

**C0080228**

**HYD Hollow Bridge Generator Refurbishment**

**REDACTED**

**December 1, 2025**



**NSEB APPROVAL SHEET**

**Project Title:** HYD Hollow Bridge Generator Refurbishment

**CI Number:** C0080228

**Date:** December 1, 2025

| Expenditure Profile |               |                  | Type of Filing                      |                                  |
|---------------------|---------------|------------------|-------------------------------------|----------------------------------|
| Year                | Budget Amount | Project Estimate | <input type="checkbox"/>            | Capital Project Authorization    |
| 2025                |               | 715,901          | <input checked="" type="checkbox"/> | Unforeseen and Unbudgeted (U&U)  |
| 2026                |               | 1,871,269        | <input type="checkbox"/>            | Planned & Advanced (P&A)         |
|                     |               |                  | <input type="checkbox"/>            | Subsequent Approval Item         |
|                     |               |                  | <input type="checkbox"/>            | Authorization to Overspend (ATO) |
|                     |               |                  | <input type="checkbox"/>            | Scope Change                     |
|                     |               |                  | <input type="checkbox"/>            | Final Cost (FIN)                 |
| <b>Total</b>        | \$0           | \$2,587,170      |                                     |                                  |

**COMMENTS**

Submitted on behalf of NOVA SCOTIA POWER INCORPORATED

Approved on behalf of NOVA SCOTIA ENERGY BOARD

Authorized Signatory  
Dave Pickles  
Chief Operating Officer

DATE  
November 28, 2025

DATE

**CI Number: C0080228**

**Title: HYD Hollow Bridge Generator Refurbishment**

**Start Date:** 2025/10  
**In-Service Date:** 2026/04  
**Final Cost Date:** 2026/10  
**Function:** Hydro  
**Forecast Amount:** \$2,587,170

**DESCRIPTION:**

This project is for the refurbishment of the generator of the Hollow Bridge Hydro Unit, including the rewind of both major components of the electrical generator - rotor and stator. The generator stator was last re-wound in 2008. The generator rotor is original to the unit, although NS Power believes that some previous work has been performed on this asset prior to 2025.

The Hollow Bridge Hydro Unit is located on the Black River Hydro System and has been in service since 1940. Hollow Bridge Hydro Unit is rated at 5.3MW and produces approximately 25.5GWh/year. Hollow Bridge is a “run of river” design, making it critical for water passage to the bottom three plants on the system.

**Summary of Related CIs +/- 2 years:**

Pursuant to Section 11.2 of the CEJC, related CIs for Hydro projects include “work completed on the same generating unit and dam structures, but not necessarily the same asset.”

- No other projects in 2024 ,2025, 2026, 2027, or 2028

**Depreciation Class:** Hydraulic Production Plant – Black River Hydro System

**Estimated Life of the Asset:** 40 Years

**Retirement Information:**

- Categorization of Retirement: Accounting Policy 6420 - Retirement and Disposal of Capital Assets
- Percentage of Asset Pool: 2.76%

**JUSTIFICATION:**

**Justification Criteria:** Hydro, Wind and Biomass

**Why do this project?**

NS Power operates a comprehensive preventative maintenance program that includes inspections, condition assessments, and targeted maintenance to ensure safe and reliable hydro operations. The Hollow Bridge generator rotor and stator have been in service for decades and maintained under this program. Despite these efforts, an unforeseen stator fault occurred in September 2025, causing significant winding damage and forcing the unit offline. Testing confirmed widespread insulation degradation in both components, making partial repairs impractical.

The NS Power team acted quickly to assess the damage and evaluate options to minimize impacts on generation and water management across the Black River system. Refurbishment is essential to restore reliability, maintain generation capacity, and ensure safe, controlled water passage for downstream plants and environmental flow compliance. It was determined that the stator fault resulted in the need for a complete rewind of the stator. More details on the current condition of the generator stator can be found in Attachment 1, as well as condition information on the generator rotor in Attachment 2.

**Why do this project now?**

Hollow Bridge is unable to operate until the refurbishment of the generator is complete. Without operation of this unit, the flow on the Black River system is restricted. Furthermore, without the timely return to service of Hollow Bridge, environmental maintenance flows in Spring 2026 would have to be supplemented from Gaspereau Lake, at the risk of impacting fish passage in the Gaspereau River. Without Hollow Bridge generating unit, water management at the site

becomes highly manual, requiring frequent operator interventions to adjust flows through the Hollow Bridge bypass. This increases operational risk and reduces the ability to maintain safe, controlled water management across the Black River system.

**Why do this project this way?**

Two stator rewind options were evaluated, as outlined in Partially Confidential Attachment 3: Global VPI and B-Stage Coil. Global VPI (Vacuum Pressure Impregnation) involves fully re-insulating and impregnating stator windings under vacuum and pressure, improving durability and electrical integrity. Both options provide similar life extension, but Global VPI offers lower cost and shorter completion time. Stator testing also confirmed that bypassing failed stator coils was unsuccessful and would not address underlying insulation degradation.

For the rotor, partial refurbishment was deemed high-risk due to insulation fragility noted in Attachment 2; a full rewind ensures long-term reliability and safety.

Rewinding the rotor and refurbishing the stator is estimated at ten times more cost-effective than full generator replacement and achieves similar life extension (approximately 40 years). Full replacement would require civil modifications, extended outage duration, and substantially higher capital cost, which is not justified given the current condition and expected performance after refurbishment.

**Contingency Statement**

Contingency for this project has been determined using a combination of internal subject matter expert judgment, previous experience with hydro generator refurbishment projects, and the non-binding contingency guidelines. Consistent with the maturity matrix, this project is being filed as a Class 3 estimate with a contingency of 20 percent. Contingency is intended to account for further findings such as deteriorated copper in the rotor windings as well as the presence of asbestos. These factors cannot be fully assessed until the rotor arrives at the rewind facility, where a detailed inspection can be completed once the generator is fully disassembled. Contingency may also be required for additional overtime work to complete the project within the available outage window, or an increase to material or contract costs.

| <b>Location: Hydro</b><br><b>C#: C0080228</b><br><b>Title: HYD Hollow Bridge Generator Refurbishment</b><br><b>Execution Year: 2025</b> |      |          |                            |                |                             | Cost Support Reference | Completed Similar Projects (FP#'s) |
|-----------------------------------------------------------------------------------------------------------------------------------------|------|----------|----------------------------|----------------|-----------------------------|------------------------|------------------------------------|
| Description                                                                                                                             | Unit | Quantity | Unit Estimate              | Total Estimate |                             |                        |                                    |
| <b>Regular Labour</b>                                                                                                                   |      |          |                            |                |                             |                        |                                    |
| Hydro River Staff - Construction                                                                                                        | PD   | 378      | \$ 417                     | \$ 157,626     |                             |                        |                                    |
| Engineering Staff                                                                                                                       | PD   | 129      | \$ 472                     | \$ 60,960      |                             |                        |                                    |
| Project Support Staff                                                                                                                   | PD   | 13       | \$ 396                     | \$ 5,000       |                             |                        |                                    |
|                                                                                                                                         |      |          | Sub-Total                  | \$ 223,586     |                             |                        |                                    |
| <b>Overtime Labour</b>                                                                                                                  |      |          |                            |                |                             |                        |                                    |
| Hydro River Staff - Construction                                                                                                        | PD   | 58       | \$ 834                     | \$ 48,372      |                             |                        |                                    |
|                                                                                                                                         |      |          | Sub-Total                  | \$ 48,372      |                             |                        |                                    |
| <b>Travel Expenses</b>                                                                                                                  |      |          |                            |                |                             |                        |                                    |
| Site Visits                                                                                                                             | lot  | 1        | \$ 2,250                   | \$ 2,250       |                             |                        |                                    |
| Accommodations                                                                                                                          | lot  | 1        | \$ 37,800                  | \$ 37,800      |                             |                        |                                    |
| Factory Acceptance Tests                                                                                                                | lot  | 1        | \$ 15,000                  | \$ 15,000      |                             |                        |                                    |
|                                                                                                                                         |      |          | Sub-Total                  | \$ 55,050      |                             |                        |                                    |
| <b>Materials</b>                                                                                                                        |      |          |                            |                |                             |                        |                                    |
| Stator Rewind                                                                                                                           | lot  | 1        |                            |                | Attachment 3 Lines 5+a+b    |                        |                                    |
| Dismantle of Rotor and Overhaul                                                                                                         | lot  | 1        |                            |                | Attachment 5, Line 3 Page 4 |                        |                                    |
| Rotor Pole Refurbishment                                                                                                                | each | 28       |                            |                | Attachment 5, Line 4 Page 4 |                        |                                    |
| Re-Assembly of Rotor                                                                                                                    | lot  | 1        |                            |                | Attachment 5, Line 5 Page 4 |                        |                                    |
| Exciter Refurb                                                                                                                          | lot  | 1        |                            |                |                             |                        |                                    |
|                                                                                                                                         |      |          | Sub-Total                  |                |                             |                        |                                    |
| <b>Contracts</b>                                                                                                                        |      |          |                            |                |                             |                        |                                    |
| Stator Testing and Investigation                                                                                                        | lot  | 1        |                            |                | Attachment 4, Page 3        |                        |                                    |
|                                                                                                                                         |      |          | Sub-Total                  |                |                             |                        |                                    |
| <b>Consulting</b>                                                                                                                       |      |          |                            |                |                             |                        |                                    |
| Engineering Lift Plan                                                                                                                   | lot  | 1        | \$ 10,000                  | \$ 10,000      |                             |                        |                                    |
|                                                                                                                                         |      |          | Sub-Total                  | \$ 10,000      |                             |                        |                                    |
| <b>Meals</b>                                                                                                                            |      |          |                            |                |                             |                        |                                    |
| Meals                                                                                                                                   | lot  | 1        | \$ 3,050                   | \$ 3,050       |                             |                        |                                    |
|                                                                                                                                         |      |          | Sub-Total                  | \$ 3,050       |                             |                        |                                    |
| <b>Freight Postage Delivery</b>                                                                                                         |      |          |                            |                |                             |                        |                                    |
| Stator Transport                                                                                                                        | lot  | 1        | \$ 16,632                  | \$ 16,632      |                             |                        |                                    |
| Rotor Transport                                                                                                                         | lot  | 1        |                            |                | Attachment 5, Line 7 Page 4 |                        |                                    |
|                                                                                                                                         |      |          | Sub-Total                  |                |                             |                        |                                    |
| <b>Rental/Maint of Equipment</b>                                                                                                        |      |          |                            |                |                             |                        |                                    |
| Crane Rental for Stator                                                                                                                 | lot  | 1        | \$ 4,000                   | \$ 4,000       |                             |                        |                                    |
| Crane Rental for Rotor                                                                                                                  | lot  | 1        | \$ 6,000                   | \$ 6,000       |                             |                        |                                    |
| Scaffolding                                                                                                                             | lot  | 1        | \$ 10,384                  | \$ 10,384      |                             |                        |                                    |
|                                                                                                                                         |      |          | Sub-Total                  | \$ 20,384      |                             |                        |                                    |
| <b>Other Goods and Services</b>                                                                                                         |      |          |                            |                |                             |                        |                                    |
| Contingency                                                                                                                             | %    | 20%      | \$ 1,921,943               | \$ 384,389     |                             |                        |                                    |
|                                                                                                                                         |      |          | Sub-Total                  | \$ 384,389     |                             |                        |                                    |
| <b>Interest Capitalized</b>                                                                                                             |      |          |                            |                |                             |                        |                                    |
| AFUDC                                                                                                                                   |      |          |                            | \$ 27,209      |                             |                        |                                    |
|                                                                                                                                         |      |          | Sub-Total                  | \$ 27,209      |                             |                        |                                    |
| <b>Administrative Overhead</b>                                                                                                          |      |          |                            |                |                             |                        |                                    |
| Administrative Overhead                                                                                                                 |      |          |                            | \$ 232,641     |                             |                        |                                    |
| Contractor Admin Overhead                                                                                                               |      |          |                            | \$ 20,989      |                             |                        |                                    |
|                                                                                                                                         |      |          | Sub-Total                  | \$ 253,629     |                             |                        |                                    |
|                                                                                                                                         |      |          | Sub-Total (no AO, AFUDC)   | \$ 2,306,332   |                             |                        |                                    |
|                                                                                                                                         |      |          | TOTAL (AO, AFUDC included) | \$ 2,587,170   |                             |                        |                                    |
| Original Cost                                                                                                                           |      |          |                            | \$ 1,084,509   |                             |                        |                                    |

Note 1: The labour figures noted above are an average of salaries across a variety of jobs within similar classifications including fringe, and are used solely for budgeting purposes.

Note 2: Small differences in totals are attributable to rounding.



**Instructions:** Select option in Column B.  
Columns C through G will auto-populate.

Document No: XXX-XX-XXXX-XXXX

| Project Cost Estimate Input Checklist and Maturity Matrix            |                        |                         |         |         |         |         |
|----------------------------------------------------------------------|------------------------|-------------------------|---------|---------|---------|---------|
| Hydropower                                                           | Required fields:       | Estimate Classification |         |         |         |         |
| Project Name: HYD Hollow Bridge Generator Refurbishment              | Started or Preliminary | Class 5                 | Class 4 | Class 3 | Class 2 | Class 1 |
| Maturity Level of Project Definition Deliverables                    | Defined or Complete    |                         |         |         |         |         |
| General Project Data                                                 |                        |                         |         |         |         |         |
| <b>A. Scope</b>                                                      |                        |                         |         |         |         |         |
| Project Scope of Work Description                                    | Defined (D)            | P                       | P       | D       | D       | D       |
| Site Infrastructure (Access, Construction Power, Camp, etc.)         | Defined (D)            | NR                      | P       | D       | D       | D       |
| <b>B. Capacity</b>                                                   |                        |                         |         |         |         |         |
| Facility Output / Production Profile                                 | Defined (D)            | P                       | P       | D       | D       | D       |
| Electrical Power Requirements (when not the primary capacity driver) | Defined (D)            | NR                      | P       | D       | D       | D       |
| <b>C. Project Location</b>                                           |                        |                         |         |         |         |         |
| Plant and Associated Facilities                                      | Defined (D)            | P                       | P       | D       | D       | D       |
| <b>D. Requirements</b>                                               |                        |                         |         |         |         |         |
| Codes and/or Standards                                               | Defined (D)            | NR                      | P       | D       | D       | D       |
| Communication Systems                                                | Not Applicable (NA)    | NR                      |         |         |         |         |
| Fire Protection and Life Safety                                      | Defined (D)            | NR                      | P       | D       | D       | D       |
| Environmental Monitoring                                             | Defined (D)            | NR                      | NR      | P       | P       | D       |
| <b>E. Technology Selection</b>                                       |                        |                         |         |         |         |         |
| Not Applicable                                                       |                        |                         |         |         |         |         |
| <b>F. Strategy</b>                                                   |                        |                         |         |         |         |         |
| Contracting/Sourcing                                                 | Defined (D)            | NR                      | P       | D       | D       | D       |
| Escalation                                                           | Defined (D)            | NR                      | P       | D       | D       | D       |
| <b>G. Planning</b>                                                   |                        |                         |         |         |         |         |
| Regulatory Approval & Permitting                                     | Preliminary (P)        | P                       | P       |         |         |         |
| Material Utilization (Borrow Sources)                                | Preliminary (P)        | P                       |         | P/D     |         |         |
| Logistics Plan                                                       | Defined (D)            | P                       | P       | P       | D       | D       |
| Work Breakdown Structure (WBS)                                       | Defined (D)            | P                       | P       | P/D     | D       | D       |
| Decommissioning/Demolition Plan                                      | Defined (D)            | NR                      | P       | D       | D       | D       |
| Integrated Project Plan                                              | Not Applicable (NA)    | NR                      |         |         |         |         |
| Project Code of Accounts                                             | Defined (D)            | NR                      | P       | D       | D       | D       |
| Project Schedule                                                     | Defined (D)            | NR                      | P       | D       | D       | D       |
| Risk Register                                                        | Defined (D)            | NR                      | P       | D       | D       | D       |
| Stakeholder Consultation/Engagement/Management Plan                  | Defined (D)            | NR                      | P       | D       | D       | D       |
| Start-up & Commissioning Plan                                        | Defined (D)            | NR                      | P       | P/D     | D       | D       |
| <b>H. Studies</b>                                                    |                        |                         |         |         |         |         |
| Hydraulics                                                           | Not Applicable (NA)    |                         |         |         |         |         |
| Topography & Bathymetry                                              | Not Applicable (NA)    |                         |         |         |         |         |
| Environmental Impact/Sustainability Assessment                       | Not Applicable (NA)    | NR                      |         |         |         |         |
| Environment/Existing Conditions                                      | Not Applicable (NA)    | NR                      |         |         |         |         |
| Soils & Hydrology                                                    | Not Applicable (NA)    | NR                      |         |         |         |         |
| Geotechnical Investigation                                           | Not Applicable (NA)    | NR                      |         |         |         |         |
| <b>Technical Deliverables (Specifications and/or Drawings)</b>       |                        |                         |         |         |         |         |
| Block Flow Diagrams                                                  | Not Applicable (NA)    |                         |         |         |         |         |
| Hydraulic Design & Probable Maximum Flood (PMF)                      | Not Applicable (NA)    |                         |         |         |         |         |
| Equipment Data Sheets                                                | Preliminary (P)        | NR/S                    | P       |         |         |         |
| Equipment Lists: Electrical                                          | Preliminary (P)        | NR/S                    | P       |         |         |         |
| Equipment Lists: Process/Utility/Mechanical                          | Preliminary (P)        | NR/S                    | P       |         |         |         |
| Design Specifications                                                | Complete (C)           | NR                      | S/P     | C       | C       | C       |
| Electrical One-Line Drawings                                         | Complete (C)           | NR                      | S/P     | C       | C       | C       |
| General Equipment Arrangement Drawings                               | Complete (C)           | NR                      | S/P     | C       | C       | C       |
| Instrument List                                                      | Complete (C)           | NR                      | S/P     | C       | C       | C       |
| Construction Permits                                                 | Preliminary (P)        | NR                      | S/P     | P/C     |         |         |
| Civil/Structural/Architectural Discipline Drawings                   | Complete (C)           | NR                      | S/P     | P       | C       | C       |
| Demolition Plans and Drawings                                        | Complete (C)           | NR                      | S/P     | P       | C       | C       |
| Erosion Control Plan & Drawings                                      | Not Applicable (NA)    | NR                      |         |         |         |         |
| Fire Protection & Life Safety Drawings & Details                     | Complete (C)           | NR                      | S/P     | P       | C       | C       |
| Mitigation Measures (Aquatic, Terrestrial, Heritage, etc.)           | Started (S)            | NR                      | P       |         |         |         |
| Dam Design & Drawings                                                | Not Applicable (NA)    | NR                      |         |         |         |         |
| De-silting Basins                                                    | Not Applicable (NA)    | NR                      |         |         |         |         |
| Gates & Cranes Design & Drawings                                     | Not Applicable (NA)    | NR                      |         |         |         |         |
| Intake Design & Drawings                                             | Not Applicable (NA)    | NR                      |         |         |         |         |
| Penstock Design & Drawings                                           | Not Applicable (NA)    | NR                      |         |         |         |         |
| Powerhouse Design & Drawings                                         | Complete (C)           | NR                      | P       | P       | P/C     | C       |
| Spillway Design & Drawings                                           | Not Applicable (NA)    | NR                      |         |         |         |         |
| Turbine and Generator Design & Drawings                              | Preliminary (P)        | NR                      | P       | P       | P/C     |         |
| Electrical Schedules                                                 | Complete (C)           | NR                      | NR/S    | P       | P/C     | C       |
| Instrument & Control Schedules                                       | Complete (C)           | NR                      | NR/S    | P       | P/C     | C       |
| Instrument Data Sheets                                               | Complete (C)           | NR                      | NR/S    | P       | P/C     | C       |
| Spare Parts Listings                                                 | Preliminary (P)        | NR                      | NR      | P       | P/C     |         |
| Electrical Discipline Drawings                                       | Preliminary (P)        | NR                      | NR      | S/P     | P/C     |         |
| Facility Emergency Communication Plan & Drawings                     | Preliminary (P)        | NR                      | NR      | S/P     | P/C     |         |
| Information Systems/Telecommunication Drawings                       | Not Applicable (NA)    | NR                      | NR      |         |         |         |
| Instrumentation/Control System Discipline Drawings                   | Preliminary (P)        | NR                      | NR      | S/P     | P/C     |         |
| Mechanical Discipline Drawings                                       | Complete (C)           | NR                      | NR      | S/P     | P/C     | C       |
| Auxiliary Electrical Design & Drawings                               | Not Applicable (NA)    | NR                      | NR      |         |         |         |
| Auxiliary Mechanical Design & Drawings                               | Not Applicable (NA)    | NR                      | NR      |         |         |         |
| Protection & Controls System Design & Drawings                       | Started (S)            | NR                      | NR      | S       |         |         |
| Total # Deliverables for Class Estimate                              |                        | 7                       | 33      | 38      | 35      | 30      |
| % Defined/Complete towards Class Estimate                            |                        | 100%                    | 100%    | 88%     | 81%     | 70%     |

**Comments:**

This project is being submitted as a Class 3 estimate. The defined deliverables of this project indicate that 88% of the Class 3 deliverables have been completed. A contingency value of 20% was selected to account for specific risks such as deteriorated copper in the rotor windings as well as the presence of asbestos. These factors cannot be fully assessed until the rotor arrives at the rewind facility, where a detailed inspection can be completed. Contingency may also be used for any unforeseen requirement of overtime, or the increase to material on contract costs.

## Legend:

The maturity level is an approximation of the completion status of the deliverable. The completion is indicated by the following descriptors:

### General Project Data:

- Not Required (NR): May not be required for all estimates of the specified class, but specific project estimates may require at least preliminary development.
- Preliminary (P): Project definition has begun and progressed to at least an intermediate level of completion. Review and approvals for its current status has occurred.
- Defined (D): Project definition is advanced, and reviews have been conducted. Development may be near completion with the exception of final approvals.

### Technical Deliverables:

- Not Required (NR): Deliverable may not be required for all estimates of the specified class, but specific project estimates may require at least preliminary development.
- Started (S): Work on the deliverable has begun. Development is typically limited to sketches, rough outlines, or similar levels of early completion.
- Preliminary (P): Work on the deliverable is advanced. Interim, cross-functional reviews have usually been conducted. Development may be near completion except for final reviews and approvals.
- Complete (C): The deliverable has been reviewed and approved as appropriate.

## Inclusions

For the purposes of this document, the term *hydropower industries* is assumed to include private and public utilities involved with the production of electrical power, exclusive of transmission and distribution, using natural gravitational force of falling or flowing water, excluding tidal forces, to drive a turbine that powers a generator.

The common thread among private and public utilities (for the purpose of estimate classification) is their reliance on user requirements, statement of objectives, design reports (i.e. geotechnical investigations, sourcing borrow materials and hydraulic design/modeling) and/or environmental data collection and studies as primary scope defining documents. These documents are key deliverables in determining the degree of project definition, and thus the extent and maturity of estimate input information.

Cost estimates for hydropower facilities are typically composed of key features such as:

- Reservoir area preparation (e.g., clearing, removal of structures and earthmoving).
- River management (e.g., cofferdams, diversion channels or tunnels, sediment management plans, environmental monitoring programs).
- Principal structures (e.g., dams, dykes, intakes, penstocks, powerhouse(s), low level outlet(s), power tunnel(s), de-silting basin(s), and spillway structure(s)).
- Permanent infrastructure (e.g., access roads, railroads, bridges, offices, warehouse and housing).
- Temporary infrastructure (e.g., construction camp, site access roads, airport, workshops, construction power etc).
- Environmental mitigation features (e.g. fish ladder(s), water bypass and creation of new fish or wildlife habitat).
- Owner's costs (e.g., stakeholder involvement, licensing, studies and investigations, administration and overhead, catering.).

Some, but not all, of these features are unique to the hydropower industries.

Typical hydropower facilities may include: turbines, generators, exciters, governors, transformers, gates for intake, spillway and draft tubes, and supporting electrical, mechanical, telecom, protection, and control systems. The water storage reservoir is typically required to support the operations of the hydropower facility.



# **HOLLOW BRIDGE STATOR REPAIR**

**PO 2162345**

**NTS JOB 60387  
OCTOBER 21,2025**

The information contained in this report is in reference to the work complete at the Hollow bridge generating station which began on September 16, 2025. Prior to starting work a site visit was conducted by Edward Newhook from NorthPoint Technical Services (NTS) on September 11<sup>th</sup>.

Prior to the visit on September 11<sup>th</sup> Nova Scotia Power (NSP) had already identified a failure that had occurred in phase B of the winding which was located at the bottom of the slot section where the coil exits the stator iron. During the visit the winding connection was identified which found the generator connection was as follows:

- Total slots: 240
- Coils per phase: 80
- Groups per phase: 28
- Number of parallel circuits: 2
- Groups per parallel: 14
- Each parallel having 12 groups of three coils and two groups of 2 coils.

Based on the discussion while on site it was suggested by NTS that it was possible to bypass coils in the damaged area.

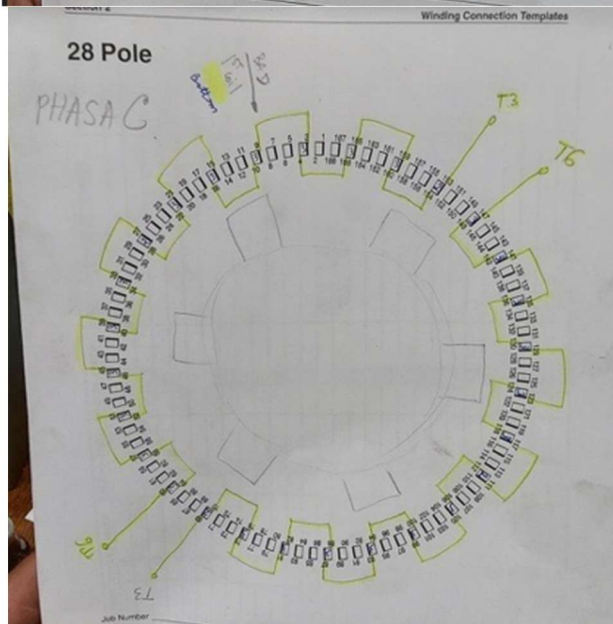
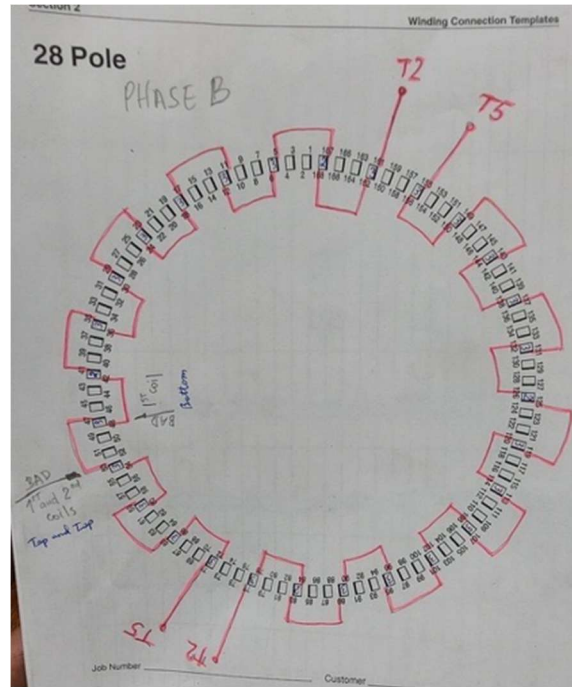
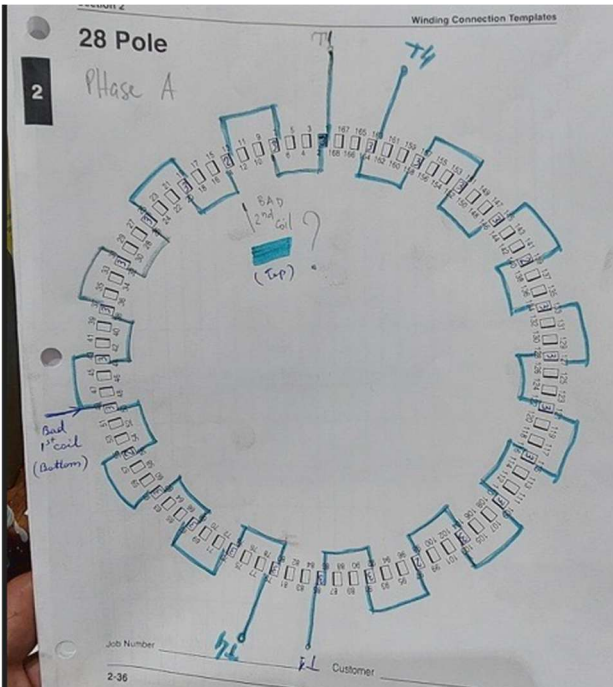
As noted above, on September 16<sup>th</sup> two technicians from NTS arrived on site and began evaluation of the unit to confirm the failure location and investigate if the unit had failed in more than the one area that was found by NSP prior to the September 11<sup>th</sup> site visit.

The task on site was to completely map the winding connection identifying by phase and identify the coils in each group so that any defective coils could be easily identified. The importance of this step is to be able to provide engineering with the correct information to ensure the proper coils are bypassed to balance the winding.

### **Balancing of the winding:**

It is important to understand the requirement of maintaining a balanced winding in such circumstances as this. Due to each phase having two parallel circuits it is very important to have the same number of coils in each parallel, if this is not the case there would be circulating currents within the winding while in operation. Circulating currents will cause heating in the respective phase which can lead to failure. It is also important to have the same number of coils in each phase. While in operation the voltage from the generator builds through the connection from the wye point to the main terminal leads through each turn within a coil. In this case as we have 40 coils with 4 turns per coil in each parallel the voltage would build from zero at the wye point to 3988V at the main terminal (6900L-L / 1.73) or 24.9V per turn. If we have a different number of coils per phase we would have a voltage unbalance at the main terminals.

Below are the initial three winding diagrams which identify the winding connection for the machine. This initial inspection identified that there were failures in each of the three phases, these are identified on the drawings as "bad coil."



Above picture showing one of the coils which had failed.

Next the coils which were identified as defective or “bad” were isolated from the remainder of the circuit so that insulation resistance testing could be completed.

Once this was completed, testing found that there were additional grounded coils in the winding. To identify where the additional grounds were located the technician removed the connection of the parallels, splitting each phase into two circuit

In areas where additional grounds occurred the technicians had to isolate the failed coils by splitting the circuit by opening the connection between groups creating multiple coil segments.

For example, each parallel has 14 groups so the jumper between group 7 and 8 would be cut to isolate the section and make two segments. If group 1-7 showed a ground fault but segment 8-14 passed no additional cutting would take place in segment 8-14. Where segment 1-7 would be cut again between group 4-5 to identify the fault. This process would continue until the fault was identified down to a single group of two or three coils. The group of coils were then split to determine which coil had the fault.

A sample of this testing is shown below for each phase. During the testing it was identified that the stator winding was very susceptible to moisture. NSPI installed heaters under the unit to help prevent moisture from hindering the ability to test.

| PHASE A                                                                          |       |    |      |         |       |                                 |      |         |       |    |      |
|----------------------------------------------------------------------------------|-------|----|------|---------|-------|---------------------------------|------|---------|-------|----|------|
| CIRCUIT 1                                                                        |       |    |      |         |       | CIRCUIT 2                       |      |         |       |    |      |
| SECTION 1 (NO. OF GROUPS 5)                                                      |       |    |      |         |       | SECTION 4 (NO. OF GROUPS 5)     |      |         |       |    |      |
| START LEAD 1                                                                     |       |    |      |         |       | START LEAD 85                   |      |         |       |    |      |
| FINISH LEAD 26                                                                   |       |    |      |         |       | FINISH LEAD 110                 |      |         |       |    |      |
| 1 MINUTE IR RESULTS                                                              |       |    |      |         |       | 1 MINUTE IR RESULTS             |      |         |       |    |      |
| PASS / FAIL                                                                      |       |    |      |         |       | PASS / FAIL                     |      |         |       |    |      |
| 1000VDC                                                                          | 12500 | MD | PASS | 1000VDC | 20000 | MD                              | PASS | 1000VDC | 20000 | MD | PASS |
| 2500VDC                                                                          | 15500 | MD | PASS | 2500VDC | 23000 | MD                              | PASS | 2500VDC | 23000 | MD | PASS |
| 5000VDC                                                                          | 18500 | MD | PASS | 5000VDC | 27500 | MD                              | PASS | 5000VDC | 27500 | MD | PASS |
| HI POT TEST                                                                      |       |    |      |         |       | HI POT TEST                     |      |         |       |    |      |
| PASS / FAIL                                                                      |       |    |      |         |       | PASS / FAIL                     |      |         |       |    |      |
| 11.7KV DC (25KVA) 0.463 $\mu$ A                                                  |       |    |      |         |       | 11.7KV DC (25KVA) 0.409 $\mu$ A |      |         |       |    |      |
| PASS                                                                             |       |    |      |         |       | PASS                            |      |         |       |    |      |
| SECTION 2 (NO. OF GROUPS 5)                                                      |       |    |      |         |       | SECTION 5 (NO. OF GROUPS 5)     |      |         |       |    |      |
| START LEAD 32                                                                    |       |    |      |         |       | START LEAD 116                  |      |         |       |    |      |
| FINISH LEAD 55                                                                   |       |    |      |         |       | FINISH LEAD 139                 |      |         |       |    |      |
| 1 MINUTE IR RESULTS                                                              |       |    |      |         |       | 1 MINUTE IR RESULTS             |      |         |       |    |      |
| PASS / FAIL                                                                      |       |    |      |         |       | PASS / FAIL                     |      |         |       |    |      |
| 1000VDC                                                                          | 12500 | MD | PASS | 1000VDC | 17000 | MD                              | PASS | 1000VDC | 17000 | MD | PASS |
| 2500VDC                                                                          | 16000 | MD | PASS | 2500VDC | 21500 | MD                              | PASS | 2500VDC | 21500 | MD | PASS |
| 5000VDC                                                                          | 20000 | MD | PASS | 5000VDC | 25000 | MD                              | PASS | 5000VDC | 25000 | MD | PASS |
| HI POT TEST                                                                      |       |    |      |         |       | HI POT TEST                     |      |         |       |    |      |
| PASS / FAIL                                                                      |       |    |      |         |       | PASS / FAIL                     |      |         |       |    |      |
| 11.7KV DC (25KVA) 0.917 $\mu$ A                                                  |       |    |      |         |       | 11.7KV DC (25KVA) 0.562 $\mu$ A |      |         |       |    |      |
| PASS                                                                             |       |    |      |         |       | PASS                            |      |         |       |    |      |
| SECTION 3 (NO. OF GROUPS 4)                                                      |       |    |      |         |       | SECTION 6 (NO. OF GROUPS 4)     |      |         |       |    |      |
| START LEAD 61                                                                    |       |    |      |         |       | START LEAD 145                  |      |         |       |    |      |
| FINISH LEAD 79                                                                   |       |    |      |         |       | FINISH LEAD 163                 |      |         |       |    |      |
| 1 MINUTE IR RESULTS                                                              |       |    |      |         |       | 1 MINUTE IR RESULTS             |      |         |       |    |      |
| PASS / FAIL                                                                      |       |    |      |         |       | PASS / FAIL                     |      |         |       |    |      |
| 1000VDC (500VDC)                                                                 | 0.1   | MD | FAIL | 1000VDC | 12000 | MD                              | PASS | 1000VDC | 12000 | MD | PASS |
| 2500VDC                                                                          |       | MD |      | 2500VDC | 15000 | MD                              | PASS | 2500VDC | 15000 | MD | PASS |
| 5000VDC                                                                          |       | MD |      | 5000VDC | 18000 | MD                              | PASS | 5000VDC | 18000 | MD | PASS |
| HI POT TEST                                                                      |       |    |      |         |       | HI POT TEST                     |      |         |       |    |      |
| PASS / FAIL                                                                      |       |    |      |         |       | PASS / FAIL                     |      |         |       |    |      |
| 11.7KV DC $\mu$ A                                                                |       |    |      |         |       | 11.7KV DC $\mu$ A               |      |         |       |    |      |
| FAIL                                                                             |       |    |      |         |       | FAIL                            |      |         |       |    |      |
| NOTES:<br>* Discharged at 5800V<br>Hand Held Megger reads 0.5 M $\Omega$ @ 1000V |       |    |      |         |       |                                 |      |         |       |    |      |

| PHASE B                          |       |    |      |                  |       |                                |      |         |       |    |      |
|----------------------------------|-------|----|------|------------------|-------|--------------------------------|------|---------|-------|----|------|
| CIRCUIT 1                        |       |    |      |                  |       | CIRCUIT 2                      |      |         |       |    |      |
| SECTION 1 (NO. OF GROUPS 5)      |       |    |      |                  |       | SECTION 4 (NO. OF GROUPS 5)    |      |         |       |    |      |
| START LEAD 77                    |       |    |      |                  |       | START LEAD 161                 |      |         |       |    |      |
| FINISH LEAD 102                  |       |    |      |                  |       | FINISH LEAD 18                 |      |         |       |    |      |
| 1 MINUTE IR RESULTS              |       |    |      |                  |       | 1 MINUTE IR RESULTS            |      |         |       |    |      |
| PASS / FAIL                      |       |    |      |                  |       | PASS / FAIL                    |      |         |       |    |      |
| 1000VDC (500VDC)                 | 0.5   | MD | Fail | 1000VDC          | 15000 | MD                             | PASS | 1000VDC | 15000 | MD | PASS |
| 2500VDC                          |       | MD |      | 2500VDC          | 19000 | MD                             | PASS | 2500VDC | 19000 | MD | PASS |
| 5000VDC                          |       | MD |      | 5000VDC          | 23000 | MD                             | PASS | 5000VDC | 23000 | MD | PASS |
| HI POT TEST                      |       |    |      |                  |       | HI POT TEST                    |      |         |       |    |      |
| PASS / FAIL                      |       |    |      |                  |       | PASS / FAIL                    |      |         |       |    |      |
| 11.7KV DC $\mu$ A                |       |    |      |                  |       | 11.7KV DC $\mu$ A              |      |         |       |    |      |
| FAIL                             |       |    |      |                  |       | FAIL                           |      |         |       |    |      |
| SECTION 2 (NO. OF GROUPS 5)      |       |    |      |                  |       | SECTION 5 (NO. OF GROUPS 5)    |      |         |       |    |      |
| START LEAD 108                   |       |    |      |                  |       | START LEAD 24                  |      |         |       |    |      |
| FINISH LEAD 131                  |       |    |      |                  |       | FINISH LEAD 47                 |      |         |       |    |      |
| 1 MINUTE IR RESULTS              |       |    |      |                  |       | 1 MINUTE IR RESULTS            |      |         |       |    |      |
| PASS / FAIL                      |       |    |      |                  |       | PASS / FAIL                    |      |         |       |    |      |
| 1000VDC                          | 50000 | MD | PASS | 1000VDC          | 12000 | MD                             | PASS | 1000VDC | 12000 | MD | PASS |
| 2500VDC                          | 35000 | MD | PASS | 2500VDC          | 12500 | MD                             | PASS | 2500VDC | 12500 | MD | PASS |
| 5000VDC                          | 40000 | MD | PASS | 5000VDC          | 13000 | MD                             | PASS | 5000VDC | 13000 | MD | PASS |
| HI POT TEST                      |       |    |      |                  |       | HI POT TEST                    |      |         |       |    |      |
| PASS / FAIL                      |       |    |      |                  |       | PASS / FAIL                    |      |         |       |    |      |
| 11.7KV DC (55KVA) 0.329 $\mu$ A  |       |    |      |                  |       | 11.7KV DC (55KVA) 1.43 $\mu$ A |      |         |       |    |      |
| PASS                             |       |    |      |                  |       | PASS                           |      |         |       |    |      |
| SECTION 3 (NO. OF GROUPS 4)      |       |    |      |                  |       | SECTION 6 (NO. OF GROUPS 4)    |      |         |       |    |      |
| START LEAD 137                   |       |    |      |                  |       | START LEAD 53                  |      |         |       |    |      |
| FINISH LEAD 155                  |       |    |      |                  |       | FINISH LEAD 71                 |      |         |       |    |      |
| 1 MINUTE IR RESULTS              |       |    |      |                  |       | 1 MINUTE IR RESULTS            |      |         |       |    |      |
| PASS / FAIL                      |       |    |      |                  |       | PASS / FAIL                    |      |         |       |    |      |
| 1000VDC                          | 15000 | MD | PASS | 1000VDC (500VDC) |       | MD                             | Fail | 1000VDC | 15000 | MD | PASS |
| 2500VDC                          | 20000 | MD | PASS | 2500VDC          |       | MD                             |      | 2500VDC | 20000 | MD | PASS |
| 5000VDC                          | 25000 | MD | PASS | 5000VDC          |       | MD                             |      | 5000VDC | 25000 | MD | PASS |
| HI POT TEST                      |       |    |      |                  |       | HI POT TEST                    |      |         |       |    |      |
| PASS / FAIL                      |       |    |      |                  |       | PASS / FAIL                    |      |         |       |    |      |
| 11.7KV DC (55KVA) 0.337 $\mu$ A  |       |    |      |                  |       | 11.7KV DC $\mu$ A              |      |         |       |    |      |
| PASS                             |       |    |      |                  |       |                                |      |         |       |    |      |
| NOTES:<br>* Discharged at 11.7KV |       |    |      |                  |       |                                |      |         |       |    |      |

| PHASE C                     |                     |      |                                                                                                                                             |                   |      |
|-----------------------------|---------------------|------|---------------------------------------------------------------------------------------------------------------------------------------------|-------------------|------|
| CIRCUIT 1                   |                     |      | CIRCUIT 2                                                                                                                                   |                   |      |
| SECTION 1 (NO. OF GROUPS 1) |                     |      | SECTION 1 (NO. OF GROUPS 2)                                                                                                                 |                   |      |
| START LEAD 51               |                     |      | START LEAD 69                                                                                                                               |                   |      |
| FINISH LEAD 52              |                     |      | FINISH LEAD 78                                                                                                                              |                   |      |
| 1 MINUTE IR RESULTS         |                     |      | 1 MINUTE IR RESULTS                                                                                                                         |                   |      |
| 1000VDC                     | 45000 MD            | PASS | 1000VDC                                                                                                                                     | 16000 MD          | PASS |
| 2500VDC                     | 57000 MD            | PASS | 2500VDC                                                                                                                                     | 19000 MD          | PASS |
| 5000VDC                     | 56000 MD            | PASS | 5000VDC                                                                                                                                     | 21000 MD          | PASS |
| HI POT TEST                 |                     |      | HI POT TEST                                                                                                                                 |                   |      |
| 11.7KV DC                   | (61.5kMVA) 0.190 uA | PASS | 11.7KV DC                                                                                                                                   | (24kMVA) 0.430 uA | PASS |
| SECTION 2 (NO. OF GROUPS 2) |                     |      | SECTION 2 (NO. OF GROUPS 3)                                                                                                                 |                   |      |
| START LEAD 57               |                     |      | START LEAD 81                                                                                                                               |                   |      |
| FINISH LEAD 63              |                     |      | FINISH LEAD 94                                                                                                                              |                   |      |
| 1 MINUTE IR RESULTS         |                     |      | 1 MINUTE IR RESULTS                                                                                                                         |                   |      |
| 1000VDC                     | 15000 MD            | PASS | 1000VDC                                                                                                                                     | 13000 MD          | PASS |
| 2500VDC                     | 17500 MD            | PASS | 2500VDC                                                                                                                                     | 14800 MD          | PASS |
| 5000VDC                     | 19500 MD            | PASS | 5000VDC                                                                                                                                     | 16000 MD          | PASS |
| HI POT TEST                 |                     |      | HI POT TEST                                                                                                                                 |                   |      |
| 11.7KV DC                   | (22kMVA) 0.534 uA   | PASS | 11.7KV DC                                                                                                                                   | (27kMVA) 0.435 uA | PASS |
| SECTION 3 (NO. OF GROUPS )  |                     |      | SECTION 3 (NO. OF GROUPS 1)                                                                                                                 |                   |      |
| START LEAD                  |                     |      | START LEAD 129                                                                                                                              |                   |      |
| FINISH LEAD                 |                     |      | FINISH LEAD 130                                                                                                                             |                   |      |
| 1 MINUTE IR RESULTS         |                     |      | 1 MINUTE IR RESULTS                                                                                                                         |                   |      |
| 1000VDC                     |                     | MD   | 1000VDC                                                                                                                                     | 47000 MD          | PASS |
| 2500VDC                     |                     | MD   | 2500VDC                                                                                                                                     | 50000 MD          | PASS |
| 5000VDC                     |                     | MD   | 5000VDC                                                                                                                                     | 55000 MD          | PASS |
| HI POT TEST                 |                     |      | HI POT TEST                                                                                                                                 |                   |      |
| 11.7KV DC                   |                     | uA   | 11.7KV DC                                                                                                                                   |                   | FAIL |
| NOTES:                      |                     |      | Section 4 (6) 2 group<br>start lead 141<br>Finish lead 147<br>1000V DC 20000 MVA PASS<br>2500V DC 24000 MVA PASS<br>5000V DC 29000 MVA PASS |                   |      |



Above picture showing a jumper that would have been cut to isolate a segment of the winding for testing.

Once all testing was completed there were a total of 11 coils within the winding that had either failed an insulation resistance test or a 11,700v high potential test. The remaining 229 coils passed a 11,700v DC high potential test. The value of 11,700v test value was selected based on the principle that this would be the equivalent voltage stress on the winding while in operation using the IEEE multiplier of 1.7 times ac voltage stress. It was accepted by NSP that once the coils had passed the high potential test they would not be tested again at high potential. All further testing would be polarization index testing at 5000vdc.

The table below was established by engineering to identify which of the 24 coils would have to be bypassed in the winding to either remove defective coils from the circuit or balance the winding.

| PHASE              | A  | A  | A   | A   | A   | A   |
|--------------------|----|----|-----|-----|-----|-----|
| CIRCUIT            | 1  | 1  | 1   | 2   | 2   | 2   |
| GROUP START        | 67 | 62 | 44  | 151 | 127 | 115 |
| GROUP FINISH       | 68 | 61 | 43  | 152 | 128 | 116 |
| COILS PER GROUP    | 3  | 3  | 3   | 3   | 3   | 3   |
| COIL LOCATION      |    |    |     |     |     |     |
| COIL DEFECTIVE     | X  | X  |     | X   |     |     |
| REMOVED TO BALANCE |    |    | X   |     | X   | X   |
| PHASE              | B  | B  | B   | B   | B   | B   |
| CIRCUIT            | 1  | 1  | 1   | 2   | 2   | 2   |
| GROUP START        | 47 | 59 | 167 | 125 | 143 | 77  |
| GROUP FINISH       | 48 | 60 | 168 | 126 | 144 | 78  |
| COILS PER GROUP    | 3  | 3  | 2   | 2   | 3   | 3   |
| COIL LOCATION      | 3  | 1  | 2   | 2   | 1   | 1   |
| COIL DEFECTIVE     | X  | X  | X   |     |     | X   |
| REMOVED TO BALANCE |    |    |     | X   | X   |     |

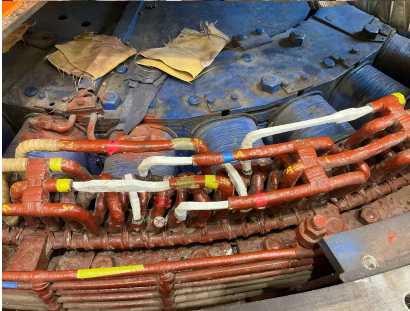
| PHASE           | C  | C  | C  | C   | C   | C  |
|-----------------|----|----|----|-----|-----|----|
| CIRCUIT         | 1  | 1  | 1  | 2   | 2   | 2  |
| GROUP START     | 46 | 10 | 33 | 135 | 130 | 75 |
| GROUP FINISH    | 45 | 9  | 32 | 136 | 129 | 76 |
| COILS PER GROUP | 3  | 3  | 3  | 3   | 3   | 3  |
| COIL LOCATION   | 1  | 1  | 3  | 3   | 3   | 1  |

Above noted 24 coils is 10% of the complete original winding which would be removed to balance the circuits. The removal of coils does add additional turn to turn stress on the coils, but NTS engineering supported the decision to move forward with repairs.

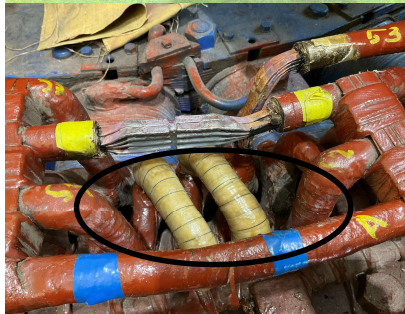
Next technicians had to begin the bypassing process. This would include the scope of work below:



Braze all previously cut jumpers that were cut to identify damaged coils



Insulate jumper connections with mica tape and epoxy (left) then protective glass tape over top (right)



Clean braze and insulate the 24 identified coils identified by engineering to balance the winding.

Once the connection was completed the technicians completed a winding resistance verification of each of the six parallel circuits to confirm the value was within an acceptable range. The readings were within 1% which was well within acceptable range.

Prior to connection of the six circuits to the circuit rings to complete the final connections it was decided that this would be a good opportunity to complete an insulation resistance (IR) test of the winding at 1000vdc. During the test one of the parallels in phase B showed very low IR . At that

time, it was believed that the low IR could be due to epoxy that was not yet fully cured. The next day NSP completed a Polarization index test at 5000vdc, several of the test showed very low IR and at least one circuit had failed to ground.

Based on the fact that all coils that still remain in the circuit had previously passed a 11,700 vdc high potential test, it was decided between NTS and NSP that there could be no level of certainty on the health of the winding if it was attempted to be put back in service. The final decision was to stop all work and do no further repairs to the machine.

Written with best regards,

Edward Newhook  
NorthPoint Technical Services  
Moncton, NB

|                                                                                   |                                             |                |
|-----------------------------------------------------------------------------------|---------------------------------------------|----------------|
|  | HYDRO AND WIND                              |                |
|                                                                                   | DATE ISSUED:<br>OCT 28 <sup>th</sup> , 2025 | REVISION DATE: |
| HOLLOW BRIDGE ROTOR TECHNICAL<br>MEMORANDUM                                       | REVISION NO. 1                              | Page 1 of 3    |

Subject: Hollow Bridge Rotor Condition Assessment

Date: October 28, 2025

Author: Frederick Porter PEng.

Senior Electrical Engineer – Hydro



## Executive Summary

The Hollow Bridge Generator rotor shows widespread insulation failure and poor winding conditions. Initial and segmented tests confirmed distributed ground wall degradation, unaffected by heating. Pole impedance is within acceptable limits, but winding materials suggest 1940s-era construction. Due to age and damage, full pole rewinding is recommended before returning the rotor to service.

## Historical Context

As part of the scoping activities for the Hollow Bridge Generator refurbishment, the condition of the rotor was assessed on October 22nd.

Operations reported a history of mediocre insulation quality associated with Hollow Bridge Rotor See Appendices. It has no historical record of refurbishment.

## Testing

A preliminary insulation resistance test was conducted on the rotor equipment, excluding the rotor interconnection leads. The test yielded a resistance value of 0Ω at 500 V and failed to build voltage using a Hikoi Insulation Tester.

Subsequent to the preliminary testing the rotor circuit was segmented into four equivalent quadrants to determine whether the insulation degradation was localized or distributed.

|                                                                                   |                                                         |                       |
|-----------------------------------------------------------------------------------|---------------------------------------------------------|-----------------------|
|  | HYDRO AND WIND                                          |                       |
|                                                                                   | <b>DATE ISSUED:</b><br><b>OCT 28<sup>th</sup>, 2025</b> | <b>REVISION DATE:</b> |
| HOLLOW BRIDGE ROTOR TECHNICAL<br>MEMORANDUM                                       | REVISION NO. 1                                          | Page 2 of 3           |

Each quadrant failed insulation testing, confirming that the poor ground wall insulation is distributed throughout the rotor.

The rotor was then heated to assess whether trapped moisture contributed to the insulation failures. No improvement was observed, suggesting that moisture is not the primary cause of poor insulation. All 4 segments failed insulation testing.

|             |               |                |        |
|-------------|---------------|----------------|--------|
| Poles 1-7   | 90kOhm @30Sec | 92kOhm @1Min   | 142VDC |
| Poles 8-15  | 47kOhm @30Sec | 48kOhm @1Min   | 76VDC  |
| Poles 16-21 | 2kOhm @30Sec  | 2kOhm @1Min    | 3VDC   |
| Poles 21-28 | 28kOhm @30Sec | 126kOhm @1Min* | 197VDC |

#### Pole Drop Test:

A pole drop test was performed to evaluate pole impedance. The maximum deviation observed was 1.4%, which is within acceptable limits and passes standard criteria.

#### Winding Condition and Refurbishment History

No records of prior rotor refurbishment are available. The winding condition appears poor and likely original. Interturn insulation material is unknown but appears to be a thin felt product which would be indicative of 1940s construction.

Disassembly of windings from the pole body is highly destructive to the ground wall insulation and typically necessitates its replacement. If the ground wall is replaced and the interturn windings are reused, the ground wall will likely be damaged again during any future refurbishment of the interturn windings.

#### Conclusion

The rotor exhibits widespread insulation degradation and poor winding condition, with no documented refurbishment history. These findings and considering the construction of the poles it is my recommendation that the poles be rewound prior to return to service.

|                                                                                   |                                                         |                       |
|-----------------------------------------------------------------------------------|---------------------------------------------------------|-----------------------|
|  | HYDRO AND WIND                                          |                       |
|                                                                                   | <b>DATE ISSUED:</b><br><b>OCT 28<sup>th</sup>, 2025</b> | <b>REVISION DATE:</b> |
| HOLLOW BRIDGE ROTOR TECHNICAL<br>MEMORANDUM                                       | REVISION NO. 1                                          | Page 3 of 3           |

## Appendix A

### Pole Drop Results

| Pole | VAC   | Deviation | Mean V | 4.298214 |
|------|-------|-----------|--------|----------|
| 1    | 4.3   | 0.04%     |        |          |
| 2    | 4.298 | 0.00%     |        |          |
| 3    | 4.266 | 0.75%     |        |          |
| 4    | 4.283 | 0.35%     |        |          |
| 5    | 4.275 | 0.54%     |        |          |
| 6    | 4.331 | 0.76%     |        |          |
| 7    | 4.295 | 0.07%     |        |          |
| 8    | 4.343 | 1.04%     |        |          |
| 9    | 4.289 | 0.21%     |        |          |
| 10   | 4.295 | 0.07%     |        |          |
| 11   | 4.286 | 0.28%     |        |          |
| 12   | 4.303 | 0.11%     |        |          |
| 13   | 4.265 | 0.77%     |        |          |
| 14   | 4.255 | 1.01%     |        |          |
| 15   | 4.284 | 0.33%     |        |          |
| 16   | 4.33  | 0.74%     |        |          |
| 17   | 4.298 | 0.00%     |        |          |
| 18   | 4.316 | 0.41%     |        |          |
| 19   | 4.288 | 0.24%     |        |          |
| 20   | 4.262 | 0.84%     |        |          |
| 21   | 4.238 | 1.40%     |        |          |
| 22   | 4.292 | 0.14%     |        |          |
| 23   | 4.267 | 0.73%     |        |          |
| 24   | 4.351 | 1.23%     |        |          |
| 25   | 4.345 | 1.09%     |        |          |
| 26   | 4.36  | 1.44%     |        |          |
| 27   | 4.306 | 0.18%     |        |          |
| 28   | 4.329 | 0.72%     |        |          |

Quantities and Prices NorthPoint / Wajax

Please provide lump sum pricing for the following items:

| Item                             | Price (CAD\$) |
|----------------------------------|---------------|
| Hollow Bridge Stator Unit Rewind |               |
| Delivery                         | 11 weeks      |
| Freight                          | \$0.00        |
| Warranty                         | 12/18 months  |
| Total                            |               |

PRICING FOR GLOBAL VPI OPTION

| Item           | Description                                                        | Lump Sum (CAD) |
|----------------|--------------------------------------------------------------------|----------------|
| 1              | Hollow Bridge Stator Unit Rewind Global VPI                        |                |
| 2              | Delivery for standard lead time weeks                              | 11 Weeks       |
| 3              | Freight                                                            |                |
| 4              | Warranty                                                           |                |
| 5              | Total                                                              |                |
| Option pricing |                                                                    |                |
| a              | Expedited delivery to reduce lead time to 9 weeks                  |                |
| b              | Expense to complete voltage endurance and Thermal Cycling of coils |                |

PRICING FOR B-STAGE COIL OPTION

| Item           | Description                                                        | Lump Sum (CAD) |
|----------------|--------------------------------------------------------------------|----------------|
| 1              | Hollow Bridge Stator Unit Rewind B-Stage coil system               |                |
| 2              | Delivery for standard lead time weeks                              | 21 Weeks       |
| 3              | Freight                                                            |                |
| 4              | Warranty                                                           |                |
| 5              | Total                                                              |                |
| Option pricing |                                                                    |                |
| a              | Expedited delivery to reduce lead time to 17 weeks                 |                |
| b              | Expense to complete voltage endurance and Thermal Cycling of coils |                |
| c              | Pricing to complete VPI process after rewind with B-Stage coils    |                |

# JOB ESTIMATE



NorthPoint Technical Services  
4920 - 43 Street SE  
Calgary, AB T2B3N3  
CANADA  
4032792211

**JOB NO** 00060387  
**RECEIVED DATE** 9/12/2025  
**PAGE** 1

**S** NOVA001CAD  
**O** NOVA SCOTIA POWER INC  
**L** PO BOX 910 STN CE  
**D** HALIFAX, NS B3J 3S8

**S** 3  
**H** NS POWER CORP HOLLOW BRIDGE  
**I** 1919 BLACK RIVER ROAD  
**P** WOLFVILLE, NS B4P2R1

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|---------------|-----------|---------------|

## NAMEPLATE DATA

No nameplate data

## SPECIAL INSTRUCTIONS

No special instructions

| LABOR CODE / ITEM ID | DESCRIPTION                                                                                                                                                                               | UNIT | QTY     | UNIT PRICE | EXTENSION |
|----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---------|------------|-----------|
| MN1001               | SHOP TIME IN PRPE FOR ON SITE QC REP                                                                                                                                                      | hour | 4.0000  |            |           |
| MN1002               | TRAVEL MONTREAL TO MONCTON QC REP                                                                                                                                                         | hour | 8.0000  |            |           |
| MN1001               | REVIEW SCOPE IN MONCTON QC REP                                                                                                                                                            | hour | 8.0000  |            |           |
| MN1002               | TRAVEL OFFICE TO SITE OT QC REP                                                                                                                                                           | hour | 5.0000  |            |           |
| MN1004               | ON SITE ELECTRICAL REPAIRS RT QC REP<br>72 HOURS ON SITE ESTIMATED UP TO SEPT 26.                                                                                                         | hour | 72.0000 |            |           |
| MN1004               | ON SITE ELECTRICAL TESTING OT QC REP<br>ON SITE 28 HOURS TOTAL 4 PER DAY UP TO SEPT 26 INCLUDING 10 HOURS STANDBY ON SEPTEMBER 20TH.                                                      | hour | 46.0000 |            |           |
| MN1007               | ON SITE AND TRAVEL DT QC REP<br>SIX HOURS STANDBY ON SEPT 21, FOUR HOURS TRAVEL ON SEPT 21 AND TWO HOURS PER DAY TRAVEL WHILE ON SITE DUE TO<br>ACCOMIDATION AVAILABILITY. 26 HOURS TOTAL | hour | 26.0000 |            |           |
| MN1006               | TRAVEL MONCTON TO MONTREAL RT QC REP                                                                                                                                                      | hour | 8.0000  |            |           |
| MN1001               | SHOP TIME IN PRPE FOR ON SITE MON REP                                                                                                                                                     | hour | 6.0000  |            |           |
| MN1001               | REVIEW SCOPE IN MONCTON MON REP                                                                                                                                                           | hour | 8.0000  |            |           |
| MN1002               | TRAVEL OFFICE TO SITE RT MON REP                                                                                                                                                          | hour | 5.0000  |            |           |
| MN1004               | ON SITE ELECTRICAL REPAIRS RT MON REP<br>72 HOURS ON SITE ESTIMATED UP TO SEPT 26.                                                                                                        | hour | 72.0000 |            |           |
| MN1004               | ON SITE ELECTRICAL REPAIRS OT MON REP<br>ON SITE 36 HOURS TOTAL 4 PER DAY TUESDAY TO FRIDAY AND 12 ON SATURDAY                                                                            | hour | 36.0000 |            |           |
| MN1007               |                                                                                                                                                                                           | hour | 20.0000 |            |           |

# JOB ESTIMATE



NorthPoint Technical Services  
4920 - 43 Street SE  
Calgary, AB T2B3N3  
CANADA  
4032792211

**JOB NO** 00060387  
**RECEIVED DATE** 9/12/2025  
**PAGE** 2

**S** NOVA001CAD  
**O** NOVA SCOTIA POWER INC  
**L** PO BOX 910 STN CE  
**D** HALIFAX, NS B3J 3S8

**T**  
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**S** 3  
**H** NS POWER CORP HOLLOW BRIDGE  
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ON SITE AND TRAVEL DT MON REP  
TWO HOURS PER DAY TRAVEL WHILE ON SITE DUE TO ACCOMIDATION AVABILITY. 26 HOURS TOTAL

|                                                                        |      |                |
|------------------------------------------------------------------------|------|----------------|
| MN1008                                                                 | HOUR | 6.0000         |
| COMPLETE SERVICE REPORT<br>INCLUDING DWG FILE OF WINDING DIAGRAM       |      |                |
| SIT-TRAVEL<br>FLIGHT<br>ESTIMATE \$900.00 + 15%                        | EA   | 1.0000         |
| SIT-TRAVEL<br>HOTEL<br>ESTIMATE \$165.00 PER NIGHT PLUS 15%            | EA   | 24.0000        |
| SIT-PER-DIEM<br>PAID PER-DIEM PAID DAILY                               | EA   | 26.0000        |
| SIT-MILEAGE<br><br>MILEAGE COST PAID PER KM                            | EA   | 1,400.00<br>00 |
| SIT-SHOP SUPPLIES<br>MISC SHOP SUPPLIES<br>ESTIMATED 5% OF LABOUR COST | EA   | 1.0000         |

NOTES  
QUOTE BASED ON FIVE DAYS ON SITE STARTING ON TUESDAY FINISHINNG ON SATURDAY.  
INVOICE WILL BE BASED ON ACTUAL HOURS  
ALL COST ARE COST PLS 15 PRECENT MARGIN

COMPLETION OF THE WORK  
BASED ON OUR KNOWLEDGE TO DATE OF THE WORK THAT WILL BE REQUIRED TO REPAIR THE STATOR WHICH WOULD INCLUDE:  
- CONECTION OF GROUP JUMPERS  
- BYPASS DAMAGED COILS  
- ISOLATE DAMAGED COILS TO BALANCE WINDING  
- INSULATE ALL REPAIRED AREAS AND REPLACE BLOCKING

WE ESITMATE THIS WILL TAKE TWO RES A TOTAL OF 10 DAYS ON SITE INCLUDING TESTING AND DEMOB FROM SITE.

|                                                                                                                                                             |      |         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------|------|---------|
| MN1004                                                                                                                                                      | HOUR | 60.0000 |
| ON SITE ELECTRICAL REPAIRS RT QC REP<br>60 HOURS ON SITE UP TO OCT 9, 2025                                                                                  |      |         |
| MN1004                                                                                                                                                      | HOUR | 29.0000 |
| ON SITE ELECTRICAL TESTING OT QC REP<br>ON SITE 4 HOURS PER DAY DURING WEEK DAYS UP TO OCT 6, 2025                                                          |      |         |
| MN1007                                                                                                                                                      | HOUR | 79.0000 |
| ON SITE ELECTRICAL TESTING DT QC REP<br>12 HOURS PER DAY FOR 2 SATURDAYS AND 2 SUNDAYS UP TO OCT 9. 2026. ALSO ANY HOURS WORKED IN ADDITION TO 12 HOURS PER |      |         |

# JOB ESTIMATE



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| CUSTOMER PO #                                                                                                       | RFQ/RFP # | Customer WO # |         |
|---------------------------------------------------------------------------------------------------------------------|-----------|---------------|---------|
| SHIFT.                                                                                                              |           |               |         |
| MN1004                                                                                                              |           | HOUR          | 60.0000 |
| ON SITE ELECTRICAL REPAIRS RT MON REP                                                                               |           |               |         |
| 60 HOURS ON SITE UP TO OCT 9, 2025                                                                                  |           |               |         |
| MN1004                                                                                                              |           | HOUR          | 29.0000 |
| ON SITE ELECTRICAL REPAIRS OT MON REP                                                                               |           |               |         |
| ON SITE 4 HOURS PER DAY DURING WEEK DAYS UP TO OCT 9, 2025                                                          |           |               |         |
| MN1007                                                                                                              |           | HOUR          | 79.0000 |
| ON SITE ELECTRICAL REPAIRS DT MON REP                                                                               |           |               |         |
| 12 HOURS PER DAY FOR 2 SATURDAYS AND 2 SUNDAYS UP TO OCT 9, 2026 ALSO ANY DAYS WHERE MORE THAN 12 HOURS WERE WORKED |           |               |         |
| IN SINGLE SHIFT.                                                                                                    |           |               |         |
| SIT-TRAVEL                                                                                                          |           | EA            | 30.0000 |
| HOTEL                                                                                                               |           |               |         |
| ESTIMATE \$165.00 PER NIGHT PLUS 15%                                                                                |           |               |         |
| SIT-TRAVEL                                                                                                          |           | EA            | 32.0000 |
| PAID PER-DIEM PAID DAILY                                                                                            |           |               |         |
| ESTIMATE \$165.00 PER NIGHT PLUS 15%                                                                                |           |               |         |
| SIT-SHOP SUPPLIES                                                                                                   |           | EA            | 1.0000  |
| MISC SHOP SUPPLIES                                                                                                  |           |               |         |
| ESTIMATED 5% OF LABOUR COST                                                                                         |           |               |         |
| MN1000                                                                                                              |           | HOUR          | 8.0000  |
| ENGINEERING SUPPORT                                                                                                 |           |               |         |
| 8 HOURS TOTAL ENGINEERING SUPPORT FROM MONTREAL.                                                                    |           |               |         |
| SIT-OUTSIDE OTH SERV                                                                                                |           | EA            | 1.0000  |
| REWIND STATOR                                                                                                       |           |               |         |
| TOTAL                                                                                                               |           |               |         |

# JOB ESTIMATE



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Repair Estimate

Valid for 30 calendar days from the above date  
Estimate does not include Sales Tax if applicable.  
Estimate does not include Freight if applicable.  
Based upon our Standard Terms and Conditions

Received By: \_\_\_\_\_ Date: \_\_\_\_\_

Subject to NorthPoint's standard Terms and Conditions which can be found at [wajax.com/terms-conditions/](http://wajax.com/terms-conditions/)

English:

Notwithstanding any provisions of the purchase order, terms and conditions, or any other contract, the Customer accepts that Wajax may increase the Purchase Price at any time before delivery date to reflect any surcharges, tariffs or import duties imposed by any governmental authority.

French:

Nonobstant toute disposition du bon de commande, des modalités et conditions ou de tout autre contrat, le client accepte que Wajax puisse augmenter le prix d'achat à tout moment avant la date de livraison pour refléter les suppléments, les tarifs ou les droits d'importation imposés par toute autorité gouvernementale.

**REDACTED (CONFIDENTIAL INFORMATION REMOVED)**

**C0080228 Attachment 5 has been removed due to confidentiality.**