

MANUFACTURING INSPECTION ABB TRANSFORMER PLANT MONTREAL, QUEBEC AUG 28 AND 29, 2018

Prepared for: Natural Resources Canada and Nalcor Energy

Project Lead: Nik Argirov

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Quality Assurance Statement

Office Address	803-633 Kinghorne Mews, Vancouver BC, V6Z 3H3
Prepared by	Vlad Kahle and Nik Argirov
Approved for Issue by	Nik Argirov

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1. GENERAL

On Aug 28 and 29, 2018, the Independent Engineer (IE), Argirov Engineering Inc (AEI), together with Nalcor representative, participated in visit at the ABB transformer factory facility and the High Voltage Test Laboratory (IREQ) in Montreal, Quebec.

Five (four operational plus one spare) ABB manufactured GSU transformers will be installed in the LCP Muskrat Falls Generation (MFG) plant.

The Unit 1 and Unit 2 GSUs were already factory acceptance tested (FAT) in the facilities. IE visited the ABB plant to witness the FAT of the Unit 3 GSU.

Attendees:

Georges Imbeau, ABB Commercial operations

Liljana Bozic, ABB Power Transformer division

Jerome Ndayizamba, ABB Test manager

Frank Gillespie, NALCOR Area Manager

Nik Argirov, IE

Vlad Kahle, IE

2. AGENDA

1. **ABB Transformer Facility Visit**

- Safety orientation was followed by technical discussion.
- After manufacturing and testing the MFG GSU transformers will be de-oiled, filled with dry air and stored in the Quebec facility for up to 6 months.
- Air and desiccant will be regularly monitored prior and after the shipment to site. There are apparently no concerns with this relatively long storage period.
- Once they are on site, the transformers will be placed on their pads and oiled. There is no time limit in place on storing oiled transformers.
- The transformers are equipped with their instrumentation and shipped to the lab. The radiators (and fans) will not be installed for the tests. Full load tests and no-load tests will not generate enough heat to require transformer cooling.
- Type tests have been completed and no heat runs will be performed on the individual units.
- Tests at IREQ will be conducted according to ANSI/ IEE C547.12.90-2015b and CSA C88-M90 standards.
- IREQ Test Request document was provided and discussed at length.
- Test program was discussed with the manager and technical staff. IE were provided with the test report for MFG Unit #2. A quick review of the test report confirms that all industry standard tests are being carried out.

2. ABB Transformer Workshop Visit

- Assembly line is well organized, clean and different manufacturing processes and shipping are well separated.
- Quality control is in place, manufacturing steps on individual components are tracked by hand written logs. When required, this method also permits task handover to the second and third shift technicians.
- This facility appears to have all the necessary equipment and knowledgeable staff for production of the MFG GSU transformers.

3. IREQ Hi Voltage Lab Visit

- ABB's Test Manager Jerome Ndayizamba is responsible for the test program.
- ABB performs some of the factory acceptance tests, such as the direct current and insulation resistance testing, in their facility and they use IREQ facility for the high power and high voltage tests.
- IE were shown the IREQ high voltage and high-power test bays as well as their respective control rooms.
- Full load losses testing was completed on Aug. 28th.
- No load losses testing was completed on Aug. 29th.
- On Aug. 29th the transformer was being moved to the High Voltage test bay, requiring several hours. As a result, the lightning and switching impulse tests were scheduled for another day.

3. COMMENTS AND CONCLUSIONS

ABB specialists satisfactorily answered all IE questions. The performed tests were well prepared and documented and were conducted in professional manner. It is the IE opinion that the ABB staff are suitably qualified for acceptance testing of the MFG GSU's.

APPENDIX

Photographs



Photo 1: MFG GSU Transformer in the High Power Test Bay