

# MANUFACTURING INSPECTION NVC FABRICATION FACILITY IN FITSU-SHI, YOKOHAMA, JAPAN MARCH 19, 2015

Prepared for: Natural Resources Canada and Nalcor Energy

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## *Quality Assurance Statement*

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## TABLE OF CONTENTS

1. GENERAL .....	1
2. ORIENTATION MEETING.....	1
3. NVC QA/QC PROCESS .....	2
4. FACTORY TOUR.....	3
5. CLOSEOUT MEETING.....	3
6. COMMENTS AND CONCLUSIONS.....	4

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## 1. GENERAL

On March 19, 2015, the Independent Engineer (IE), MWH, represented by Nik Argirov, together with Lower Churchill Management Corporation (LCMC) and Nippon High Voltage Cable Corporation (NVC) representatives, performed plant and project equipment (Lower Churchill Project (LCP) Strait of Belle Isle (SOBI) submarine cable) inspection at the NVC fabrication facility in Fittsu-Shi, Yokohama, Japan.

The purpose of this plant inspection was to verify the status of NVC's work under the Contract and to review their QA/QC process relative to the manufacture of the LCP SOBI submarine cable as well as the HV underground cables.

## 2. ORIENTATION MEETING

The meeting started with an informative presentation by NVC's plant manager overviewing the company's corporate history, organization, policies and operations. The following are highlights from that presentation:

NVC was registered in 2006 as a partnership between Nexans (66%) and VISCAS Corporation (34%). The Company currently employs 100 people and its main products are:

- Submarine cables: Mass impregnated or Oil Filled
- High voltage underground cables: Oil Filled or XLPE

The basic values of the company are: 1) Think Customer; 2) Commit to Excellence; 3) Value People and 4) Work Globally.

NVC's values are enhanced by well-defined and strongly adhered to Safety, Quality and Environmental company's policies.

### **NVC Safety Policy:**

NVC promotes industrial safety and health activities with the cooperation of all of its employees. NVC follows the principle that "Safety and Health should have priority over all".

The company represented its focus is on the prevention of industrial accidents and illness. Risk assessment and safety awareness are foremost in their corporate culture. The company mitigates risk by setting industrial safety and health targets, periodic target review and continuous improvements to their internal industrial safety and health management systems. The company communicated that it has prioritized the need to continuously improve the safety awareness of its employees. NVC acts proactively to systematically raise its internal standards of industrial safety and health as it continues to meet all external industrial safety and health requirements. Additionally, NVC highlighted its ongoing commitment to disclosure of internal industrial safety and health policies to interested parties.

In January 2015, the company celebrated a significant achievement: 3000d without a Lost Time Incident (LTI). Companywide safety targets for 2015 are no LTI's and Medical Treatment Incidents (MTI's) and reduction of risks by 20%.

### **NVC Companywide Environmental Policy:**

1. Make efforts to prevent environmental pollution and continue to improve environmental management systems by continuous consciousness of environmental impact by using energies and resources of various chemical products etc. including metals and plastics in the manufacturing process with response to changes in factory load.

2. Try to reduce the industrial wastes and the use of regulated chemical substances, making continual improvement in energy/resource saving and recycling activities.
3. Comply with the environment-related laws and regulations, as well as the standards agreed upon with local municipalities or among the industry, and make a voluntary standard for control if necessary.
4. Try to raise consciousness about the environment through environmental education and public relations activities within the company.
5. Actively participate in the environmental protection activities in the local communities, providing information on such activities.

The IE was also informed of the Manufacturing status and the status of Type Tests:

- 1<sup>st</sup> Batch – Factory Acceptance Tests (FAT) of Land and Landfall/submarine cable finished. Rewinding and load out in preparation.
- 2<sup>nd</sup> Batch - Armoring first lot of 2<sup>nd</sup> batch completed. Armoring of the second lot of 2<sup>nd</sup> batch in progress.
- 3<sup>rd</sup> Batch - Paper lapping in progress.
- All three loops of SOBI Type Tests have been completed. The testing included a variety of mechanical and electrical tests. .Procedures were adapted to the specific SOBI conditions.

### 3. NVC QA/QC PROCESS

The main pillars of the companywide quality policy are:

1. “Satisfaction of customer and internal post process”.
2. Consideration of “Safety, Quality, Lead time”.
3. “Cost competitiveness”.
4. “Human resource development” of continuous improvement (Kaizen).
5. “Continuous process improvement”.

NVC reported that it’s QA audit process consists of external, standard (ISO, OHSA) compliance audits, external customer performed audits as well as internal audits as presented in the following table:

External audits		Internal audits
ISO, OHSAS Compliance audits	Customers performed audits	
1. ISO9001 Auditor : BUREAU VERITAS Valid date : 28 June 2016 Last audit date : 14-15 April 2014  2. ISO14001 Auditor : BUREAU VERITAS Valid date : 31 Dec. 2016  3. OHSAS Auditor : BUREAU VERITAS Valid date : 3 Dec. 2017  *The IE was presented with the certificates of these audits	1. Auditor : LCMC - Last audit date : 17-19 June 2014 - Other audit dates : 5-7 August 2013 7-9 May 2013 26-27 April 2012  2. Auditor : NxN - Last audit date : 24-28 June 2013	Five internal audits carried out according to internal regulation(NVS-G-005)  Certificates for some of the audits were made available

NVC follows a systematic approach in identifying, reporting and mitigating Nonconformances associated with the Work which include; those generated in the design, manufacture, supply, installation, testing and pre-commissioning and/or service delivery process(es). The approach/process conforms to the contractual agreement between NVC and LCMC.

Nonconformities are reported (Nonconformance Reports - NCR's) upon occurrence and are submitted electronically using NVC's standard Nonconformity form. Mitigating action for any NCR cannot be performed by NVC without prior LCMC's approval.

This process includes also a well-defined system of reactive and preventive actions.

## 4. FACTORY TOUR

Submarine and High Voltage (HV) Underground Cable manufacturing is a continuous, conveyer-based process that requires extreme precision, controlled and in many occasions (stations) a dust free environment.

The tour started at the Drawing and Stranding operation where the profiled copper wires are fed into the conveyer in a proper sequence forming a tightly wound internal core – the main copper conductor. Following this is the Paper Lapping operation where the main insulation layer (multiple layers of high-density craft paper) is created. The process continues into the Drying and Impregnation operation. The passage from paper lapping into the drying tank is a dust-free and contamination controlled operation and requires an air controlled and process isolation environment. The Drying and Impregnation is a three-step process, as follows:

- (1) Drying – The cable is fed into the drying tank where the paper dries in a vacuum environment. Precision drying is achieved by controlling and monitoring the reduction of vacuum, resulting from evaporation in the tank;
- (2) Mass-impregnation – The paper is impregnated with high-viscosity mineral oil compound applied in high temperature and increased pressure;, and
- (3) Cooling – Cooling where the temperature drops to room level and is followed by the lead sheath installation in the lead press.

The cable then moves into the PE (polyethylene) Taping, galvanized steel wire Armoring and finally PE Jacketing operation. After the PE tape installation, and before the steel armoring, a fiber optic system/cable is also fed into the conveyer and integrated into the main cable system. The fiber optic cable is the main communication and temperature monitoring system.

Upon completion of the Jacketing and Armoring operations, the cable is ready for testing. The IE was introduced to the High Voltage Lab as well as the outdoor bending/tension test yards, however no test was witnessed as all three loops of Type Tests were already completed and Batch #1 stored on the outdoor turntable. Batch #1 cable was ready for rewinding and loading out for shipping.

Note: Due to the propriety nature of the manufacturing process, photos were not allowed to be taken in any of the NVC facilities.

## 5. CLOSEOUT MEETING

Upon conclusion of the factory tour, a conference call was conducted by all the site visit participants with representatives of Nexans, Norway. The call commenced with a brief account of the factory tour proceedings. The IE observed that in our opin-

ion, no major obstacles exist for timely completion of the remaining (Batch #2 and #3) manufacturing activities. NVC also advised that they are in process of identifying the right type vessel for shipping the cable to site in case the installation vessel Skagerrak would not be available.

Another matter of discussion was the recent introduction of a mid-point field joint splicing of the submarine cables. NVC reached the conclusion this joint was necessary to mitigate potential risk issues related to pull out of the cables through the Horizontal Directionally Drilled (HDD) bores/tunnels. IE requested that further to the scheduled Type Tests for the joint, performing Non-Destructive Testing (NDT) should be investigated for all welded/soldered splices of profiled copper wires and steel armor. NVC accepted the recommendation and advised that they will investigate performing NDT on manufactured joints.

## 6. COMMENTS AND CONCLUSIONS

The following conclusions and comments are presented:

- The IE found the workmanship of the manufacturing very good. All of the different operations along the conveyer length were found to be of impressive precision and excellent quality.
- The manufacturing process thus far has been carried out in compliance with very high standards of safety, quality and environmental criteria.
- Work under this Contract appears to be on schedule.