at: _____

Comments:

f) Record partial wicket gate setting (commissioned value TBD) [Test Req'd] ( )

Found at: _____

Left at: _____

Comments:

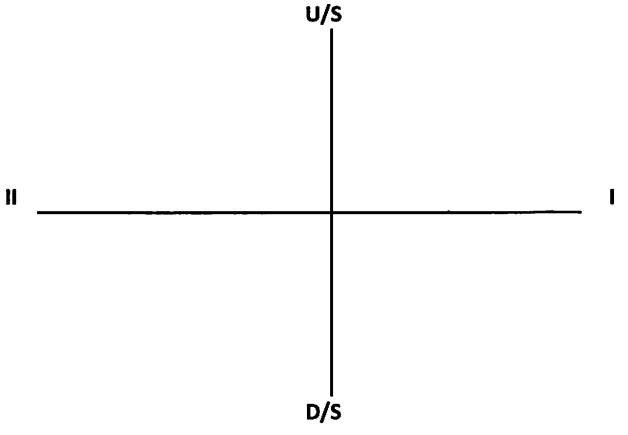
NALCOR ENERGY EXPLOITS GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 5 Rev. No.: 2 Rev. Date: 9/11/2015 Index No. GF9-020 Folder No.: GF9

Asset No. & Description: 720103 - GF9 TURBINE
Type of Inspection: PM6 (ANNUAL) **Work Order:** _____
Department: MECHANICAL
Inspection Start Date: _____ **Supervisor's Review Signature:** _____
Inspection Completion Date: _____ **Planner's Review Signature:** _____
Reference Drawing and Manuals:

ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
1. Turbine Guide Bearing	
a) Inspect for oil leaks and take an oil sample.	( )
Comments:	
b) Inspect guide bearing housing bolts to ensure they are tight. If guide bearing covers are removed, check tightness of hold-down bolts.	( )
Comments:	
2. Operating Ring/Linkages	
a) Clean and Inspect wicket gate linkages for signs of mechanical damage.	( )
Comments:	
b) Inspect wicket gate shearpins to ensure all are properly in place. Replace any damaged shearpins.	( )
Comments:	
c) Inspect eccentric pins to ensure they are tight. Adjust as required.	( )
Comments:	
d) Inspect self-lubricated bushings of operating ring pins and links for signs of damage.	( )
Comments:	

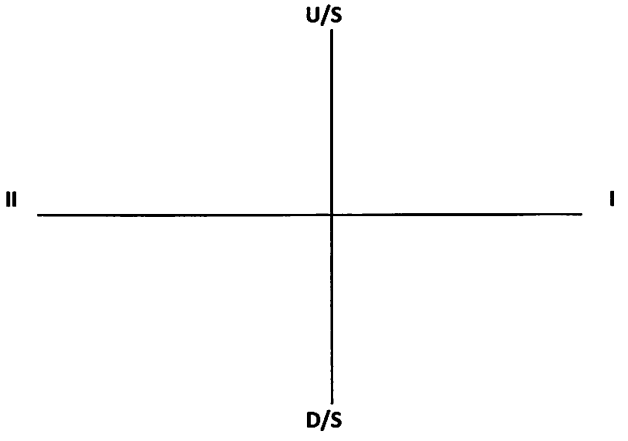
Asset No. & Description: 720103 - GF9 TURBINE	**Sheet:** 2 of 5
Type of Inspection: PM6 (ANNUAL)	**Rev. #:** 2
Department: MECHANICAL	**Rev. Date:** 9/11/2015
	Index No. GF9-020 **Folder No.: GF9**

ACTIVITIES (Initial Box Upon Completion)	**CHECKED BY**
3. Runner	
a) Check Runner crown (top) seal clearances. (See dwg 730D-20006) Nominal diametral = 2.6 - 3.1mm (.102 - .122")	( )



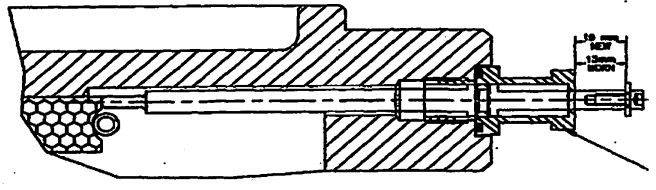
Comments:

b) Check Runner band (bottom) seal clearances. (See dwg 730D-20004) Nominal diametral = 3.5 - 3.9mm (.138 - .154")	( )



Comments:

Asset No. & Description: 720103 - GF9 TURBINE	**Sheet:** 3 of 5
Type of Inspection: PM6 (ANNUAL)	**Rev. #:** 2
Department: MECHANICAL	**Rev. Date:** 9/11/2015
	Index No. GF9-020 **Folder No.: GF9**

ACTIVITIES (Initial Box Upon Completion)	**CHECKED BY**
4. Shaft Mechanical Seal	
a) Inspect cooling water piping to seal for leaks and damage. Repair as required.	( )
Comments:	
b) Measure the wear indication on the seal (New = 19mm ; Worn = 13mm).	( )
Measurement = _____ mm	
	
WEAR INDICATOR DETAIL	
Comments:	
5. Head Cover	
a) Visually inspect head cover signs of mechanical damage and cracks. Inspect head cover bolts to ensure they are tight. Torque = 180 N-m Lub. (132 ft-lbs) as per Dwg. 730D-20016 Detail 6.	( )
Comments:	
6. Spiral Case	
a) Inspect spiral case drain valve and piping for leaks and overall condition. Verify operation of the drain valve.	( )
Comments:	
b) Inspect Spiral Case door for leakage. Ensure bolts are tight. If door is opened, replace door gasket.	( )
Comments:	

Asset No. & Description: 720103 - GF9 TURBINE	**Sheet:** 4 of 5
Type of Inspection: PM6 (ANNUAL)	**Rev. #:** 2
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	Index No. GF9-020 **Folder No.: GF9**

ACTIVITIES (Initial Box Upon Completion)	**CHECKED BY**
c) Inspect Spiral Case for overall condition. Inspect for signs of cavitation.	( )
Comments:	
7. Wicket Gates and Stay Vanes	
a) Inspect stay vanes for signs of wear, scouring, and other damage.	( )
Comments:	
b) Check wicket gate top and bottom clearances and record below.	( )

Gate #	Clearances	
	Top	Bottom
1 (Upstream)		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13 (Downstream)		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		

From drawings 730D-20004 and 730D-20006, Nominal Top and Bottom clearances are 1.0mm (0.039").

Comments:

Asset No. & Description: 720103 - GF9 TURBINE	**Sheet:** 5 of 5
Type of Inspection: PM6 (ANNUAL)	**Rev. #:** 2
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	Index No. GF9-020 **Folder No.:** GF9

ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
c) Inspect wicket gates for cavitation and other signs of mechanical damage.	( )
Comments:	
d) Check wicket gate heel to toe clearances and record below.	( )

Gate #	Clearances	
	Top	Bottom
1 - 2		
2 - 3		
3 - 4		
4 - 5		
5 - 6		
6 - 7		
7 - 8		
8 - 9		
9 - 10		
10 - 11		
11 - 12		
12 - 13		
13 - 14		
14 - 15		
15 - 16		
16 - 17		
17 - 18		
18 - 19		
19 - 20		
20 - 21		
21 - 22		
22 - 23		
23 - 24		
24 - 1		

e) Inspect wicket gate wear rings for signs of wear, scouring, and other damage.	( )
Comments:	

NL HYDRO EXPLOITS GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 2 Rev. No.: 0 Rev. Date: 3/22/2017 Index No. GF9-921 Folder #: GF9

Asset No. & Description: 720103 - GF9 Turbine
Type of Inspection: PM9-Major **Work Order:** _____
Department: ELECTRICAL
Inspection Start Date: _____ **Supervisor's Review Signature:** _____
Inspection Completion Date: _____ **Planner's Review Signature:** _____
Reference Drawing and Manuals:

ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
1. TURBINE	
a) Inspect shearpin plugs and wiring for looseness and mechanical damage. Replace as required. Ensure wiring is secure.	( )
Comments:	
b) Test shearpin circuit to ensure alarm is received.	( )
Comments:	
c) Inspect Turbine Pit lighting and replace as required.	( )
Comments:	
d) Inspect the creep detection system. Test to verify its alarms and operation.	( )
Comments:	

Asset No. & Desc.: 720109 - GF9 Turbine	**Sheet:** 2 of 2
Type of Inspection: PM9-Major	**Rev. #:** 0
Department: ELECTRICAL	**Rev. Date:** 3/22/2017
	Index No. GF9-921 **Folder #: GF9**

ACTIVITIES (Initial Box Upon Completion) **CHECKED BY**

f) The Turbine section is equipped with the following instruments and their alarms. Inspect wiring and connections for each instrument and test to ensure alarms are received. ( )

Location	Measurement	ID	Alarms	Comment
Turbine Guide Bearing	Oil Level	LS-100	Low oil level @ start-up. Trip on start-up.	
			Low oil level alarm, unit in operation	
			Very low oil level alarm, unit in operation. Unit trip	
			High oil level @ start-up. Trip on start-up.	
	Vibration	VE-100	- Alarm on start-up - Guide Bearing high vibration	
		VE-101		
		VE-102		
	Babbit Temperature	TE-100	High temperature alarm	
			Very high temp. trip	
	Oil Temperature	TE-101	High temperature alarm	
Shaft Seal	Water Flow	FD-102	Low water flow alarm	
	Temperature	TE-102	High Temp. alarm	
			Very High temp. trip	
Pit Flood Detector	Water Level	LSH-101	High water level at the headcover. Unit trip	
Wicket Gates Shearpin	Pin Sheared	YE101 - YE124	Wicket Gate shearpin alarm. Unit trip	
Servomotors	Operating Ring Position	ZSL-100	Wicket Gates closed indication (0%)	
		ZSL-101	Wicket Gates open indication	
		ZSL-102	Speed no load	
		ZSL-103	Double Slope	

Comments:

NL HYDRO EXPLOITS GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 2 Rev. No.: 2 Rev. Date: 9/11/2015 Index No. GF9-040 Folder #: GF9

Asset No. & Description: 700009 - GF9 UNIT HV Cables
Type of Inspection: PM9-Major **Work Order:** _____
Department: ELECTRICAL
Inspection Start Date: _____ **Supervisor's Review Signature:** _____
Inspection Completion Date: _____ **Planner's Review Signature:** _____
Reference Drawing and Manuals:

ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
1.	
a) **Comments:**	( )
b **Comments:**	( )
c) **Comments:**	( )
d) **Comments:**	( )
e) **Comments:**	( )
f) **Comments:**	( )
g) **Comments:**	( )
g) **Comments:**	( )

Asset No. & Description: 700009 - GF9 UNIT HV Cables		**Sheet:** 2 of 2	
Type of Inspection: PM9-Major		**Work Order:** _____	
Department: ELECTRICAL		**Rev. Date:** 9/11/2015	
		Index No. GF9-040	**Folder #:** GF9

ACTIVITIES (Initial Box Upon Completion)	**CHECKED BY**
h)	( )
Comments:	
i)	( )
Comments:	
j)	( )
Comments:	
k)	( )
Comments:	
l)	( )
Comments:	
Additional Comments:	

NL HYDRO EXPLOITS GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 4 Rev. No.: 0 Rev. Date: 3/22/2017 Index No. GF9-930 Folder No.: GF9

Asset No. & Description: 720141 - GF9 EXCITER
Type of Inspection: PM9-Major **Work Order:** _____
Department: ELECTRICAL
Inspection Start Date: _____ **Supervisor's Review Signature:** _____
Inspection Completion Date: _____ **Planner's Review Signature:** _____
Reference Drawing and Manuals:

ACTIVITIES (Initial Box Upon Completion and Comments)	CHECKED BY
1. Exciter Field Breaker	
a) Inspect and verify operation of the Exciter Field molded case breaker.(Enter test if required)	( )
Comments:	
b) Clean outside of molded breaker casing. Comment on condition found.	( )
Comments:	
c) Inspect the main fixed contacts with cover removed. Comment.	( )
Comments:	
d) Inspect the main moving contacts with cover removed. Comment.	( )
Comments:	
e) Measure the main contacts resistance with a micro-ohm meter (ductor).	( )
Comments:	
f) Inspect the arc chutes. Comment on condition.	( )
Comments:	

Asset No. & Description: 720141 - GF9 EXCITER	Sheet: 2 of 4
Type of Inspection: PM9-Major	Rev. No.: 0
Department: ELECTRICAL	Rev. Date: 3/22/2017
	Index No. GF9-930 Folder No.: GF9

ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
g) Clean and vacuum enclosure inside & outside. Comment on condition.	( )
Comments:	
h) Inspect wiring and connections to ensure all are tight and in good condition.	( )
Comments:	
2. Exciter Field Flashing	
a) Inspect and clean field flashing contactors. Comment on condition.	( )
Comments:	
b) Inspect field flashing resistor wiring and connections. Comment.	( )
Comments:	
c) Inspect Field Flashing Source. Comment on condition.	( )
Comments:	
3. Transformer	
a) Inspect transformer cubicles for any foreign material. Clean and vacuum inside and outside of cubicle. Comment on condition found.	( )
Comments:	

Asset No. & Description: 720141 - GF9 EXCITER	Sheet: 3 of 4
Type of Inspection: PM9-Major	Rev. #: 0
Department: ELECTRICAL	Rev. Date: 3/22/2017
	Index No. GF9-930 Folder No.: GF9

ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
b) Inspect the physical, electrical, and mechanical condition of the transformer including evidence of moisture, corona, and brittleness.	( )
Comments:	
c) Verify that the core, frame, and enclosure are properly grounded. Measure core insulation to ground if ground strap is removable.	( )
Comments:	
d) Verify tightness of accessible bolted electrical connections.	( )
Comments:	
e) Verify tightness of cabinet cable connectors & cable supports.	( )
Comments:	
f) Verify surge arrestors.	( )
Comments:	
g) Verify that as-left tap connections for mechanical stress and tightness.	( )
Comments:	
h) Perform insulation resistance tests winding-to-winding and each winding-to-ground.	( )
Comments:	

Asset No. & Description: 720141 - GF9 EXCITER	Sheet: 4 of 4
Type of Inspection: PM9-Major	Rev. #: 0
Department: ELECTRICAL	Rev. Date: 3/22/2017
	Index No. GF9-930 Folder No.: GF9

ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
i) Perform resistance measurements through exposed bolted connections with a low resistance ohmmeter.	( )
Comments:	
j) Verify operation of all Exciter alarms and trips.	( )
Comments:	
With the Power "ON", check the following:	
k) Verify field flashing from source [Test Required].	( )
Comments:	
ADDITIONAL REMARKS:	

NL HYDRO EXPLOITS GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 9 Rev. No.: 0 Rev. Date: 3/22/2017 Index No. GF9-902 Folder No.: GF9

Asset No. & Description: 720125 - GF9 GENERATOR
Type of Inspection: PM9-Major **Work Order:** _____
Department: ELECTRICAL
Inspection Start Date: _____ **Supervisor's Review Signature:** _____
Inspection Completion Date: _____ **Planner's Review Signature:** _____
Reference Drawing and Manuals:

ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
CRITICAL PARTS INSPECTION 1. **Generator Slip Ring Assembly**	
a) Check brushes for cracks, uneven surfaces, etc. Replace any brush projecting from a brush box 1/8" or less, before pig tail contact brush box.	( )
Comments:	
b) Measure and record length of carbon brushes. (See table on page three for recording results)	( )
c) Inspect and clean all slip ring insulators.	( )
Comments:	
d) Check slip rings for pitting, discoloration or scouring.	( )
Comments:	
e) Check all mounting hardware for tightness.	( )
Comments:	
f) Measure and record wear on lower slip ring. Base Reading _____.	( )
Comments:	

Asset No. & Description: 720125 - GF9 GENERATOR	Sheet: 2 of 9
Type of Inspection: PM9-Major	Rev. #: 0
Department: ELECTRICAL	Rev. Date: 3/22/2017
	Index No. GF9-902 Folder No.: GF9

ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
g) Measure and record wear on upper slip ring. Base reading _____.	( )
Comments:	
h) Check and clean all brush holders,insulators, springs ,pigtail connections, speed sensors , and associated hardware,etc.	( )
Comments:	
i) Check brush force and freedom of movement.	( )
Comments:	
j) Check clearance between the brush boxes and the collection rings.	( )
Comments:	
k) Clean the collector. Surface of collector rings shall be clean and free of rust at all times. Take following precautions: *i) Avoid finger marks. Skin acids and/or moisture promotes the development of rust on the polished steel surface.* *ii) If collector is to be out of service for long periods of time, envelope in rust inhib. grease to prevent the cond. of moisture.* *iii) Clean the ring surfaces with industrial alcohol prior to returning the collection to service.*	( )
Comments:	
l) *Clean interior and exterior of enclosure*	( )
Comments:	

Asset No. & Description: 720125 - GF9 GENERATOR	**Sheet:** 3 of 9
Type of Inspection: PM9-Major	**Rev. #:** 0
Department: ELECTRICAL	**Rev. Date:** 3/22/2017
	Index No. GF9-902 **Folder No.: GF9**

Date of Check: _____ Checked By: _____

BRUSH MEASUREMENT (CLOCKWISE)

Unit mwhour meter reading: _____

mwhours accumulated since last inspection: _____

	Top Ring		Bottom Ring	
	Top	**Bottom**	**Top**	**Bottom**
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
21				
22				

Comments: _____

Asset No. & Description: 720125 - GF9 GENERATOR	Sheet: 4 of 9
Type of Inspection: PM9-Major	Rev. #: 0
Department: ELECTRICAL	Rev. Date: 3/22/2017
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ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
m) Meggar slip rings @500V &250V for1 minute. Record Results. [Test Required]	( )
Comments: 500V= 250V=	
2. Generator Rotor ** Remove ALL covers.	
a) Clean accessible parts of the rotor. Clean rotor ventilation ducts if excess build-up of material is present.	( )
Comments:	
b) Check rotor bus lead (flexible jumpers), insulators,to slip rings:	
i) Check tightness of bolts.	( )
Comments:	
ii) Visually inspect for abnormal wear and cracks.	( )
Comments:	
iii) Check laminate layers for peeling.	( )
Comments:	
c) Inspect Rotor field cable supports and mounting clamps and ensure all bolting is tight and cables are secure.	( )
Comments:	

Asset No. & Description: 720125 - GF9 GENERATOR	Sheet: 5 of 9
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ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
d) Inspect wedges between field poles for signs of movement. Report all findings immediately to maintenance supervisor.	( )
Comments:	
e) Inspect field pole connections, taping, and insulators for visual indication of breakdown.	( )
Comments:	
f) Inspect rotor pole keys to ensure they are tight. Report all findings immediately to maintenance supervisor.	( )
Comments:	
g) Inspect rotor rim keys to ensure they are tight and properly blocked. Report all findings immediately to maintenance supervisor.	( )
Comments:	
3. Current Transformers ** Remove ALL covers.	
a) Check mounting hardware and connections.	( )
Comments:	
b) Wipe down all accessible areas with clean dry cloths.	( )
Comments:	

Asset No. & Description: 720125 - GF9 GENERATOR	Sheet: 6 of 9
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ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
c) Visually inspect cablings for cracks or mechanical damage.	( )
Comments:	
4. Generator Stator ** Remove ALL covers.	
a) Inspect Generator Main leads and Neutral leads. Inspect insulators and taping for signs of break-down or other damage.	( )
Comments:	
b) Inspect Stator RTD's wiring and connections. Ensure all connections are tight and wiring is not damaged. Verify operation if found faulted.	( )
Comments:	
c) Inspect stator coils for signs of corona discharge, end distortion, cracked insulation or other mechanical damage. Report all findings.	( )
Comments:	
d) Inspect for signs of coil movement. Check slot packing for tightness and signs of migration of slot fillers.	( )
Comments:	
e) Inspect stator frame sole plates for signs of movement and evidence of fretting.	( )
Comments:	

Asset No. & Description: 720125 - GF9 GENERATOR	**Sheet:** 7 of 9
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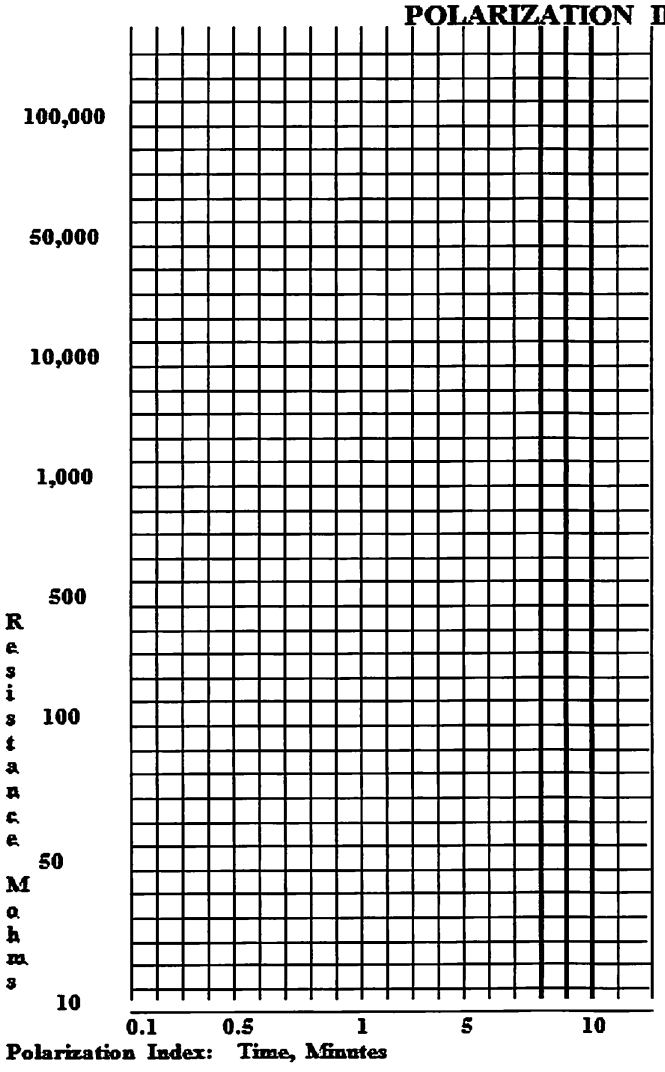
Date of Test: _____ Tested By: _____

*** Remove fuses F1, F2, F3. Pull out PT Drawer. Remove grounding transformer lead.

POLARIZATION INDEX TEST



Time	Mohms
15 Sec.	
30 Sec.	
45 Sec.	
1 Min.	
2 Min.	
3 Min.	
4 Min.	
5 Min.	
6 Min.	
7 Min.	
8 Min.	
9 Min.	
10 Min.	

Comments: _____

Asset No. & Description: 720125 - GF9 GENERATOR	Sheet: 8 of 9
Type of Inspection: PM9-Major	Rev. #: 0
Department: ELECTRICAL	Rev. Date: 3/22/2017
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ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
f) Inspect lashings and ties for looseness, movement, and deterioration.	( )
Comments:	
g) Inspect punchings at fingers for looseness and signs of fretting.	( )
Comments:	
h) Inspect & complete Load Test on Stator Heaters.	( )
Comments:	
5. Generator Thrust Bearing a) Verify operation of Generator Bearing temp. probe. Test to verify temp. range.	( )
Comments:	
6. Generator Neutral Grounding Cabinet a) Vacuum cubicle inside and out.	( )
Comments:	
b) Check all wiring and connections.	( )
Comments:	
c) Inspect resistor. Record resistance of resistor.	( )
Comments:	

Asset No. & Description: 720125 - GF9 GENERATOR	Sheet: 9 of 9
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ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
7. Generator Shaft Grounding Brush	
a) Remove and replace brush and clean holder. Check brush for good contact with shaft. Ensure 9mm spacing between brushholder and shaft.	( )
Comments:	
8. Generator Brake Switches {Coordinate with mechanical crew}	
a) Check mounting hardware.	( )
Comments:	
b) Check wiring for loose connections, broken connections, and mechanical damage.	( )
Comments:	
c) Check operation of switches.	( )
Comments:	
d) Check brake solenoid wiring for loose connections.	( )
Comments:	
e) Check operation of brake solenoid for free movement.	( )
Comments:	
f) Check timing of brake application. Standard: ____ Secs. Actual: ____ Secs.	( )
Comments:	

NL HYDRO EXPLOITS GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 2 Rev. No.: 0 Rev. Date: 3/22/2017 Index No. GF9-940 Folder #: GF9

Asset No. & Description: 720098 - GF9 UNIT BREAKER (52-G9)
Type of Inspection: PM9-Major **Work Order:** _____
Department: ELECTRICAL
Inspection Start Date: _____ **Supervisor's Review Signature:** _____
Inspection Completion Date: _____ **Planner's Review Signature:** _____
Reference Drawing and Manuals:

ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
1. G9 UNIT BREAKER (SF6-Vacuum)	
a) Clean and vacuum complete enclosure inside and exterior before proceeding.	( )
Comments:	
b) Inspect all wiring and connections to ensure all are tight and secure. Inspect all bolts and mounting hardware.	( )
Comments:	
c) Inspect and lubricate linkages beneath breaker. Also lubricate all moving parts. (Note: Clean out old Lubricant before applying fresh lubricant.)	( )
Comments:	
d) Perform megger test at 2500volts minumum on breaker. Record results.	( )
Comments:	
e) Clean all breaker insulation with dry lint-free cloth.	( )
Comments:	

Asset No. & Description:	**720098 - GF9 UNIT BREAKER (52-G9)**	**Sheet:**	2 of 2
Type of Inspection:	PM9-Major	**Rev. #:**	0
Department:	ELECTRICAL	**Rev. Date:**	3/22/2017
		Index No.	GF9-940 **Folder #: GF9**

ACTIVITIES (Initial Box Upon Completion)	**CHECKED BY**
f) Inspect breaker contacts, auxiliary contacts and record micro-ohm test (ductor)on breaker main contacts. **Comments:**	( )
g) Inspect close and open indications for proper operation. **Comments:**	( )
g) Inspect operation of closing and tripping device of breaker. **Comments:**	( )
h) Inspect breaker interlocks. **Comments:**	( )
i) Inspect closing and tripping coils **Comments:**	( )
j) Inspect operation of rack-in and rack-out indication. **Comments:**	( )
k) Monitor and record Breaker Resistance. **Resistance =** _____ **Comments:**	( )
l) Record counter operations if equipped **Operations =**	( )

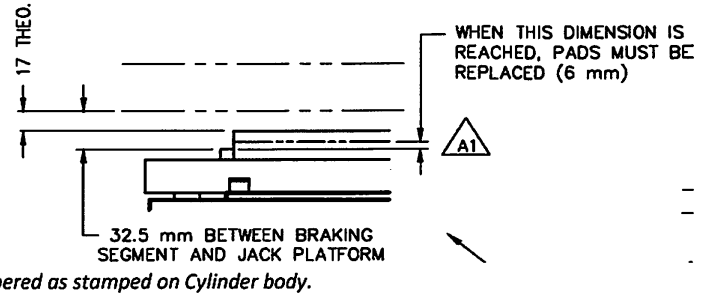
NL HYDRO EXPLOITS GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 5 Rev. No.: 0 Rev. Date: 3/27/2017 Index No. GF9-901 Folder No.: GF9

Asset No. & Description: 720125 - GF9 GENERATOR
Type of Inspection: PM9 (MAJOR) **Work Order:** _____
Department: MECHANICAL
Inspection Start Date: _____ **Supervisor's Review Signature:** _____
Inspection Completion Date: _____ **Planner's Review Signature:** _____
Reference Drawing and Manuals:

ACTIVITIES (Initial Box Upon Completion)	CHECKED BY

1. Generator Brakes / Jacking System

a) Check brake pad thickness and record. See diagram below: ( )



Numbered as stamped on Cylinder body.

Brake Pad 1 = _____ Brake Pad 5 = _____
Brake Pad 2 = _____ Brake Pad 6 = _____
Brake Pad 3 = _____ Brake Pad 7 = _____
Brake Pad 4 = _____ Brake Pad 8 = _____

b) Check brake pads for cracks. Report to supervisor immediately if brake pads require replacement. ( )

Comments:

c) Inspect brake track for excessive scouring or warpage and check brake plate bolts for looseness. Check that brake cylinders are fully retracted and not rubbing on track. ( )

Comments:

d) Inspect Jacking system reservoir pump. ( )

Comments:

Asset No. & Description: 720125 - GF9 GENERATOR	Sheet: 2 of 5
Type of Inspection: PM9 (MAJOR)	Rev. No.: 0
Department: MECHANICAL	Rev. Date: 3/27/2017
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ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
e) Inspect and grease brake cylinders (Swepco 110). Check for excessive leakage and sticking. Report all findings.	( )
Comments:	
f) Inspect air piping for damage and pressure test brakes for air leaks.	( )
Comments:	
2. Thrust/Guide Bearing Assembly	
a) Clean external bearing assembly. Check for leaks and loose bolts.	( )
Comments:	
b) Take oil sample. Comment on oil condition.	( )
Comments:	
c) Inspect cooling water piping to bearing coolers for leaks. Disassemble piping at inlet and outlet to cooling coils and inspect visiable portions of both piping and coils for signs of fouling.	( )
Comments:	
d) Reassemble piping to cooling coils and inspect for water leakage.	( )
Comments:	
3. Thrust Bearing Oil Lift System (High Lift Pump)	
a) Visually inspect oil lift pump and piping for oil leaks and condition of equipment.	( )
Comments:	

Asset No. & Description: 720125 - GF9 GENERATOR **Type of Inspection:** PM9 (MAJOR) **Department:** MECHANICAL	**Sheet:** 3 of 5 **Rev. No.:** 0 **Rev. Date:** 3/27/2017 **Index No.** GF9-901 **Folder No.: GF9**

ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
b) Replace inline oil filter cartridge. Comment on condition of removed filter. **Comments:**	( )
c) Verify operation of oil lift system. Attach dial indicator on turbine shaft and take reading of lift (0.005" min.) and maximum pressure reached. **Comments:**	( )
4. Generator Rotor ** Remove ALL covers a) Inspect generator rotor for mechanical damage and stress cracks at welds. Inspect bolts to ensure they are tight. Wipe down welds with a rag to get a good visual. Pay particular attention to welds near coupling hub and fan blade welds. **Comments:**	( )
b) Inspect the rotor balancing weights to ensure they are properly seated and secure. **Comments:**	( )
c) Inspect coupling bolts and bolt locking devices for signs of damage and looseness. Report all findings. **Comments:**	( )

Asset No. & Description: 720125 - GF9 GENERATOR Type of Inspection: PM9 (MAJOR) Department: MECHANICAL	Sheet: 4 of 5 Rev. No.: 0 Rev. Date: 3/27/2017 Index No. GF9-901 Folder No.: GF9

ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
d) Inspect rotor fan blades for signs of mechanical damage and cracking. Report findings.	( )
Comments:	
5. Generator Main Bracket ** Remove ALL covers	
a) Inspect generator main bracket for mechanical damage and stress cracks at welds. Wipe down welds with a rag to get a good visual.	( )
Comments:	
6. Generator Stator	
a) Inspect Stator foundations for signs of cracking or movement. Report all findings.	( )
Comments:	
b) Inspect Stator frame sole plates and keys for signs of movement and evidence of fretting, binding or displacement. Report all findings.	( )
Comments:	
c) Inspect the stator core for signs of buckling, waviness, evidence of vibration of core laminations, loose tightening plates, and hot spots via pealing of paint. Report all findings.	( )
Comments:	
d) Inspect cleanliness of air ducts. Report findings.	( )
Comments:	

Asset No. & Description: 720125 - GF9 GENERATOR **Type of Inspection:** PM9 (MAJOR) **Department:** MECHANICAL	**Sheet:** 5 of 5 **Rev. No.:** 0 **Rev. Date:** 3/27/2017 **Index No.** GF9-901 **Folder No.: GF9**

ACTIVITIES (Initial Box Upon Completion)	**CHECKED BY**
5. Generator Main Bracket ** Remove ALL covers	
a) Inspect generator main bracket for mechanical damage and stress cracks at welds. Wipe down welds with a rag to get a good visual.	( )
Comments:	
6. Stator Air Coolers (6)	
a) Inspect Air Coolers for signs of water leakage. Inspect cleanliness of finned tubes. Remove cooler and clean if found dirty.	( )
Comments:	
b) Check each tube for looseness. If tube is found loose, report immediately.	( )
Comments:	
c) Disconnect piping to coolers and inspect internal piping for signs of corrosion and fouling. Remove covers of water boxes to inspect internals of tubesheet.	( )
Comments:	
d) Inspect air vent valves on each cooler to ensure proper operation.	( )
Comments:	

NL HYDRO EXPLOITS GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 3 Rev. No.: 0 Rev. Date: 3/28/2017 Index No.: GF9-910 Folder No.: GF9

Asset No. & Description: 710186 - GF9 GOVERNOR
Type of Inspection: PM6 (ANNUAL) **Work Order:** _____
Department: MECHANICAL
Inspection Start Date: _____ **Supervisor's Review Signature:** _____
Inspection Completion Date: _____ **Planner's Review Signature:** _____
Reference Drawing and Manuals:

	ACTIVITIES (Initial Box Upon Completion)	Completed By
1.	HPU System	
a)	Replace oil filters and take an oil sample. Comment on cleanliness of filters removed.	( )
	Comments:	
b)	Visually inspect pumps and HPU unit for leaks. Check for pump noise and vibration. Inspect piping connections for signs of leakage and looseness.	( )
	Comments:	
c)	Verify operation of (3) unloader valves.	( )
	Comments:	
d)	Inspect & Test DC Pump	( )
	Comments:	
2.	Governor Accumulators	
a)	Inspect nitrogen pre-charged accumulators and piping. Add nitrogen as required as per operating instructions.	( )
	Comments:	

Asset No. & Description: 710186 - GF9 GOVERNOR	Sheet: 2 of 3
Type of Inspection: PM6 (ANNUAL)	Rev. #: 0
Department: MECHANICAL	Rev. Date: 3/28/2017
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ACTIVITIES (Initial Box Upon Completion)	Completed By
3. Governor Gate System ***(Complete work with Unit Pressurized)*** a) Check the gate position pointer at 50% for proper alignment. [Test Req'd]	( )

	Reading on Operating Ring	Reading on HMI
Found At		
Left At		

Comments:

b) Monitor and record zero position of gate position indicator. [Test Req'd] ( )

	Reading on Operating Ring	Reading on HMI
Found At		
Left At		

Comments:

c) Monitor and record wicket gate opening time from 0 – 100%.[Test Req'd] ( )

Found at: _____

Left at: _____

Comments:

d) Monitor and record wicket gate closing time from 100% – 0%.[Test Req'd] ( )

Found at: _____

Left at: _____

Comments:

Asset No. & Description: 710186 - GF9 GOVERNOR	Sheet: 3 of 3	
Type of Inspection: PM6 (ANNUAL)	Rev. #: 0	
Department: MECHANICAL	Rev. Date: 3/28/2017	
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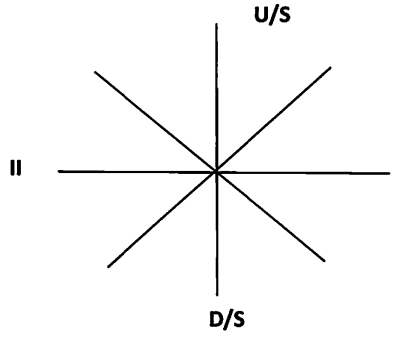
	ACTIVITIES (Initial Box Upon Completion)	Completed By
e)	Test wicket gate squeeze [Test Req'd]. With hydraulics pressurized, close gates completely and apply full pressure to closing servo (squeeze). Install dial indicator on closing servo rod. Shut hydraulic pressure to servomotors, allow pressure to drop back to 0psi, and record reading on dial indicator.	( )
	Comments:	
4.	HPU Sump Heat Exchanger	
a)	Inspect and test HPU sump heat exchanger system. Verify there are no leaks in piping and equipment and pump is in good operating condition.	( )
	Comments:	
4.	HPU Piping	
a)	Inspect HPU piping on skid as well as piping to servomotors. Verify there are no leaks in piping, all fittings are tight, and all piping is secured.	( )
	Comments:	

NL HYDRO EXPLOITS GENERATION PREVENTIVE MAINTENANCE CHECKSHEETS	Sheet: 1 of 8 Rev. No.: 0 Rev. Date: 3/27/2017 Index No. GF9-920 Folder No.: GF9

Asset No. & Description: 720103 - GF9 TURBINE
Type of Inspection: PM9 (MAJOR) **Work Order:** _____
Department: MECHANICAL
Inspection Start Date: _____ **Supervisor's Review Signature:** _____
Inspection Completion Date: _____ **Planner's Review Signature:** _____
Reference Drawing and Manuals:

ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
1. Turbine Guide Bearing	
a) Clean bearing covers, inspect for oil leaks and take an oil sample.	( )
Comments:	
b) Check Turbine Bearing clearances @ 8 locations below. (See dwg 730D-20079). Nominal diametral = 0.3 - 0.43mm (.012 - .017"). Long feeler gages (18 - 24") required.	( )
c) Inspect guide bearing housing bolts to ensure they are tight. If guide bearing covers are removed, check tightness of hold-down bolts.	( )
Comments:	
2. Operating Ring/Linkages	
a) Clean and Inspect wicket gate linkages for signs of mechanical damage.	( )
Comments:	



Comments: _____

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Department: MECHANICAL	**Rev. Date:** 3/27/2017
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ACTIVITIES (Initial Box Upon Completion)	**CHECKED BY**
b) Inspect wicket gate shearpins to ensure all are properly in place. Replace any damaged shearpins.	( )
Comments:	
c) Inspect eccentric pins to ensure they are tight. Adjust as required.	( )
Comments:	
d) Inspect self-lubricated bushings of operating ring pins and links for signs of wear and damage.	( )
Comments:	
e) Remove shearpins on 4 gates and measure the hydraulic pressure required to rotate wicket gate using the Guide Vane alignment device and specified hydraulic jack as shown on drawing #730D-20055.	( )
Comments:	

U/S Gate #_____

Axis II Gate #_____ **Axis I Gate #_____**

D/S Gate #_____

Gate #	Hydr. Pressure (psi)

3. Shaft Mechanical Seal	
a) Dis-assemble cooling water piping and thoroughly clean. Replace all components and fittings that are worn/damaged. Flush after re-assembly.	( )
Comments:	

Asset No. & Description: 720103 - GF9 TURBINE	Sheet: 3 of 8
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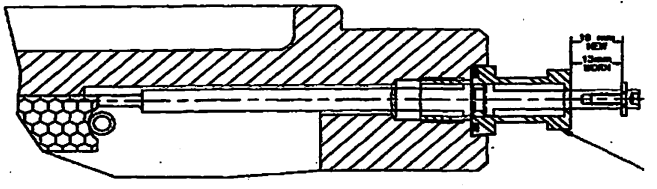
ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
b) Measure the wear indication on the seal (New = 19mm ; Worn = 13mm). Measurement = _____ mm	( )



WEAR INDICATOR DETAIL

Comments:

4. Head Cover

a)	Thoroughly clean and visually inspect head cover signs of mechanical damage and cracks. Inspect head cover bolts to ensure they are tight. Torque = 180 N-m Lub. (132 ft-lbs) as per Dwg. 730D-20016 Detail 6.	( )

Comments:

5. Servomotors

a)	Inspect Servomotors for signs of leakage, rod damage, seal damage, etc. Remove servo pins and inspect for wear, damage, etc. Lubricate pins using an EP220 grease (Shell Gadus S2 V220 or equiv.).	( )

Comments:

b)	Inspect servo jam nuts for signs of movement or looseness. Ensure jam nuts are tightly secured. If jam nuts have backed off, report immediately.	( )

Comments:

c)	Test wicket gate squeeze [Test Req'd]. With hydraulics pressurized, close gates completely and apply full pressure to closing servo (squeeze). Install dial indicator on closing servo rod. Shut hydraulic pressure to servomotors, allow pressure to drop back to 0psi, and record reading on dial indicator. Co-ordinate test with Mechanical Governor PM.	( )

Comments:

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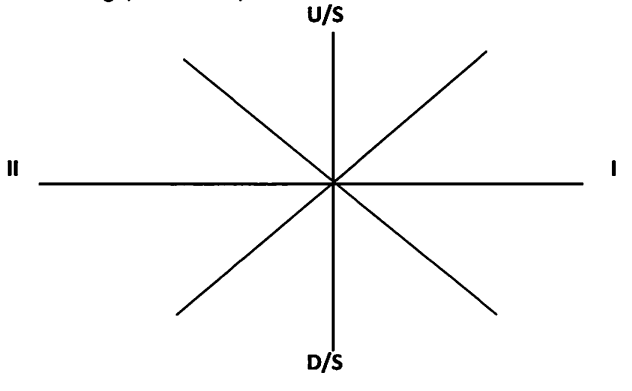
ACTIVITIES (Initial Box Upon Completion)	**CHECKED BY**
6. Spiral Case	
a) Inspect spiral case drain valve and piping for leaks and overall condition. Verify operation of the drain valve.	( )
Comments:	
b) Inspect Spiral Case door for leakage. Grease hinges using a Lithium EP2 grease. (Shell Gadus S2 V220 or equiv.) . Replace door O-ring (Parker O-ring #2-391, Nitrile Buna N 70 Duro.)	( )
Comments:	
c) Inspect Spiral Case for signs of wear, damage, and cavitation.	( )
Comments:	
d) Bolt torque required for closing door is 100 N*m lubricated (74 lbf*ft).	( )
Comments:	
7. Runner Seals (measured from scroll case)	
a) Check Runner crown (top) seal clearances. (See dwg 730D-20006) Nominal diametral = 2.6 - 3.1mm (.102 - .122"). Inspect seal for signs of damage, corrosion, etc.	( )



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Type of Inspection: PM9 (MAJOR)	Rev. #: 0
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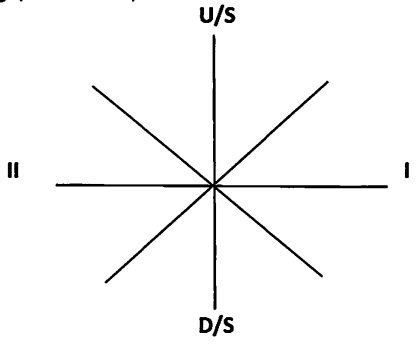
ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
b) Check Runner band (bottom) seal clearances. (See dwg 730D-20004) Nominal diametral = 3.5 - 3.9mm (.138 - .154"). Inspect seal for signs of damage, corrosion, etc.	( )



Comments:

8. Wicket Gates and Stay Vanes

a) Inspect stay vanes for signs of wear, scouring, and other damage. ( )

Comments:

b) Inspect wicket gates for signs of damage, wear and cavitation. ( )

Comments:

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ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
c) Inspect wicket gate sealing surfaces at bottom ring and headcover for signs of wear, scouring, and other damage. Report all findings.	( )

Comments:

d) Check wicket gate top and bottom clearances and record below. ( )

Gate #	Clearances	
	Top	Bottom
1 (Upstream)		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13 (Downstream)		
14		
15		
16		
17		
18		
19		
20		
21		
22		
23		
24		

From drawings 730D-20004 and 730D-20006, Nominal Top and Bottom clearances are 1.0mm (0.039").

Comments:

Asset No. & Description: 720103 - GF9 TURBINE	**Sheet:** 7 of 8
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ACTIVITIES (Initial Box Upon Completion) **CHECKED BY**

e) Check wicket gate heel to toe clearances and record below. ( )

Gate #	Clearances	
	Heel	Toe
1 - 2		
2 - 3		
3 - 4		
4 - 5		
5 - 6		
6 - 7		
7 - 8		
8 - 9		
9 - 10		
10 - 11		
11 - 12		
12 - 13		
13 - 14		
14 - 15		
15 - 16		
16 - 17		
17 - 18		
18 - 19		
19 - 20		
20 - 21		
21 - 22		
22 - 23		
23 - 24		
24 - 1		

9. <u>Drafttube</u>

a) Grease Drafttube door hinges. Use a Lithium EP2 grease. (Shell Gadus S2 V220 or equiv.) ( )

Comments:

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Department: MECHANICAL	Rev. Date: 3/27/2017
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ACTIVITIES (Initial Box Upon Completion)	CHECKED BY
b) Inspect sealing surfaces of door and clean as required. Replace gasket. Gasket material is 70 Durometer Neoprene, 5 mm thickness. Overall door dimensions are 930mm x 930mm. Gasket to be single pc with no joins.	( )
Comments:	
c) Inspect drafttube cone for signs of damage, wear, and cavitation. Report all findings.	( )
Comments:	
d) Bolt torque required for closing door is 65 N*m lubricated (48 lbf*ft).	( )
Comments:	
10. <u>Runner (inspect from Draftube platform)</u>	
a) Inspect runner for signs of damage, wear, and cavitation. Report all findings. Co-ordinate inspection with LTAP group.	( )
Comments:	
b) Inspect runner cone for signs of wear, damage, and cavitation. Report all findings.	( )
Comments:	