



**REQUEST FOR PROPOSALS
DEMANDE DE PROPOSITIONS**

**RETURN BIDS TO :
RETOURNER LES
SOUMISSIONS A:**

National Research Council Canada (NRC)
Procurement Services
1200 Montreal Road, Building M-22
Ottawa, Ontario
K1A 0R6
Bid Fax: (613) 991-3297

Title/Sujet STJ- TOW TANK WAVEMAKER	
Solicitation No./N. de l'invitation 17-22042	Date 28 July 2017
Solicitation Closes/L'invitation prend fin at/à 14 :00 on/le 01 September 2017	Time Zone/Fuseau Horaire EST
Address Enquiries To/Adresser demandes de renseignements à : Alain Leroux Telephone No./N. de téléphone : (613)991-9980 Facsimile No./N. de télécopieur : (613) 991-3297	

Instructions: See Herein

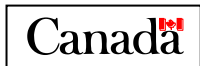
Instructions: Voir aux présentes

Proposal To:

We hereby offer to sell to Her Majesty the Queen in right of Canada, in accordance with the terms and conditions set out herein, referred to herein or attached hereto, the goods, services, and construction listed herein and on any attached sheets at the price(s) set out therefor.

Proposition aux:

Nous offrons par la présente de vendre à Sa Majesté la Reine du chef du Canada, aux conditions énoncées ou incluses par référence dans la présente et aux annexes ci-jointes, les biens, services et construction énumérés ici sur toute feuille ci-annexée, au(x) prix indiqué(s).



Vendor/Firm Name and Address Raison sociale et adresse du fournisseur/de l'entrepreneur	
Telephone No./N. de telephone Facsimile No./N. de télécopieur	
Name and title of person authorized to sign on behalf of Vendor/Firm (type or print) Nom et titre de la personne autorisé à signer au nom du fournisseur/de l'entrepreneur (taper ou écrire en caractères d'imprimerie)	
Signature	Date

STJ – Tow Tank Wavemaker

1.0 PRESENTATION OF PROPOSALS

- 1.1 You are invited to submit four copies of a Technical Proposal and two copies of a Financial Proposal in two separate envelopes to fulfil the following requirement forming part of this Request for Proposals. One envelope **must** be clearly marked 'Technical Proposal' and the other envelope **must** be marked 'Financial Proposal'. All financial information **must** be fully contained in the Financial Proposal, and only in the Financial Proposal. Vendors who provide financial information in the technical proposal will be disqualified. **All proposals should include the front page of this RFP duly completed.**

2.0 SCOPE OF WORK

- 2.1 This contract covers the necessary work to prepare the site to receive a new Wavemaker system, including civil, electrical and mechanical changes to the existing facility. It also includes the removal of all existing equipment that will no longer be used, including the existing wavemaker and the hydraulic support system, and the necessary structural changes to allow the water basin to receive the new system. Work will be completed at the NRC facility located at:

Ocean Coastal and River Engineering – OCRE
1 Arctic Avenue
St. John's, NL A1B 3T5

OPTIONAL SCOPE: Installation of the new Wave maker supervised by the equipment supplier. Installation includes electrical connections and mechanical assembly. Refer to installation manual in **Appendix B** of Plans and Specifications for more details.

3.0 PERIOD OF CONTRACT

- 3.1 NRC anticipates that the work will begin on **contract award** and be completed by **December 8th, 2017.**

4.0 ENQUIRIES

- 4.1 If you require clarification regarding any aspect of this RFP, address all queries to the Contracting Authority, identified below, at least 10 working days before the closing date. All queries must be in writing and queries received less than 10 working days prior to the closing date cannot be guaranteed a response. Information received verbally will not be binding upon the NRC.

Alain Leroux

Contracting Authority, Procurement Services
National Research Council Canada
1200 Montreal Road, Bldg. M-22

Ottawa, Ontario K1A 0R6 Telephone: **613 991-9980**
Facsimile: **613 991-3297**

- 4.2 To ensure the equality of information among Bidders, responses to general enquiries will be made available to all bidders unless such publications would reveal proprietary information. The bidder who initiates the question will not be identified. Technical questions that are considered proprietary by the bidder must be clearly identified. NRC will respond individually to the bidder if it considers the questions proprietary. If NRC does not consider the question proprietary, the bidder submitting it will be allowed to withdraw the question, or have the question and answer made available through the Open Bidding System (OBS) to all bidders.
- 4.3 Vendors who attempt to obtain information regarding any aspect of this RFP during the solicitation period through any NRC contacts other than the Contracting Authority identified herein, may be disqualified (for that reason alone).
- 4.4 It is the responsibility of the Bidder to obtain clarification of the requirement contained herein, if necessary, prior to submitting its proposal. The Bidder must have written confirmation from the Contracting Authority for any changes, alterations, etc., concerning this RFP.

5.0 PROPOSAL CLOSING DATE AND BID SUBMISSION INSTRUCTIONS

- 5.1 Proposals must be delivered not later than 2:00 PM EST, **01 September 2017**, to the following **Contracting Authority**:

Alain Leroux

Contracting Authority, Procurement Services
National Research Council Canada
1200 Montreal Road, Bldg. M-22
Ottawa, Ontario K1A 0R6 Telephone: (613) 991-9980

Proposals must not be sent directly to the Project Authority

- 5.2 Proposals must be delivered in a sealed envelope and the Bidder's name and the RFP No. should be clearly indicated on the Proposal Envelope. It is the vendor's responsibility to obtain date and time stamped receipt signed by the receptionist as proof that NRC has received their proposal within the prescribed time limit. All risks and consequences of incorrect delivery of bids are the responsibility of the Bidder.
- 5.3 Due to the nature of this solicitation, NRC will not accept any proposal documents by facsimile.
- 5.4 NRC will not accept any proposal documents by electronic mail or on diskette.
- 5.5 Proposals received after the closing date will not be considered and will be returned to the sender. The sender has the sole responsibility for the timely dispatch and delivery of a proposal and cannot transfer such responsibility to the NRC. No supplementary information will be accepted after the closing deadline unless NRC requests a clarification.
- 5.6 All submitted proposals become the property NRC and will not be returned to the originator.

6.0 EVALUATION CRITERIA

6.1 Selection Criteria

Potential bidders will be rated in a combination of technical score and price rating. For this project the total score will be established as follows:

Technical rating 60%	=	Technical Score (Points)
Price rating 40%	=	Price Score (Points)
<hr/>		
Total Score	=	Max. 100 points

6.2 Requirement for proposal format

The following proposal format information should be implemented when preparing the proposal:

- Submit one (1) bound original plus three (3) bound copies of the proposal;
- Paper size should be - 216mm x 279mm (8.5" x 11");
- Minimum font size - 11 point Times or equal;
- Minimum margins - 12 mm left, right, top, and bottom;
- Double-sided submissions are mandatory;
- One (1) 'page' means one side of a 216mm x 279mm (8.5" x 11") sheet of paper;
- 279mm x 432 mm (11" x 17") fold-out sheets (i.e. for spreadsheets and organization charts) will be counted as two pages;
- The order of the proposals should follow the order established in the Request for Proposal SRE section.

6.3 Specific requirement for the proposal

The maximum number of pages (including text and graphics) to be submitted for the Rated Requirements is Thirty (30) pages.

The following are not part of the page limitation mentioned above:

- Covering letter;
- Cover Page;
- Tab/Dividers, provided they are free of text and/or graphics
- Declaration/Certifications Form (Appendix A);
- Integrity Provisions – Required Documentation;
- Front page of the RFP;
- Front page of revision(s) to the RFP;
- Price Proposal Form

Consequence of non-compliance: any pages which extend beyond the above page limitation and any other attachments will be extracted from the proposal and will not be forwarded to the NRC Evaluation Board member for evaluation.

6.4 Mandatory requirements

Failure to meet the mandatory requirement will render the proposal as non-responsive and no further evaluation will be carried out.

- Bidders must demonstrate that they have been established as General Contractor for at least 10 years and that they have experience working with commercial and industrial construction scopes in excess of \$1,000,000.00 dollars.
- Bidders must demonstrate that they have successfully completed at least 5 local projects.
Local for this specific tender, means any project located in the province of Newfoundland. Successfully means that the project was accepted by the owner without major issues. Bidders to provide contact name and number to allow NRC to reference check the project.
- All disciplines shall be licensed to provide the necessary professional services to the full extent that may be required by provincial requirements in the province of Newfoundland.
- Contractor shall demonstrate experience with heavy equipment assembly and disassembly within the construction site.
- Bidders must be present at either one of the two mandatory site visits which will take place at

1 Artic Avenue
St. John's – Newfoundland

on the following times and dates :

- Tuesday August 10, 2017 at 9:30am
- Thursday August 15, 2017 at 9:30am

7 RATED REQUIREMENTS

7.2 Achievement of proponent on projects (similar projects)

Describe the Proponent's accomplishments, achievements and experience as Prime Contractor on projects. Select a maximum of two (2) public/private sector collaboration

projects, of comparable size and complexity to the present project, that were successfully completed within the last six (6) years. These projects should be functional and occupied for at least one (1) year.

Information that should be supplied:

- How this project is comparable/relevant to the requested project;
- A brief project description, stakeholders involved, management approach, construction challenges and resolutions;
- Stakeholder management strategy;
- Budget control and management - i.e. contract price & final construction cost - explain variation;
- Project schedule control and management - i.e. initial schedule and revised schedule - explain variation; project developed under a fast track schedule approach will receive higher consideration.
- Information on equipment being installed and commissioned
- Client references - name, address, phone and fax of client contact at working level references may be checked;
- Names of key personnel responsible for project delivery, as a minimum the Project Manager and Site superintendent;

7.3 Proponent experience with fast track schedule projects.

Demonstrate proponent experience with fast track schedule projects. Discussed tools and strategies used to obtain the project delivery date.

Information that should be supplied:

- Contractor experience with past projects:
 - Provide examples of similar projects; A brief project description, proposed and achieved schedule, schedule challenges and resolutions;
 - Project schedule control and management. Demonstrate how the schedule on those projects was achieved or improved.
- Contractor approach to proposed project:
 - Provide a suggested project schedule to this tender's project demonstrating the main milestones and important tasks.
 - Discuss how the provided schedule will be maintained and/or improved.

7.4 Proponent experience with heavy equipment projects.

Describe the proponent experience working with heavy equipment where assembly and disassembly where required as well as installation and commission support. Examples

should demonstrate, but should not be limited too, experience with electrical and mechanical installations.

Information that should be supplied:

- Provide examples of similar projects where heavy equipment where disassembled and removed.
 - Provide examples of Electrical and Mechanical installation projects that where managed by your company.
- Provide examples of similar projects where equipment was assembled on site and interfaced with existing systems;
 - Provide examples of Electrical and Mechanical installation projects that where managed by your company.

7.5 Understanding of the Project

The Proponent should demonstrate a good understanding of the goals of the project, the functional/technical requirements, the constraints and the issues that will shape the end product.

Information that should be supplied:

- A description of the project main objectives and technical requirements;
- A description of the approach to deal with significant issues, challenges and constraints during the project, in special the ones related to schedule activities (i.e. crashing);
- Demonstrate understanding of the stakeholder engagement needed.

8 EVALUATION AND RATING

In the first instance, price envelopes will remain sealed and only the technical components of the proposals which are responsive will be reviewed, evaluated and rated by a NRC Evaluation Board in accordance with the following to establish

Technical Ratings:

Criterion	Weight Factor	Rating	Weighted Rating
Achievement of proponent on projects (similar projects)	2.0	0 – 10	0 - 20
Proponent experience with fast track schedule projects.	4.0	0 - 10	0 - 40
Proponent experience with heavy	3.0	0 – 10	0 – 30

equipment projects.			
Understanding of the Project	1.0	0 - 10	0 - 10
Total Technical Rating	-	-	0 -100

No further consideration will be given to proponents not achieving the pass mark of sixty (60) points. The successful Bidder shall be the one who cumulates the highest combined score of the technical assessment (60%) and tendered amount (40%), as shown below:

TABLE A	Bidder #1	Bidder #2	Bidder #3
Technical score	85 points out of 100	80 out of 100	75 out of 100
Tendered amount	\$320,000	\$310,000	\$300,000

For information only:

	Technical score	Tendered amount score	Final score
Bidder #1	$\frac{85 \times 60(\%)}{100} = 51$	$\frac{300 \times 40(\%)}{320 \text{ k}} = 37.5$	= 88.5 (successful bid)
Bidder #2	$\frac{80 \times 60(\%)}{100} = 48$	$\frac{300 \times 40(\%)}{310 \text{ k}} = 37.5$	= 86.71
Bidder #3	$\frac{75 \times 60(\%)}{100} = 45$	$\frac{300 \times 40(\%)}{300 \text{ k}} = 40$	= 85

TOTAL MAXIMUM POINTS:

100

9.0 COST PROPOSAL

- 9.1 The cost proposal must be a **fixed price quotation, FOB Destination, excluding GST/HST**. The fixed price must include all the materials and services required to fulfil all aspects of the Statement of Work. Bidders should identify the currency on which the cost proposal is based.
- 9.2 **GOODS AND SERVICES TAX (GST) and HARMONIZED SALES TAX (HST):** The GST and HST, whichever is applicable, shall be considered an applicable tax for the purposes of this RFP and extra to the price herein. The amount of GST or HST shall be disclosed and shown as a separate item.
- 9.3 Bids will be evaluated in Canadian currency, therefore, for evaluation purposes, the exchange rate quoted by the Bank of Canada as being in effect on date of bid closing, shall

be applied as the conversion factor for foreign currency. Prices quoted shall not be subject to, or conditional upon, fluctuations in commercial or other interest rates during either the evaluation or contract period.

10.0 **CONDITIONS OF SUBMISSION**

- 10.1 There shall be no payment by the National Research Council for costs incurred in the preparation and submission of proposals in response to this request. No payment shall be made for costs incurred for clarification(s) and/or demonstration(s) that may be required by NRC. The National Research Council reserves the right to reject any or all proposals submitted, or to accept any proposal in whole or in part without negotiation. A contract will not necessarily be issued as a result of this competition. NRC reserves the right to amend, cancel or reissue this requirement at any time.
- 10.2 The method of selection will be highest combined Technical Rating (60%) and Price (40%)
- 10.3 Proposals submitted must be valid for not less than sixty (60) calendar days from the closing date of the RFP.

11.0 **SECURITY LEVEL**

- 11.1 Prior to the performance of the obligations under this contract, all personnel that will be involved with the project must be cleared to the security level of **RELIABILITY** as defined in the security policy of Canada.
- 11.2 Any Contract resulting from this invitation will be subject to the Security Requirements Check List (SRCL), form TBS/SCT 350-103, attached at Appendix "G".

12.0 **CONFIDENTIALITY**

- 12.1 This document is UNCLASSIFIED, however; the contractor shall treat as confidential, during as well as after the services contracted for, any information of the affairs of NRC of a confidential nature to which its servants or agents become privy.

13.0 **CRIMINAL CODE OF CANADA**

- 13.1 Canada may reject an offer where the Bidder, or any employee or subcontractor included as part of the offer, has been convicted under section 121 ("Frauds on the government" & Contractor subscribing to election fund"), 124 ("Selling or purchasing office"), or 418 ("Selling defective stores to Her Majesty") of the Criminal Code.

14.0 **DEBRIEFINGS**

- 14.1 After contract award, bidders may request a debriefing on the results of the bid solicitation. Bidders should make the request to the Contracting Authority within 15 working days of receipt of notification that their bid was unsuccessful. The debriefing may be provided in writing, by telephone or in person.

15.0 **FORMER PUBLIC SERVANT**

- 15.1 Contracts with former public servants (FPS) in receipt of a pension or of a lump sum payment must bear the closest public scrutiny, and reflect fairness in the spending of

public funds. In order to comply with Treasury Board policies and directives on contracts with FPS, bidders must provide the information required below.

15.2 Definitions

For the purposes of this clause,

"former public servant" is any former member of a department as defined in the Financial Administration Act, R.S., 1985, c. F-11, a former member of the Canadian Armed Forces or a former member of the Royal Canadian Mounted Police. A former public servant may be:

- a) an individual;
- b) an individual who has incorporated;
- c) a partnership made of former public servants; or
- d) a sole proprietorship or entity where the affected individual has a controlling or major interest in the entity.

"lump sum payment period" means the period measured in weeks of salary, for which payment has been made to facilitate the transition to retirement or to other employment as a result of the implementation of various programs to reduce the size of the Public Service. The lump sum payment period does not include the period of severance pay, which is measured in a like manner.

"pension" means, a pension or annual allowance paid under the Public Service Superannuation Act (PSSA), R.S., 1985, c.P-36, and any increases paid pursuant to the Supplementary Retirement Benefits Act, R.S., 1985, c.S-24 as it affects the PSSA. It does not include pensions payable pursuant to the Canadian Forces Superannuation Act, R.S., 1985, c.C-17, the Defence Services Pension Continuation Act, 1970, c.D-3, the Royal Canadian Mounted Police Pension Continuation Act, 1970, c.R-10, and the Royal Canadian Mounted Police Superannuation Act, R.S., 1985, c.R-11, the Members of Parliament Retiring Allowances Act, R.S., 1985, c.M-5, and that portion of pension payable to the Canada Pension Plan Act, R.S., 1985, c.C-8.

15.3 Former Public Servant in Receipt of a Pension

As per the above definitions, is the Bidder a FPS in receipt of a pension? **Yes () No ()**

If so, the Bidder must provide the following information, for all FPS in receipt of a pension, as applicable:

- a) name of former public servant;
- b) date of termination of employment or retirement from the Public Service.

15.4 By providing this information, Bidders agree that the successful Bidder's status, with respect to being a former public servant in receipt of a pension, will be reported on departmental websites as part of the published proactive disclosure reports in accordance with Contracting Policy Notice: 2012-2 and the Guidelines on the Proactive Disclosure of Contracts.

15.5 Work Force Reduction Program

Is the Bidder a FPS who received a lump sum payment pursuant to the terms of a work force reduction program? **Yes () No ()**

If so, the Bidder must provide the following information:

- a) name of former public servant;
- b) conditions of the lump sum payment incentive;
- c) date of termination of employment;
- d) amount of lump sum payment;
- e) rate of pay on which lump sum payment is based;
- f) period of lump sum payment including start date, end date and number of weeks;
- g) number and amount (professional fees) of other contracts subject to the restrictions of a work force reduction program.

15.6 For all contracts awarded during the lump sum payment period, the total amount of fees that may be paid to a FPS who received a lump sum payment is \$5,000, including the Goods and Services Tax or Harmonized Sales Tax.

16.0 **OFFICE OF THE PROCUREMENT OMBUDSMAN (OPO)**

15.1 The Office of the Procurement Ombudsman (OPO) was established by the Government of Canada to provide an independent avenue for suppliers to raise complaints regarding the award of contracts under \$25,000 for goods and under \$100,000 for services. You have the option of raising issues or concerns regarding the solicitation, or the award resulting from it, with the OPO by contacting them by telephone at 1-866-734-5169 or by e-mail at boa.opo@boa-opo.gc.ca. You can also obtain more information on the OPO services available to you at their website at www.opo-boa.gc.ca.

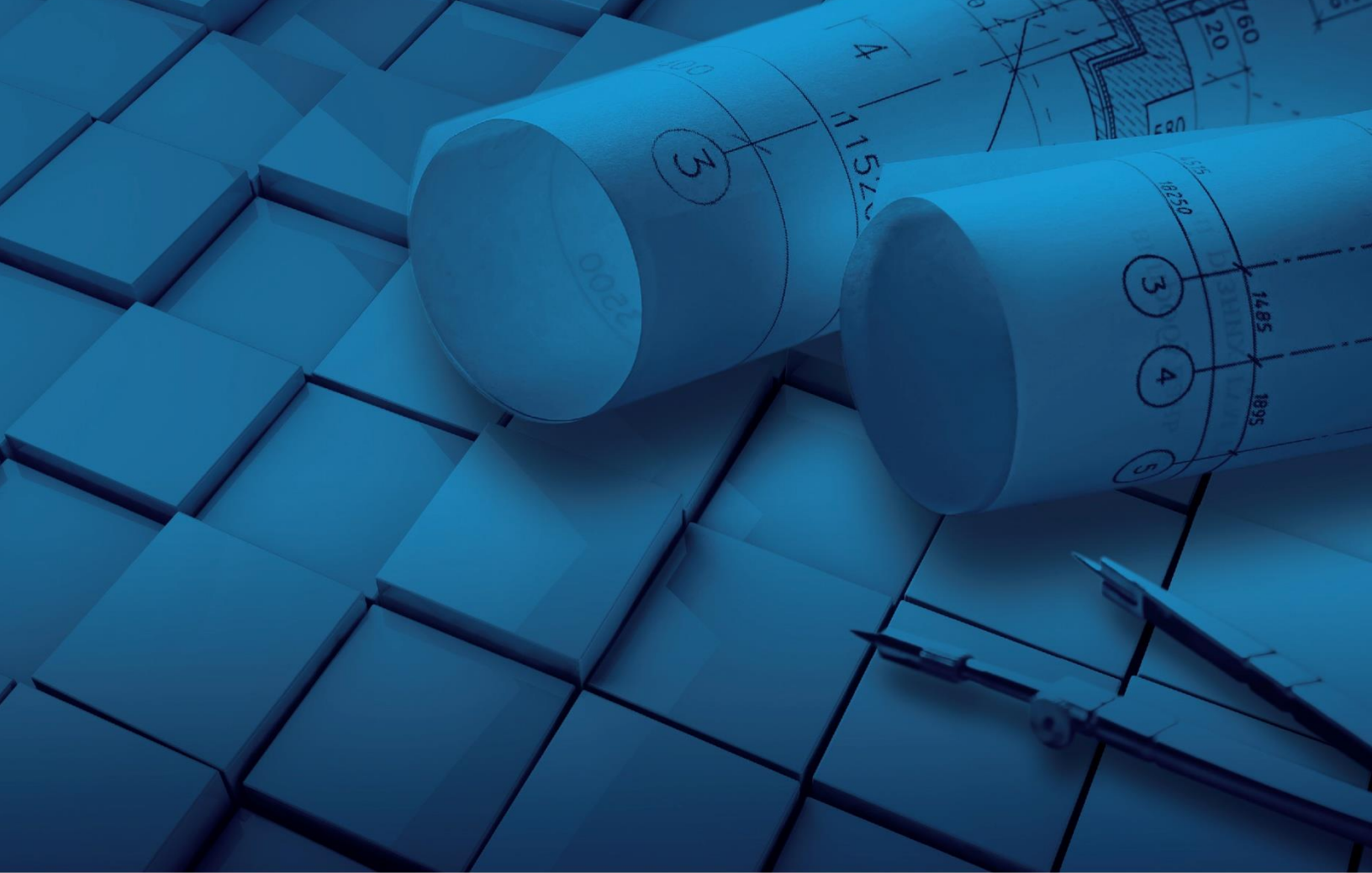
17.0 **INTEGRITY PROVISIONS**

7.1 By responding to this RFP, the Proponent is subject to the integrity provisions contained in the following documents:

- The Government of Canada's Integrity Provision
- Ineligibility and Suspension Policy (the "Policy") in effect on the date the Bid solicitation is issued
- all related Directives related to the above policy in effect on that date

7.2 These documents are incorporated by reference and form a binding part of the Bid solicitation. The Bidder must comply with the Policy and Directives at the following

link: <https://buyandsell.gc.ca/policy-and-guidelines/standard-acquisition-clauses-andconditions-manual/1/2003/21>



SPECIFICATIONS

SOLICITATION #: 17-22042

BUILDING: STJ
Memorial University Campus, 1 Arctic Avenue
St-John's, NL

PROJECT: STJ – Tow Tank Wavemaker

PROJECT #: STJ-IMC0168

Date: July 2017

SPECIFICATION

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BUYANDELL NOTICE

STJ – Tow Tank Wavemaker

The National Research Council Canada, Memorial University Campus, 1 Arctic Avenue, St-John's, NL has a requirement for a project that includes:

This contract covers the necessary work to prepare the site to receive a new Wavemaker system, including civil, electrical and mechanical changes to the existing facility. It also includes the removal of all existing equipment that will no longer be used, including the existing wavemaker and the hydraulic support system, and the necessary structural changes to allow the water basin to receive the new system.

OPTIONAL SCOPE: Installation of the new Wavemaker supervised by the equipment supplier. Installation includes electrical connections and mechanical assembly. Refer to installation manual in **Appendix B** for more details.

1. GENERAL:

Questions regarding any aspect of the project are to be addressed to and answered only by the Departmental Representative (or his designate) or the Contracting Authority.

Any information received other than from the Departmental Representative (or his designate) or the Contracting Authority will be disregarded when awarding the contract and during construction.

Firms intending to submit tenders on this project should obtain tender documents through the Buyandsell.gc.ca TMA services provider. Addenda, when issued, will be available from the Buyandsell.gc.ca TMA service provider. Firms that elect to base their bids on tender documents obtained from other sources do so at their own risk and will be solely responsible to inform the tender calling authority of their intention to bid. Tender packages are not available for distribution on the actual day of tender closing.

2. MANDATORY SITE VISIT:

It is mandatory that the bidder attends one of the site visits at the designated date and time. At least one representative from proponents that intend to bid must attend.

The site visits will be held on August 10th and August 15th, 2017 at **9:30**. Meet Rodney Griffiths at STJ Building, Memorial University Campus, 1 Arctic Avenue, St-John's, NL. Bidders who, for any reason, cannot attend at the specified date and time will not be given an alternative appointment to view the site and their tenders, therefore, will be considered as non-responsive. **NO EXCEPTIONS WILL BE MADE.**

As proof of attendance, at the site visit, the Contracting Authority will have an Attendance Form which **MUST** be signed by the bidder's representative. It is the responsibility of all bidders to ensure they have signed the Mandatory Site Visit Attendance form prior to leaving the site. Proposals submitted by bidders who have not attended the site visit or failed to sign the Attendance Form will be deemed non-responsive.

3. TENDER CLOSING DATE:

Tender closing date is September 1st, 2017 at 14:00.

4. TENDER RESULTS

Following the Tender closing, the tender results will be sent by facsimile to all Contractors who submitted a tender.

5. SECURITY REQUIREMENT FOR CANADIAN CONTRACTORS

5.1 MANDATORY SECURITY REQUIREMENT:

- .1 All personnel that will be involved with the project must be security screened to **RELIABILITY** status level as defined in the security policy of Canada.

6.0 WHSCC (WORKPLACE HEALTH SAFETY AND COMPENSATION COMMISSION)

- .1 All Bidders must provide a valid WHSCC certificate with their Tender or prior to contract award.

7.0 OFFICE OF THE PROCUREMENT OMBUDSMAN

- .1 **Dispute Resolution Services**
The parties understand that the Procurement Ombudsman appointed pursuant to Subsection 22.1(1) of the *Department of Public Works and Government Services Act* will, on request or consent of the parties to participate in an alternative dispute resolution process to resolve any dispute between the parties respecting the interpretation or application of a term and condition of this contract and their consent to bear the cost of such process, provide to the parties a proposal for an alternative dispute resolution process to resolve their dispute. The Office of the Procurement Ombudsman may be contacted by telephone at 1-866-734-5169 or by e-mail at boa.opo@boa-opo.gc.ca.
- .2 **Contract Administration**
The parties understand that the Procurement Ombudsman appointed pursuant to Subsection 22.1(1) of the *Department of Public Works and Government Services Act* will review a complaint filed by [*the supplier or the contractor or the name of the entity awarded this contract*] respecting administration of this contract if the requirements of Subsection 22.2(1) of the *Department of Public Works and Government Services Act* and Sections 15 and 16 of the *Procurement Ombudsman Regulations* have been met, and the interpretation and application of the terms and conditions and the scope of the work of this contract are not in dispute. The Office of the Procurement Ombudsman may be contacted by telephone at 1-866-734-5169 or by e-mail at boa.opo@boa-opo.gc.ca.
- .3 **The Office of the Procurement Ombudsman (OPO) was established by the Government of Canada to provide an independent avenue for suppliers to raise complaints regarding the award of contracts under \$25,000 for goods and under \$100,000 for services. You have the option of raising issues or concerns regarding the solicitation, or the award resulting from it, with the OPO by contacting them by telephone at 1-866-734-5169 or by e-mail at boa.opo@boa-opo.gc.ca. You can also obtain more information on the OPO services available to you at their website at www.opo-boa.gc.ca.**

The Departmental Representative or his designate for this project is: **Rodney Griffiths**
Telephone: **709 772-7987**

Contracting Authority for this project is: **Alain Leroux alain.leroux@nrc-cnrc.gc.ca**
Telephone: **613 991-9980**

INSTRUCTIONS TO BIDDERS

Article 1 – Receipt of Tender

- 1a) Tenders must be received not later than the specified tender closing time. Tenders received after this time are invalid and shall not be considered, regardless of any reason for their late arrival.
- 1b) A letter of printed telecommunication from a bidder quoting a price shall not be considered as a valid tender unless a formal tender has been received on the prescribed Tender Form.
- 1c) Bidders may amend their tenders by letter or printed telecommunication provided that such amendments are received not later than the specified tender closing time.
- 1d) Any amendments to the tender which are transmitted by telefax must be signed and must clearly identify the tenderer.

All such amendments are to be addressed to:
National Research Council of Canada
Marc Bedard, Senior Contracting Officer
Building M-22
Montreal Road, Ottawa, Ontario
K1A 0R6

Fax: (613) 991-3297

Article 2 – Tender Form & Qualifications

- 1) All tenders must be submitted on the Construction Tender Form and the tender must be signed in compliance with the following requirements:
 - a) Limited Company: The full names of the Company and the name(s) and status of the authorized signing officer(s) must be printed in the space provided for that purpose. The signature(s) of the authorized officer(s) and the corporate seal must be affixed.
 - b) Partnership: The firm name and the name(s) of the person(s) signing must be printed in the space provided. One or more of the partners must sign in the presence of a witness who must also sign. An adhesive coloured seal must be affixed beside each signature.
 - c) Sole Proprietorship : The business name and the name of the sole proprietor must be printed in the space provided. The sole proprietor must sign in the presence of a witness who must also sign. An adhesive coloured seal must be affixed beside each signature.
- 2) Any alterations in the printed part of the Construction Tender Form or failure to provide the information requested therein, may render the tender invalid.
- 3) All space in the Construction Tender Form must be completed and any handwritten or typewritten corrections to the parts so completed must be initialed immediately to the side of the corrections by the person or persons executing the tender on behalf of the the tenderer.
- 4) Tenders must be based on the plans, specifications and tender documents provided.

Article 3 - Contract

- 1) The Contractor will be required to sign a contract similar to the Standard Contract Form for Fixed Price Construction Contracts, a blank specimen of which is enclosed in the package for reference purposes.

Article 4 – Tender Destination

- 1a) Tenders are to be submitted in sealed envelopes to:
National Research Council Canada
Administrative Services and Property Management Branch
STJ Building
Memorial University, 1 Arctic Avenue
St-John's, NL
A1B 3T5

Endorsed "Tender for (insert title of work as it appears in the drawings and specifications)" and must bear the name and address of the tenderer.

- 1b) Unless otherwise specified, the only documents required to be submitted with the tender are the Tender form and the Bid Security.

Article 5 - Security

- 1a) Bid Security is required and must be submitted in one of the following forms:
 - i) a certified cheque payable to the Receiver General for Canada and drawn on a member of the Canadian Payments Association or a local cooperative credit society that is a member of a central cooperative credit society having membership in the Canadian Payments Association; **OR**
 - ii) bonds of the Government of Canada, or bonds unconditionally guaranteed as to principal and interest by the Government of Canada; **OR**
 - iii) a bid bond.
- 1b) Regardless of the Bid Security submitted, it should never be more than \$250,000 maximum, calculated at 10% of the first \$250,000 of the tendered price, plus 5% of any amount in excess of \$250,000.
- 2a) Bid Security shall accompany each tender or, if forwarded separately from the tender, shall be provided not later than the specified tender closing time. Bid Security must be in the **ORIGINAL** form. Fax or photocopies and **NOT** acceptable. **FAILURE TO PROVIDE THE REQUIRED BID SECURITY SHALL INVALIDATE THE TENDER.**
- 2b) If the tender is not accepted, the Bid Security submitted pursuant to Article 8 shall be returned to the tenderer.
- 3a) The successful tenderer is required to provide security within 14 days of receiving notice of tender acceptance. The tenderer must furnish **EITHER**:
 - i) a Security Deposit as described in 1(b) above together with a Labour and Material Payment Bond in the amount of at least 50% of the amount payable under the contract, **OR**

- ii) a Performance Bond and a Labour and Material Payment Bond – each in the amount of 50% of the amount payable under the contract.
- 3b) Should it not be possible to obtain a Labour Material Payment Bond as required under 3(a) above, on making application thereof to at least two acceptable Bonding Companies, an additional Security Deposit of a straight 10% of the amount payable under the contract must be furnished.
- 3c) Where a tender has been accompanied by a Security Deposit, as described in 1(b) above, the amount of the Security Deposit required under 3(a) above may be reduced by the amount of the Security Deposit which accompanied the tender.
- 3d) Bonds must be in an approved form and from the companies whose

bonds are acceptable to the Government of Canada. Samples of the approved form of Bid Bond, Performance Bond and Labour and Material Payment Bond and a list of acceptable Bonding Companies may be obtained from the Contracting Officer, National Research Council, Building M-22, Montreal Road, Ottawa, Ontario, K1A 0R6.

Article 6 – Interest On Security Deposits

- 1) Tenderers are notified that they must make their own arrangements with their bankers as to the interest, if any, on the amount of the certified cheque accompanying their tender. The Council will not pay interest on said cheque pending the awarding of the contract nor be responsible for the payments of interest under any arrangement made by the tenderers.

Article 7 – Sales Tax

- 1) The amount of the tender shall include all taxes as levied under the Excise Act, the Excise Tax Act, the Old Age Security Act, the Customs Act or the Customs Tariff, in force or applicable at the time.
- 2) In Quebec, the Provincial Sales Tax should not be included in the Tender Price as the Federal Government is exempt. Tenderers should contact the Provincial Revenue Minister to recover all taxes paid for goods and services rendered under this contract.

Tenderers must include in their Tender Price the amount of Provincial Sales Tax for which the exemption does not apply.

Article 8 – Examination of Site

- 1) All parties tendering shall examine the sites of the proposed work before sending in their tender and make themselves thoroughly acquainted with the same and obtain for themselves any and all information that may be necessary for the proper carrying out of the Contract. No after claim will be allowed or entertained for any work or material that may be requisite and necessary for the proper execution and completion of this Contract with the exception of that provided for under GC 35 in the General Conditions of the General Specification.

Article 9 – Discrepancies, Omissions, Etc.

- 1a) Bidders finding discrepancies in, or omissions from, drawings, specifications or other documents, or having any doubt as to the meaning or intent of any part thereof, should at once notify the Engineer who will send written instructions or explanation to all bidders.
- 1b) Neither the Engineer nor the Council will be responsible for oral instructions.
- 1c) Addenda or corrections issued during the time of the bidding shall be covered in the proposal. However, the contract supersedes all communications, negotiations and agreements, either written or oral, relating to the work and made prior to the date of the contract.

Article 10 – No additional Payments for Increased Costs

- 1) The only other adjustments in the contract price allowed are those specified in the General Conditions of the General Specification. The contract price will not be amended for change in freight rates, exchange rates, wage rates or cost of materials, plant or services.

Article 11 – Awards

- 1a) The Council reserves the power and right to reject tenders received from parties who cannot show a reasonable acquaintance with and preparation for the proper performance of the class of work herein specified and shown on plans. Evidence of such competence must be furnished by the tenderers if required to do so.
- 1b) A tenderer may be required to furnish to the Contracting Office, National Research Council of Canada, Building M-22, 1200 Montreal Road, Ottawa, Ontario, K1A 0R6, Canada, unsigned copies of the insurance requirements as covered by the Insurance Conditions of the General Specification.
- 1c) The Council does not bind itself to accept the lowest or any tender.

Article 12 – Harmonized Sales Tax

- 1) The Harmonized Sales Tax (HST) which is now in effect shall be considered an applicable tax for the purpose of this tender. However, the bidder shall NOT include any amount in the bid price for said HST. The successful contractor will indicate on each application for payment as a separate amount the appropriate HST the Owner is legally obliged to pay. This amount will be paid to the Contractor in addition to the amount certified for payment under the Contract in addition to the amount certified for payment under the Contract and will therefore not affect the Contract Price. The Contractor agrees to remit any HST collected or due to Revenue Canada.

Acceptable Bonding Companies

Published September 2010

The following is a list of insurance companies whose bonds may be accepted as security by the government.

1. Canadian Companies

- ACE INA Insurance
- Allstate Insurance Company of Canada
- Ascentus Insurance Ltd. (Surety only)
- Aviva Insurance Company of Canada
- AXA Insurance (Canada)
- AXA Pacific Insurance Company
- Canadian Northern Shield Insurance Company
- Certas Direct Insurance Company (Surety only)
- Chartis Insurance Company of Canada (formerly AIG Commercial Insurance Company of Canada)
- Chubb Insurance Company of Canada
- Commonwealth Insurance Company
- Co-operators General Insurance Company
- CUMIS General Insurance Company
- The Dominion of Canada General Insurance Company
- Echelon General Insurance Company (Surety only)
- Economical Mutual Insurance Company
- Elite Insurance Company
- Everest Insurance Company of Canada
- Federated Insurance Company of Canada
- Federation Insurance Company of Canada
- Gore Mutual Insurance Company
- Grain Insurance and Guarantee Company
- The Guarantee Company of North America
- Industrial Alliance Pacific General Insurance Corporation
- Intact Insurance Company
- Jevco Insurance Company (Surety only)
- Lombard General Insurance Company of Canada
- Lombard Insurance Company
- Markel Insurance Company of Canada
- The Missisquoi Insurance Company
- The Nordic Insurance Company of Canada
- The North Waterloo Farmers Mutual Insurance Company (Fidelity only)
- Novex Insurance Company (Fidelity only)
- The Personal Insurance Company
- Pilot Insurance Company
- Quebec Assurance Company
- Royal & Sun Alliance Insurance Company of Canada
- Saskatchewan Mutual Insurance Company
- Scottish & York Insurance Co. Limited
- The Sovereign General Insurance Company
- TD General Insurance Company
- Temple Insurance Company

- Traders General Insurance Company
- Travelers Guarantee Company of Canada
- Trisura Guarantee Insurance Company
- The Wawanesa Mutual Insurance Company
- Waterloo Insurance Company
- Western Assurance Company
- Western Surety Company

2. Provincial Companies

Surety bonds issued by the following companies may be accepted provided that the contract of suretyship was executed in a province in which the company is licensed to do business as indicated in brackets.

- AXA Boreal Insurance Company (P.E.I., N.B., Que., Ont., Man., B.C.)
- AXA Boreal Insurance Company (P.E.I., N.B., Que., Ont., Man., B.C.)
- ALPHA, Compagnie d'Assurances Inc. (Que.)
- Canada West Insurance Company (Ont., Man., Sask, Alta., B.C., N.W.T.) (Surety only)
- The Canadian Union Assurance Company (Que.)
- La Capitale General Insurance Inc. (Nfld. & Lab., N.S., P.E.I., Que.(Surety only), Man., Sask., Alta., B.C., Nun., N.W.T., Yuk.)
- Coachman Insurance Company (Ont.)
- Continental Casualty Company (Nfld. & Lab., N.S., P.E.I., N.B., Que., Ont., Man., Sask., Alta., B.C., Nun., N.W.T., Yuk.)
- GCAN Insurance Company (Nfld. & Lab., N.S., P.E.I., N.B., Que., Ont., Man., Sask., Alta., B.C., Nun., N.W.T., Yuk.)
- The Insurance Company of Prince Edward Island (N.S., P.E.I., N.B.)
- Kingsway General Insurance Company (N.S., N.B., Que., Ont., Man., Sask., Alta., and B.C.)
- Liberty Mutual Insurance Company (Nfld. & Lab., N.S., P.E.I., N.B., Que., Ont., Man., Sask., Alta., B.C., Nun., N.W.T., Yuk.)
- Manitoba Public Insurance Corporation (Man.)
- Norgroupe Assurance Générales Inc.
- Orleans General Insurance Company (N.B., Que., Ont.)
- Saskatchewan Government Insurance Office (Sask.)
- SGI CANADA Insurance Services Ltd. (Ont., Man., Sask., Alta.)
- L'Unique General Insurance Inc. (Nfld. & Lab., N.S., P.E.I., N.B., Que.(Surety only), Ont.(Surety only), Man., Sask., Alta., B.C.(Surety only), Nun., N.W.T., Yuk.)

3. Foreign Companies

- Aspen Insurance UK Limited
- Compagnie Française d'Assurance pour le Commerce Extérieur (Fidelity only)
- Eagle Star Insurance Company Limited
- Ecclesiastical Insurance Office Public Limited Company (Fidelity only)
- Lloyd's Underwriters
- Mitsui Sumitomo Insurance Company, Limited
- NIPPONKOA Insurance Company, Limited
- Sompo Japan Insurance Inc.
- Tokio Marine & Nichido Fire Insurance Co., Ltd.
- XL Insurance Company Limited (Surety only)
- Zurich Insurance Company Ltd

Articles of Agreement

Standard Construction Contract – Articles of Agreement
(23/01/2002)

- A1 Contract Documents
- A2 Date of Completion of Work and Description of Work
- A3 Contract Amount
- A4 Contractor's Address
- A5 Unit Price Table

Articles of Agreement

These Articles of Agreement made in duplicate this day of .

Between

Her Majesty the Queen, in right of Canada (referred to in the contract documents as “ Her Majesty”) represented by the National Research Council Canada (referred to in the contract documents as the “Council”)

and

(referred to in the contract documents as the “Contractor”)

Witness that in consideration for the mutual promises and obligations contained in the contract, Her Majesty and the Contractor covenant and agree as follows:

A1 Contract Documents

(23/01/2002)

1.1 Subject to A1.4 and A1.5, the documents forming the contract between Her Majesty and the Contractor, referred to herein as the contract documents, are

1.1.1 these Articles of Agreement,

1.1.2 the document attached hereto, marked “A” and entitled “Plans and Specifications”, referred to herein as the Plans and Specifications,

1.1.3 the document attached hereto, marked “B” and entitled “Terms of Payment”, referred to herein as the Terms of Payment,

1.1.4 the document attached hereto, marked “C” and entitled “General Conditions”, referred to herein as the General Conditions,

1.1.5 the document attached hereto, marked “D” and entitled “Labour Conditions”, referred to herein as the Labour Conditions,

1.1.6 the document attached hereto, marked “E” and entitled “Insurance Conditions”, referred to herein as the Insurance Conditions,

1.1.7 the document attached hereto, marked “F” and entitled “Contract Security Conditions”, referred to herein as the Contract Security Conditions, and

1.1.8 any amendment or variation of the contract documents that is made in accordance with the General Conditions.

1.1.9 the document entitled Fair Wage Schedules for Federal Construction Contracts referred to herein as Fair Wage Schedules

1.1.10

Articles of Agreement

The Council hereby designates _____ of _____ of the Government of Canada as the Engineer for the purposes of the contract, and for all purposes of or incidental to the contract, the Engineer's address shall be deemed to be:

1.2 In the contract

1.3.1 "Fixed Price Arrangement" means that part of the contract that prescribes a lump sum as payment for performance of the work to which it relates; and

1.3.2 "Unit Price Arrangement" means that part of the contract that prescribes the product of a price multiplied by a number of units of measurement of a class as payment for performance of the work to which it relates.

1.3 Any of the provisions of the contract that are expressly stipulated to be applicable only to a Unit Price Arrangement are not applicable to any part of the work to which a Fixed Price Arrangement is applicable.

1.4 Any of the provisions of the contract that are expressly stipulated to be applicable only to a Fixed Price Arrangement are not applicable to any part of the work to which a Unit Price Arrangement is applicable.

A2 Date of Completion of Work and Description of Work

(23/01/2002)

2.1 The contractor shall, between the date of these Articles of Agreement and the _____, _____, in the careful and workmanlike manner, diligently perform and complete the following work:

which work is more particularly described in the Plans and Specifications.

Articles of Agreement

A3 Contract Amount

(23/01/2002)

- 3.1 Subject to any increase, decrease, deduction, reduction or set-off that may be made under the Contract, Her Majesty shall pay the Contractor at the times and in the manner that is set out or referred to in the Terms of Payment
- 3.1.1 the sum of _____ (GST/HST extra), in consideration for the performance of the work or the part thereof that is subject to Fixed Price Arrangement, and
- 3.1.2 a sum that is equal to the aggregate of the products of the number of units of Measurement of each class of labour, plant and material that is set out in a Final Certificate of Measurement referred to in GC44.8 multiplied in each case by the appropriate unit price that is set out in the Unit Price Table in consideration for the performance of the work or the part thereof that is subject to a Unit Price Arrangement.
- 3.2 For the information and guidance of the Contractor and the persons administering the contract on behalf of Her Majesty, but not so as to constitute a warranty , representation or undertaking of any nature by either party, it is estimated that the total amount payable by Her Majesty to the Contractor for the part of the work to which a Unit Price Arrangement is applicable will be approximately \$N/A
- 3.3 A3.1.1 is applicable only to a Fixed Price Arrangement.
- 3.4 A3.1.2 and A3.2 applicable only to a Unit Price Arrangement.

A4 Contractor's Address

(23/01/2002)

- 4.1 For all purposes of or incidental to the contract, the Contractor's address shall be deemed to be:

Articles of Agreement

A5 Unit Price Table

(23/01/2002)

5.1 Her Majesty and the Contractor agree that the following table is the Unit Price Table for the purposes of the contract.

Column 1 Item	Column 2 Class of Labour Plant Or Material	Column 3 Unit of Measurement	Column 4 Estimated Total Quantity	Column 5 Price per Unit	Column 6 Estimated Total Price
		N/A			

5.2 The Unit Price Table that is set out in A5.1 designates the part of the work to which a Unit Price Arrangement is applicable.

5.3 The part of the work that is not designated in the Unit Price Table referred to in A5.2 is the part of the work to which a Fixed Price Arrangement is applicable.

Articles of Agreement

Signed on behalf of Her Majesty by

as Senior Contracting Officer

and _____

as _____

of the **National Research Council Canada**

on the _____

day of _____

Signed, sealed and delivered by

as _____ and
Position

by _____

as _____
Position

of

on the _____

day of _____

Seal

TOW TANK WAVE MAKER


NRC Project No.: IMC0168

**SPECIFICATIONS
(Issued for Tender)**

July 2017

PROFESSIONAL STAMPS AND PERMITS

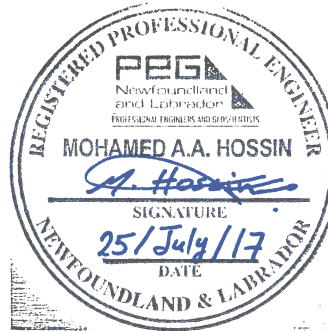
PROVINCE OF NEWFOUNDLAND AND LABRADOR



PERMIT HOLDER
THIS PERMIT ALLOWS

MADERRA ENGINEERING

To practice Professional Engineering
in Newfoundland and Labrador.
Permit No. as issued by PEG Y0253
which is valid for the year 2017
by Permit Holder (MIRC No.) 03054



REGISTERED PROFESSIONAL ENGINEER
PEG
Newfoundland and Labrador
PROFESSIONAL ENGINEERS AND GEODETISTS
MOHAMED A.A. HOSSIN
M. Hossin
SIGNATURE
25/July/17
DATE
NEWFOUNDLAND & LABRADOR

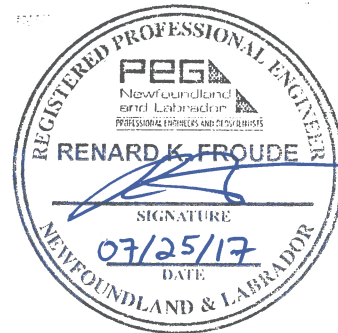
PROVINCE OF NEWFOUNDLAND AND LABRADOR



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MADERRA ENGINEERING

To practice Professional Engineering
in Newfoundland and Labrador.
Permit No. as issued by PEG Y0253
which is valid for the year 2017
by Permit Holder (MIRC No.) 02824



REGISTERED PROFESSIONAL ENGINEER
PEG
Newfoundland and Labrador
PROFESSIONAL ENGINEERS AND GEODETISTS
RENARD K. FROUDE
R. Froude
SIGNATURE
07/25/17
DATE
NEWFOUNDLAND & LABRADOR

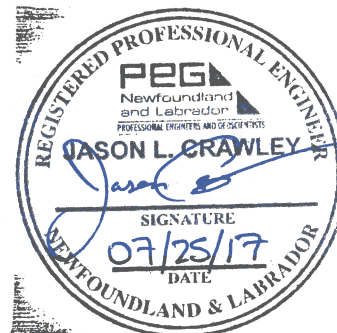
PROVINCE OF NEWFOUNDLAND AND LABRADOR



PERMIT HOLDER
THIS PERMIT ALLOWS

MADERRA ENGINEERING

To practice Professional Engineering
in Newfoundland and Labrador.
Permit No. as issued by PEG Y0253
which is valid for the year 2017
by Permit Holder (MIRC No.) 03820



REGISTERED PROFESSIONAL ENGINEER
PEG
Newfoundland and Labrador
PROFESSIONAL ENGINEERS AND GEODETISTS
JASON L. CRAWLEY
J. Crawley
SIGNATURE
07/25/17
DATE
NEWFOUNDLAND & LABRADOR



NEWFOUNDLAND AND LABRADOR
Chris Woodford
CHRISTOPHER WOODFORD
Member / Licence Holder
Expires 31 Dec 2017
Date: 07/25/17
ASSOCIATION OF ARCHITECTS

DIVISION 1 - GENERAL REQUIREMENTS

Section #00 10 00 - General Instructions
Section #00 15 45 - General and Fire Safety Requirements
Section #01 35 43 - Environmental Requirements
Section #01 56 00 - Temporary Barriers and Enclosures
Section #01 74 11 - Cleaning
Section #01 74 21 - Construction/Demolition Waste Management and Disposal

DIVISION 2 – EXISTING CONDITIONS

Section #02 41 13 - Selective Site Demolition
Section #02 41 16 - Structure Demolition

DIVISION 3 - CONCRETE

Section #03 10 00 - Concrete Forming and Accessories
Section #03 20 00 - Concrete Reinforcing
Section #03 30 00 - Cast-in-Place Concrete
Section #03 35 00 - Concrete Finishing

DIVISION 4 - MASONRY

Section #04 05 00 - Common Work Results for Masonry
Section #04 05 12 - Masonry Mortar and Grout
Section #04 05 19 - Masonry Anchorage and Reinforcing
Section #04 22 00 - Concrete Unit Masonry

DIVISION 7 - THERMAL & MOISTURE PROTECTION

Section #07 21 20 - Low Expanding Foam Sealant
Section #07 84 00 - Firestopping
Section #07 92 00 - Joint Sealants

DIVISION 8 - OPENINGS

Section #08 11 00 - Metal Doors and Frames
Section #08 71 00 - Door Hardware

DIVISION 9 - FINISHES

Section #09 91 23 - Interior Painting

DIVISION 10 - SPECIALTIES

Section #10 44 16.19 - Fire Extinguishers and Fire Blankets

DIVISION 21 - FIRE SUPPRESSION

Section #21 13 13 - Wet Pipe Sprinkler Systems

DIVISION 22 – PLUMBING

Section #22 05 00 - Common Work Results for Plumbing

DIVISION 23 - HEATING, VENTILATION AND AIR CONDITIONING (HVAC)

Section #23 05 00 - Common Work Results of HVAC

Section #23 33 16 - Dampers – Fire and Smoke

Section #23 34 00 - HVAC Fans

DIVISION 25 - INTEGRATED AUTOMATION

Section #25 05 01 - EMCS: General Requirements

Section #25 30 02 - EMCS: Field Control Devices

DIVISION 26 - ELECTRICAL

Section #26 05 00 - Common Work Results – Electrical

Section #26 05 14 - Power Cable and Overhead Conductors

Section #26 05 20 - Wire and Box Connectors (0 - 1000V)

Section #26 05 21 - Wires and Cables (0 - 1000V)

Section #26 05 22 - Connectors and Terminations

Section #26 05 27 - Grounding – Primary

Section #26 05 28 - Grounding – Secondary

Section #26 05 29 - Hangers and Supports for Electrical Systems

Section #26 05 31 - Splitters, Junction, Pull Boxes and Cabinets

Section #26 05 32 - Outlet Boxes, Conduit Boxes and Fittings

Section #26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings

Section #26 05 36 - Cable Trays for Electrical Systems

Section #26 12 19 - Pad Mounted, Dry Type, Medium Voltage Transformers

Section #26 24 01 - Service Equipment

Section #26 24 02 - Service Entrance Board

Section #26 24 16.01 - Panelboards Breaker Type

Section #26 24 16.02 - Panelboards Switch and Fuse Type

Section #26 27 26 - Wiring Devices

Section #26 28 13.01 - Fuses - Low Voltage

Section #26 28 16.02 - Moulded Case Circuit Breakers

Section #26 28 18 - Ground Fault Equipment Protection

Section #26 28 23 - Disconnect Switches - Fused and Non-Fused

Section #26 50 00 - Lighting

Section #26 52 00 - Emergency Lighting

Section #26 53 00 - Exit Signs

Section #26 80 00 - Commissioning of Electrical Systems

Section #26 90 00 - Wiring of Equipment Supplied by Others

APPENDICES

Appendix A - Tow Tank Wave-Maker Safety Notes
Appendix B - Bosch Installation Instructions

1. PROJECT CONTEXT

- .1 The National Research Council of Canada, Ocean, Coastal and River Engineering Portfolio (NRC-OCRE), in St. John's, NL, is replacing the current wave generation capability of its Tow Tank facility located in St. Johns Newfoundland, Canada. The Towing tank facility is 200 m long, 12 m wide and 7 m water depth. It currently has a hydraulic powered dual flap wave maker 12 m wide by 5 m deep located at one end of the tank. The existing wave maker will be replaced with an electrically driven multi segmented system. Procurement of the new wave maker is in progress

2. SCOPE OF WORK:

- .1 This contract covers the necessary work to prepare the site to receive a new Wavemaker system, including civil, electrical and mechanical changes to the existing facility. It also includes the removal of all existing equipment that will no longer be used, including the existing wavemaker and the hydraulic support system, and the necessary structural changes to allow the water basin to receive the new system. Work will be completed at the NRC facility located at:

Ocean Coastal and River Engineering – OCRE
1 Arctic Avenue
St. John's, NL A1B 3T5

- .2 **OPTIONAL SCOPE:** Installation of the new Wavemaker supervised by the equipment supplier. Installation includes electrical connections and mechanical assembly. Refer to installation manual in **Appendix B** for more details.

3. WORK OUT OF SCOPE

- .1 NRC OCRE will be responsible to drain and refill the basin with water
- .2 NRC OCRE will be responsible to verify rail system alignment prior to equipment commissioning
- .3 NRC OCRE will be responsible for verifying the basin for leakage and patching the basin as needed.

4. DRAWINGS

- .1 The following drawings illustrate the work and form part of the contract documents:

IMC0168-M01	Mechanical Fit-Up Segmented Wave Generator MCC Room
IMC0168-M02	Mechanical Sections @ Segmented Wave Generator MCC Room
IMC0168-E01	Clearwater Tank Basement
IMC0168-E02	Clearwater Tank Main Level
IMC0168-E03	Electrical Single Line Diagram and Details
IMC0168-E04	Part Plan Segmented Wave Generator MCC Room
IMC0168-E05	Building Services Demolition Former Pump Room
IMC0168-E06	Electrical Demolition Mail Level

IMC0168-E07	Part Plan New Electrical Room and Details
IMC0168-S01	Clearwater Tank Main Level (Demolition)
IMC0168-S02	Clearwater Tank Main Level (Demolition) Sections
IMC0168-S03	Clearwater Tank Basement Level (New Conditions)
IMC0168-S04	Clearwater Tank Basement Level (New Conditions) Details
IMC0168-S05	Clearwater Tank Basement Level (New Conditions) Details
IMC0168-S06	Clearwater Tank Main Level New Concrete Curb Details
IMC0168-A01	Part Plan Segmented Wave Generator MCC Room

5. COMPLETION

- .1 Complete all work within 15 week(s) after receipt of notification of acceptance of tender.

Milestone note: New Wavemaker equipment needs to be installed and basin ready to be refilled with water by December 8, 2017.

6. GENERAL

- .1 The word "provide" in this Specification means to supply and install.
- .2 Provide items mentioned in either the drawings or the specification.

7. SPECIFIED ACCEPTABLE & ALTERNATIVE EQUIPMENT & MATERIALS

- .1 Materials and equipment scheduled and/or specified on the drawings or in the specifications have been selected to establish a performance and quality standard. In most cases, acceptable manufacturers are stated for any material or equipment specified by manufacturer's name and model number. Contractors may base their tender price on materials and equipment supplied by any of the manufacturers' names as acceptable for the particular material or equipment.
- .2 In addition to the manufacturers specified or named as acceptable, you may propose alternative manufacturers of materials or equipment to the Departmental Representative for acceptance. For a product to be considered as an alternative product substitute, make a written application to the Departmental Representative during the tender period, not later than seven (7) working days before tender closing.
- .3 Certify in writing that the alternative meets all requirements of the specified material or equipment. In addition, it shall be understood that all costs required by or as a result of acceptance or proposed alternatives, will be borne by the contractor.
- .4 Approval of alternatives will be signified by issue of an Addendum to the Tender Documents.
- .5 Any alternative manufacturers or materials submitted which are incomplete and cannot be evaluated, or are later than seven (7) working days before tender closing date or after the tender period, will not be considered.

8. MINIMUM STANDARDS

- .1 Conform to or exceed minimum acceptable standards of the various applicable federal, provincial and municipal codes such as The National Building Code, The National Fire

Code, Canadian Plumbing Code, Canadian Electrical Code, Canadian Code for Construction Safety and the Provincial Construction Safety Act.

- .2 Work to conform to referenced standards and codes as reaffirmed or revised to date of specification.

9. WORKPLACE HAZARDOUS MATERIAL INFORMATION SYSTEM (WHMIS)

- .1 The general contractor shall comply with Federal and Provincial legislation regarding the WHMIS. The contractor's responsibilities include, but are not limited to the following:
 - .1 To ensure that any controlled product brought on site by the contractor or sub-contractor is labeled;
 - .2 To make available to the workers and the Departmental Representative, Material Safety Data Sheets (MSDS) for these controlled products;
 - .3 To train own workers about WHMIS, and about the controlled products that they use on site;
 - .4 To inform other contractors, sub-contractors, the Departmental Representative, authorized visitors and outside inspection agency personnel about the presence and use of such products on the site.
 - .5 The site foreman or superintendent must be able to demonstrate, to the satisfaction of the Departmental Representative, that he/she has had WHMIS training and is knowledgeable in its requirements. The Departmental Representative can require replacement of this person if this condition or implementation of WHMIS is not satisfactory.

10. DESIGNATED SUBSTANCES

- .1 Comply with Provincial legislation if encountering specifically listed designated substances on the work site while performing the work described in these contract documents:
 - .1 It is the responsibility of the general contractor to ensure that each prospective subcontractor for this project has received a copy of the listed designated substances which may be present on site.

11. COST BREAKDOWN

- .1 Submit, for approval by the Departmental Representative, a cost breakdown of tender 72 hours after the contract is awarded.
- .2 Use the approved cost breakdown as the basis for submitting all claims.
- .3 Request Departmental Representative's verbal approval to amount of claim prior to preparing and submitting the claim in its final form.

12. SUB-TRADES

- .1 Submit no later than 72 hours after tender closing, a complete list of sub trades for the Departmental Representative's review.

13. PERSONNEL SECURITY AND IDENTIFICATION

- .1 All persons employed by the contractor, or by any subcontractor and present on the site must be security cleared in accordance with the requirements of the Section entitled Special Instructions to Tenderers.
- .2 Security shall be obtained before activities on site can begin. Contractor to present a list of necessary clearance two (2) days after the project kick off meeting.
- .3 All such persons must wear and keep visible identification badges as issued by the Security Office of NRC.

14. WORKING HOURS AND ESCORTING REQUIREMENTS

- .1 Normal working hours on the NRC property are from 8:00 a.m. until 4:30 p.m., Monday to Friday inclusive, except statutory holidays.
- .2 At all other times, special written passes are required for access to the building site.
- .3 Before scheduling any work outside normal working hours, obtain permission from the Departmental Representative to perform the specific tasks.
- .4 An escort may be required whenever working outside normal hours. Contractor to bear the associated costs.

15. SCHEDULE

- .1 The contractor shall prepare a detailed schedule, fixing the date for commencement and completion of the various parts of the work and update the said schedule. Such schedule shall be made available to the Departmental Representative not later than two weeks after the award of the contract and prior to commencement of any work on site.
- .2 Notify Departmental Representative in writing of any changes in the schedule.
- .3 Fifteen business (15) day(s) before the scheduled completion date, arrange to do an interim inspection with the Departmental Representative.

16. PROJECT MEETINGS

- .1 Hold bi-weekly project status meetings at times and locations approved by the Departmental Representative.
- .2 Notify all parties concerned of meetings to ensure proper coordination of work.
- .3 Departmental Representative will set times for project meetings, contractor will be responsible to prepare the meeting agenda, and for recording and distributing minutes.

17. SHOP DRAWINGS

- .1 Submit to Departmental Representative for review, shop drawings, product data and samples specified within three (3) week(s) after contract award.

- .2 Submit to Departmental Representative for review a complete list of all shop drawings, product data and samples specified and written confirmation of corresponding delivery dates within one (1) week after shop drawings, product data and samples approval date. This list shall be updated on a four (4) week basis and any changes to the list shall be immediately notified in writing to the Departmental Representative.
- .3 Review shop drawings, data sheets and samples prior to submission.
- .4 Submit electronic copy of all shop drawings and product data and samples for review, unless otherwise specified.
- .5 Review of shop drawings and product data by the Departmental Representative does not relieve the contractor of the responsibility for errors and omissions and for the conformity with contract documents.

18. SAMPLES AND MOCK-UPS

- .1 Submit samples in sizes and quantities as specified.
- .2 Where colour, pattern or texture is criterion, submit full range of samples.
- .3 Construct field samples and mock-ups at locations acceptable to Departmental Representative.
- .4 Reviewed samples or mock-ups will become standards of workmanship and material against which installed work will be checked on the project.

19. MATERIALS AND WORKMANSHIP

- .1 Install only new materials on this project unless specifically noted otherwise.
- .2 Only first class workmanship will be accepted, not only with regard to safety, efficiency, durability, but also with regard to neatness of detail and performance.

20. WORK & MATERIALS SUPPLIED BY OWNER

- .1 Work and materials not included in this contract are described on drawings and in this specification.
- .2 Deliver to a storage place, as directed by the Departmental Representative, all materials returned to the Owner.
- .3 Unless otherwise specified, accept owner-supplied materials at their storage location and provide all transportation as required.
- .4 General Contractor's duties:
 - .1 Unload at site.
 - .2 Promptly inspect products and report damaged or defective items.
 - .3 Give written notification to the Departmental Representative for items accepted in good order.

- .4 Handle at site, including uncrating and storage.
- .5 Repair or replace items damaged on site.
- .6 Install, connect finished products as specified.

21. SITE ACCESS

- .1 Make prior arrangements with the Departmental Representative before starting work or moving materials and equipment on site.
- .2 Obtain approval of Departmental Representative for regular means of access during the construction period.
- .3 Obtain approval of Departmental Representative before temporarily suspending operations on site; before returning to the site and before leaving the site at the end of the job.
- .4 Provide and maintain access to site.
- .5 Build and maintain temporary roads and provide snow removal during period of work.
- .6 Make good any damage and clean up dirt, debris, etc., resulting from contractor's use of existing roads.

22. USE OF SITE

- .1 Restrict operations on the site to the areas approved by the Departmental Representative
- .2 Locate all temporary structures, equipment, storage, etc., to the designated areas.
- .3 Restrict parking to the designated areas.

23. ACCEPTANCE OF SITE

- .1 Inspect the site before commencing work, review any unexpected conditions with the Departmental Representative.
- .2 Commencement of work will imply acceptance of existing conditions.

24. SITE OFFICE & TELEPHONE

- .1 Contractor to erect a temporary site office at his own expense.
- .2 Install and maintain a telephone, if necessary.
- .3 Use of NRC phones is not permitted unless in the case of an emergency.

25. SANITARY FACILITIES

- .1 Provide sanitary facilities, and bear all associated costs.

26. TEMPORARY SERVICES

- .1 A source of temporary power will be made available in the area. Bear all costs to make connections to the power source and perform distribution on site.
- .2 Provide all load centres, breakers, conduit, wiring, disconnects, extension cords, transformers, as required from the source of power.
- .3 Power is to be used only for power tools, lighting, controls, motors, and not for space heating.
- .4 A source of temporary water will be made available if required.
- .5 Bear all costs associated with distributing the water to the required locations.
- .6 Comply with NRC requirements when connecting to existing systems in accordance with the articles entitled "Co-operation" and "Service Interruptions" of this section.

27. DOCUMENTS REQUIRED AT WORK SITE

- .1 The contractor shall keep on the site, one (1) up-to-date copy of all contract documents, including specifications, drawings, addenda, shop drawings, change notices, schedule and any reports or bulletins pertaining to the work, in good order, available to the Departmental Representative and to his / her representatives at all times.
- .2 At least one (1) copy of specifications and drawings shall be marked by the contractor to show all work "As Built" and shall be provided to the Departmental Representative with the Application for Payment and for the Final Certificate of Completion.

28. CO-OPERATION

- .1 Co-operate with NRC staff in order to keep disruption of normal research work to an absolute minimum.
- .2 Work out in advance, a schedule for all work which might disrupt normal work in the building.
- .3 Have schedule approved by the Departmental Representative.
- .4 Notify the Departmental Representative in writing, 72 hours prior to any intended interruption of facilities, areas, corridors, mechanical or electrical services and obtain requisite permission.

29. PROTECTION AND WARNING NOTICES

- .1 Provide all materials required to protect existing equipment.
- .2 Erect dust barriers to prevent dust and debris from spreading through the building.
- .3 Place dust protection in the form of cover sheets over equipment and furniture and tape these sheets to floors, to ensure no dust infiltration.

- .4 Repair or replace any and all damage to Owner's property caused during construction, at no cost to the Owner and to the satisfaction of the Departmental Representative.
- .5 Protect the buildings, roads, lawns, services, etc. from damage which might occur as a result of this work.
- .6 Plan and co-ordinate the work to protect the buildings from the leakage of water, dust, etc.
- .7 Ensure that all doors, windows, etc., that could allow transfer of dust, noise, fumes, etc., to other areas of the building are kept closed.
- .8 Be responsible for security of all areas affected by the work under the Contract until acceptance by NRC. Take all necessary precautions to prevent entry to the work area by unauthorized persons and guard against theft, fire and damage by any cause. Secure working area at the end of each day's work and be responsible for same.
- .9 Provide and maintain adequate safety barricades around the work sites to protect NRC personnel and the public from injury during the construction.
- .10 Post warnings, in all instances where possible injury could occur such as Work Overhead, Hard Hat Areas, etc. or as required by the Departmental Representative.
- .11 Provide temporary protective enclosures over building entrances and exits to protect pedestrians. All enclosures to be structurally sound against weather and falling debris.

30. BILINGUALISM

- .1 Ensure that all signs, notices, etc. are posted in both official languages.
- .2 Ensure that all identification of services called for by under this contract are bilingual.

31. LAYOUT OF WORK

- .1 Location of equipment, fixtures, outlets and openings indicated on drawings or specified are to be considered as approximate.
- .2 Locate equipment, fixtures and distribution systems to provide minimum interference and maximum usable space and in accordance with the manufacturer's recommendations for safety, access and maintenance.
- .3 Employ competent person to lay out work in accordance with the contract documents.

32. DISCREPANCIES & INTERFERENCES

- .1 Prior to the start of the work, examine drawings and specifications. Report at once to the Departmental Representative, any defects, discrepancies, omissions or interferences affecting the work.
- .2 Contractor to immediately inform the Departmental Representative in writing, of any discrepancies between the plans and the physical conditions so the Departmental Representative may promptly verify same.

- .3 Any work done after such a discovery, until authorized, is at the contractor's risk.
- .4 Where minor interferences as determined by the Departmental Representative are encountered on the job and they have not been pointed out on the original tender or on the plans and specifications, provide offsets, bends or reroute the services to suit job conditions at no extra cost.
- .5 Arrange all work so as not to interfere in any way with other work being carried out.

33. MANUFACTURER'S INSTRUCTIONS

- .1 Unless otherwise specified, comply with manufacturer's latest printed instructions for materials and installation methods.
- .2 Notify the Departmental Representative in writing of any conflict between these specifications and manufacturer's instruction. Departmental Representative will designate which document is to be followed.

34. TEMPORARY HEATING AND VENTILATING

- .1 Bear the costs of temporary heat and ventilation during construction including costs of installation, fuel, operation, maintenance, and removal of equipment.
- .2 Use of direct-fired heaters discharging waste products into the work areas will not be permitted unless prior approval is given by the Departmental Representative.
- .3 Furnish and install temporary heat and ventilation in enclosed areas as required to:
 - .1 Facilitate progress of work.
 - .2 Protect work and products against dampness and cold.
 - .3 Reduce moisture condensation on surfaces to an acceptable level.
 - .4 Provide ambient temperature and humidity levels for storage, installation and curing of materials.
 - .5 Provide adequate ventilation to meet health regulations for a safe working environment.
- .4 Maintain minimum temperature of 10 °C (50 °F) or higher where specified as soon as finishing work is commenced and maintain until acceptance by the Departmental Representative. Maintain ambient temperature and humidity levels as required for comfort of NRC personnel.
- .5 Prevent hazardous or unhealthy accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction including also, storage areas and sanitary facilities.
 - .1 Dispose of exhaust materials in a manner that will not result in a harmful or unhealthy exposure to persons.
- .6 Maintain strict supervision of operation of temporary heating and ventilating equipment.
 - .1 Enforce conformance with applicable codes and standards.

- .2 Comply with instructions of the Departmental Representative including provision of full-time watchman services when directed.
- .3 Enforce safe practices.
- .4 Vent direct-fired combustion units to outside.
- .7 Submit tenders assuming existing or new equipment and systems will not be used for temporary heating and ventilating.
- .8 After award of contract, Departmental Representative may permit use of the permanent system providing agreement can be reached on:
 - .1 Conditions of use, special equipment, protection, maintenance, and replacement of filters.
 - .2 Methods of ensuring that heating medium will not be wasted and in the case of steam, agreement on what is to be done with the condensate.
 - .3 Saving on contract price.
 - .4 Provisions relating to guarantees on equipment.

35. CONNECTIONS TO AND INTERRUPTIONS TO EXISTING SERVICES

- .1 Where work involves breaking into or connecting to existing services, carry out work at times and in the manner agreed to by the Departmental Representative and by authorities having jurisdiction, with minimum disruption to NRC Personnel and vehicular traffic and minimum service interruption. Do not operate any NRC equipment or plant.
- .2 Before commencing work, establish location and extent of service lines in area of work and notify Departmental Representative of findings.
- .3 Submit a schedule to and obtain approval from the Departmental Representative for any shut-down or closure of active service or facility; allow minimum 72 hours notice. Adhere to approved schedule and provide notice to the Departmental Representative.
- .4 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .5 Provide detours, bridges, alternate feeds, etc., as required to minimize disruptions.
- .6 Protect existing services as required and immediately make repairs if damage occurs.
- .7 Remove any abandoned service lines as indicated on the contract documents and as approved by the Departmental Representative; cap or otherwise seal lines at cut-off points. Record and provide a copy to the Departmental Representative of locations of maintained, re-routed and abandoned service lines.

36. CUTTING AND PATCHING

- .1 Cut existing surfaces as required to accommodate new work.
- .2 Remove all items as shown or specified.

- .3 Patch and make good with identical materials, the surfaces that have been disturbed, cut or damaged, to the satisfaction of the Departmental Representative.
- .4 Where new pipes pass through existing construction, core drill an opening. Size openings to leave 12mm (1/2") clearance around the pipes or pipe insulation. Do not drill or cut any surface without the approval of the Departmental Representative.
- .5 Obtain written approval of the Departmental Representative before cutting openings through existing or new structural members.
- .6 Seal all openings where cables, conduits or pipes pass through walls with an acoustic sealant conforming to CAN/CGSB-19.21-M87.
- .7 Where cables, conduits and pipes pass through fire rated walls and floors, pack space between with compressed glass fibres and seal with fire stop caulking in accordance with CAN/CGSB-19.13-M87 AND NBC 3.1.7.

37. FASTENING DEVICES

- .1 Do not use explosive actuated tools, without first obtaining permission from the Departmental Representative.
- .2 Comply with the requirements of CSA A-166 (Safety Code for Explosive Actuated Tools).
- .3 Do not use any kind of impact or percussion tool without first obtaining permission from the Departmental Representative.

38. OVERLOADING

- .1 Ensure that no part of the building or work is subjected to a load which will endanger safety or cause permanent deformation or structural damage.

39. DRAINAGE

- .1 Provide temporary drainage and pumping as required to keep excavations and site free of water.

40. ENCLOSURE OF STRUCTURES

- .1 Construct and maintain all temporary enclosures as required to protect foundations, sub-soil, concrete, masonry, etc., from frost penetration or damage.
- .2 Maintain in place until all chances of damage are over and proper curing has taken place.
- .3 Provide temporary weather tight enclosures for exterior openings until permanent sash and glazing and exterior doors are installed.
- .4 Provide lockable enclosures as required to maintain the security of NRC facilities and be responsible for the same.

- .5 Provide keys to NRC security personnel when required.
- .6 Lay out the work carefully and accurately and verify all dimensions and be responsible for them. Locate and preserve general reference points.
- .7 Throughout the course of construction, keep continuously acquainted with field conditions, and the work being developed by all trades involved in the project. Maintain an awareness of responsibility to avoid space conflict with other trades.
- .8 Conceal all services, piping, wiring, ductwork, etc., in floors, walls or ceilings except where indicated otherwise.

41. STORAGE

- .1 Provide storage as required to protect all tools, materials, etc., from damage or theft and be responsible for the same.
- .2 Do not store flammable or explosive materials on site without the authorization of the Departmental Representative.

42. GENERAL REVIEW

- .1 Periodic review of the contractor's work by the Departmental Representative does not relieve the contractor of the responsibility of making the work in accordance with contract documents. Contractor shall carry out his own quality control to ensure that the construction work is in accordance with contract documents.
- .2 Inform the Departmental Representative of any impediments to the installation and obtain his / her approval for actual location.

43. INSPECTION OF BURIED OR CONCEALED SERVICES

- .1 Prior to concealing any services that are installed, ensure that all inspection bodies concerned, including NRC, have inspected the work and have witnessed all tests. Failure to do so may result in exposing the services again at the contractor's expense.

44. TESTING

- .1 On completion, or as required by local authority inspectors and/or Departmental Representative during progress of work and before any services are covered up and flushing is complete, test all installations in the presence of the Departmental Representative.
- .2 Obtain and hand to the Departmental Representative all acceptance certificates or test reports from authority having jurisdiction. The project will be considered incomplete without the same.

45. PARTIAL OCCUPANCY

- .1 NRC may request partial occupancy of the facility if the contract extends beyond the expected completion date.

- .2 Do not restrict access to the building, routes, and services.
- .3 Do not encumber the site with materials or equipment.

46. DISPOSAL OF WASTES

- .1 Dispose of waste materials including volatiles, safely off NRC property. Refer to the section entitled "General and Fire Safety Requirements" included as part of this specification.

47. CLEAN-UP DURING CONSTRUCTION

- .1 On a daily basis, maintain project site and adjacent area of campus including roofs, free from debris and waste materials.
- .2 Provide on-site dump containers for collection of waste materials and rubbish.

48. FINAL CLEAN-UP

- .1 Upon completion do a final clean-up to the satisfaction of the Departmental Representative.
- .2 Special attention should be given to the basin clean-up. Department representative will provide guidance as needed and approved work when completed.
- .3 Clean all new surfaces, lights, existing surfaces affected by this work, replace filters, etc.
- .4 Clean all resilient flooring and prepare to receive protective finish. Protective finish applied by NRC

49. WARRANTY AND RECTIFICATION OF DEFECTS IN WORK

- .1 Refer to General Conditions "C", section GC32.
- .2 Ensure that all manufacturers' guarantees and warranties are issued in the name of the **General Contractor** and the National Research Council.

50. MAINTENANCE MANUALS

- .1 Provide three (3) bilingual copies of maintenance manuals or two English and two French maintenance manuals immediately upon completion of the work and prior to release of holdbacks.
- .2 Manuals to be neatly bound in hard cover loose leaf binders.
- .3 Manuals to include operating and maintenance instructions, all guarantees and warranties, shop drawings, technical data, etc., for the material and apparatus supplied under this contract.

END OF SECTION

1. GENERAL CONSTRUCTION SAFETY REQUIREMENTS

- .1 The Contractor shall take all necessary steps to protect personnel (workers, visitors, general public, etc.) and property from any harm during the course of the contract.
- .2 The Contractor shall be solely responsible for the construction safety of both its employees and those of its sub-contractors at the work site, and for initiating, maintaining and supervising safety precautions, programs and procedures in connection with the performance of the work.
- .3 The Contractor shall comply with all Federal, Provincial and Municipal safety codes and regulations and all provincial OSH regulation . In the event of any conflict between any provisions in legislation or codes, the most stringent provisions shall apply.
- .4 Periodic review of the contractor's work by the Departmental Representative, using the criteria of the contract documents, does not relieve the contractor of his safety responsibilities in carrying out the work in accordance with the contract documents. The contractor shall consult with the Departmental Representative to ensure that this responsibility is carried out.
- .5 The Contractor shall ensure that only competent personnel are permitted to work on site. Throughout the term of the contract, any person will be removed from the site who is not observing or complying with the safety requirements.
- .6 All equipment shall be in safe operating condition and appropriate to the task.
- .7 Following a project and site hazard assessment, the Contractor shall develop a Site Specific Safety Plan based on the following minimum requirements:
 - .1 Provide a safety board mounted in a visible location on the project site, with the following information included thereon:
 - .1 Notice of Project
 - .2 Site specific Safety Policy
 - .3 Copy of Provincial OSH regulation
 - .4 Building Schematic showing emergency exits
 - .5 Building emergency procedures
 - .6 Contact list for NRC, Contractor and all involved sub-contractors
 - .7 Any related MSDS sheets
 - .8 Proper Emergency phone number
- .8 The Contractor shall provide competent personnel to implement its safety program and those of any Health and Safety Act legislation applicable at this project location, and to ensure they are being complied with.
- .9 The Contractor shall provide safety orientation to all its employees as well as those of any subcontractors under its jurisdiction.

- .10 The Departmental Representative will monitor to ensure that safety requirements are met and that safety records are properly kept and maintained. Continued disregard for safety standards can cause the contract to be cancelled and the Contractor or sub-contractors removed from the site.
 - .1 A copy of OCRE safety notes which provide an overview of the hazards and mitigations related to working in empty tanks that have been identified through OCRE internal hazard prevention program can be found in **APPENDIX A**
- .11 The Contractor will report to the Departmental Representative and jurisdictional authorities, any accident or incident involving Contractor or NRC personnel or the public and/or property arising from the Contractor's execution of the work.
- .12 If entry to a laboratory is required as part of the work of the Contractor, a safety orientation shall be provided to all his employees as well as those of any subcontractors regarding lab safety requirements and procedures, as provided by the Researcher or the Departmental Representative.

2. FIRE SAFETY REQUIREMENTS

.1 Authorities

1. The Fire Commissioner of Canada (FC) is the authority for fire safety at NRC.
2. For the purpose of this document, "Departmental Representative" will be deemed as the NRC person in charge of the project and who will enforce these Fire Safety Requirements.
3. Comply with the following standards as published by the Office of the Fire Commissioner of Canada:
 - a. Standard No. 301 - June 1982 "Standard for Construction Operations";
 - b. Standard No. 302 - June 1982 "Standard for Welding and Cutting".

.2 Smoking

- .1 Smoking is prohibited inside all NRC buildings, as well as roof areas.
- .2 Obey all "NO SMOKING" signs on NRC premises.

.3 Hot Work

- .1 Prior to commencement of any "Hot Work" involving welding, soldering, burning, heating, use of torches or salamanders or any open flame, obtain a Hot Work Permit from the Departmental Representative.
- .2 Prior to commencement of "Hot Work", review the area of hot work with the Departmental Representative to determine the level of fire safety precautions to be taken.

.4 Reporting Fires

- .1 Know the exact location of the nearest Fire Alarm Pull Station and telephone, including the emergency phone number.
- .2 REPORT immediately, all fire incidents as follows:
 - .1 Activate nearest fire alarm pull station and;
 - .2 Telephone the emergency phone numbers which will be provided at the project kick off meeting:
 4. When reporting a fire by phone, give the location of fire, building number and be prepared to verify location.
 5. The person activating fire alarm pull station must remain at a safe distance from the scene of the fire but readily available to provide information and direction to the Fire Department personnel.

.5 Interior and Exterior Fire protection & Alarm Systems

- .1 DO NOT OBSTRUCT OR SHUT OFF FIRE PROTECTION EQUIPMENT OR SYSTEMS, INCLUDING BUT NOT LIMITED TO FIRE ALARM SYSTEMS, SMOKE/HEAT DETECTORS, SPRINKLER SYSTEM, PULL STATIONS, EMERGENCY CALL BUTTONS AND PA SYSTEMS, WITHOUT AUTHORIZATION FROM THE DEPARTMENTAL REPRESENTATIVE.
- .2 WHEN ANY FIRE PROTECTION EQUIPMENT IS TEMPORARILY SHUT DOWN, ALTERNATIVE MEASURES AS PRESCRIBED BY THE DEPARTMENTAL REPRESENTATIVE SHALL BE TAKEN TO ENSURE THAT FIRE PROTECTION IS MAINTAINED.
- .3 DO NOT LEAVE FIRE PROTECTION OR ALARM SYSTEMS INACTIVE AT THE END OF A WORKING DAY WITHOUT NOTIFICATION AND AUTHORISATION FROM THE DEPARTMENTAL REPRESENTATIVE. THE DEPARTMENTAL REPRESENTATIVE WILL ADVISE THE (FPO) OF THE DETAILS OF ANY SUCH EVENT.
- .4 DO NOT USE FIRE HYDRANTS, STANDPIPES AND HOSE SYSTEMS FOR OTHER THAN FIRE FIGHTING PURPOSES UNLESS AUTHORISED BY DEPARTMENTAL REPRESENTATIVE.

.6 Fire Extinguishers

- .1 Provide a minimum of 1-20 lb. ABC Dry Chemical Fire Extinguisher at each hot work or open flame location.
- .2 Provide fire extinguishers for hot asphalt and roofing operations as follows:
 - a. Kettle area - 1-20 lb. ABC Dry Chemical;
 - b. Roof - 1-20 lb. ABC Dry Chemical at each open flame location.
- .3 Provide fire extinguishers equipped as below:
 - c. Pinned and sealed;
 - d. With a pressure gauge;
 - e. With an extinguisher tag signed by a fire extinguisher servicing company.

- .4 Carbon Dioxide (CO₂) extinguishers will not be considered as substitutes for the above.

.7 Roofing Operations

- .1 Kettles:
 - .1 Arrange for the location of asphalt kettles and material storage with the Departmental Representative before moving on site. Do not locate kettles on any roof or structure and keep them at least 10m (30 feet) away from a building.
 - .2 Equip kettles with 2 thermometers or gauges in good working order; a hand held and a kettle-mounted model.
 - .3 Do not operate kettles at temperatures in excess of 232°C (450 °F).
 - .4 Maintain continuous supervision while kettles are in operation and provide metal covers for the kettles to smother any flames in case of fire. Provide fire extinguishers as required in article 2.6.
 - .5 Demonstrate container capacities to Departmental Representative prior to start of work.
 - .6 Store materials a minimum of 6m (20 feet) from the kettle.
- .2 Mops:
 - .1 Use only glass fibre roofing mops.
 - .2 Remove used mops from the roof site at the end of each working day.
- .3 Torch Applied Systems:
 - .1 DO NOT USE TORCHES NEXT TO WALLS.
 - .2 DO NOT TORCH MEMBRANES TO EXPOSED WOOD OR CAVITY
 - .3 Provide a Fire Watch as required by article 2.9 of this section.
- .4 Store all combustible roofing materials at least 3m (10 feet) away from any structure.
- .5 Keep compressed gas cylinders a minimum of 6m (20 feet) away from the kettle, protected from mechanical damage and secured in an upright position.

.8 Welding / Grinding Operations

- .1 Contractor to provide fire blankets, portable fume extraction devices, screens or similar equipment to prevent exposure to welding flash, or sparks from grinding.

.9 Fire Watch

- .1 Provide a fire watch for a minimum of one hour after the termination of any hot work operation.
- .2 For temporary heating, refer to General Instructions Section 00 010 00.
- .3 Equip fire watch personnel with fire extinguishers as required by article 2.6.

.10 Obstruction of access/egress routes-roadways, halls, doors, or elevators

- .1 Advise the Departmental Representative in advance of any work that would impede the response of Fire Department personnel and their apparatus. This includes violation of minimum overhead clearance, erection of barricades and the digging of trenches.
- .2 Building exit routes must not be obstructed in any way without special permission from the Departmental Representative, who will ensure that adequate alternative routes are maintained.
- .3 The Departmental Representative will advise the FPO of any obstruction that may warrant advanced planning and communication to ensure the safety of building occupants and the effectiveness of the Fire Department.

.11 Rubbish and Waste Materials

- .1 Keep rubbish and waste materials to a minimum and a minimum distance of 6m (20 feet) from any kettle or torches.
- .2 Do not burn rubbish on site.
- .3 Rubbish Containers
 - .1 Consult with the Departmental Representative to determine an acceptable safe location for any containers and the arrangement of chutes etc. prior to bringing the containers on site.
 - .2 Do not overfill the containers and keep area around the perimeter free and clear of any debris.
- .4 Storage
 - .1 Exercise extreme care when storing combustible waste materials in work areas. Ensure maximum possible cleanliness, ventilation and that all safety standards are adhered to when storing any combustible materials.
 - .2 Deposit greasy or oily rags or materials subject to spontaneous combustion in CSA or ULC approved receptacles and remove at the end of the work day or shift, or as directed.

.12 Flammable Liquids

- .1 The handling, storage and use of flammable liquids is governed by the current National Fire Code of Canada.
- .2 Flammable Liquids such as gasoline, kerosene and naphtha may be kept for ready use in quantities not exceeding 45 litres (10 imp gal), provided they are stored in approved safety cans bearing the ULC seal of approval and kept away from buildings, stockpiled combustible materials etc. Storage of quantities of flammable liquids exceeding 45 litres (10 imp gal) for work purposes, require the permission of the Departmental Representative.

- .3 Flammable liquids are not to be left on any roof areas after normal working hours.
- .4 Transfer of flammable liquids is prohibited within buildings.
- .5 Do not transfer flammable liquids in the vicinity of open flames or any type of heat producing device.
- .6 Do not use flammable liquids having a flash point below 38 °C (100 °F) such as naphtha or gasoline as solvents or cleaning agents.
- .7 Store flammable waste liquids for disposal in approved container located in a safe, ventilated area. Waste flammable liquids are to be removed from the site on a regular basis.
- .8 Where flammable liquids, such as lacquers or urethane are used, ensure proper ventilation and eliminate all sources of ignition. Inform the Departmental Representative prior to, and at the cessation of such work.

3. Questions and/or clarifications

- .1 Direct any questions or clarification on Fire or General Safety, in addition to the above requirements, to the Departmental Representative.

END OF SECTION

PART 1 **GENERAL**

1.1 **FIRES**

- .1 Fires and burning of rubbish on site not permitted.

1.2 **DISPOSAL OF WASTES**

- .1 Do not bury rubbish and waste materials on site.
- .2 Do not dispose of waste or volatile materials, such as mineral spirits, oil or paint thinner into waterways, storm or sanitary sewers.

1.3 **DRAINAGE**

- .1 Provide temporary drainage and pumping as necessary to keep excavations and site free from water.
- .2 Do not pump water containing suspended materials into waterways, sewer or drainage systems.
- .3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authority requirements.

1.4 **SITE CLEARING AND PLANT PROTECTION**

- .1 Protect trees and plants on site and adjacent properties where indicated.
- .2 Wrap in burlap, trees and shrubs adjacent to construction work, storage areas and trucking lanes, and encase with protective wood framework from grade level to height of 2 m.
- .3 Protect roots of designated trees to dripline during excavation and site grading to prevent disturbance or damage. Avoid unnecessary traffic, dumping and storage of materials over root zones.
- .4 Minimize stripping of topsoil and vegetation.
- .5 Restrict tree removal to areas indicated or designated by NRC Departmental Representative

1.5 **WORK ADJACENT TO WATERWAYS**

- .1 Do not operate construction equipment in waterways.
- .2 Do not use waterway beds for borrow material.
- .3 Do not dump excavated fill, waste material or debris in waterways.

- .4 Design and construct temporary crossings to minimize erosion to waterways.
- .5 Do not skid logs or construction materials across waterways.
- .6 Avoid indicated spawning beds when constructing temporary crossings of waterways.
- .7 Do not blast under water or within 100 m of indicated spawning beds.

1.6 POLLUTION CONTROL

- .1 Maintain temporary erosion and pollution control features installed under this contract.
- .2 Control emissions from equipment and plant to local authorities emission requirements.
- .3 Prevent sandblasting and other extraneous materials from contaminating air beyond application area, by providing temporary enclosures.
- .4 Cover or wet down dry materials and rubbish to prevent blowing dust and debris. Provide dust control for temporary roads.

1.7 NOTIFICATION

- .1 NRC Departmental Representative will notify Contractor in writing of observed non-compliance with Federal, Provincial or Municipal environmental laws or regulations, permits, and other elements of environmental protection. Contractor: after receipt of such notice, inform NRC Departmental Representative of proposed corrective action and take such action as approved by NRC Departmental Representative.
- .2 NRC Departmental Representative may issue stop order of work until satisfactory corrective action has been taken.
- .3 No time extensions will be granted or equitable adjustments allowed to Contractor for such suspensions.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 **GENERAL**

1.1 **SECTION INCLUDES**

- .1 Barriers.
- .2 Environmental Controls.
- .3 Traffic Controls.
- .4 Fire Routes.

1.2 **INSTALLATION AND REMOVAL**

- .1 Provide temporary controls in order to execute Work expeditiously.
- .2 Remove from site all such work after use.

1.3 **HOARDING**

- .1 Erect temporary site enclosures using 38 x 89 mm construction grade lumber framing at 600 mm centres, installed on 89 x 89 mm wood posts at 2400 mm centres or 50 mm dia. steel posts at 2400 mm centres. Posts to be place in post holes filled with concrete to minimum 900 mm depth. Finish temporary site enclosures with 1200 x 2400 x 13 mm exterior grade fir plywood to CSA O121 or chain link fence fabric.
- .2 Apply plywood panels or chain link fence fabric vertically flush and butt jointed.
- .3 Provide one lockable truck entrance gate and at least one pedestrian door as directed and conforming to applicable traffic restrictions on adjacent streets. Equip gates with locks and keys.
- .4 Erect and maintain pedestrian walkways including roof and side covers, complete with signs and electrical lighting as required by law.
- .5 Paint public side of site enclosure in selected colours with one coat primer to CGSB 1.189M and one coat exterior paint to CGSB 1.59. Maintain public side of enclosure in clean condition.
- .6 Provide barriers around trees and plants designated to remain. Protect from damage by equipment and construction procedures.

1.4 **GUARD RAILS AND BARRICADES**

- .1 Provide secure, rigid guard rails and barricades around deep excavations, open shafts, open stair wells, open edges of floors and roofs.
- .2 Provide as required by governing authorities.

1.5 WEATHER ENCLOSURES

- .1 Provide weather tight closures to unfinished door and window openings, tops of shafts and other openings in floors and roofs.
- .2 Close off floor areas where walls are not finished; seal off other openings; enclose building interior work for temporary heat.
- .3 Erect enclosures to allow access for installation of materials and working inside enclosure.
- .4 Design enclosures to withstand wind pressure and snow loading.

1.6 DUST TIGHT SCREENS

- .1 Provide dust tight screens or insulated partitions to localize dust generating activities, and for protection of workers, finished areas of Work and public.
- .2 Maintain and relocate protection until such work is complete.

1.7 ACCESS TO SITE

- .1 Provide and maintain access roads, sidewalk crossings, ramps and construction runways as may be required for access to Work.
- .2 Build and maintain temporary roads where indicated or directed and provide snow removal during period on work.
- .3 If authorized to use existing roads for access to project site, maintain such roads for duration of Contract and make good damage resulting from Contractor's use of roads.

1.8 PUBLIC TRAFFIC FLOW

- .1 Provide and maintain competent signal flag operators, traffic signals, barricades and flares, lights, or lanterns as required to perform Work and protect the public.

1.9 FIRE ROUTES

- .1 Maintain access to property including overhead clearances for use by emergency response vehicles.

1.10 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

- .1 Protect surrounding private and public property from damage during performance of Work.
- .2 Be responsible for damage incurred.

1.11 PROTECTION OF BUILDING FINISHES

- .1 Provide protection for finished and partially finished building finishes and equipment during performance of Work.
- .2 Provide necessary screens, covers, and hoardings.
- .3 Confirm with NRC Departmental Representative locations and installation schedule 3 days prior to installation.
- .4 Be responsible for damage incurred due to lack of or improper protection.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 **GENERAL**

1.1 **GENERAL**

- .1 Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.
- .2 Store volatile waste in covered metal containers and remove from premises at end of each working day.
- .3 Provide adequate ventilation during use of volatile or noxious substances. Use for building ventilation systems is not permitted for this purpose.

1.2 **PROJECT CLEANLINESS**

- .1 Maintain Work in tidy condition, free from accumulation of waste products and debris, other than that caused by NRC Departmental Representative and other Contractors.
- .2 Remove waste materials and debris from site at the end of each working day. Do not burn waste materials on site.
- .3 Clear snow and ice from access to building.
- .4 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .5 Provide on-site containers for collection of waste materials and debris.
- .6 Clean interior areas prior to start of finish work, maintain areas free of dust and other contaminants during finishing operations.
- .7 Store volatile waste in covered metal containers, and remove from premises at end of each working day.
- .8 Provide adequate ventilation during use of volatile or noxious substances. Use of building ventilation systems is not permitted for this purpose.
- .9 Use only cleaning materials recommended by manufacturer of surface to be cleaned, and as recommended by cleaning material manufacturer.
- .10 Schedule cleaning operations so that resulting dust, debris and other contaminants will not fall on wet, newly painted surfaces nor contaminate building systems.

1.3 **FINAL CLEANING**

- .1 Refer to General Conditions.

- .2 When Work is Substantially Performed, remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .3 Remove waste products and debris other than that caused by others, and leave Work clean and suitable for occupancy.
- .4 When the Work is Totally Performed, remove surplus products, tools, construction machinery and equipment. Remove waste products and debris other than that caused by the NRC Departmental Representative or other Contractors.
- .5 Remove waste materials from the site at regularly scheduled times or dispose of as directed by the NRC Departmental Representative. Do not burn waste materials on site.
- .6 Make arrangements with and obtain permits from authorities having jurisdiction for disposal of waste and debris.
- .7 Leave the work broom clean before the inspection process commences.
- .8 Clean and polish glass, mirrors, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
- .9 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls, floors and ceilings.
- .10 Clean lighting reflectors, lenses, and other lighting surfaces.
- .11 Vacuum clean and dust building interiors.
- .12 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .13 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .14 Remove dirt and other disfiguration from exterior surfaces.
- .15 Clean roofs, gutters, downspouts and drainage systems. Clean areaways and sunken wells.
- .16 Sweep and wash clean paved areas.
- .17 Clean equipment and fixtures to a sanitary condition; clean or replace filters of mechanical equipment.
- .18 Remove snow and ice from access to building.
- .19 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.

1.4 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials in accordance with Section 00 10 00 – General Instructions.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

END OF SECTION

PART 1 **GENERAL**

1.1 **SECTION INCLUDES**

- .1 Text, schedules and procedures for systematic Waste Management Program for construction, deconstruction, demolition, and renovation projects, including:
 - .1 Diversion of Materials.
 - .2 Waste Audit (WA) - Schedule A.
 - .3 Waste Reduction Workplan (WRW) - Schedule B.
 - .4 Demolition Waste Audit (DWA) - Schedule C.
 - .5 Cost/Revenue Analysis Workplan (CRAW) - Schedule D.
 - .6 Materials Source Separation Program (MSSP).
 - .7 Canadian Governmental Responsibility for the Environment Resources - Schedule E.

1.2 **DEFINITIONS**

- .1 Demolition Waste Audit (DWA): Relates to actual waste generated from project.
- .2 Materials Source Separation Program (MSSP): Consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.
- .3 Recyclable: Ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse by others.
- .4 Recycle: Process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .5 Recycling: Process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .6 Reuse: Repeated use of product in same form but not necessarily for same purpose. Reuse includes:
 - .1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
 - .2 Returning reusable items including pallets or unused products to vendors.
- .7 Salvage: Removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .8 Separate Condition: Refers to waste sorted into individual types.
- .9 Source Separation: Acts of keeping different types of waste materials separate beginning from first time they became waste.

1.3 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)

- .1 Prepare MSSP and have ready for use prior to project start-up.
- .2 Implement MSSP for waste generated on project in compliance with approved methods and as reviewed by authorities having jurisdiction.
- .3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
- .4 Provide containers to deposit reusable and recyclable materials.
- .5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.
- .6 Locate separated materials in areas which minimize material damage.
- .7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.
 - .1 Transport to recycling facility.

1.4 STORAGE, HANDLING AND PROTECTION

- .1 Unless specified otherwise, materials for removal become Contractor's property.
- .2 Protect, stockpile, store and catalogue salvaged items.
- .3 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to approved local facility.
- .4 Protect structural components not removed for demolition from movement or damage.
- .5 Support affected structures. If safety of building is endangered, cease operations and immediately notify Department having jurisdiction.
- .6 Protect surface drainage, mechanical and electrical from damage and blockage.
- .7 Separate and store materials produced during dismantling of structures in designated areas.
- .8 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.
 - .1 On-site source separation is recommended.

1.5 DISPOSAL OF WASTES

- .1 Do not bury rubbish or waste materials.
- .2 Do not dispose of any waste into waterways, storm, or sanitary sewers.

- .3 Remove materials from deconstruction as deconstruction/disassembly Work progresses.
- .4 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.
- .5 Any information regarding waste management sites/locations, recycling depot locations approved by Environment Canada can be obtained by contacting:

Newfoundland and Labrador
Department of Municipal Affairs and Environment
West Block, Confederation Building
P.O. Box 8700
St. John's, NL A1B 4J6
Email: MAinfo@gov.nl.ca

1.6 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises.
- .2 Provide security measures approved by NRC Departmental Representative.

1.7 SCHEDULING

- .1 Coordinate Work with other activities at site to ensure timely and orderly progress of Work.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 APPLICATION

- .1 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

3.2 CLEANING

- .1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.
- .2 Clean-up work area as work progresses.
- .3 Source separate materials to be reused/recycled into specified sort areas.

3.3 DIVERSION OF MATERIALS

- .1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by NRC Departmental Representative and consistent with applicable fire regulations.
 - .1 Mark containers or stockpile areas.
 - .2 Provide instruction on disposal practices.
- .2 On-site sale or distribution of salvaged materials to third parties is not permitted.

END OF SECTION

PART 1 **GENERAL**

1.1 **SECTIONS INCLUDES**

- .1 Methods and procedures for demolishing, salvaging, recycling and removing sitework items designated to be removed in whole or in part, and for backfilling resulting trenches and excavations.

1.2 **SUBMITTALS**

- .1 Shop drawings
 - .1 Submit for approval drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning, where required by authorities having jurisdiction.
 - .2 Submit drawings stamped and signed by qualified professional engineer licensed in Province of Newfoundland and Labrador, Canada.

1.3 **QUALITY ASSURANCE**

- .1 Convene pre-installation meeting one week prior to beginning work of this section to:
 - .1 Verify project requirements.
 - .2 Review installation and substrate conditions.
 - .3 Co-ordination with building subtrades.
- .2 Arrange for site visit with NRC Departmental Representative to examine existing site conditions adjacent to demolition work, prior to start of Work.

1.4 **DELIVERY, STORAGE AND HANDLING**

- .1 Protect existing items designated to remain and items designated for salvage. In event of damage to such items, immediately replace or make repairs to approval of NRC Departmental Representative and at no cost to NRC Departmental Representative.
- .2 Remove and store materials to be salvaged, in manner to prevent damage.
- .3 Store and protect in accordance with requirements for maximum preservation of material.

1.5 **SITE CONDITIONS**

- .1 In all circumstances ensure that demolition work does not contribute to excess air and noise pollution.
- .2 Do not dispose, of waste or volatile materials such as mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers. Ensure proper disposal procedures are maintained throughout project.

- .3 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authorities.

1.6 EXISTING CONDITIONS

- .1 Prior to start of any demolition work remove contaminated or hazardous materials as defined by authorities having jurisdiction from site and dispose of at designated disposal facilities

1.7 SCHEDULING

- .1 Employ necessary means to meet project time lines without compromising specified minimum rates of material diversion.
- .2 Notify NRC Departmental Representative in writing when unforeseen delays occur.

PART 2 EXECUTION

2.1 PREPARATION

- .1 Inspect site with NRC Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.
- .2 Locate and protect utilities. Preserve active utilities traversing site in operating condition.
- .3 Notify and obtain approval of utility companies before starting demolition.

2.2 REMOVAL OF HAZARDOUS WASTES

- .1 Remove contaminated or dangerous materials defined by authorities having jurisdiction, relating to environmental protection, from site and dispose of in safe manner to minimize danger at site or during disposal.

2.3 REMOVAL OPERATIONS

- .1 Remove items as indicated in the drawings.
- .2 Do not disturb items designated to remain in place.
- .3 Contractor to build a ramp using compacted granular fill so the ramp has minimum slope to allow for a crane and forklift to operate at the area as shown on drawing IMC1068-S01.
- .4 Removal from site

- .1 Interim removal of stockpiled material will be required by NRC Departmental Representative, if it is deemed to interfere with operations of NRC Departmental Representative, Owner or other contractors.

2.4 RESTORATION

- .1 Restore areas and existing works outside areas of demolition to match conditions of adjacent, undisturbed areas.

2.5 CLEAN UP

- .1 Upon completion of work, remove debris, trim surfaces and leave work site clean.
- .2 Use cleaning solutions and procedures which are not harmful to health, are not injurious to plants, and do not endanger wildlife, adjacent water courses or ground water.

END OF SECTION

PART 1 **GENERAL**

1.1 **SECTION INCLUDES**

- .1 Methods and procedures for demolition of structures, parts of structures.

1.2 **REFERENCES**

- .1 Canadian Standards Association (CSA).
 - .1 CSA S350, Code of Practice for Safety in Demolition of Structures

1.3 **QUALITY ASSURANCE**

- .1 Prior to start of Work arrange for site visit with NRC Departmental Representative to examine existing site conditions adjacent to demolition work
- .2 Hold project meetings a weekly basis.
- .3 Ensure key personnel, site supervisor, project manager, subcontractor representatives, attend.

1.4 **WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials in accordance with Section 00 10 00 – General Instructions.

1.5 **EXISTING CONDITIONS**

- .1 Structures to be demolished to be based on their condition on date that tender is accepted.
- .2 Salvage items as identified by NRC Departmental Representative. Remove, protect and store salvaged items as directed by NRC Departmental Representative. Deliver to NRC Departmental Representative as directed.

1.6 **DEMOLITION DRAWINGS**

- .1 Where required by authorities having jurisdiction, submit for approval drawings, diagrams or details showing sequence of demolition work and supporting structures and underpinning.
- .2 Submit drawings stamped and signed by qualified professional engineer licensed in Province of Newfoundland and Labrador, Canada.

1.7 **ENVIRONMENTAL PROTECTION**

- .1 Ensure work is done in accordance with Section 00 10 00 – General Instructions.

- .2 Prevent movement, settlement or damage of adjacent structures, services, walks, paving, trees, landscaping, adjacent grades parts of existing building to remain.
- .3 Support affected structures and, if safety of structure being demolished or adjacent structures or services appears to be endangered cease operations and notify NRC Departmental Representative.
- .4 Prevent debris from blocking surface drainage system, elevators, mechanical and electrical systems which must remain in operation.
- .5 Ensure that demolition work does not adversely affect adjacent watercourses, groundwater and wildlife, or contribute to excess air and noise pollution.
- .6 Fires and burning of waste or materials is not permitted on site.
- .7 Do not bury waste or materials on site.
- .8 Do not dispose of waste or volatile materials such as mineral spirits, oil, petroleum based lubricants, or toxic cleaning solutions into watercourses, storm or sanitary sewers. Ensure proper disposal procedures are maintained throughout project.
- .9 Do not pump water containing suspended materials into watercourses, storm or sanitary sewers, or onto adjacent properties.
- .10 Control disposal or runoff of water containing suspended materials or other harmful substances in accordance with local authorities' requirements.
- .11 Protect trees, plants and foliage on site and adjacent properties where indicated.
- .12 Prevent extraneous materials from contaminating air beyond application area, by providing temporary enclosures during demolition work.
- .13 Cover or wet down dry materials and waste to prevent blowing dust and debris. Control dust on all temporary roads.

1.8 SCHEDULING

- .1 Ensure project time lines are met without compromising specified minimum rates of material diversion. Notify NRC Departmental Representative in writing of delays.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 PREPARATION

- .1 Do work in accordance with province of Newfoundland and Labrador Health and Safety Requirements.

- .2 Disconnect electrical and telephone service lines entering buildings to be demolished. Post warning signs on electrical lines and equipment which must remain energized to serve other properties during period of demolition.
- .3 Disconnect and cap designated mechanical services.
 - .1 Sewer and water lines: remove to property line.
 - .2 Other underground services: remove and dispose of as directed by NRC Departmental Representative.
- .4 Do not disrupt active or energized utilities designated to remain undisturbed.
- .5 Remove rodent and vermin as required by NRC Departmental Representative.

3.2 SAFETY CODE

- .1 Do demolition work in accordance with Section 00 10 00 – General Instructions.
- .2 Blasting operations not permitted during demolition.

3.3 DEMOLITION

- .1 Remove the existing wave maker structure as shown on the drawings
- .2 Place approved containment before disconnecting existing wave maker hydraulic system pipes. Ensure complete drainage, removal and disposal of the hydraulic system fluid
- .3 Remove all existing wave maker anchoring system and accessories except for the side long wall bearing plates.
- .4 Remove existing equipment, services, and obstacles where required for refinishing or making good of existing surfaces, and replace as work progresses.
- .5 At end of each day's work, leave Work in safe and stable condition. Protect interiors of parts not to be demolished from exterior elements at all times.
- .6 Demolish to minimize dusting. Keep materials wetted as directed by NRC Departmental Representative.
- .7 Remove any temporary structural framing used for bracing once demolition work is complete.
- .8 Only dispose of material specified by selected alternative disposal option as directed by NRC Departmental Representative.
- .9 Ensure that these materials will not be disposed of in landfill or waste stream destined for landfill.
- .10 Remove and dispose of demolished materials except where noted otherwise and in accordance with authorities having jurisdiction.

- .11 Environmental:
 - .1 Remove contaminated or dangerous materials as defined by authorities having jurisdiction, relating to environmental protection, from site and dispose of in safe manner to minimized danger at site or during disposal.
- .12 Prior to the start of any demolition work remove contaminated or hazardous materials as defined by authorities having jurisdiction, from site and dispose of at designated disposal facilities.
- .13 Use natural lighting to work by wherever possible. Shut off all lighting except those required for security purposes at the end of each day.

3.4 STOCKPILING

- .1 Stockpile materials in a location as directed by NRC Departmental Representative.
- .2 Designate appropriate security resources/measures to prevent vandalism, damage and theft.
- .3 Separate from general waste stream each of the following materials. Stockpile materials in neat and orderly fashion in location and as directed by NRC Departmental Representative for alternate disposal. Stockpile materials in accordance with applicable fire regulations.
 - .1 Steel
 - .2 Concrete waste
 - .3 Wiring and conduit.
 - .4 Outlets/Switches
 - .5 Floor receptacles.
 - .6 Metal duct work, baffles, HVAC equipment.
 - .7 Miscellaneous metals.
- .4 Supply separate, clearly-marked disposal bins for all categories of waste material. Do not remove bins from site until inspected and approved by NRC Departmental Representative.
- .5 Provide collection areas for collection of miscellaneous metals in the area of demolition.

3.5 REMOVAL FROM SITE

- .1 Notify NRC Departmental Representative in writing of any materials identified as not suitable for alternate disposal. Provide reasons prior to approval for disposal.
- .2 Dispose of materials as directed by NRC Departmental Representative.
- .3 Remove stockpiled material as directed by NRC Departmental Representative when it interferes with operations of project construction.

- .4 Remove stockpiles of like materials by an alternate disposal option once collection of materials is complete.
- .5 Transport material designated for alternate disposal in accordance with applicable regulations.
- .6 Dispose of materials not designated for alternate disposal in accordance with applicable regulations.

3.6 COORDINATION

- .1 Coordinate alternative disposal activities with NRC Departmental Representative on site waste diversion representative.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 03 20 00 - Concrete Reinforcing.
- .2 Section 03 30 00 - Cast-in-place Concrete.
- .3 Section 03 35 00 – Concrete Finishing.

1.2 **REFERENCES**

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA-O86S1, Supplement No. 1 to CAN/CSA-O86-01, Engineering Design in Wood.
 - .3 CSA O121, Douglas Fir Plywood.
 - .4 CSA O151, Canadian Softwood Plywood.
 - .5 CAN/CSA-S269.3, Concrete Formwork.

1.3 **SUBMITTALS**

- .1 Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1, for falsework drawings. Comply with CAN/CSA-S269.3, for formwork drawings.
- .2 Indicate formwork design data, such as permissible rate of concrete placement, and temperature of concrete, in forms.
- .3 Indicate sequence of erection and removal of formwork/falsework as directed by NRC Departmental Representative.
- .4 Each shop drawing submission shall bear stamp and signature of qualified professional engineer licensed in Province of Newfoundland and Labrador, Canada.

PART 2 **PRODUCTS**

2.1 **MATERIALS**

- .1 Formwork materials:
 - .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121.

- .2 For concrete with special architectural features, use formwork materials to CSA-A23.1/A23.2.
- .2 Form liner:
 - .1 Plywood: medium density overlay Douglas Fir to CSA O121, Canadian Softwood Plywood to CSA O151, T and G thickness as indicated.
- .3 Form release agent: chemically active release agents containing compounds that react with free lime in concrete resulting in water insoluble soaps, non-toxic, biodegradable.
- .4 Falsework materials: to CSA-S269.1.

PART 3 **EXECUTION**

3.1 **FABRICATION AND ERECTION**

- .1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
- .2 Fabricate and erect falsework in accordance with CSA S269.1.
- .3 Fabricate and erect formwork in accordance with CAN/CSA-S269.3, to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.
- .4 Align form joints and make watertight. Keep form joints to minimum.
- .5 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.
- .6 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections. Ensure that all anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .7 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 **REMOVAL AND RESHORING**

- .1 Leave formwork in place for following minimum periods of time after placing concrete.
 - .1 3 days for pads.
- .2 Provide all necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.
- .3 Space reshoring in each principal direction at not more than 3000 mm apart.
- .4 Re-use formwork and falsework subject to requirements of CSA-A23.1A23.2.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 03 10 00 – Concrete Forming and Accessories.
- .2 Section 03 30 00 - Cast-in-Place Concrete.

1.2 **REFERENCES**

- .1 American Concrete Institute (ACI)
 - .1 SP-66, ACI Detailing Manual, 2004.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A185/A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - .2 ASTM A497/A497M, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
 - .3 ASTM A1022/A1022M, Standard Specification for Deformed and Plain Stainless Steel Wire and Welded Wire for Concrete Reinforcement.
- .3 Canadian Standards Association (CSA)
 - .1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of test and Standard Practices for Concrete.
 - .2 CSA-A23.3, Design of Concrete Structures.
 - .3 CSA-G30.18, Carbon Steel Bars for Concrete Reinforcement.
 - .4 CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel /Structural Quality Steel.
 - .5 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .6 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .4 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC, Reinforcing Steel Manual of Standard Practice.

1.3 **SUBMITTALS**

- .1 Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacings, locations of reinforcement and mechanical splices if approved by NRC Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings. Indicate sizes, spacings and locations of chairs, spacers and hangers. Prepare reinforcement drawings in accordance with Reinforcing Steel Manual of Standard Practice - by Reinforcing Steel Institute of Canada. SP-66, ACI Detailing Manual, 2004, American Concrete Institute.

- .2 Detail lap lengths and bar development lengths to CSA-A23.3, unless otherwise indicated.
- .3 Submit drawings stamped and signed by professional engineer registered or licensed in the Province of Newfoundland and Labrador.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Substitute different size bars only if permitted in writing by NRC Departmental Representative.
- .2 Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise.
- .3 Cold-drawn annealed steel wire ties: to ASTM A497/A497M.
- .4 Welded steel wire fabric: to ASTM A185/A185M. Provide in flat sheets only.
- .5 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .6 Mechanical splices: subject to approval of NRC Departmental Representative.
- .7 Plain round bars: to CSA-G40.20/G40.21.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1A23.2, SP-66, and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Obtain NRC Departmental Representative approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of NRC Departmental Representative, weld reinforcement in accordance with CSA W186.
- .4 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide NRC Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to commencing reinforcing work.
- .2 Upon request inform NRC Departmental Representative of proposed source of material to be supplied.

PART 3 **EXECUTION**

3.1 **FIELD BENDING**

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by NRC Departmental Representative.
- .2 When field bending is authorized, bend without heat, applying a slow and steady pressure.
- .3 Replace bars which develop cracks or splits.

3.2 **PLACING REINFORCEMENT**

- .1 Place reinforcing steel as indicated on reviewed placing drawings and in accordance with CSA-A23.1/A23.2.
- .2 Use plain round bars as slip dowels in concrete. Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint. When paint is dry, apply a thick even film of mineral lubricating grease.
- .3 Prior to placing concrete, obtain NRC Departmental Representative approval of reinforcing material and placement.
- .4 Ensure cover to reinforcement is maintained during concrete pour.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 03 10 00 - Concrete Forming and Accessories.
- .2 Section 03 20 00 - Concrete Reinforcing.

1.2 **REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM C260, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C494/C494M, Standard Specification for Chemical Admixtures for Concrete.
 - .4 ASTM D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
 - .5 ASTM D624, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
 - .6 ASTM D1751, Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.34, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .3 Canadian Standards Association (CSA)
 - .1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CAN3-A266.4, Guidelines for the Use of Admixtures in concrete.
 - .3 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .4 CSA-A3001, Cementitious Materials for Use in Concrete.

1.3 **ACRONYMS AND TYPES**

- .1 Cement: hydraulic cement or blended hydraulic cement (XXb - where b denotes blended).
 - .1 Type GU or GUb - General use cement.

1.4 SUBMITTALS

- .1 At least 4 weeks prior to commencing work, inform NRC Departmental Representative of proposed source of aggregates and provide access for sampling.
- .2 Submit testing results and reports for review by NRC Departmental Representative and do not proceed without written approval when deviations from mix design or parameters are found.
- .3 Certificates:
 - .1 Minimum 4 weeks prior to starting concrete work submit to NRC Departmental Representative manufacturer's test data and certification by qualified independent inspection and testing laboratory that following materials will meet specified requirements:
 - .1 Portland cement.
 - .2 Blended hydraulic cement.
 - .3 Supplementary cementing materials.
 - .4 Grout.
 - .5 Admixtures.
 - .6 Aggregates.
 - .7 Water.
 - .8 Waterstops.
 - .9 Waterstop joints.
 - .10 Joint filler.
 - .2 Provide certification that mix proportions selected will produce concrete of quality, yield and strength as specified in concrete mixes, and will comply with CSA-A23.1/A23.2.
 - .3 Provide certification that plant, equipment, and materials to be used in concrete comply with requirements of CSA-A23.1/A23.2.

1.5 SOURCE QUALITY CONTROL

- .1 Have all concrete produced and delivered by a ready-mix plant that is a member of the Atlantic Provinces Ready Mixed Concrete Association (APRMCA) and holds a current "Certificate of Ready Mixed Concrete Production Facilities" issued by the Association. Submit a copy of this certificate to the NRC Departmental Representative for approval.

1.6 QUALITY ASSURANCE

- .1 Minimum 4 weeks prior to starting concrete work, submit proposed quality control procedures in accordance with Section 00 10 00 - General Instructions for NRC Departmental Representative approval for following items:
 - .1 Falsework erection.
 - .2 Curing.

- .3 Finishes.
- .4 Formwork removal.
- .5 Joints.

1.7 DELIVERY, STORAGE AND HANDLING

- .1 Concrete hauling time: maximum allowable time for concrete to be delivered to site of Work and discharged not to exceed 120 minutes after batching.
 - .1 Modifications to maximum time limit must be agreed to NRC Departmental Representative and concrete producer as described in CSA A23.1/A23.2.
 - .2 Deviations to be submitted for review by NRC Departmental Representative.
- .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.
- .3 Waste Management and Disposal:
 - .1 Divert unused concrete materials from landfill to local facility approved by NRC Departmental Representative.
 - .2 Provide an appropriate area on the job site where concrete trucks can be safely washed.
 - .3 Divert unused admixtures and additive materials (pigments, fibres) from landfill to official hazardous material collections site as approved by the NRC Departmental Representative.
 - .4 Unused admixtures and additive materials must not be disposed of into sewer systems, into lakes, streams, onto ground or in other location where it will pose health or environmental hazard.
 - .5 Prevent admixtures and additive materials from entering drinking water supplies or streams. Using appropriate safety precautions, collect liquid or solidify liquid with inert, noncombustible material and remove for disposal. Dispose of waste in accordance with applicable local, Provincial and National regulations.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Portland cement: to CAN/CSA-A3001, Type GU.
- .2 Water: to CAN/CSA-A23.1.
- .3 Aggregates: to CSA-A23.1.
- .4 Coarse aggregates to be normal density to CSA-A23.1/A23.2.
- .5 Admixtures:
 - .1 Air entraining admixture: to ASTM C260.

- .6 Non premixed dry pack grout: composition of non metallic aggregate Portland cement with sufficient water for the mixture to retain its shape when made into a ball by hand and capable of developing compressive strength of 50 MPa at 28 days.
- .7 Ribbed waterstops: extruded PVC of sizes indicated shop welded corner and intersecting pieces.
 - .1 Tensile strength: to ASTM D412, method A, Die "C".
 - .2 Elongation: to ASTM D412, method A, Die "C", minimum 275%.
 - .3 Tear resistance: to ASTM D624, method A, Die "B".
- .8 Premoulded joint fillers:
 - .1 Bituminous impregnated fiber board: to ASTM D1751.
- .9 Polyethylene film: minimum 0.25 mm thickness to ASTM C171.
- .10 Bonding adhesive: as approved by NRC Departmental Representative.

2.2 MIXES

- .1 Proportion normal density concrete in accordance with CSA-A23.1/A23.2, Alternative 1 to give following quality and yield for all concrete.
 - .1 Cement:
 - .1 Type GU Portland cement.
 - .2 Minimum compressive strength is 30 MPa at 28 days: for structural design.
 - .3 Minimum cement content: 300 kg/m³ of concrete.
 - .4 Class of exposure: N.
 - .5 Nominal size of coarse aggregate: 20 mm.
 - .6 Slump at time and point of discharge: 75 to 100 mm.
 - .7 Air content: 5 to 8 %.
 - .8 Chemical admixtures: admixtures in accordance with ASTM C494.

PART 3 EXECUTION

3.1 PREPARATION

- .1 Obtain NRC Departmental Representative approval before placing concrete. Provide two (2) working days notice prior to placing of concrete.
- .2 Place concrete reinforcing in accordance with Section 03 20 00 - Concrete Reinforcing.
- .3 During concreting operations:
 - .1 Development of cold joints not allowed.

- .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.
- .4 Pumping of concrete is permitted only after approval of equipment and mix.
- .5 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .6 Prior to placing of concrete obtain NRC Departmental Representative approval of proposed method for protection of concrete during placing and curing in adverse weather.
- .7 Protect previous Work from staining.
- .8 Clean and remove stains prior to application for concrete finishes.
- .9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .10 Do not place load upon new concrete until authorized by NRC Departmental Representative.

3.2 CONSTRUCTION

- .1 Do cast-in-place concrete work in accordance with CSA-A23.1/A23.2.
- .2 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.
- .3 Finishing.
 - .1 Finish concrete in accordance with CSA-A23.1/A23.2.
 - .2 Use procedures to CSA-A23.1/A23.2, to remove excess bleed water. Ensure surface is not damaged.
 - .3 Wet cure using polyethylene sheets placed over sufficiently hardened concrete to prevent damage. Overlap adjacent edges 150 mm and tightly seal with sand on wood planks. Weigh sheets down to maintain close contact with concrete during the entire curing period.
 - .4 Where burlap is used for moist curing, place two prewetted layers on concrete surface and keep continuously wet during curing period.
 - .5 Finish concrete floor to meet requirements of CSA-A23.1/A23.2.
 - .6 Concrete floor to have finish hardness equal or greater than Mohs hardness in accordance with CSA-A23.1/A23.2.
 - .7 Provide swirl-trowelled finish for exterior walks, ramps, pads.
 - .8 Provide float finish for interior floor slabs.
 - .9 Rub exposed sharp edges of concrete with carborundum to produce 25 mm chamfer

3.3 SITE TOLERANCE

- .1 Concrete slab tolerances in accordance with CSA-A23.1/A23.2, F-number Method, $F_F = 25$, $F_L = 20$.

3.4 FIELD QUALITY CONTROL

- .1 Inspection and testing of concrete and concrete materials will be carried out by a Testing Laboratory designated by NRC Departmental Representative in accordance with CSA-A23.1/A23.2, and Section 00 10 00 – General Instructions.
- .2 NRC Departmental Representative will pay for costs of Testing Laboratory Services. Costs of retesting due to deficient work will be paid for by contractor, by credit change order.
- .3 Cure cylinders on job site under same conditions as concrete which they represent.
- .4 Non-destructive Methods for Testing Concrete shall be in accordance with CSA-A23.1/A23.2.
- .5 Provide Certificate of Field Quality Inspection and Testing to NRC Departmental Representative for inclusion in Commissioning Manual.
- .6 Inspection or testing by NRC Departmental Representative will not augment or replace Contractor quality control nor relieve the Contractor of his contractual responsibility.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 03 30 00 - Cast-in-Place Concrete.

1.2 **REFERENCES**

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-25.20, Surface Sealer for Floors.
- .2 Canadian Standards Association (CSA)
 - .1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.

1.3 **PRODUCT DATA**

- .1 Submit WHMIS MSDS - Material Safety Data Sheets. WHMIS MSDS acceptable to Labour Canada and Health and Welfare Canada for concrete floor treatment materials. Indicate VOC content.
- .2 Include application instructions for concrete floor treatment.

1.4 **ENVIRONMENTAL REQUIREMENTS**

- .1 Temporary lighting:
 - .1 Minimum 1200 W light source, placed 2.5 m above floor surface, for each 40 sq m of floor being treated.
- .2 Electrical power:
 - .1 Provide sufficient electrical power to operate equipment normally used during construction.
- .3 Work area:
 - .1 Make the work area water tight protected against rain and detrimental weather conditions.
- .4 Temperature:
 - .1 Maintain ambient temperature of not less than 10°C from 7 days before installation to at least 48 hours after completion of work and maintain relative humidity not higher than 40% during same period.
- .5 Moisture:
 - .1 Ensure concrete substrate is within moisture limits prescribed by flooring manufacturer.

- .6 Safety:
 - .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials.
- .7 Ventilation:
 - .1 Ventilate area of work as directed by NRC Departmental Representative by use of approved portable supply and exhaust fans.
 - .2 Ventilate enclosed spaces in accordance with NRC section 00 10 00 – General Instructions.
 - .3 Provide continuous ventilation during and after coating application.

PART 2 **PRODUCTS**

2.1 **CHEMICAL HARDENERS**

- .1 Type 1- Sodium silicate.
- .2 Water: potable.

2.2 **SEALING COMPOUNDS**

- .1 Surface sealer: to CAN/CGSB-25.20, Type 2 - water based.
- .2 Surface sealers may not be manufactured or formulated with aromatic solvents formaldehyde halogenated solvents mercury lead cadmium hexavalent chromium and their compounds.

2.3 **WET CURE**

- .1 Clear polyethylene film to ASTM C171, minimum thickness 0.15 mm.

2.4 **MIXES**

- .1 Mixing, ratios and application in accordance with manufacturer's instructions.

PART 3 **EXECUTION**

3.1 **EXAMINATION**

- .1 Verify that slab surfaces are ready to receive work and elevations are as indicated on drawings by manufacturer.

3.2 **PREPARATION OF EXISTING SLAB**

- .1 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radiused edges unless otherwise indicated.

- .2 Saw cut control joints to CSA-A23.1/A23.2, 24 hours maximum after placing of concrete.
- .3 Use mechanical stripping to remove chlorinated rubber or existing surface coatings.
- .4 Use protective clothing, eye protection, respiratory equipment during stripping of chlorinated rubber or existing surface coatings.

3.3 APPLICATION

- .1 After floor treatment is dry, seal control joints and joints at junction with vertical surfaces with sealant.
- .2 Apply floor treatment in accordance with Sealer manufacturer's written instructions.
- .3 Clean overspray. Clean sealant from adjacent surfaces.

3.4 PROTECTION

- .1 Protect finished installation in accordance with manufacturer's instructions.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 00 10 00 – General Instructions
- .2 Section 04 05 12 - Masonry Mortar and Grout.
- .3 Section 04 05 19 - Masonry Anchorage and Reinforcing.
- .4 Section 04 05 23 - Masonry Accessories.
- .5 Section 04 22 00 - Concrete Unit Masonry.

1.2 **REFERENCES**

- .1 Canadian Standards Association (CSA International).
 - .1 CSA-A165 Series, Standards on Concrete Masonry Units.
 - .2 CSA A179, Mortar and Grout for Unit Masonry.
 - .3 CSA-A371, Masonry Construction for Buildings.
- .2 International Masonry Industry All-Weather Council (IMIAC).
 - .1 Recommended Practices and Guide Specification for Cold Weather Masonry Construction.

1.3 **SUBMITTALS**

- .1 Product Data.
 - .1 Submit manufacturer's printed product literature, specifications and data, including product characteristics, performance criteria, limitations and colors.
- .2 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) - Material Safety Data Sheets (MSDS).
- .3 Samples.
 - .1 Submit samples:
 - .1 Two of each type of masonry unit specified including special shapes.
 - .2 One of each cured and coloured samples of mortar and grout, illustrating mortar colour and colour range.
 - .3 One of each type of masonry accessory specified.
 - .4 One of each type of masonry reinforcement, tie and connector proposed for use.
 - .2 Submit samples tested to laboratories employing technicians certified/trained in procedures for testing masonry units.
 - .3 Samples used for testing, when accepted, become standard for material used.

- .4 Shop drawings.
 - .1 Provide drawings stamped and signed by professional engineer licensed in Province of Newfoundland and Labrador, Canada.
 - .2 Provide confirmation to NRC Departmental Representative that temporary bracing and support has been designed by professional engineer.
- .5 Manufacturer's Instructions.
 - .1 Submit manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

- .1 Submit laboratory test reports certifying compliance of masonry units and mortar ingredients with specification requirements.
- .2 Submit certified test reports showing compliance with specified performance characteristics and physical properties.
- .3 For clay units, in addition to requirements set out in referenced CSA and ASTM Standards include data indicating initial rate of absorption.
- .4 Qualifications:
 - .1 Manufacturer: minimum five (5) years experience in manufacturing components similar to or exceeding requirements of project.
 - .2 Installer: experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
 - .3 Masons: company or person specializing in masonry installations with minimum five (5) years documented experience with masonry work similar to this project.
 - .1 Masons employed on this project must demonstrate ability to reproduce mock-up standards.

1.5 JOB MOCK-UPS.

- .1 Construct mock-ups in accordance with Section 00 10 00 – General Instructions.
- .2 Construct mock-up panel of exterior masonry wall construction 1200 x 1800 mm showing masonry colours and textures, use of reinforcement, ties, through-wall flashing, weep holes, jointing, coursing, mortar and workmanship.
- .3 Mock-up will be used to judge workmanship, substrate preparation, operation of equipment and material application.
- .4 Construct mock-up where directed.
- .5 Provide written notice of mock-up completion and allow two (2) working days after completion of mock-up for NRC Departmental Representative review. Commence work only upon receipt of approval of mock-up by NRC Departmental Representative.

- .6 When accepted, mock-up will demonstrate minimum standard for this work. Mock-up may remain as part of finished work.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, handle and protect materials in accordance with Section 00 10 00 – General Instructions.
- .2 Deliver materials to job site in dry condition.
- .3 Keep materials dry until use except where wetting of bricks is specified
- .4 Store under waterproof cover on pallets or plank platforms held off ground by means of plank or timber skids.
- .5 Replace defective or damaged materials with new.

1.7 SITE CONDITIONS

- .1 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.
- .2 Provide temporary bracing of masonry work during and after erection until permanent lateral support is in place.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Masonry materials are specified in related Sections indicated in 1.1.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 PREPARATION

- .1 Provide temporary bracing and support of masonry work during and after erection until permanent lateral support is in place.
- .2 Bracing approved by NRC Departmental Representative.
- .3 Establish and protect lines, levels, and coursing.

- .4 Protect adjacent materials from damage and disfiguration.

3.3 INSTALLATION

- .1 Do masonry work in accordance with CSA-A371, except where specified otherwise.
- .2 Build masonry plumb, level, and true to line, with vertical joints in alignment respecting construction tolerances permitted by CAN/CSA-A371.
- .3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

3.4 CONSTRUCTION

- .1 Exposed masonry:
 - .1 Remove chipped, cracked, and otherwise damaged units, in accordance with CSA A-165, in exposed masonry and replace with undamaged units.
- .2 Jointing:
 - .1 Allow joints to set just enough to remove excess water, then tool with round jointer to provide smooth, joints true to line, compressed, uniformly concave joints where concave joints are indicated.
 - .2 Strike flush joints concealed in walls and joints in walls to receive plaster, tile, insulation, or other applied material except paint or similar thin finish coating.
- .3 Cutting:
 - .1 Cut out for electrical switches, outlet boxes, and other recessed or built-in objects.
 - .2 Make cuts straight, clean, and free from uneven edges.
- .4 Wetting of bricks:
 - .1 Except in cold weather, wet bricks having an initial rate of absorption exceeding 1 g/minute/1000 mm²: wet to uniform degree of saturation, 3 to 24 hours before laying, and do not lay until surface dry.
 - .2 Wet tops of walls built of bricks qualifying for wetting, when recommencing work on such walls.
- .5 Support of loads:
 - .1 Use 30 MPa concrete to Section 03 30 00 - Cast-in-Place Concrete, where concrete fill is used in lieu of solid units.
 - .2 Use grout to CSA A179, where grout is used in lieu of solid units.
 - .3 Install building paper below voids to be filled with grout; keep paper 25 mm back from faces of units.
- .6 Provision for movement:

- .1 Leave 6 mm space between top of non-load bearing walls and partitions and structural elements. Do not use wedges.
- .2 Built masonry to tie in with stabilizers, with provision for vertical movement.
- .7 Control joints:
 - .1 Construct continuous control joints where indicated or detailed.
- .8 Expansion joints:
 - .1 Build-in continuous expansion joints where indicated or detailed.

3.5 SITE TOLERANCES

- .1 Tolerances in notes to CSA-A371 apply.

3.6 FIELD QUALITY CONTROL

- .1 Inspection and testing will be carried out by Testing Laboratory designated by NRC Departmental Representative.
- .2 NRC Departmental Representative will pay costs for testing, as specified in Section 00 10 00 – General Instructions.
- .3 Cost of testing will be paid from cash allowance specified in Section 00 10 00 – General Instructions. Re-testing as a result of deficient work will be paid for by contractor, credit change order.
- .4 Provide Certificate of Field Quality Inspection and testing to NRC Departmental Representative for inclusion in Commissioning Manual.

3.7 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.8 PROTECTION

- .1 Temporary Bracing and Supports:
 - .1 Provide temporary bracing and supports of masonry work during and after erection until permanent lateral support is in place.
 - .2 Provide confirmation to NRC Departmental Representative that temporary bracing and support has been designed by professional engineer.
 - .3 Brace masonry walls as necessary to resist wind pressure and lateral forces during construction.
- .2 Moisture Protection:

- .1 Keep masonry dry using waterproof, nonstaining coverings that extend over walls and down sides sufficient to protect walls from wind driven rain, until completed and protected by flashing or other permanent construction.
- .2 Cover completed and partially completed work not enclosed or sheltered with waterproof covering at end of each work day. Anchor securely in position.
- .3 Air Temperature Protection: protect completed masonry as per Part 1 article Site Conditions.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 00 10 00 – General Instructions.
- .2 Section 04 05 00 - Common Work Results for Masonry.

1.2 **REFERENCES**

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA A179, Mortar and Grout for Unit Masonry.
 - .3 CAN/CSA A371, Masonry Construction for Buildings.
 - .4 CAN/CSA-A3000, Cementitious Materials Compendium; CAN/CSA-A3002, Masonry and Mortar Cement.

1.3 **SUBMITTALS**

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet including product characteristics, performance criteria, and limitations.
 - .2 Submit copy of WHMIS MSDS Material Safety Data Sheets. Indicate VOC's mortar, grout, parging, colour additives and admixtures, expressed as grams per litre (g/L).
- .2 Samples:
 - .1 Submit two samples of mortar showing actual product colour when set.
- .3 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.

1.4 **QUALITY ASSURANCE**

- .1 Submit test reports showing compliance with specified performance characteristics and physical properties.

1.5 **DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handles masonry mortar and grout materials in accordance with Section 00 10 00 – General Instructions, supplemented as follows:
 - .1 Deliver prepackaged, dry-blended mortar mix to project site in labelled plastic-lined bags each bearing name and address of manufacturer, production codes or batch numbers, and color or formula numbers.

- .2 Maintain mortar, grout and packaged materials clean, dry, and protected against dampness, freezing, traffic and contamination by foreign materials.

1.6 SITE CONDITIONS

- .1 Ambient Conditions: maintain materials and surrounding air temperature to:
 - .1 Minimum 5 degrees C prior to, during, and 48 hours after completion of masonry work.
 - .2 Maximum 32 degrees C prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Use same brands of materials and source of aggregate for entire project.
- .2 Cement:
 - .1 Portland Cement: to CAN/CSA-A3000.
 - .2 Masonry Cement: to CAN/CSA-A3002 and CAN/CSA A179.
 - .3 Mortar Cement: to CAN/CSA-A3002 and CAN/CSA A179.
 - .4 Packaged Dry Combined Materials for mortar: to CAN/CSA A179, using gray color cement.
- .3 Aggregate: supplied by one supplier.
 - .1 Fine Aggregate: to CAN/CSA A179, natural sand.
 - .2 Course Aggregate: to CAN/CSA A179.
- .4 Water: clean and potable.

2.2 MORTAR MIXES

- .1 Mortar for interior masonry:
 - .1 Non-Loadbearing: Type N based on proportion specifications.
- .2 Following applies regardless of mortar types and uses specified above:
 - .1 Mortar for calcium silicate brick and concrete brick: Type N based on proportion specifications.
 - .2 Mortar for stonework: Type N based on proportion specifications.
 - .3 Mortar for grouted reinforced masonry: Type S based on proportion specifications.

2.3 MORTAR MIXING

- .1 Use a batch type mixer in accordance with CAN/CSA A179.

- .2 Use mortar within 2 hours after mixing at temperatures of 32 degrees C, or 2-1/2 hours at temperatures under 5 degrees C.

2.4 GROUT MIXES

- .1 Lintels: minimum grout mix 10 to 12.5 MPa strength at 28 days or as otherwise indicated on drawings; 200-250 mm slump; mixed in accordance with CAN/CSA A179.
- .2 Grout: minimum compressive strength of 12.5 MPa at 28 days or as otherwise indicated on drawings. Maximum aggregate size and grout slump: CAN/CSA A179.

2.5 GROUT MIXING

- .1 Mix grout ingredients in quantities needed for immediate use in accordance with CAN/CSA A179.
- .2 Add admixtures in accordance with manufacturer's instructions; mix uniformly.
- .3 Do not use calcium chloride or chloride based admixtures.

PART 3 EXECUTION

3.1 EXAMINATION

- .1 Verify that conditions of substrate are acceptable for masonry installation in accordance with manufacturer's written instructions.
- .2 Visually inspect substrate in presence of NRC Departmental Representative.
- .3 Inform NRC Departmental Representative of unacceptable conditions immediately upon discovery.
- .4 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from NRC Departmental Representative.

3.2 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.3 CONSTRUCTION

- .1 Do masonry mortar and grout work in accordance with CSA A179, except where specified otherwise.

3.4 MIXING

- .1 Clean all mixing boards and mechanical mixing machine between batches.

- .2 Mortar must be weaker than the units it is binding.
- .3 Contractor to appoint one individual to mix mortar, for duration of project. In the event that this individual must be changed, mortar mixing must cease until the new individual is trained, and mortar mix is tested.

3.5 MORTAR PLACEMENT

- .1 Install mortar to manufacturer's instructions.
- .2 Install mortar to requirements of CAN/CSA A179.
- .3 Remove excess mortar from grout spaces.

3.6 GROUT PLACEMENT

- .1 Install grout in accordance with manufacturer's instructions.
- .2 Install grout in accordance with CAN/CSA A179.
- .3 Work grout into masonry cores and cavities to eliminate voids.
- .4 Do not install grout in lifts greater than 400 mm, without consolidating grout by rodding.
- .5 Do not displace reinforcement while placing grout.

3.7 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.
- .2 Remove droppings and splashings using clean sponge and water.
- .3 Clean masonry with low pressure clean water and soft natural bristle brush.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 00 10 00 – General Instructions.
- .2 Section 04 05 00 - Common Work Results for Masonry.
- .3 Section 04 05 12 – Masonry Mortar and Grout.
- .4 Section 04 22 00 – Concrete Unit Masonry.

1.2 **REFERENCES**

- .1 Canadian Standards Association (CSA International).
 - .1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
 - .2 CSA-A370, Connectors for Masonry.
 - .3 CSA-A371, Masonry Construction for Buildings.
 - .4 CSA G30.18, Carbon Steel Bars for Concrete Reinforcement.
 - .5 CSA S304.1, Design of Masonry Structures.
 - .6 CSA A179, Mortar and Grout For Unit Masonry.
 - .7 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .2 Reinforcing Steel Institute of Canada (RSIC).
 - .1 Reinforcing Steel Manual of Standard Practice.

1.3 **SUBMITTALS**

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet .
 - .2 Submit two copies of WHMIS MSDS - Material Safety Data Sheets. Indicate VOC's for epoxy coatings and galvanized protective coatings and touch-up products illustrating products to be incorporated into project for specified products .
- .2 Shop Drawings:
 - .1 Shop drawings consist of bar bending details, lists and placing drawings. Provide shop drawings detailing bar bending details, anchorage details, lists and placing drawings.
 - .2 On placing drawings, indicate sizes, spacing, location and quantities of reinforcement and connectors.
 - .3 Indicate on shop drawings, bar bending details, lists, quantities of reinforcement, sizes, spacings, locations of reinforcement and mechanical splices if approved by

NRC Departmental Representative, with identifying code marks to permit correct placement without reference to structural drawings. Indicate sizes, spacings and locations of chairs, spacers and hangers. Prepare reinforcement drawings in accordance with Reinforcing Steel Manual of Standard Practice - by Reinforcing Steel Institute of Canada . ANSI/ACI 315 and ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structure.

- .3 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.

1.4 SITE MEASUREMENTS

- .1 Make site measurements necessary to ensure proper fit of members.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Bar reinforcement: to CSA-A371, and CAN/CSA G30.18, Grade 400.
- .2 Wire reinforcement: to CSA-A371, and CSA S304.1, two wire ladder or truss type, galvanized.
- .3 Corrosion protection for wire reinforcement: to CSA S304.1, galvanized to CSA S304.1 and CSA-A370.

2.2 FABRICATION

- .1 Fabricate reinforcing in accordance with CSA-A23.1/A23.2 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Fabricate connectors in accordance with CSA-A370.
- .3 Obtain NRC Departmental Representative's approval for locations of reinforcement splices other than shown on placing drawings.
- .4 Upon approval of NRC Departmental Representative, weld reinforcement in accordance with CSA W186.
- .5 Ship reinforcement and connectors, clearly identified in accordance with drawings.

2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide NRC Departmental Representative with certified copy of mill test report of reinforcement steel and connectors, showing physical and chemical analysis, minimum 5 weeks prior to commencing reinforcement work.
- .2 Upon request inform NRC Departmental Representative of proposed source of material to be supplied.

PART 3 **EXECUTION**

3.1 **MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.2 **GENERAL**

- .1 Supply and install masonry connectors and reinforcement in accordance with CSA-A370, CSA-A371, CSA-A23.1/A23.2, and CSA-S304.1, unless indicated otherwise.
- .2 Prior to placing concrete, mortar, obtain NRC Departmental Representative's approval of placement of reinforcement and connectors.
- .3 Supply and install additional reinforcement to masonry as indicated.

3.3 **REINFORCED LINTELS AND BOND BEAMS**

- .1 Reinforce masonry lintels and bond beams as indicated.
- .2 Place and grout reinforcement in accordance with CSA-S304.1, CSA-A371 and CSA-A179.
- .3 Support and position reinforcing bars in accordance with CAN/CSA A371.

3.4 **GROUTING**

- .1 Grout masonry in accordance with CSA-S304.1, CSA-A371 and CSA-A179, and as indicated.

3.5 **ANCHORS**

- .1 Supply and install metal anchors as indicated.

3.6 **LATERAL SUPPORT AND ANCHORAGE**

- .1 Supply and install lateral support and anchorage in accordance with CSA-S304.1 and as indicated.

3.7 **MOVEMENT JOINTS**

- .1 Reinforcement will not be continuous across movement joints unless otherwise indicated.

3.8 **FIELD BENDING**

- .1 Do not field bend reinforcement and connectors except where indicated or authorized by NRC Departmental Representative.

- .2 When field bending is authorized, bend without heat, applying a slow and steady pressure.
- .3 Replace bars and connectors which develop cracks or splits.

3.9 FIELD TOUCH-UP

- .1 Touch up damaged and cut ends of epoxy coated or galvanized reinforcement steel and connectors with compatible finish to provide continuous coating.

3.10 CLEANING

- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 00 10 00 – General Instructions
- .2 Section 04 05 12 – Masonry Mortar and Grout
- .3 Section 04 05 19 - Masonry Anchorage and Reinforcing
- .4 Section 09 91 23 – Interior Painting

1.2 **REFERENCES**

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA A165 SERIES, CSA Standards on Concrete Masonry Units, covers: A165.1, A165.2, A165.3.
 - .2 CAN/CSA A371, Masonry Construction for Buildings.
 - .3 CSA S304.1, Design of Masonry Structures.
- .2 Underwriters' Laboratories of Canada (ULC).
 - .1 CAN/ULC-S101, Standard Methods of Fire Endurance Tests of Building Construction and Materials.

1.3 **SUBMITTALS**

- .1 Product Data
 - .1 Submit manufacturer's printed product Literature, specifications and data sheet illustrating products to be incorporated into project for specified products.
- .2 Samples
 - .1 Two of each type of concrete masonry unit specified.
- .3 Manufacturer's Instructions
 - .1 Submit manufacturer's installation instructions.

1.4 **QUALITY ASSURANCE**

- .1 Mock-up
 - .1 Construct mock-up 10 m² minimum of brick unit masonry in area designated by NRC Departmental Representative before proceeding with brick unit masonry work.
 - .2 Allow two (2) working days for inspection of mock-up by NRC Departmental Representative before proceeding with Concrete Unit Masonry Work.

- .2 Test reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .4 Pre-installation meeting: conduct pre-installation meeting to verify project requirements manufacturer's instructions and manufacturer's warranty requirements.

1.5 QUALIFICATIONS

- .1 Manufacturer: company specializing in manufacturing products of this section with minimum 10 years experience.
- .2 Installer: company specializing in performing work of this section approved by manufacturer. Minimum 5 years experience.
- .3 Design structural installations under direct supervision of Professional Engineer experienced in structural design of concrete masonry installation and registered in the Province of Newfoundland and Labrador.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with Section 00 10 00 – General Instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
 - .1 Offload concrete unit masonry packages using equipment that will not damage the surfaces.
 - .2 Do not use brick tongs to move or handle masonry.
- .3 Storage and Handling Requirements:
 - .1 Store materials off ground, in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
 - .2 Do not double stack cubes of concrete unit masonry.
 - .3 Cover masonry units with non-staining waterproof membrane covering.
 - .4 Allow air circulation around units.
 - .5 Installation of wet or stained masonry units is prohibited.
 - .6 Keep concrete unit masonry in individual cardboard packaging provided by manufacturer until units are ready to be installed.
 - .7 Store and protect concrete unit masonry from nicks, scratched, and blemishes.
 - .8 Replace defective or damaged materials with new.

PART 2 **PRODUCTS**

2.1 **MATERIALS**

- .1 Standard concrete block units: to CAN/CSA-A165, Series (CAN/CSA-A165.1)
 - .1 Classification: H/10/A/M
 - .2 Size: modular.
 - .3 Special shapes: provide bull nosed units for exposed corners. Provide purpose-made shapes for lintels and bond beams. Provide additional special shapes as indicated.

2.2 **ACCESSORIES**

- .1 Reinforcement: to Section 04 05 19 - Masonry Anchorage and Reinforcing.
- .2 Connectors: to Section 04 05 19 - Masonry Anchorage and Reinforcing.
- .3 Mortar and mortar mixes: to Section 04 05 12 - Masonry Mortar and Grout.
- .4 Grout and grout mixes: to Section 04 05 12 - Masonry Mortar and Grout.

2.3 **CLEANING COMPOUNDS**

- .1 Use VOC products to limits listed in Section 00 10 00 – General Instructions.
- .2 Compatible with substrate and acceptable to masonry manufacturer for use on products.
- .3 Cleaning compounds compatible with concrete unit masonry and in accordance with manufacturer's written recommendations and instructions.

2.4 **TOLERANCES**

- .1 Tolerances for standard concrete unit masonry tolerances in accordance with CAN/CSA A165.1, supplemented as follows:
 - .1 Maximum variation between units within specific job lot not to exceed 2.0 mm.
 - .2 No parallel edge length, width or height dimension for individual unit to differ by more than 2.0 mm.
 - .3 Out of square tolerance not to exceed 2.0 mm.

PART 3 **EXECUTION**

3.1 **INSTALLATION**

- .1 Concrete block units.
 - .1 Bond: running
 - .2 Coursing height: 200 mm for one block and one joint

- .3 Jointing: concave where exposed or where paint or other finish coating is specified
- .2 Special Shapes:
 - .1 Install special units to form corners, returns, offsets, reveals and indents without cut ends being exposed and without losing bond or module.
 - .2 Install reinforced concrete block lintels over openings in masonry where steel or reinforced concrete lintels are not indicated.
 - .3 End bearing: not less than 200 mm.

3.2 CONSTRUCTION

- .1 Cull out masonry units, in accordance with CAN/CSA A165 and approved range of color samples, with chips, cracks, broken corners, excessive color and texture variation.
- .2 Build in miscellaneous items such as bearing plates, steel angles, bolts, anchors, inserts, sleeves and conduits.
- .3 Construct masonry walls using running bond unless otherwise noted.
- .4 Fit masonry closely against electrical and plumbing outlets so collars, plates and covers overlap and conceal cuts.
- .5 Install movement joints and keep free of mortar where indicated.
- .6 Hollow Units: spread mortar setting bed from outside edge of face shells. Gauge amount of mortar on top and end of unit to create full joints, equivalent to shell thickness. Avoid excess mortar.
- .7 Ensure compacted head joints. Use full or face-shell joint as indicated.
- .8 Tamp units firmly into place.
- .9 Do not adjust masonry units after mortar has set. Where resetting of masonry is required, remove, clean and reset units in new mortar.
- .10 Tool exposed joints concave; strike concealed joints flush.
- .11 After mortar has achieved initial set up, tool joints.
- .12 Do not interrupt bond below or above openings.

3.3 CLEANING

- .1 Standard block: Allow mortar droppings on masonry to partially dry then remove by means of trowel, followed by rubbing lightly with small piece of block and finally by brushing.

- .2 Upon completion of installation remove surplus materials, rubbish, tools and equipment barriers.

3.4 PROTECTION

- .1 Brace and protect concrete unit masonry in accordance with Section 04 05 00 - Common Work Results for Masonry.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 00 10 00 – General Instructions.

1.2 **REFERENCES**

- .1 Canadian Urethane Foam Contractors' Association Inc. (CUFCA)
- .2 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S101, Fire Endurance Tests of Building Construction and Materials.
 - .2 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
 - .3 CAN/ULC-S705.1, Standard for Thermal Insulation Spray Applied Rigid Foam, Medium Density, Material Specification.
 - .4 CAN/ULC-S705.2, Standard for Thermal Insulation Spray Applied Rigid Foam, Medium Density, Installer's Responsibilities-Specification.

1.3 **TEST REPORTS**

- .1 Submit test reports, verifying qualities of foam sealant meet or exceed requirements of this specification.
- .2 Submit test reports in accordance with CAN/ULC-S101 for fire endurance and CAN/ULC-S102 for surface burning characteristics.

1.4 **QUALITY ASSURANCE**

- .1 Applicators to conform to CUFCA Quality Assurance Program.

1.5 **SAFETY REQUIREMENTS**

- .1 Protect workers as recommended by CAN/ULC-S705.2 and manufacturer's recommendations:
 - .1 Workers must wear gloves, respirators, dust masks, eye protection, protective clothing when applying foam sealant.
 - .2 Workers must not eat, drink or smoke while applying foam sealant.

1.6 **PROTECTION**

- .1 Ventilate area in accordance with Section 00 10 00 – General Instructions.
- .2 Ventilate area to receive insulation by introducing fresh air and exhausting air continuously during and 24 hours after application to maintain non-toxic, unpolluted, safe working conditions.

- .3 Provide temporary enclosures to prevent spray and noxious vapours from contaminating air beyond application area.
- .4 Protect adjacent surfaces and equipment from damage by overspray, fall-out, and dusting of insulation materials.
- .5 Dispose of waste foam sealant daily in location designated by NRC Departmental Representative and decontaminate empty drums in accordance with foam sealant manufacturer's instructions.

1.7 ENVIRONMENTAL REQUIREMENTS

- .1 Apply foam sealant only when surfaces and ambient temperatures are within manufacturers' prescribed limits.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Low expanding, one-component, polyurethane foam sealant, curing to a semi-rigid, closed cell urethane foam providing a RSI of 0.9 per 25.4 mm. To meet the following physical properties:

.1	Density:	25.7 kg/m ³
.2	Compressive Strength Parallel @ 10%:	69-96 psi
.3	Tensile Strength:	103 psi
.4	Water Vapour Transmission:	5.97 perms
.5	Flame Spread:	20
.6	Smoke Development:	70

PART 3 **EXECUTION**

3.1 **APPLICATION**

- .1 Apply foam sealant to clean surfaces in accordance manufacturer's printed instructions. Surfaces to be free of dust, dirt, oil and other foreign materials.
- .2 Cover surfaces not intended to be foamed.
- .3 Apply foam sealant to perimeter of openings indicated and to thickness as recommended by manufacturer. Trim excess cured foam from finished area.
- .4 Cover exposed urethane foam sealants to protect from adverse affects from ultraviolet light (sunlight).

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED WORK**

- .1 Fire stopping and smoke seals within mechanical assemblies (i.e inside ducts, dampers) and electrical assemblies (i.e. inside cable trays) are specified in Division 23 and 26 respectively.
- .2 Coordinate work of this section with other sections as required to properly execute the work and as necessary maintain satisfactory progress of the work of other sections.

1.2 **RELATED SECTIONS**

- .1 Section 00 10 00 – General Instructions.

1.3 **REFERENCES**

- .1 Underwriter’s Laboratories of Canada (ULC)
 - .1 CAN-S115, Fire Tests of Firestop Systems.

1.4 **DEFINITIONS**

- .1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.
- .2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.
- .3 Multiple Component Fire Stop System: exact group of fire stop materials that are identified within Listed Systems Design to create on site fire stop system.
- .4 Tightly Fitted; (ref: NBC Part 3.1.9.1.1 and 9.10.9.6.1): penetrating items that are cast in place in buildings of noncombustible construction or have "0" annular space in buildings of combustible construction.
 - .1 Words "tightly fitted" should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

1.5 **SUBMITTALS**

- .1 Prior to start of work submit the following:
 - .1 Duplicate 300 x 300 mm samples showing actual firestop material proposed for project.

- .2 Shop drawings to show proposed material, reinforcement, anchorage, fastenings and method of installation. Construction details should accurately reflect actual job conditions.
- .3 Manufacturer's engineering judgement identification number and drawing details when no ULC or cUL system is available. Engineering judgement must include both project name and contractor's name who will install firestop system as described in drawing.
- .4 Manufacturer's product data for materials and prefabricated devices, providing descriptions are sufficient for identification at job site. Include manufacturer's printed instructions for installation. Include manufacturer's specifications, training letter, and technical data for each material including the composition and limitations, documentation of ULC or CUL firestop systems to be used.
- .5 Material safety data sheets provided with product delivered to job site.

1.6 MOCK-UP

- .1 Construct mock-up in accordance with Section 00 10 00 – General Instructions.
- .2 Construct mock-up showing service penetrations, fire separation and floor assemblies. Mock-up may be part of finished work.
- .3 Allow two (2) working days for inspection of mock-up by NRC Departmental Representative before proceeding with membrane work.

1.7 MANUFACTURER'S REPRESENTATIVE

- .1 A manufacturer's representative is to be on site during initial installation of firestop systems to train appropriate contractor personnel in proper selection and installation procedures and at commissioning stage to certify acceptance completed installation. Training will be done as per manufacturer's written recommendations published in their literature and drawing details.

1.8 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: person specializing in fire stopping installations with minimum five (5) years documented experience approved by the fire stopping manufacturer.
 - .2 Manufacturer: company with minimum five (5) years experience in producing of material used for work required for this project, with sufficient production capacity to produce and deliver required units without causing delay in work.
- .2 All fire stopping materials for this project to be supplied by a single manufacturer.

PART 2 **PRODUCTS**

2.1 **MATERIALS**

- .1 Use only firestop products that have been ULC or cUL tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements and fire-rating involved for each separate instance.
- .2 Fire stopping and smoke seal systems: in accordance with CAN-S115.
 - .1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of CAN-S115 and not to exceed opening sizes for which they are intended.
 - .2 Firestop system rating: as indicated on drawings.
- .3 Service penetration assemblies: certified and tested by ULC or cUL in accordance with CAN-S115.
- .4 Service penetration firestop components: certified and tested by ULC or cUL in accordance with CAN-S115.
- .5 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.
- .6 Non-curing, re-penetrable intumescent sealants, caulking or putty material for use with flexible cables or cable bundles.
- .7 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal. Consult with NRC Departmental Representative and damper manufacturer prior to installation ULC or cUL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
- .8 Intumescent sealants or caulking materials for use with combustible items (penetrants consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe. No silicone based firestop are allowed to be applied on plastic pipes.
- .9 Primers: to manufacturer's recommendation for specific material, substrate, and end use.
- .10 Water (if applicable): potable, clean and free from injurious amounts of deleterious substances.
- .11 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.
- .12 Sealants for vertical joints: non-sagging.

PART 3 **EXECUTION**

3.1 **PREPARATION**

- .1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and frost free.
- .2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.
- .3 Maintain insulation around pipes and ducts penetrating fire separation without interruption to vapour barrier.
- .4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

3.2 **INSTALLATION**

- .1 Install fire stopping and smoke seal material and components in accordance with ULC certification or UL Products Certified for Canada (CUL) and manufacturer's instructions.
- .2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.
- .3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.
- .4 Tool or trowel exposed surfaces to a neat finish.
- .5 Remove excess compound promptly as work progresses and upon completion.

3.3 **INSPECTION**

- .1 Notify NRC Departmental Representative when ready for inspection and prior to concealing or enclosing firestopping materials and service penetration assemblies.

3.4 **SCHEDULE**

- .1 Firestop and smoke seal at:
 - .1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
 - .2 Edge of floor slabs at curtain wall and precast concrete panels.
 - .3 Perimeter of fire-resistance rated masonry and gypsum board partitions.
 - .4 Intersection of fire-resistance rated masonry and gypsum board partitions.

- .5 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
- .6 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
- .7 Openings and sleeves installed for future use through fire separations.
- .8 Around mechanical and electrical assemblies penetrating fire separations.
- .9 Rigid ducts: greater than 129 cm²: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

3.5 FIRE SEPARATIONS

- .1 Coordinate fire separation labelling/stenciling as per Sections 09 91 23 – Interior Painting and 09 91 23.01 – Interior Re-Painting.

3.6 CLEAN UP

- .1 Remove excess materials and debris and clean adjacent surfaces immediately after application.
- .2 Remove temporary dams after initial set of fire stopping and smoke seal materials.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 00 10 00 – General Instructions.

1.2 **REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM C321, Standard Test Method for Bond Strength of Chemical-Resistant Mortars.
 - .2 ASTM C834, Standard Specification for Latex Sealants.
 - .3 ASTM C882, Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.
 - .4 ASTM C919, Standard Practice for Use of Sealants in Acoustical Applications.
 - .5 ASTM C920, Standard Specification for Elastomeric Joint Sealants.
 - .6 ASTM C1330, Standard Specification for Cylindrical Sealant Backing for use with Cold Liquid Applied Sealants.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-19.21, Sealing and Bedding Compound Acoustical.
- .3 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Protection Act (CEPA).
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act (TDGA).

1.3 **SUBMITTALS**

- .1 Manufacturer's product to describe.
 - .1 Caulking compound.
 - .2 Primers.
 - .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
 - .4 Installation instructions, surface preparation and product limitations.
- .2 Submit duplicate samples of each type of material and colour.
- .3 Cured samples of exposed sealants for each color where required to match adjacent material.

- .4 Manufacturers' instructions to include installation instructions for each product used.

1.4 QUALITY ASSURANCE

- .1 Manufacturer Qualifications: company engaged in the manufacturing of products specified in this section with a minimum of ten (10) years documented experience.
- .2 Applicator Qualifications: Experienced installer equipped and trained for application of joint sealant required for this project with record of successful completion of projects of similar scope.
 - .1 Applicator to be approved by sealant manufacturer.
 - .2 Applicator to submit documentation of a minimum three (3) successfully completed projects of similar size, scope and complexity.

1.5 MOCK-UP

- .1 Construct mock-up to show location, size, shape and depth of joints complete with back-up material, primer, caulking and sealant. Mock-up may be part of finished work.
- .2 Allow two (2) working days for inspection of mock-up by NRC Departmental Representative before proceeding with sealant work.
- .3 Mock-up will be used:
 - .1 To judge workmanship, substrate preparation, operation of equipment and material application.
- .4 When accepted, mock-up will demonstrate minimum standard of quality required for this Work.

1.6 FIELD ADHESION/COHESION TESTS

- .1 Test Frequency:
 - .1 Perform a field test each type of sealant and substrate combination, for all interior and exterior sealants associated with the building envelope.
 - .2 Perform three (3) additional tests for each failed test.
- .2 Locate test joints as directed by NRC Departmental Representative. Tests to be performed in the presence of the NRC Departmental Representative and/or manufacturer's representative.
- .3 Notify NRC Departmental Representative seven (7) days prior to dates tests are to be performed.
- .4 Test joint sealants by hand-pull methods #1 and # 2. Record test results in Field Adhesion/Cohesion Test Form.
 - .1 Test Method #1:
 - .1 Make a knife cut horizontally from one side of the joint to the other.

- .2 Make two (2) vertical cuts (from the horizontal cut) approximately 75 mm long on each side of the joint.
 - .3 Pry out flap created from cuts.
 - .4 Firmly grasp flap and slowly pull at 90° from sealant plane.
 - .5 Pull flap until adhesive or cohesive failure occurs.
 - .1 Adhesive failure will be evidenced by the sealant pulling off clean from the substrate.
 - .2 Cohesion failure will be evidenced by the sealant ripping or failing within itself, leaving well-adhered sealant to the substrate.
- (Cohesive failure is considered a positive result).**
- .2 Test Method # 2:
 - .1 Follow steps one (1) through four (4) of Test Method # 1.
 - .2 Mark a benchmark on the sealant 25 mm (1") from the plane of the installed sealant.
 - .3 Firmly grasp the flap and pull slowly, while holding a ruler parallel to the sealant flap. Note the position of the benchmark on the ruler.
 - .4 Refer to manufacturer's printed literature for each sealant tested for the required extension factor pass criteria; (i.e.: if the 25 mm (1") benchmark on the sealant can be pulled to 100 mm (4") and held with no failure of sealant, 400% elongation is achieved.)
 - .5 **If no failure occurs prior to the manufacturer's stated extension factor, the test is successful.** Extension factor should be three (3) times the movement capability of the sealant.
 - .5 Inspect joints for:
 - .1 Complete fill,
 - .2 Absence of voids,
 - .3 Primer,
 - .4 Proper width/depth ratio, and
 - .5 Back up material.
 - .6 Repair sealants pulled in test area by applying new sealants following same procedures used to original seal joints.
 - .7 Contractor shall repair test areas at no additional cost to the Owner.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, handle, store and protect materials in accordance with Section 00 10 00 – General Instructions.
- .2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

- .3 Condition products to approximately 16 to 20 degrees C for use in accordance with manufacturer's recommendations.
- .4 Handle all products with appropriate precautions and care as stated on the Material Safety Data Sheet.

1.8 PROJECT CONDITIONS

- .1 Environmental Limitations:
 - .1 Do not proceed with installation of joint sealants under following conditions:
 - .1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4°C.
 - .2 When joint substrates are wet.
 - .2 Joint-Width Conditions:
 - .1 Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
 - .3 Joint-Substrate Conditions:
 - .1 Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

PART 2 PRODUCTS

2.1 SEALANT MATERIALS

- .1 Sealants and Caulking compounds must:
 - .1 Meet or exceed all applicable governmental and industrial safety and performance standards; and
 - .2 Be manufactured and transported in such a manner that all steps fo the process, including the disposal of waste products arising therefrom, will meet the requirements of all applicable governmental acts, by laws and regulations including, for facilities located in Canada, the Fisheries Act and the Canadian Environmental Protection Act (CEPA).
- .2 Sealant and caulking compounds must not be formulated or manufactured with: aromatic solvents, fibrous talc or asbestos, formaldehyde, halogenated solvents, mecury, lead, cadium, hexavalent chromium, barium or their compounds, except barium sulphate.
- .3 Sealant and caulking compounds must no contain a total of volatile organic compound (VOC's) in excess of 100 grams per litre as calculated from records of the amounts of constituents used to make the product.
- .4 Sealant and caulking compounds must be accompanied by detailed instructions for proper application so as to minimize health concerns and maximize performance, and information describing proper disposal methods.

- .5 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.
- .6 When low toxicity caulks are not possible, confine usage to areas which off-gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off-gas time.
- .7 Where sealants are qualified with primers use only these primers.
- .8 Sealants acceptable for use on this project must be listed on CGSB Qualified Products List issued by CGSB Qualification Board for Joint Sealants. Where sealants are qualified with primers use only these primers.

2.2 SEALANT MATERIAL DESIGNATIONS

- .1 Single component, low odor, moisture cure, medium modulus, low VOC sealant for use in sealing air/vapour barrier penetrations, to ASTM C920, Type S, Grade NS, Class 35.
 - .1 ASTM C719: $\pm 35\%$.
 - .2 Ultimate Elongation: 450 - 550%.
 - .3 Modulus, 100%: 275 - 345 kPa.
 - .4 Shore A Hardness: 25 ± 5 .
 - .5 Tensile Strength: 1034 – 1378 kPa.
 - .6 Maximum VOC: 5 g/L.
- .2 Single component, medium modulus, high-performance, neutral-cure silicone sealant for general purpose exterior use, to ASTM C920, Type S, Grade NS, Class 35, Use NT, M, A and O.
 - .1 ASTM C719: $\pm 25\%$.
 - .2 Ultimate Elongation: 550%.
 - .3 Modulus, 50% extension: 380 kPa.
 - .4 Shore A Hardness: 25 ± 5 .
 - .5 Tensile Strength: 1240 kPa.
 - .6 Maximum VOC: 35 g/L.
 - .7 Colour to be selected from manufacturer's standard range.
- .3 Single component, low modulus, neutral-cure silicone sealant for general purpose masonry use, to ASTM C920, Type S, Grade NS, Class 50, Use T, NT, M, G, A and O.
 - .1 ASTM C719: $\pm 50\%$.
 - .2 Ultimate Elongation: 1600%.
 - .3 Modulus, 50% extension: 193 kPa.
 - .4 Shore A Hardness: 15.
 - .5 Tensile Strength: 690 kPa.
 - .6 Maximum VOC: 22 g/L.

- .7 Colour to be selected from manufacturer's standard range.
- .4 Two-component, high modulus, neutral-cure flexible silicone rubber sealant for use with aluminum window and curtain wall fabrication, assembly and glazing installation, to ASTM C1184 and ASTM C920, Type M, Grade NS, Class 12 ½, Use NT.
 - .1 ASTM C719: ± 25%.
 - .2 Ultimate Elongation: 120%.
 - .3 Shore A Hardness: 30 - 40.
 - .4 Tensile Strength: 2000 kPa.
 - .5 Maximum VOC: < 18 g/L.
- .5 Single component, medium modulus, neutral-cure silicone sealant for general roofing applications, to ASTM C920, Type S, Grade NS, Class 50, Use NT, G, A and O.
 - .1 ASTM C719: ± 50%.
 - .2 Shore A Hardness: 35.
 - .3 Tensile Strength: 415 kPa.
 - .4 Maximum VOC: 28 g/L.
 - .5 Colour to be selected from manufacturer's standard range.
- .6 Single component, chemical cure, silicone rubber sealant, for use with plumbing fixtures, showers, sinks, tubs, and junction of counter tops and adjacent wall finishes, to ASTM C920, Type S, Grade NS, Class 25, Use NT.
 - .1 Shore A Hardness: 25.
 - .2 Tensile Strength: 2100 kPa.
 - .3 Maximum VOC: 36 g/L.
 - .4 Colour to be selected from manufacturer's standard range.
- .7 Single component, high-performance, elastomeric polyurethane sealant, paintable, for general purpose interior use, to ASTM C920, Type S, Grade NS, Class 35, Use NT, M, A, T, O and I.
 - .1 ASTM C719: 35%.
 - .2 Ultimate Elongation: 800%.
 - .3 Shore A Hardness: 25 - 30.
 - .4 Tensile Strength: 2400 kPa.
 - .5 Maximum VOC: 35 g/L.
 - .6 Colour to be selected from manufacturer's standard range.
- .8 Single component, non-skinning, non-hardening, synthetic rubber sealant for use in acoustical applications, to CAN/CGSB 19.21.
 - .1 Shrinkage: maximum 20%.
 - .2 Maximum VOC: 53 g/L.
 - .3 Sag: Maximum 4.0 mm.

- .9 Two-component, non-sag, tamper resistant, elastomeric polyurethane sealant, for use in interior joints, penetrations, doors, windows, perimeters of fixtures, where a flexible security sealant is required due to idle tampering or vandalism, to ASTM C920, type M, Grade NS, Class 12.5, Use T₁, M and O.
 - .1 Ultimate Elongation: 175 - 200%.
 - .2 Shore A Hardness: 40 - 45.
 - .3 Tensile Strength: 2000 to 2400 kPa.
 - .4 Maximum VOC: Activator - < 25 g/L, Base - < 100 g/L.
 - .5 Colour to be selected from manufacturer's standard range.

2.3 ACCESSORIES

- .1 Primer: Type as recommended by sealant manufacturer. Primer to be compatible with joint forming materials.
- .2 Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer and compatible with joint forming materials.
- .3 Preformed Compressible and Non-Compressible back-up materials.
 - .1 Polyethylene, Urethane, Neoprene or Vinyl Foam.
 - .1 Extruded closed cell foam backer rod.
 - .2 Size: oversize 30 to 50 %.
 - .2 Neoprene or Butyl Rubber.
 - .1 Round solid rod, Shore A hardness 70.
 - .3 High Density Foam.
 - .1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m³ density, or neoprene foam backer, size as recommended by manufacturer.
 - .4 Bond Breaker Tape.
 - .1 Polyethylene bond breaker tape which will not bond to sealant.

PART 3 EXECUTION

3.1 PROTECTION

- .1 Protect installed Work of other trades from staining or contamination.

3.2 SURFACE PREPARATION

- .1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.
- .2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair work.

- .3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- .4 Ensure joint surfaces are dry and frost free.
- .5 All joint forming materials to be primed prior to sealant installation.
- .6 Prepare surfaces in accordance with manufacturer's directions.

3.3 PRIMING

- .1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.
- .2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.

3.4 BACKUP MATERIAL

- .1 Apply bond breaker tape where required to manufacturer's instructions.
- .2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.5 MIXING

- .1 Mix materials in strict accordance with sealant manufacturer's instructions.

3.6 APPLICATION

- .1 Sealant.
 - .1 Apply sealant in accordance with manufacturer's written instructions.
 - .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
 - .3 Apply sealant in continuous beads.
 - .4 Apply sealant using gun with proper size nozzle.
 - .5 Use sufficient pressure to fill voids and joints solid.
 - .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
 - .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
 - .8 Remove excess compound promptly as work progresses and upon completion.
- .2 Curing.
 - .1 Cure sealants in accordance with sealant manufacturer's instructions.
 - .2 Do not cover up sealants until proper curing has taken place.

- .3 Cleanup.
 - .1 Clean adjacent surfaces immediately and leave Work neat and clean.
 - .2 Remove excess and droppings, using recommended cleaners as work progresses.
 - .3 Remove masking tape after initial set of sealant.

3.7 CLEANING

- .1 Clean adjacent surfaces immediately and leave Work neat and clean.
- .2 Remove excess and droppings, using recommended cleaners as work progresses.
- .3 Remove masking tape after initial set of sealant.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 00 10 00 – General Instructions.
- .2 Section 07 92 00 – Joint Sealants.
- .3 Section 08 71 00 - Door Hardware.
- .4 Section 09 91 23 - Interior Painting.

1.2 **REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
 - .1 ASTM A653/A653M, Specification for Steel Sheet Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanized) by the Hot Dip Process.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating.
 - .2 CGSB 41-GP-19Ma, Rigid Vinyl Extrusions for Windows and Doors.
- .3 Canadian Standards Association (CSA)
 - .1 G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CSA W59, Welded Steel Construction (Metal Arc Welding).
- .4 Canadian Steel Door Manufacturers' Association, (CSDMA).
 - .1 CSDMA, Specifications for Commercial Steel Doors and Frames.
 - .2 CSDMA, Recommended Selection and Usage Guide for Commercial Steel Doors.
- .5 National Fire Protection Association (NFPA)
 - .1 NFPA 80, Standard for Fire Doors and Fire Windows.
 - .2 NFPA 252, Standard Methods of Fire Tests of Door Assemblies.
- .6 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN4-S104M, Fire Tests of Door Assemblies.
 - .2 CAN4-S105M, Fire Door Frames Meeting the Performance Required by CAN4-S104.
 - .3 CAN/ULC-S701, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .4 CAN/ULC-S702, Thermal Insulation, Mineral Fibre, for Buildings.
 - .5 CAN/ULC-S704, Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

1.3 DESIGN REQUIREMENTS

- .1 Design door assembly to withstand minimum 1,000,000 swing cycles in accordance with ANSI A151.1, with no failure of any design features of the door.
- .2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.
- .3 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104 and NFPA 252 for ratings specified or indicated.
- .4 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN4-S104 and NFPA 252 and listed by nationally recognized agency having factory inspection services and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

1.4 SUBMITTALS

- .1 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, arrangement of hardware and fire rating and finishes.
- .2 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings and reinforcing fire rating and finishes.
- .3 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

1.5 DELIVERY STORAGE AND HANDLING

- .1 Deliver, store, handle and protect doors and frames in accordance with Section 00 10 00 – General Instructions.
- .2 Deliver, handle and store doors and frames at the job site in such a manner as to prevent damage.
- .3 Store doors and frames under cover with doors stored in a vertical position on blocking, clear of floor and with blocking between doors to permit air circulation.

1.6 QUALITY ASSURANCE

- .1 Conform to requirements to ANSI A117.1
- .2 Company specializing in manufacturing products specified with a minimum of five (5) years documented experience.

1.7 WARRANTY

- .1 Provide a written warranty for work of this section from manufacturer for failure due to defective materials and from contractor for failure due to defective installation workmanship, for one (1) year respectively from the date of Substantial Completion.

PART 2 PRODUCTS

2.1 MATERIALS

- .1 Hot dipped galvanized steel sheet: to ASTM A653/A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.
- .2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653/A653M, ZF75.

2.2 DOOR CORE MATERIALS

- .1 Stiffened: face sheets welded insulated core.
 - .1 Expanded polystyrene: CAN/ULC-S701, density 16 to 32 kg/m³.
 - .2 Polyurethane: to CAN/ULC-S704 rigid, modified polyisocyanurate, closed cell board. Density 32 kg/m³.
- .2 Temperature rise rated (TRR): core composition to limit temperature rise on unexposed side of door to 250°C at 60 minutes. Core to be tested as part of a complete door assembly, in accordance with CAN4-S104, ASTM E152 or NFPA 252, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency having factory inspection service.
- .3 Thermal Insulation material must:
 - .1 Not require being labelled as poisonous, corrosive, flammable or explosive under the Consumer Chemical and Container Regulations of the Hazardous Products Act.
 - .2 Be manufactured using a process that uses chemical compounds with the minimum zone depletion potential (ODP) available.

2.3 ADHESIVES

- .1 Polystyrene and polyurethane cores: heat resistant, epoxy resin based, low viscosity, contact cement.

2.4 PRIMER

- .1 Touch-up prime CAN/CGSB-1.181.

2.5 ACCESSORIES

- .1 Door silencers: single stud rubber/neoprene type.

- .2 Exterior top and bottom caps steel.
- .3 Door bottom seal: Section 08 71 00 – Door Hardware.
- .4 Metallic paste filler: to manufacturer's standard.
- .5 Fire labels: metal riveted.
- .6 Sealant: Section 07 92 00 – Joint Sealants.
- .7 Finish Painting: to Section 09 91 23 – Interior Painting.

2.6 FRAMES FABRICATION GENERAL

- .1 Fabricate frames in accordance with CSDMA specifications.
- .2 Fabricate frames to profiles and maximum face sizes as indicated.
- .3 Interior frames: 1.2 mm welded type construction.
- .4 Blank, reinforce, drill and tap frames for mortised, template hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.
- .5 Protect mortised cutouts with steel guard boxes.
- .6 Prepare frame for door silencers, 3 for single door, 2 at head for double door.
- .7 Manufacturer's nameplates on frames and screens are not permitted.
- .8 Conceal fastenings except where exposed fastenings are indicated.
- .9 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
- .10 Insulate exterior frame components with polyurethane insulation.

2.7 FRAME ANCHORAGE

- .1 Shim and anchor new doors in accordance with CAN/CSA A440.4.
- .2 Provide appropriate anchorage to floor and wall construction.
- .3 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
- .4 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.

- .5 Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm o.c. maximum.

2.8 FRAMES: WELDED TYPE

- .1 Welding in accordance with CSA W59.
- .2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.
- .3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.
- .4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.
- .5 Securely attach floor anchors to inside of each jamb profile.
- .6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.9 DOOR FABRICATION GENERAL

- .1 Doors: swing type, flush, with provision for glass and/or louvre openings as indicated.
- .2 Fabricate doors with longitudinal edges locked seam. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish.
- .3 Doors: manufacturers' proprietary construction, tested and/or engineered as part of a fully operable assembly, including door, frame, gasketing and hardware in accordance with ASTM E330.
- .4 Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.
- .5 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.
- .6 Reinforce doors where required, for surface mounted hardware. Provide flush steel top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.
- .7 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.
- .8 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in strict conformance with CAN4-S104 ASTM E152 NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

- .9 Manufacturer's nameplates on doors are not permitted.

2.10 HOLLOW STEEL CONSTRUCTION

- .1 Form each face sheet for exterior doors from 1.2 mm sheet steel.
- .2 Form each face sheet for interior doors from 1.2 sheet steel.
- .3 Reinforce doors with vertical stiffeners, securely welded to each face sheet at 150 mm on centre maximum.
- .4 Fill voids between stiffeners of exterior doors with insulation as specified.
- .5 Fill voids between stiffeners of interior doors with honeycomb core.

PART 3 EXECUTION

3.1 INSTALLATION GENERAL

- .1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.
- .2 Install doors and frames to CSDMA Installation Guide.

3.2 FRAME INSTALLATION

- .1 Set frames plumb, square, level and at correct elevation.
- .2 Secure anchorages and connections to adjacent construction.
- .3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.
- .4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.
- .5 Caulk perimeter of frames between frame and adjacent material.
- .6 Maintain continuity of air barrier and vapour retarder.

3.3 DOOR INSTALLATION

- .1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 00 - Door Hardware.
- .2 Provide even margins between doors and jambs and doors and finished floor as follows.

- .1 Hinge side: 1.0 mm.
 - .2 Latch side and head: 1.5 mm.
 - .3 Finished floor: 13 mm.
- .3 Adjust operable parts for correct function.

3.4 FINISH REPAIRS

- .1 Touch up with primer finishes damaged during installation.
- .2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.5 COMMISSIONING

- .1 Contractor to instruct maintenance personnel in operation and maintenance of doors and hardware.
- .2 Confirm operation and function for all doors and hardware.
- .3 Commissioning will be witnessed by NRC Departmental Representative and Certificate will be signed by Contractor and NRC Departmental Representative.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 00 10 00 – General Instructions.
- .2 Section 08 11 00- Metal Doors & Frames.

1.2 **REFERENCES**

- .1 American National Standards Institute (ANSI) / Builders Hardware Manufacturers Association (BHMA)
 - .1 ANSI/BHMA A156.1, American National Standard for Butts and Hinges.
 - .2 ANSI/BHMA A156.2, Bored and Preamsembled Locks and Latches.
 - .3 ANSI/BHMA A156.4, Door Controls - Closers.
 - .4 ANSI/BHMA A156.5, Cylinders and Input Devices for Locks.
 - .5 ANSI/BHMA A156.6, Architectural Door Trim.
 - .6 ANSI/BHMA A156.8, Door Controls - Overhead Stops and Holders.
 - .7 ANSI/BHMA A156.13, Mortise Locks and Latches Series 1000.
 - .8 ANSI/BHMA A156.16, Auxiliary Hardware.
 - .9 ANSI/BHMA A156.18, Materials and Finishes.
 - .10 ANSI/BHMA A156.21, Thresholds.
 - .11 ANSI/BHMA A156.22, Door Gasketing and Edge Seal Systems.
 - .12 ANSI/BHMA A156.28, Keying Systems.
- .2 Canadian Steel Door and Frame Manufacturers' Association (CSDFMA)
 - .1 CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction).
 - .2 CSDFMA Recommended Dimensional Standards for Commercial Steel Doors and Frames.

1.3 **SUBMITTALS**

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and data sheet.
- .2 Samples:
 - .1 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.
 - .2 After approval samples will be returned for incorporation in the Work.
- .3 Hardware List:
 - .1 Submit contract hardware list.

- .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.
- .4 Manufacturer's Instructions:
 - .1 Submit manufacturer's installation instructions.
- .5 Closeout Submittals
 - .1 Provide operation and maintenance data for door closers, locksets, door holders electrified hardware and fire exit hardware for incorporation into manual specified in Section 00 10 00 – General Instructions.

1.4 WARRANTY

- .1 Provide a written manufacturer's warranty for work of this Section for failure due to defective materials for ten (10) years, dated from substantial completion certificate.
- .2 Provide a written Contractor's warranty for work of this Section for failure due to defective installation workmanship for one (1) year, dated from submittal completion certificate.

1.5 QUALITY ASSURANCE

- .1 Regulatory Requirements:
 - .1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.
- .2 Only products certified in accordance with ANSI/BHMA standards are acceptable. Items that are equal in design, function and quality will be accepted upon approval of the NRC Departmental Representative.
- .3 Only recognized contract hardware distributors will be considered for the work of this section. The distributor shall have on staff a qualified Architectural Hardware Consultant recognized by the Door and Hardware Institute or a person with equivalent qualifications to assist installers and direct detailing, processing and delivery of material, and certify installation acceptance.
- .4 Upon completion of finish hardware installation, hardware supplier shall inspect work and shall certify in writing that all items and their installation are in accordance with requirements of Contract Documents and are functioning properly.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Deliver, store, handle and protect materials in accordance with Section 00 10 00 – General Instructions.
- .2 Store finishing hardware in locked, clean and dry area.
- .3 Package each item of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

1.7 MAINTENANCE SERVICE

- .1 Provide maintenance service for one year during warranty period to maintain all barrier free entrance automatic operators as follows:
 - .1 Qualified service personal approved by manufacturer of operators.
 - .2 Site inspection every three months will all necessary adjustment made during this visit. Separate warranty service calls, if required, will only qualify as an inspection if time of call is close to the three month intervals.
 - .3 Make detailed reports of each visit and copy to Owner and Engineer.
 - .4 Cost of this service will be included as part of this Section and is not covered by any allowance amount.

PART 2 PRODUCTS

2.1 HARDWARE ITEMS

- .1 Only door locksets and latches listed on ANSI/BHMA Standards list are acceptable for use on this project.
- .2 Use one manufacturer's products only for similar items.

2.2 DOOR HARDWARE

- .1 Locks and latches:
 - .1 Bored and preassembled locks and latches: to ANSI/BHMA A156.2, 4000 bored lock, grade 1, designed for function and keyed as stated in Hardware Schedule.
 - .2 Mortise locks and latches: to ANSI/BHMA A156.13, series 1000 mortise lock, designed for function and keyed as stated in Hardware Schedule.
 - .3 Lever handles : design as indicated in hardware groups.
 - .4 Roses: round.
 - .5 Normal strikes: box type, lip projection not beyond jamb.
 - .6 Cylinders: key into keying system as directed.
 - .7 All corresponding cylinders to be removable.
 - .8 Finished as indicated in Hardware Groups.
- .2 Butts and hinges:
 - .1 Butts and hinges: to ANSI/BHMA A156.1, designated by letter A and numeral identifiers, followed by size and finish, listed in Hardware Schedule.
 - .2 Interior hinges of steel, unless otherwise indicated.
 - .3 Quantity, size and width of hinges in accordance with manufacturer's recommendations and ASNI/BHMA 156.1.
- .3 Door Closers and Accessories:

- .1 Door controls (closers): to ANSI/BHMA A156.4, designated by letter C and numeral identifiers listed in Hardware Schedule, size in accordance with ANSI/BHMA A156.4. Table A1.
- .2 Closers of narrow, slim line design complete with backcheck, rack and pinion hydraulic action.
- .3 Closers equipped with full cover complete with secure and concealed mounting screws
- .4 Adapter plates for added reinforcing shall be added to any opening if required to suit field conditions or door design.
- .5 Closers shall include all necessary arm brackets, cush arm supports and blade stop spacers to suit door swing, frame reveals or stop conditions.
- .6 Closers capable of field adjustments of at least fifteen (15) percent.
- .4 Door bottom seal: heavy duty, door seal of extruded aluminum frame and hollow closed cell neoprene weather seal, surface mounted with drip cap closed ends, clear anodized finish.
- .5 Thresholds:
 - .1 To ANSI/BHMA A156.21 extruded aluminum mill finish, serrated surface, with lip and vinyl door seal insert, thermally broken.
 - .2 Thresholds of aluminum material. Provide 50 mm longer than opening to allow fitting on site.
 - .3 When mullion is used, increase length of threshold to fit around mullion.
 - .4 Fasteners of countersink type suitable to properly install to floor/sill conditions. Supply complete with screw anchors.
- .6 Weatherstripping:
 - .1 Head and jamb seal:
 - .1 Extruded aluminum frame and solid closed cell neoprene insert, clear anodized finish.
- .7 Astragal: overlapping, extruded aluminum frame with vinyl insert, finished to match doors.

2.3 FASTENINGS

- .1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.
- .2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .3 Exposed fastening devices to match finish of hardware.
- .4 Use fasteners compatible with material through which they pass.

2.4 KEYING

- .1 Provide keys in triplicate for every lock in this Contract.
- .2 Stamp keying code numbers on keys and cylinders.
- .3 Provide construction cores.
- .4 Provide all permanent cores and keys to NRC Departmental Representative.

2.5 FINISHES

- .1 Following finishes are indicated as per materials.

BHMA	CAN MATERIAL	FINISH
630	C32D Stainless Steel	Satin Stainless Steel
652	C26D Steel	Plated Satin Chrome

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
- .2 Furnish metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.
- .3 Furnish manufacturers' instructions for proper installation of each hardware component.

3.2 INSTALLATION

- .1 Install door hardware in accordance with manufacturer's instructions, using special tools and jigs. Fit accurately and apply securely. Ensure that hardware is installed correctly.
- .2 Install hardware to standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers' Association.
- .3 No operating hardware shall be installed at a height of more than 1200 above the finished floor (NBC 3.4.6.16).
- .4 Installation to be done by a qualified tradesman. Technical assistance provide by door hardware supplier where required.
- .5 Closers shall be installed according to manufacturer's templates and installation instructions. Unless required otherwise, installation shall be on pull side of door. Outswing doors shall be on push side using top jamb or parallel arm installation.

- .6 Where closer or arm is installed on door, sex bolts will be used, finished to match other hardware.
- .7 Use only manufacturer's supplied fasteners. Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.
- .8 Remove construction cores and locks when directed by NRC Departmental Representative; install permanent cores and check operation of locks.

3.3 EXAMINATION

- .1 Visit site prior to start of installation of hardware.
- .2 Visit will include examination of openings, site conditions and materials for conditions that prevent proper application of finish hardware.
- .3 Report to General Contractor, in writing, defects of work prepared by other trades and other unsatisfactory site conditions. Commencement of installation will imply acceptance of prepared work by others.

3.4 FIELD QUALITY CONTROL

- .1 Hardware contractor to have a qualified AHC representative from the manufacturer/supplier on site at Substantial Completion Inspection and at commissioning of the finished hardware. Cost of the visits to be included in contract.
- .2 Provide an inspection report 6 (six) months after Substantial Completion, completed by a qualified Architectural Hardware Consultant, to note any deficiencies. The inspection should include checking each lock against the key schedule to make sure the correct locks and cylinders are on the proper doors.
- .3 Fire Rated Door Assemblies On-Site Inspection:
 - .1 Upon completion of the installation, inspect each fire rated door assembly to confirm proper operation of its closing device, confirming it meets the criteria of NFPA 80.
 - .2 Provide a written report to the NRC Departmental Representative listing each fire rated door assembly for the project including:
 - .1 Each door number,
 - .2 An itemized list of hardware set components for each door opening, and
 - .3 Each door location in the facility.

3.5 ADJUSTING

- .1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.
- .2 Lubricate hardware, operating equipment and other moving parts.

- .3 Adjust door hardware to provide tight fit at contact points with frames.
- .4 Where hardware is found defective, repair or replace or correct as desired by inspection reports.

3.6 CLEANING

- .1 Perform cleaning after installation to remove construction and accumulated environmental dirt.
- .2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacture's instructions.
- .3 Remove protective material from hardware items where present.
- .4 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

3.7 PROTECTION

- .1 All hardware shall be protected against damage from paint, plaster or other defacing materials. Whenever possible manufacturers protective covering when applied, shall not be removed until final project cleaning takes place. Material not protected by manufacture shall be covered or removed from door during painting or any other adjustments that can cause damage to hardware.

3.8 HARDWARE GROUPS

- .1 Provide hardware as specified in the previous articles in sets according to those indicated on the drawings.
- .2 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.9 COMMISSIONING

- .1 Site inspection or visit at Substantial Completion and training follow up and inspection at commissioning as directed by NRC Departmental Representative.
- .2 Provide 10 month warranty service.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 00 10 00 – General Instructions.

1.2 **REFERENCES**

- .1 Environmental Protection Agency (EPA)
 - .1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 (for Surface Coatings).
 - .2 SW-846, Test Methods for Evaluating Solid Waste: Physical/Chemical Methods.
- .2 Master Painters Institute (MPI)
 - .1 MPI Architectural Painting Specifications Manual.
- .3 Society for Protective Coatings (SSPC)
 - .1 SSPC Painting Manual, Volume Two, Systems and Specifications Manual.
- .4 National Fire Code of Canada.

1.3 **QUALITY ASSURANCE**

- .1 Contractor shall have a minimum of five years proven satisfactory experience. When requested, provide a list of last three comparable jobs including, job name and location, specifying authority, and project manager.
- .2 Qualified journeymen shall be engaged in painting work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.
- .3 Conform to latest MPI requirements for interior painting work including preparation and priming.

1.4 **ENVIRONMENTAL PERFORMANCE REQUIREMENTS**

- .1 Provide paint products meeting MPI "Environmentally Friendly" E2 or E3 ratings based on VOC (EPA Method 24) content levels.
- .2 Where indoor air quality (odour) is a problem, use only MPI listed materials having a minimum E2 or E3 rating.

1.5 **SCHEDULING**

- .1 Submit work schedule for various stages of painting to NRC Departmental Representative for approval. Submit schedule minimum of two (2) working days in advance of proposed operations.

- .2 Obtain written authorization from NRC Departmental Representative for any changes in work schedule.
- .3 Schedule painting operations to prevent disruption of occupants in and about the building.

1.6 SUBMITTALS

- .1 Submit product data and manufacturer's installation/application instructions for each paint and coating product to be used.
- .2 Submit WHMIS MSDS - Material Safety Data Sheets. Indicate VOCs during application and curing.
- .3 Upon completion, submit records of products used, records to be included in Operating and Maintenance Manuals. List products in relation to finish system and include the following:
 - .1 Product name, type and use
 - .2 Manufacturer's product number
 - .3 Colour numbers
 - .4 MPI Environmentally Friendly Classification System Rating
 - .5 Manufacturer's Material Safety Data Sheets (MSDS)
- .4 Submit full range colour sample chips to indicate where colour availability is restricted.

1.7 EXTRA MATERIALS

- .1 Submit maintenance materials from same product run as products installed in accordance with Section 00 10 00 – General Instructions. Package products with protective covering and identify with descriptive labels.
- .2 Submit one - four litre can of each type and colour of finish coating. Identify colour and paint type in relation to established colour schedule and finish formula.
- .3 Deliver to NRC Departmental Representative and store where directed.
- .4 Provide certificate signed by staff that extra materials have been received in order.

1.8 DELIVERY, HANDLING AND STORAGE

- .1 Deliver, store and handle materials in accordance with Section 00 10 00 – General Instructions.
- .2 Deliver and store materials in original containers, sealed, with labels intact.
- .3 Labels shall clearly indicate:
 - .1 Manufacturer's name and address.

- .2 Type of paint or coating.
- .3 Compliance with applicable standard.
- .4 Colour number in accordance with established colour schedule.
- .4 Remove damaged, opened and rejected materials from site.
- .5 Provide and maintain dry, temperature controlled, secure storage.
- .6 Observe manufacturer's recommendations for storage and handling.
- .7 Store materials and supplies away from heat generating devices.
- .8 Store materials and equipment in a well ventilated area with temperature range 7° C to 30° C.
- .9 Store temperature sensitive products above minimum temperature as recommended by manufacturer.
- .10 Keep areas used for storage, cleaning and preparation, clean and orderly to approval of NRC Departmental Representative. After completion of operations, return areas to clean condition to approval of Consultant.
- .11 Remove paint materials from storage only in quantities required for same day use.
- .12 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling storage, and disposal of hazardous materials.
- .13 Fire Safety Requirements:
 - .1 Provide minimum one 9 kg Type ABC dry chemical fire extinguisher adjacent to storage area.
 - .2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
 - .3 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.9 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate waste materials for reuse and recycling in accordance with Section 00 10 00 – General Instructions.
- .2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3 Place materials defined as hazardous or toxic in designated containers.
- .4 Ensure emptied containers are sealed and stored safely.
- .5 Unused paint, coating materials must be disposed of at official hazardous material collections site as approved by NRC Departmental Representative.

- .6 Paint, stain and wood preservative finishes and related materials (thinners, and solvents) are regarded as hazardous products and are subject to regulations for disposal.
- .7 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
- .8 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
- .9 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground follow these procedures:
 - .1 Retain cleaning water for water-based materials to allow sediments to be filtered out.
 - .2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
 - .3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
 - .4 Dispose of contaminants in approved legal manner in accordance with hazardous waste regulations.
 - .5 Empty paint cans are to be dry prior to disposal or recycling (where available).

1.10 SITE CONDITIONS

- .1 Heating, Ventilation and Lighting:
 - .1 Ventilate enclosed spaces.
 - .2 Perform no painting work unless adequate and continuous ventilation and sufficient heating facilities are in place to maintain ambient air and substrate temperatures above 10°C for 24 hours before, during and after paint application until paint has cured sufficiently.
 - .3 Where required, provide continuous ventilation for seven days after completion of application of paint.
 - .4 Perform no painting work unless a minimum lighting level of 323 Lux is provided on surfaces to be painted. Adequate lighting facilities shall be provided by General Contractor.
- .2 Temperature, Humidity and Substrate Moisture Content Levels:
 - .1 Unless specifically pre-approved by the specifying body, Paint Inspection Agency and the applied product manufacturer, perform no painting work when:
 - .1 Ambient air and substrate temperatures are below 10°C.
 - .2 Substrate temperature is over 32°C unless paint is specifically formulated for application at high temperatures.
 - .3 Substrate and ambient air temperatures are expected to fall outside MPI or paint manufacturer's prescribed limits.
 - .4 The relative humidity is above 60% or when the dew point is less than 3°C variance between the air/surface temperature.

- .2 Perform no painting work when the maximum moisture content of the substrate exceeds:
 - .1 12% for concrete and masonry (clay and concrete brick/block).
 - .2 15% for wood.
 - .3 12% for plaster and gypsum board.
- .3 Conduct moisture tests using a properly calibrated electronic Moisture Meter, except test concrete floors for moisture using a simple "cover patch test".
- .4 Test concrete, masonry and plaster surfaces for alkalinity as required.
- .3 Surface and Environmental Conditions:
 - .1 Apply paint finish only in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
 - .2 Apply paint only to adequately prepared surfaces and to surfaces within moisture limits noted herein.
 - .3 Apply paint only when previous coat of paint is dry or adequately cured.
- .4 Additional Interior Application Requirements:
 - .1 Apply paint finishes only when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.
 - .2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of NRC Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

PART 2 **PRODUCTS**

2.1 **MATERIALS**

- .1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.
- .2 Paint materials for paint systems shall be products of a single manufacturer.
- .3 Low odor products. Whenever possible, select products exhibiting low odor characteristics. If two products are otherwise equivalent, select the product with the lowest odor. Only qualified products with E2 or E3 "Environmentally Friendly" rating are acceptable for use on this project.
- .4 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids, shall:
 - .1 be water-based, water soluble, water clean-up.
 - .2 be non-flammable.
 - .3 be manufactured without compounds which contribute to ozone depletion in the upper atmosphere.
 - .4 be manufactured without compounds which contribute to smog in the lower atmosphere.

- .5 do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.
- .5 Water-borne surface coatings must be manufactured and transported in a manner that steps of process, including disposal of waste products arising therefrom, will meet requirements of applicable governmental acts, by-laws and regulations including, for facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).
- .6 Water-borne surface coatings must not be formulated or manufactured with aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.
- .7 Water-borne surface coatings must have a flash point of 61.0°C or greater.
- .8 Both water-borne surface coatings and recycled water-borne surface coatings must be made by a process that does not release:
 - .1 Matter in undiluted production plant effluent generating a 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
 - .2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to a natural watercourse or a sewage treatment facility lacking secondary treatment.
- .9 Water-borne paints and stains, and water borne varnishes must meet a minimum "Environmentally Friendly" E2 rating.

2.2 COLOURS

- .1 NRC Departmental Representative will provide Colour Schedule after contract award.
- .2 Selection of colours will be from manufacturers full range of colours.
- .3 Where specific products are available in a restricted range of colours, selection will be based on the limited range.
- .4 Second coat in a three coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.3 MIXING AND TINTING

- .1 Perform colour tinting operations prior to delivery of paint to site. On-site tinting of painting materials is allowed only with NRC Departmental Representative written permission.
- .2 Where thinner is used, addition shall not exceed paint manufacturer's recommendations. Do not use kerosene or any such organic solvents to thin water-based paints.

- .3 Re-mix paint in containers prior to and during application to ensure break-up of lumps, complete dispersion of settled pigment, and colour and gloss uniformity.

2.4 GLOSS/SHEEN RATINGS

- .1 Paint gloss shall be defined as the sheen rating of applied paint, in accordance with the following values:

Gloss Level Category	Units @ 60E	Units @ 85E
G1 - matte finish	max. 5	max. 10
G2 - velvet finish	max. 10	10 to 35
G3 - eggshell finish	10 to 25	10 to 35
G4 - satin finish	20 to 35	min. 35
G5 - semi-gloss finish	35 to 70	
G6 - gloss finish	70 to 85	
G7 - high gloss finish	> 85	

- .2 Gloss level ratings of painted surfaces shall be as specified herein.

2.5 INTERIOR PAINTING SYSTEMS

- .1 The following paint formulas requires a three coat finish as indicated in the MPI Architectural Painting Specifications Manual.
- .2 Structural Steel and Metal Fabrications: columns, beams, joists, etc.
- .1 INT 5.1E Alkyd G5 finish.
- .3 Galvanized Metal: doors, frames, railings, misc. steel, pipes, overhead decking, ducts, etc.
- .1 INT 5.3A Latex G5 finish.
- .2 INT 9.2A Latex G1 finish (over latex sealer) for ceilings.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 GENERAL

- .1 Perform preparation and operations for interior painting in accordance with MPI Painting Specifications Manual except where specified otherwise.
- .2 Apply all paint materials in accordance with paint manufacturer's written application instructions.

3.3 PROTECTION

- .1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage. If damaged, clean and restore such surfaces as directed by NRC Departmental Representative.
- .2 Cover or mask floors, windows and other ornamental hardware adjacent to areas being painted to prevent damage and to protect from paint drops and splatters. Use non-staining coverings.
- .3 Protect items that are permanently attached such as Fire Labels on doors and frames.
- .4 Protect factory finished products and equipment.
- .5 Protect passing pedestrians, building occupants and general public in and about the building.
- .6 Remove electrical cover plates, light fixtures, surface hardware on doors, door stops, bath accessories and other surface mounted fittings and fastenings prior to undertaking any painting operations. Store for re-installation after painting is completed.
- .7 As painting operations progress place "WET PAINT" signs in occupied areas to approval of NRC Departmental Representative.

3.4 EXAMINATION

- .1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to NRC Departmental Representative all damage, defects, unsatisfactory or unfavourable conditions before proceeding with work.
- .2 Conduct moisture testing of surfaces to be painted using a properly calibrated electronic moisture meter, except test concrete floors for moisture using a simple "cover patch test" and report findings to NRC Departmental Representative. Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.
- .3 Maximum moisture content as follows:
 - .1 Masonry/Concrete: 12%
 - .2 Concrete Block/Brick: 12%

3.5 CLEANING AND PREPARATION

- .1 Clean and prepare surfaces in accordance with MPI Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:
 - .1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths or compressed air.
 - .2 Wash surfaces with a biodegradable detergent and bleach where applicable and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

- .3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
 - .4 Allow surfaces to drain completely and allow to dry thoroughly.
 - .5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
 - .6 Use trigger operated spray nozzles for water hoses.
 - .7 Many water-based paints cannot be removed with water once dried. However, minimize the use of kerosene or any such organic solvents to clean up water-based paints.
- .2 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.
 - .3 Sand existing surfaces with intact, smooth, high gloss coatings to provide adequate adhesion for new finishes.
 - .4 Where possible, prime surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
 - .1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
 - .2 Apply wood filler to nail holes and cracks.
 - .3 Tint filler to match stains for stained woodwork.
 - .5 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.
 - .6 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes blowing with clean dry compressed air, or vacuum cleaning.
 - .7 Touch up of shop primers with primer as specified in applicable section. Major touch-up including cleaning and painting of field connections, welds, rivets, nuts, washers, bolts, and damaged or defective paint and rusted areas, shall be by supplier of fabricated material.
 - .8 Do not apply paint until prepared surfaces have been accepted by NRC Departmental Representative.

3.6 APPLICATION

- .1 Method of application to be as approved by NRC Departmental Representative. Apply paint by brush or roller. Conform to manufacturer's application instructions unless specified otherwise.
- .2 Brush and Roller Application:

- .1 Apply paint in a uniform layer using brush and/or roller of types suitable for application.
 - .2 Work paint into cracks, crevices and corners.
 - .3 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces shall be free of roller tracking and heavy stipple.
 - .4 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.
 - .5 Remove runs, sags and brush marks from finished work and repaint.
- .3 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access and only when specifically authorized by NRC Departmental Representative.
 - .4 Apply coats of paint as a continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.
 - .5 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.
 - .6 Sand and dust between coats to remove visible defects.
 - .7 Finish tops of cupboards, cabinets and projecting ledges, both above and below sight lines as specified for surrounding surfaces.
 - .8 Finish top, bottom, edges and cutouts of doors after fitting as specified for door surfaces.

3.7 MECHANICAL/ELECTRICAL EQUIPMENT

- .1 Do not paint interior transformers and substation equipment.

3.8 FIRE SEPARATIONS

- .1 Contractor to stencil on both sides of fire rated partitions the fire rating for that assembly (i.e.: **1 HR FIRE SEPARATION**).
- .2 Stenciled fire ratings to be minimum 100 mm high **RED** letters, minimum 150 mm above finished ceilings, and minimum 2400 mm o.c. along partition.

3.9 FIELD QUALITY CONTROL

- .1 Field inspection of interior painting operations to be carried out by NRC Departmental Representative.
- .2 Advise NRC Departmental Representative when each applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.
- .3 Co-operate with NRC Departmental Representative and provide access to all areas of the work.

- .4 Standard of Acceptance:
 - .1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.
 - .2 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

END OF SECTION

PART 1 **GENERAL**

1.1 **REFERENCES**

- .1 American National Standards Institute (ANSI)
 - .1 ANSI/NFPA 10, Portable Fire Extinguishers.
- .2 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S508, Rating and Fire Testing of Fire Extinguishers and Class "D" Extinguishing Media.

1.2 **SUBMITALS**

- .1 Submit manufacturer's technical data for each type of fire extinguisher and safety blanket.

1.3 **CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for incorporation into manual.

1.4 **WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate and recycle waste materials in accordance with Section 00 10 00 – General Instructions.

PART 2 **PRODUCTS**

2.1 **CARBON DIOXIDE**

- .1 Extinguishers insulated handle, hose and horn discharge assembly, self-closing lever or squeeze-grip operation, fully charged, ULC labelled for B and C class protection. Sizes 4.5, 6.8 and 9.0 kg or as indicated on drawings.

2.2 **EXTINGUISHER BRACKETS**

- .1 Type recommended by extinguisher manufacturer.

2.3 **IDENTIFICATION**

- .1 Identify extinguishers in accordance with recommendations of ANSI/NFPA 10 and CAN/ULC-S508.
- .2 Attach bilingual tag or label to extinguishers, indicating month and year of installation. Provide space for service dates.

PART 3 **EXECUTION**

3.1 **INSTALLATION**

- .1 Install or mount extinguishers in cabinets or on brackets as indicated.

END OF SECTION

PART 1 **GENERAL**

1.1 **SUMMARY**

- .1 Section Includes:
 - .1 Materials and installation for wet pipe fire protection and sprinkler systems for heated areas.

1.2 **REFERENCES**

- .1 American National Standards Institute/National Fire Prevention Association (ANSI/NFPA)
 - .1 ANSI/NFPA 13, Installation of Sprinkler Systems.
 - .2 ANSI/NFPA 24, Installation of Private Fire Service Mains and Their Appurtenances.
 - .3 ANSI/NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .3 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN4 S543, Standard for Internal Lug Quick Connect Couplings for Fire Hose.

1.3 **SAMPLES**

- .1 Submit samples of following:
 - .1 Each type of sprinkler head.

1.4 **SUBMITTALS**

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 00 10 00 – General Instructions.
- .2 Shop Drawings:
 - .1 Shop drawings: submit drawings stamped and signed by designer registered and acceptable to the authority having jurisdiction.
 - .2 Indicate:
 - .1 Materials.
 - .2 Finishes.
 - .3 Method of anchorage
 - .4 Number of anchors.
 - .5 Supports.

- .6 Reinforcement.
- .7 Assembly details.
- .8 Accessories.
- .3 Test reports:
 - .1 Submit certified test reports for wet pipe fire protection sprinkler systems from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.
- .4 Manufacturer's Field Reports: manufacturer's field reports specified.
- .3 Closeout Submittals:
 - .1 Submit maintenance and engineering data for incorporation into manual.
 - .2 Manufacturer's Catalog Data, including specific model, type, and size for:
 - .1 Pipe and fittings.
 - .2 Sprinkler heads.
 - .3 Drawings:
 - .1 Sprinkler heads and piping system layout.
 - .1 Prepare 760 mm by 1050 mm detail working drawings of system layout in accordance with NFPA 13, "Working Drawings (Plans)".
 - .2 Show data essential for proper installation of each system.
 - .3 Show details, plan view, elevations, and sections of systems supply and piping.
 - .4 Design Data:
 - .1 Calculations of sprinkler system design.
 - .2 Indicate type and design of each system and certify that each system has performed satisfactorily in the manner intended for not less than 18 months.
 - .5 Field Test Reports:
 - .1 Preliminary tests on piping system.
 - .6 Records:
 - .1 As-built drawings of each system.
 - .1 After completion, but before final acceptance, submit complete set of as-built drawings of each system for record purposes.
 - .2 Submit 760 mm by 1050 mm drawings on reproducible Mylar film with title block similar to full size contract drawings.

1.5 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: certified journeyman in wet sprinkler systems with 5 years documented experience approved by manufacturer.
- .2 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 00 10 00 – General Instructions.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle in accordance with Section 00 10 00 – General Instructions.
 - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Storage and Protection:
 - .1 Store materials indoors in dry location.
 - .2 Store and protect materials from exposure to harmful weather conditions and at temperature and humidity conditions recommended by manufacturer.
- .3 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 00 10 00 – General Instructions.

PART 2 PRODUCTS

2.1 ABOVE GROUND PIPING SYSTEMS

- .1 Provide fittings for changes in direction of piping and for connections.
 - .1 Make changes in piping sizes through tapered reducing pipe fittings, bushings will not be permitted.
- .2 Perform welding in shop; field welding will not be permitted.
- .3 Conceal piping in areas with suspended ceiling.

2.2 PIPE, FITTINGS AND VALVES

- .1 Pipe:
 - .1 Ferrous: to ANSI/NFPA 13.
 - .2 Copper tube: to ANSI/NFPA 13.
- .2 Fittings and joints to ANSI/NFPA 13:

- .1 Ferrous: screwed, welded, flanged or roll grooved.
 - .2 Copper tube: screwed, soldered, brazed.
 - .3 Provide welded, threaded, grooved-end type fittings into which sprinkler heads, sprinkler head riser nipples, or drop nipples are threaded.
 - .4 Plain-end fittings with mechanical couplings and fittings which use steel gripping devices to bite into pipe when pressure is applied will not be permitted.
 - .5 Rubber gasketed grooved-end pipe and fittings with mechanical couplings are permitted in pipe sizes 32 mm and larger.
 - .6 Fittings: ULC approved for use in wet pipe sprinkler systems.
 - .7 Ensure fittings, mechanical couplings, and rubber gaskets are supplied by same manufacturer.
 - .8 Sprinkler pipe and fittings: metal.
- .3 Pipe hangers:
- .1 ULC listed for fire protection services in accordance with NFPA.

2.3 SPRINKLER HEADS

- .1 General: to ANSI/NFPA 13 and ULC listed for fire services.
- .2 Sprinkler Head Type:
 - .1 Type A: upright bronze.
- .3 Provide nominal 12 mm orifice sprinkler heads.
 - .1 Release element of each head to be of intermediate temperature rating or higher as suitable for specific application.
 - .2 Provide corrosion-resistant sprinkler heads and sprinkler head guards in accordance with NFPA 13.
 - .3 Provide sprinkler heads as required.
 - .4 Deflector: not more than 75 mm below suspended ceilings.
 - .5 Ceiling plates: not more than 25 mm deep.
 - .6 Ceiling cups: not permitted.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 INSTALLATION

- .1 Install, inspect and test to acceptance in accordance with ANSI/NFPA 13 and ANSI/NFPA 25.

3.3 PIPE INSTALLATION

- .1 Install piping straight and true to bear evenly on hangers and supports. Do not hang piping from plaster ceilings.
- .2 Keep interior and ends of new piping and existing piping thoroughly cleaned of water and foreign matter.
- .3 Keep piping systems clean during installation by means of plugs or other approved methods. When work is not in progress, securely close open ends of piping to prevent entry of water and foreign matter.
- .4 Inspect piping before placing into position.

3.4 CONNECTIONS TO EXISTING WATER SUPPLY SYSTEMS

- .1 Notify NRC Departmental Representative in writing at least 15 days prior to connection date.
- .2 Use tapping or drilling machine valve and mechanical joint type sleeves for connections to be made under pressure.
- .3 Bolt sleeves around main piping.
- .4 Bolt valve to branch connection. Open valve, attach drilling machine, make tap, close valve, and remove drilling machine, without interruption of service.
- .5 Furnish materials required to make connections into existing water supply systems, and perform excavating, backfilling, and other incidental labour as required.

3.5 FIELD PAINTING

- .1 Clean, pretreat, prime, and paint new systems including valves, piping, conduit, hangers, supports, miscellaneous metalwork, and accessories.
- .2 Apply coatings to clean, dry surfaces, using clean brushes.
- .3 Clean surfaces to remove dust, dirt, rust, and loose mill scale.
- .4 Immediately after cleaning, provide metal surfaces with 1 coat of pretreatment primer applied to minimum dry film thickness of 0.3 mil, and one coat of zinc chromate primer applied to minimum dry film thickness of 1.0 mil.
- .5 Shield sprinkler heads with protective covering while painting is in progress.
- .6 Upon completion of painting, remove protective covering from sprinkler heads.
- .7 Remove sprinkler heads which have been painted and replace with new sprinkler heads.
- .8 Provide primed surfaces with following:

- .1 Piping in Unfinished Areas:
 - .1 Provide primed surfaces with one coat of red alkyd gloss enamel applied to minimum dry film thickness of 1.0 mil in attic spaces, spaces above suspended ceilings, crawl spaces, pipe chases, mechanical equipment room, and spaces where walls or ceiling are not painted or not constructed of a prefinished material.
 - .2 Provide piping with 50 mm wide red enamel bands or self-adhering red plastic bands spaced at maximum of 6 m intervals.

3.6 FIELD QUALITY CONTROL

- .1 Site Test, Inspection:
 - .1 Perform test to determine compliance with specified requirements in presence of NRC Departmental Representative.
 - .2 Test, inspect, and approve piping before covering or concealing.
 - .3 Preliminary Tests:
 - .1 Hydrostatically test each system at 1400 kPa for a 2 hour period with no leakage or reduction in pressure.
 - .2 Flush piping with potable water in accordance with NFPA 13.
 - .3 Piping above suspended ceilings: tested, inspected, and approved before installation of ceilings.
 - .4 Test alarms and other devices.
 - .5 Test water flow alarms by flowing water through inspector's test connection. When tests have been completed and corrections made, submit signed and dated certificate in accordance with NFPA 13.
 - .4 Formal Tests and Inspections:
 - .1 Do not submit request for formal test and inspection until preliminary test and corrections are completed and approved.
 - .2 Submit written request for formal inspection at least fifteen (15) working days prior to inspection date.
 - .3 Repeat required tests as directed.
 - .4 Correct defects and make additional tests until systems comply with contract requirements.
 - .5 Furnish appliances, equipment, instruments, connecting devices, and personnel for tests.
 - .6 Authority of Jurisdiction, will witness formal tests and approve systems before they are accepted.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

- .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
- .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.7 CLEANING

- .1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 **GENERAL**

1.1 **SUBMITTALS**

- .1 Shop drawings; submit drawings stamped and signed for approval by NRC Departmental Representative.
- .2 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .3 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
- .4 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual;
 - .2 Operation and maintenance manual approved by, and final copies deposited with, NRC Departmental Representative before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
 - .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.

- .6 Approvals:
 - .1 Submit manual to NRC Departmental Representative as specified in 00 10 00 – General Instructions.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
 - .1 NRC Departmental Representative will provide 1 set of reproducible mechanical drawings or AutoCAD files. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour for each service.
 - .4 Make available for reference purposes and inspection.
- .9 As-built drawings:
 - .1 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .2 Submit to NRC Departmental Representative for approval and make corrections as directed.
 - .3 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .4 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

1.2 QUALITY ASSURANCE

- .1 Health and Safety Requirements: Occupational health and safety in accordance with section 00 10 00 – General Instructions.

1.3 MAINTENANCE

- .1 Provide one set of special tools required to service equipment as recommended by manufacturers.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Waste Management and Disposal:

- .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 00 10 00 – General Instructions.

PART 2 **PRODUCTS**

2.1 **MATERIALS**

- .1 All materials used on this project shall be new and CSA approved unless noted otherwise.

PART 3 **EXECUTION**

3.1 **PAINTING, REPAIRS AND RESTORATION**

- .1 Prime and touch up marred finished paintwork to match original.
- .2 Restore to new condition, finishes which have been damaged.

3.2 **FIELD QUALITY CONTROL**

- .1 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.3 **DEMONSTRATION**

- .1 NRC Departmental Representative will use equipment and systems for test purposes prior to acceptance. Contractor to supply labour, material, and instruments required for testing.
- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.
- .3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.

- .5 NRC Departmental Representative may record these demonstrations on video tape for future reference.

3.4 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system

END OF SECTION

PART 1 **GENERAL**

1.1 **SUBMITTALS**

- .1 Shop drawings; submit drawings stamped and signed for approval.
- .2 Shop drawings to show:
 - .1 Mounting arrangements.
 - .2 Operating and maintenance clearances.
- .3 Shop drawings and product data accompanied by:
 - .1 Detailed drawings of bases, supports, and anchor bolts.
 - .2 Acoustical sound power data, where applicable.
 - .3 Points of operation on performance curves.
 - .4 Manufacturer to certify current model production.
 - .5 Certification of compliance to applicable codes.
- .4 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual;
 - .2 Operation and maintenance manual approved by, and final copies deposited with, NRC Departmental Representative before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
 - .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .6 Approvals:

- .1 Submit manual to NRC Departmental Representative as specified in Section 00 10 00 – General Instructions.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Site records:
 - .1 NRC Departmental Representative will provide 1 set of reproducible mechanical drawings or AutoCAD files. Provide sets of white prints as required for each phase of work. Mark changes as work progresses and as changes occur. Include changes to existing mechanical systems, control systems and low voltage control wiring.
 - .2 Transfer information weekly to reproducibles, revising reproducibles to show work as actually installed.
 - .3 Use different colour for each service.
 - .4 Make available for reference purposes and inspection.
- .9 As-built drawings:
 - .1 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
 - .2 Submit to NRC Departmental Representative for approval and make corrections as directed.
 - .3 Perform testing, adjusting and balancing for HVAC using as-built drawings.
 - .4 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .10 Submit copies of as-built drawings for inclusion in final TAB report.

1.2 QUALITY ASSURANCE

- .1 Health and Safety Requirements: Occupational health and safety in accordance with NRC Safety Policies.

1.3 MAINTENANCE

- .1 Provide one set of special tools required to service equipment as recommended by manufacturers.

1.4 DELIVERY, STORAGE, AND HANDLING

- .1 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 00 10 00 – General Instructions.

PART 2 **PRODUCTS**

2.1 **MATERIALS**

- .1 All materials used on this project shall be new and CSA approved unless noted otherwise.

PART 3 **EXECUTION**

3.1 **PAINTING, REPAIRS AND RESTORATION**

- .1 Prime and touch up marred finished paintwork to match original.
- .2 Restore to new condition, finishes which have been damaged.

3.2 **CLEANING**

- .1 Clean interior and exterior of all systems. Protect open ends of ducts, diffusers, grilles and registers during construction to prevent ingress of dust and dirt into interior of ducts. If dust or dirt is detected prior to startup, vacuum interior of all ducts and air handling units. Prior to vacuuming use video camera to record condition of ductwork. Also use video camera to record condition of ducts after cleaning.

3.3 **FIELD QUALITY CONTROL**

- .1 Site Tests: conduct following tests and submit report as described in PART 1 - SUBMITTALS.
 - .1 Submit tests as specified in other sections of this specification.
- .2 Manufacturer's Field Services:
 - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.
 - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.
 - .3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.4 **DEMONSTRATION**

- .1 NRC Departmental Representative will use equipment and systems for test purposes prior to acceptance. Contractor to supply labour, material, and instruments required for testing.
- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

- .3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.
- .5 NRC Departmental Representative may record these demonstrations on video tape for future reference.

3.5 PROTECTION

- .1 Protect equipment and systems openings from dirt, dust, and other foreign materials with materials appropriate to system

END OF SECTION

PART 1 **GENERAL**

1.1 **SUMMARY**

.1 Section Includes:

.1 Fire dampers.

1.2 **REFERENCES**

.1 American National Standards Institute/National Fire Protection Association
(ANSI/NFPA)

.1 ANSI/NFPA 90A, Standard for the Installation of Air Conditioning and
Ventilating Systems.

.2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)

.1 Material Safety Data Sheets (MSDS).

.3 Underwriters Laboratories of Canada (ULC)

.1 CAN4-S112, Fire Test of Fire Damper Assemblies.

.2 CAN4-S112.2, Standard Method of Fire Test of Ceiling Firestop Flap
Assemblies.

.3 ULC-S505, Fusible Links for Fire Protection Service.

1.3 **SUBMITTALS**

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheets.
Include product characteristics, performance criteria, and limitations.

.1 Submit two copies of Workplace Hazardous Materials Information
System (WHMIS) Material Safety Data Sheets (MSDS).

.2 Indicate the following:

.1 Fire dampers.

.2 Operators.

.3 Fusible links.

.2 Closeout Submittals:

.1 Provide maintenance data for incorporation into manual.

1.4 **QUALITY ASSURANCE**

.1 Health and Safety Requirements: Occupational health and safety in accordance with
Section 00 10 00 – General Instructions.

.2 Certificates:

- .1 Catalogue or published ratings those obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards.

1.5 MAINTENANCE

- .1 Extra Materials:
 - .1 Provide the following:
 - .1 2 fusible links of each type.

1.6 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 00 10 00 – General Instructions.

PART 2 PRODUCTS

2.1 FIRE DAMPERS

- .1 Fire dampers: arrangement Type B or C, blades out of air stream listed and bear label of ULC, meet requirements of provincial fire authority and ANSI/NFPA 90A. Fire damper assemblies to be fire tested in accordance with CAN4-S112. Minimum rating 2 hours, dynamically rated.
- .2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.
- .3 Top hinged: offset, round or square; multi-blade hinged or interlocking type; roll door type; or guillotine type; sized to maintain full duct cross section.
- .4 Fusible link actuated, weighted to close and lock in closed position when released or having negator-spring-closing operator for multi-leaf type or roll door type in horizontal position with vertical air flow.
- .5 Retaining angle iron frame, 40 x 40 x 3 mm, on full perimeter of fire damper, on both sides of fire separation being pierced.
- .6 Equip fire dampers with steel sleeve or frame installed to prevent disruption of ductwork or impair damper operation.

- .7 Equip sleeves or frames with perimeter mounting angles attached on both sides of wall or floor opening. Construct ductwork in fire-rated floor-ceiling or roof-ceiling assembly systems with air ducts that pierce ceiling to conform with ULC.
- .8 Design and construct dampers to not reduce duct or air transfer opening cross-sectional area.
- .9 Dampers shall be installed so that the centerline of the damper depth or thickness is located in the centerline of the wall, partition or floor slab depth or thickness.
- .10 Unless otherwise indicated, the installation details given in SMACNA Fire, Smoke, and Radiation Damper Installation Guide for HVAC and in manufacturer's instructions for fire dampers shall be followed.

PART 3 **EXECUTION**

3.1 **MANUFACTURER'S INSTRUCTIONS**

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 **INSTALLATION**

- .1 Install in accordance with ANSI/NFPA 90A and in accordance with conditions of ULC listing.
- .2 Maintain integrity of fire separation.
- .3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.
- .4 Install access door adjacent to each damper.
- .5 Coordinate with installer of firestopping.
- .6 Ensure access doors/panels, fusible links, damper operators are easily observed and accessible.
- .7 Install break-away joints of approved design on each side of fire separation.

3.3 **CLEANING**

- .1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 **GENERAL**

1.1 **SUMMARY**

- .1 Section Includes:
 - .1 Fans, motors, accessories, and hardware for commercial use.

1.2 **REFERENCES**

- .1 American National Standards Institute/Air Movement and Control Association (ANSI/AMCA)
 - .1 ANSI/AMCA Standard 99, Standards Handbook.
 - .2 ANSI/AMCA Standard 300, Reverberant Room Method for Sound Testing of Fans.
 - .3 ANSI/AMCA Standard 301, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- .2 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
 - .1 ANSI/AMCA 210, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
- .3 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 AHSRAE 51, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .5 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA MG 1 Motors and Generators.
 - .2 NEMA ICS 7.1 Safety Standard for Construction and Guide for Selection, Installation and Operation of Adjustable Drive Systems.
- .6 The Master Painters Institute (MPI)
 - .1 Architectural Painting Specification Manual, MPI #18, Primer, Zinc Rich, Organic.

1.3 **SYSTEM DESCRIPTION**

- .1 Performance Requirements:
 - .1 Catalogued or published ratings for manufactured items: obtained from tests carried out by manufacturer or those ordered by manufacturer from independent testing agency signifying adherence to codes and standards in force.

- .2 Capacity: flow rate, total static pressure, bhp W, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.
- .3 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.
- .4 Sound ratings: comply with AMCA 301, tested to AMCA 300. Supply unit with AMCA certified sound rating seal.
- .5 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210. Supply unit with AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.

1.4 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 00 10 00 – General Instructions. Include product characteristics, performance criteria, and limitations.
 - .1 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS)
 - .2 Shop Drawings:
 - .1 Submit shop drawings and product data.
 - .3 Provide:
 - .1 Fan performance curves showing point of operation, BHP kW and efficiency.
 - .2 Sound rating data at point of operation.
 - .3 Dimensional data.
 - .4 Installation procedures.
 - .4 Indicate:
 - .1 Motors, sheaves, bearings, shaft details.
 - .2 Minimum performance achievable with variable speed controllers and variable inlet vanes as appropriate.
 - .5 Quality assurance submittals: submit following in accordance with Section 00 10 00 – General Instructions.
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
 - .6 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual.

1.5 QUALITY ASSURANCE

- .1 Health and Safety Requirements: Occupational health and safety in accordance with Section 00 10 00 – General Instructions.

1.6 MAINTENANCE

- .1 Extra Materials:
 - .1 Spare parts to include:
 - .1 Matched sets of belts.
 - .2 Furnish list of individual manufacturer's recommended spare parts for equipment, include:
 - .1 Bearings and seals.
 - .2 Belts.
 - .3 Addresses of suppliers.
 - .4 List of specialized tools necessary for adjusting, repairing or replacing.

1.7 DELIVERY, STORAGE, AND HANDLING

- .1 Packing, shipping, handling and unloading:
 - .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Waste Management and Disposal:
 - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 00 10 00 – General Instructions.

PART 2 PRODUCTS

2.1 FANS GENERAL

- .1 Capacity: flow rate, static pressure, bhp, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.
- .2 Fans: statically and dynamically balanced, constructed in conformity with AMCA 99.
- .3 Sound ratings: comply with AMCA 301, tested to AMCA 300. Unit shall bear AMCA certified sound rating seal.
- .4 Performance ratings: based on tests performed in accordance with ANSI/AMCA 210, and ANSI/ASHRAE 51. Unit shall bear AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.
- .5 Motors:
 - .1 Open drip proof outside of air stream, TEFC when in air stream.
 - .2 Sizes as specified in equipment schedules.
- .6 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards, coupling guards, fan inlet and/or outlet safety screens as indicated
Factory primed before assembly in colour standard to manufacturer.

- .7 Scroll casing drains: as indicated.
- .8 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.

2.2 PROPELLER FANS

- .1 Performance: As per drawing schedule.
- .2 Fabricate multibladed propellers of sheet steel or aluminum of airfoil shape within bell mouth entrance on integral mounts, with grease lubricated ball bearings, with extended lubrication fittings, suited for operating in any position, direct or belt driven, complete with motor as indicated.
- .3 Provide blade guards, metallic screen and automatic back draft dampers on discharge, with gasketed edges.
- .4 Combination Magnetic Starter: 208V, single phase, ½ hp complete with 208 volt coil, heater elements, overload relays to suit fan motor, hand-off-auto selector switch mounted in door, CSA Type 12 Enclosure. Provide lamacoid nameplate indicating “Fan F-XX”, voltage, phase, hp, rating and circuit number. Starter to be supplied by mechanical, installed by electrical division.

PART 3 EXECUTION

3.1 MANUFACTURER’S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

3.2 FAN INSTALLATION

- .1 Install fans as indicated, complete with resilient mountings.
- .2 Provide sheaves and belts required for final air balance.
- .3 Bearings and extension tubes to be easily accessible.
- .4 Access doors and access panels to be easily accessible.

3.3 CLEANING

- .1 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 **GENERAL**

1.1 **SUMMARY**

- .1 Section Includes:
 - .1 General requirements for building Energy Monitoring and Control System (EMCS) that are common to NMS EMCS Sections.
 - .2 All controls work including installation of new control devices, low voltage control wiring, conduit, and modification of DDC system programming shall be completed by the NRC Service Contractor – Honeywell. The mechanical contractor is responsible for hiring Honeywell directly, and Honeywell’s cost for this work shall be carried under this contract.
 - .3 The contact information for Honeywell:
Chris C. Stockley
Sr. Account Manager
Phone: (709) 758-6015
Cell: (709) 690-1504
Fax: (709) 758-6013
chris.stockley@honeywell.com

1.2 **REFERENCES**

- .1 American National Standards Institute (ANSI)
 - .1 ANSI/ISA 5.5, Graphic Symbols for Process Displays.
- .2 American National Standards Institute (ANSI)/ Institute of Electrical and Electronics Engineers (IEEE).
 - .1 ANSI/IEEE 260.1, American National Standard Letter Symbols Units of Measurement (SI Units, Customary Inch-Pound Units, and Certain Other Units).
- .3 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
 - .1 ASHRAE STD 135, BACNET - Data Communication Protocol for Building Automation and Control Network.
- .4 Canadian Standards Association (CSA International).
 - .1 CAN/CSA-Z234.1, Canadian Metric Practice Guide.
- .5 Consumer Electronics Association (CEA).
 - .1 CEA-709.1-B, Control Network Protocol Specification.
- .6 Department of Justice Canada (Jus).
 - .1 Canadian Environmental Assessment Act (CEAA).
 - .2 Canadian Environmental Protection Act (CEPA).

- .7 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .8 Transport Canada (TC).
 - .1 Transportation of Dangerous Goods Act (TDGA).
- .9 National Electrical Manufacturers Association (NEMA)

1.3 EXISTING CONDITIONS - CONTROL COMPONENTS

- .1 Utilize existing control wiring and piping where available.
- .2 Inspect and test existing devices intended for re-use within 30 days of award of contract, and prior to installation of new devices.
 - .1 Furnish test report to NRC Departmental Representative within 40 days of award of contract listing each component to be re-used and indicating whether it is in good order or requires repair by Owner.
 - .2 Failure to produce test report will constitute acceptance of existing devices by owner.
- .3 Non-functioning items:
 - .1 Provide with report specification sheets or written functional requirements to support findings.
 - .2 Owner will repair or replace existing items judged defective yet deemed necessary for EMCS.
- .4 Submit written request for permission to disconnect controls and to obtain equipment downtime before proceeding with Work.
- .5 Assume responsibility for existing controls to be incorporated into EMCS after written receipt of approval from NRC Departmental Representative.
 - .1 Be responsible for items repaired or replaced by Owner.
 - .2 Be responsible for repair costs due to negligence or abuse of equipment repaired or replaced by Owner.
 - .3 Responsibility for existing devices terminates upon final acceptance of EMCS or applicable portions of EMCS as approved by NRC Departmental Representative.
- .6 Remove existing controls not re-used or not required. Place in approved storage for disposition as directed

PART 2 PRODUCTS

2.1 ACCEPTABLE SYSTEMS, MANUFACTURERS

- .1 All control devices shall match the existing DDC control system, be compatible with the

existing system architecture, and shall be supplied/installed by Honeywell.

PART 3 **EXECUTION**

3.1 **MANUFACTURER'S RECOMMENDATIONS**

- .1 Installation to be to manufacturer's recommendations. Provide printed copies of recommendations with shop drawings or product data.

3.2 **PAINTING**

- .1 Painting to be in accordance with NEMA, supplemented as follows:
- .2 Clean and touch up marred or scratched surfaces of factory finished equipment to match original finish.
- .3 Restore to new condition, finished surfaces which have been damaged too extensively to be primed and touched up to make good.
- .4 Clean and prime exposed hangers, racks, fastenings, and other support components.
- .5 Paint all unfinished equipment installed indoors to NEMA.

END OF SECTION

PART 1 **GENERAL**

1.1 **REFERENCES**

- .1 American National Standards Institute (ANSI)
 - .1 ANSI C12.7, Requirements for Watthour Meter Sockets.
 - .2 ANSI/IEEE C57.13, Requirements for Instrument Transformers.
- .2 Canadian Standards Association (CSA)
 - .1 CSA Type 1 Enclosure.
 - .2 CSA Type 4X Enclosures.
 - .3 CSA Type 12 Enclosures.

1.2 **SUBMITTALS**

- .1 Submit shop drawings and manufacturer's installation instructions.
- .2 Include:
 - .1 Information as specified for each device.
 - .2 Manufacturer's detailed installation instructions.
- .3 Pre-Installation Tests
 - .1 Submit samples at random from equipment shipped, as requested by NRC Departmental Representative, for testing before installation. Replace devices not meeting specified performance and accuracy.
- .4 Manufacturer's Instructions
 - .1 Submit manufacturer's installation instructions for specified equipment and devices.

1.3 **CLOSEOUT SUBMITTALS**

- .1 Submit operating and maintenance data for inclusion in operation and maintenance manual.

PART 2 **PRODUCTS**

2.1 **GENERAL**

- .1 Control devices of each category to be of same type and manufacturer.
- .2 External trim materials to be corrosion resistant. Internal parts to be assembled in watertight, shockproof, vibration-proof, heat resistant assembly.
- .3 Operating conditions: 0 - 32 °C with 10 - 90 % RH (non-condensing) unless otherwise specified.

- .4 Terminations: use standard conduit box with slot screwdriver compression connector block unless otherwise specified.
- .5 Transmitters to be unaffected by external transmitters (eg. walkie talkies).
- .6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.

2.2 TEMPERATURE SENSORS

- .1 General:
 - .1 Thermistors 10 K ohm, $\pm 0.2^{\circ}$ C accuracy, less than 0.1° C drift over 10 year span. Power supply 5 V dc, 10-35 Vdc, 24 Vac..
 - .2 RTD's: 1000 ohm at 0° C (plus or minus 0.2 ohms) platinum element with strain minimizing construction, 3 integral anchored leadwires. Coefficient of resistivity: 0.00385 ohms/ohmEC.
- .2 Sensors:
 - .1 Room type: wall mounting, in slotted type covers, LCD display $^{\circ}$ C or $^{\circ}$ F, with guard as indicated. Dual set point momentary push button, override switch.

2.3 TEMPERATURE TRANSMITTERS

- .1 Requirements:
 - .1 Input circuit: to accept 3-lead, 100 ohm at 0° C, platinum resistance detector type sensors.
 - .2 Power supply: 575 ohms at 24 V DC into load of 575 ohms. Power supply effect less than 0.01° C per volt change.
 - .3 Output signal: 4 - 20 mA into 500 ohm maximum load.
 - .4 Input and output short circuit and open circuit protection.
 - .5 Output variation: less than 0.2 % of full scale for supply voltage variation of plus or minus 10 %.
 - .6 Combined non-linearity, repeatability, hysteresis effects: not to exceed plus or minus 0.5 % of full scale output.
 - .7 Maximum current to 100 ohm RTD sensor: not to exceed 22.5 mA.
 - .8 Integral zero and span adjustments.
 - .9 Temperature effects: not to exceed plus or minus 1.0 % of full scale/ 50° C.
 - .10 Long term output drift: not to exceed 0.25 % of full scale/ 6 months.
 - .11 Transmitter ranges: Select narrowest range to suit application from following:
 - .1 Minus 50° C to plus 50° C, plus or minus 0.5° C.
 - .2 0 to 100° C, plus or minus 0.5° C.
 - .3 0 to 50° C, plus or minus 0.25° C.
 - .4 0 to 25° C, plus or minus 0.1° C.
 - .5 10 to 35° C, plus or minus 0.25° C.

PART 3 **EXECUTION.**

3.1 **INSTALLATION**

- .1 Install field control devices, conduit and wire in accordance with manufacturers recommended methods, procedures and instructions. Wiring and conduit above 50 volts by electrical Division. Coordinate requirements with Electrical Contactor.
- .2 Temperature transmitters, relays: install in CSA 2 enclosures or as required for specific applications. Provide for electrolytic isolation in all cases when dissimilar metals make contact.
- .3 Support field-mounted transmitters, sensors on pipe stands or channel brackets.
- .4 Install wall mounted devices on plywood panel properly attached to wall.

3.2 **TEMPERATURE SENSORS**

- .1 Stabilize to ensure minimum field adjustments or calibrations.
- .2 To be readily accessible and adaptable to each type of application so as to allow for quick easy replacement and servicing without special tools or skills.

3.3 **SEQUENCE OF OPERATION**

- .1 Transfer Fan F-1 to start when electrical room space temperature reaches 28°C.
- .2 Program alarms/alerts to initiate when space temperature reaches 32°C.

3.4 **IDENTIFICATION**

- .1 Identify field devices properly to match existing labelling system.

3.5 **TESTING**

- .1 Calibrate and test field devices for accuracy and performance. Submit report detailing tests performed, results obtained to NRC Departmental Representative for approval. NRC Departmental Representative will verify results at random. Provide testing equipment and manpower necessary for this verification.

END OF SECTION

PART 1 **GENERAL**

1.1 **GENERAL**

- .1 This Section covers items common to Sections of Division 26.

1.2 **REFERENCES**

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.1-15, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
 - .2 CAN/CSA-22.3 No. 1, Overhead Systems.
 - .3 CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
- .2 Consider CSA Electrical Bulletins in force at time of tender submission, while not identified and specified by number in this Division, to be forming part of related CSA Part II standard.
- .3 Where requirements of this specification exceed those of above mentioned standards, this specification shall govern.
- .4 Notify the NRC Departmental Representative as soon as possible when requested to connect equipment supplied by NRC which is not CSA approved.

1.3 **CARE, OPERATION AND START-UP**

- .1 Instruct the NRC Departmental Representative and operating personnel in the operation, care and maintenance of equipment supplied under this contract.
- .2 Operating instructions to include following:
 - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
 - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
 - .3 Safety precautions.
 - .4 Procedures to be followed in event of equipment failure.
 - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
- .3 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .4 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.4 DESIGN REQUIREMENTS

- .1 Operating voltages: to CAN3-C235
- .2 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.5 SUBMITTALS

- .1 Submit shop drawings and product data in accordance with Section 00 10 00.
- .2 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Newfoundland and Labrador, Canada.
- .3 Submit stamped engineered drawings for structures supporting transformers on walls or other structures other than the floor.
- .4 Submit wiring diagrams and installation details of equipment.
- .5 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
- .6 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
- .7 Prior to any installation of circuit breakers in either a new or existing installation, Contractor must submit three (3) copies of a certificate of origin, from the manufacturer, duly signed by the factory and the local manufacturer's representative, certifying that all circuit breakers come from this manufacturer, they are new and they meet standards and regulations. These certificates must be submitted to the NRC Departmental Representative for approval.
 - .1 The above applies to all breakers rated above 240V.
 - .2 The above applies to all breakers rated up to 240V and 100A or more.
- .8 A delay in the production of the certificate of origin won't justify any extension of the contract and additional compensation.
- .9 Any work of manufacturing, assembly or installation should begin only after acceptance of the certificate of origin by NRC Departmental Representative. Unless complying with this requirement, NRC Departmental Representative reserves the right to mandate the manufacturer listed on circuit breakers to authenticate all new circuit breakers under the contract at the Contractor's expense.
- .10 In general, the certificate of origin must contain:
 - .1 The name and address of the manufacturer and the person responsible for authentication. The responsible person must sign and date the certificate;
 - .2 The name and address of the licensed dealer and the person of the distributor responsible for the Contractor's account.

- .3 The name and address of the Contractor and the person responsible for the project.
- .4 The name and address of the local manufacturer's representative. The local representative must sign and date the certificate.
- .5 The name and address of the building where circuit breakers will be installed:
 - .1 Project title.
 - .2 End user's reference number.
 - .3 The list of circuit breakers.
- .11 Quality Control: in accordance with Section 00 10 00 – General Instructions.
 - .1 Provide CSA certified equipment and material. Where CSA certified equipment and material is not available, submit such equipment and material to authority having jurisdiction for approval before delivery to site.
 - .2 Submit test results of installed electrical systems and instrumentation.
 - .3 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
 - .4 Submit certificate of acceptance from authority having jurisdiction upon completion of Work to NRC Department Representative.
- .12 Manufacturer's Field Reports: submit to NRC Department Representative within 7 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.
- .13 Single Line Electrical Diagrams
 - .1 Provide single line electrical diagrams in glazed frames as follows:
 - .1 Electrical distribution system: locate in existing main electrical room and new electrical room.
 - .2 Electrical power generation and distribution systems: locate in power plant rooms.
 - .2 Drawings: 600 x 600 mm minimum size.

1.6 PERMITS, FEES AND INSPECTION

- .1 Submit to Electrical Inspection Division and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.
- .2 Pay all fees required for the performance of the work.
- .3 Pay all fees required for inspections.
- .4 NRC Department Representative will provide drawings and specifications required by Authorized Electrical Inspection Division and Supply Authority at no cost.
- .5 Notify NRC Department Representative of changes required by Authorized Electrical Inspection Division prior to making changes.

- .6 Request and obtain Special Inspection approval from the Authorized Electrical Inspection Department for any non-CSA approved control panels or other equipment fabricated by the contractor as part of this contract.
- .7 Furnish a Certificate of Acceptance from the Authorized Electrical Inspection Department on completion of work.

1.7 CO-ORDINATION

- .1 Co-ordinate work with work of other divisions to avoid conflict.
- .2 Locate distribution systems, equipment, and materials to provide minimum interference and maximum usable space.
- .3 Where interference occurs, NRC Department Representative must approve relocation of equipment and materials regardless of installation order.
- .4 Notwithstanding the review of shop drawings, this division may be required to relocate electrical equipment which interferes with the equipment of other trades, due to lack of co-ordination by this Division. The cost of this relocation shall be the responsibility of this Division. The NRC Department Representative shall decide the extent of relocation required.

1.8 CUTTING AND PATCHING

- .1 Inform all other divisions in time, concerning required openings. Where this requirement is not met, bear the cost of all cutting. Openings of 200 mm or smaller shall be the responsibility of Division 26. Openings larger than 200 mm shall be the responsibility of Division 1. Obtain written approval of Structural engineer before drilling any beams or floors.

1.9 PROTECTION

- .1 Protect exposed live equipment during construction for personnel safety.
- .2 Shield and mark all live parts "LIVE 120 VOLTS", or with appropriate voltage in English.
- .3 Arrange for installation of temporary doors for rooms containing electrical distribution equipment. Keep these doors locked except when under direct supervision of electrician.

1.10 RECORD DRAWINGS

- .1 Obtain and pay for three sets of white prints. As the job progresses, mark these prints to accurately indicate installed work. Have the white prints available for inspection at the site at all times and present for scrutiny at each job meeting.
- .2 Submit record drawings within 30 days prior to start of commissioning.

1.11 INSPECTION OF WORK

- .1 The Owner will make periodic visits to the site during construction to ascertain reasonable conformity to plans and specifications but will not execute quality control. The Contractor shall be responsible for the execution of his work in conformity with the construction documents and with the requirements of the inspection authority.

1.12 SCHEDULING OF WORK

- .1 Work shall be scheduled in phases as per other divisions of the architectural specifications.
- .2 Become familiar with the phasing requirements for the work and comply with these conditions.
- .3 No additional monies will be paid for contractor's requirement to comply with work phasing conditions.

1.13 FIRE RATING OF PENETRATIONS

- .1 Maintain fire ratings around conduits passing through floors, ceilings and fire rated walls.
- .2 Use 3M brand or equal fire barrier products at each penetration.
- .3 Acceptable products for fire barrier products shall be 3M #CP25 fire barrier caulk, #303 putty, #FS 195 wrap and #CS195 sheet.
- .4 Acceptable manufacturers: Nelson, Fire Stop Systems, 3M or approved equal. Material of same manufacturer to be used throughout project.

PART 2 PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- .1 Provide materials and equipment in accordance with Section 00 10 00 – General Instructions.
- .2 Equipment and material to be CSA certified. Where there is no alternative to supplying equipment, which is not CSA certified, obtain special approval from Electrical Inspection Division.
- .3 Factory assemble control panels and component assemblies.

2.2 FINISHES

- .1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.

- .1 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1-1958.
- .2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

2.3 WARNING SIGNS AND PROTECTION

- .1 Provide warning signs, as specified or to meet requirements of Authorized Electrical Inspection Department and NRC Departmental Representative.
- .2 Accept the responsibility to protect those working on the project from any physical danger due to exposed live equipment such as panel mains, outlet wiring, etc. Shield and mark all live parts with the appropriate voltage. Caution notices shall be worded in both English and French.

2.4 WIRING TERMINATIONS

- .1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminum conductors.

2.5 EQUIPMENT IDENTIFICATION

- .1 Identify with 3mm (1/8") Brother, P-Touch non-smearing tape, or an alternate approved by the NRC Departmental Representative, all electrical outlets shown on drawings and/or mentioned in the specifications. These are the lighting switches, recessed and surface mounted receptacles such as those in offices and service rooms and used to plug in office equipment, telecommunication equipment or small portable tools. Indicate only the source of power (Ex. for a receptacle fed from panel L32 circuit #1: "L32-1").
- .2 Light fixtures are the only exceptions for electrical equipment identification (except as noted in 2.5.13 below). They are not to be identified.
- .3 Identify with lamicoid nameplates all electrical equipment shown on the drawings and/or mentioned in the specification such as motor control centers, switchgear, splitters, fused switches, isolation switches, motor starting switches, starters, panelboards, transformers, high voltage cables, industrial type receptacles, junction boxes, control panels, etc., regardless of whether or not the electrical equipment was furnished under this section of the specification.
- .4 Coordinate names of equipment and systems with other Divisions to ensure that names and numbers match.
- .5 Wording on lamicoid nameplates to be approved by the NRC Departmental Representative prior to fabrication.
- .6 Provide two sets of lamicoid nameplates for each piece of equipment; one in English and one in French.

- .7 Lamicoid nameplates shall identify the equipment, the voltage characteristics and the power source for the equipment. Example: A new 120/240 volt single phase circuit breaker panelboard, L16, is fed from panelboard LD1 circuit 10.
- "PANEL L16
120/240 V
FED FROM LD1-10"
- PANNEAU L16
120/240 V
ALIMENTE PAR LD1-10
- .8 Provide warning labels for equipment fed from two or more sources - "DANGER MULTIPLE POWER FEED" black letters on a yellow background. These labels are available from NRC's Facilities Maintenance group in building M-19.
- .9 Lamicoid nameplates shall be rigid lamicaid, minimum 1.5 mm (1/16") thick with:
- .1 Black letters engraved on a white background for normal power circuits.
 - .2 Black letters engraved on a yellow background for emergency power circuits.
 - .3 White letters engraved on a red background for fire alarm equipment.
- .10 For all interior lamicaid nameplates, mount nameplates using two-sided tape.
- .11 For all exterior lamicaid nameplates, mount nameplates using self-tapping 2.3 mm (3/32") dia. slot head screws - two per nameplate for nameplates under 75 mm (3") in height and a minimum of 4 for larger nameplates. Holes in lamicaid nameplates to be 3.7 mm (3/16") diameter to allow for expansion of lamicaid due to exterior conditions.
- .1 No drilling is to be done on live equipment.
 - .2 Metal filings from drilling are to be vacuumed from the enclosure interiors.
- .12 All lamicaid nameplates shall have a minimum border of 3 mm (1/8"). Characters shall be 9 mm (3/8") in size unless otherwise specified.
- .13 Identify lighting fixtures which are connected to emergency power with a label "EMERGENCY LIGHTING/ÉCLAIRAGE D'URGENCE", black letters on a yellow background. These labels are available from NRC's Facilities Maintenance group in building M-19.
- .14 Provide neatly typed updated circuit directories in a plastic holder on the inside door of new panelboards.
- .15 Carefully update panelboard circuit directories whenever adding, deleting, or modifying existing circuitry.
- .16 Identify molded case breaker with lamicaid nameplate.

2.6 WIRING IDENTIFICATION

- .1 Unless otherwise specified, identify wiring with permanent indelible identifying markings, using either numbered or coloured plastic tapes on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Maintain phase sequence and colour coding throughout.
- .4 Colour code: to CSA C22.1, Canadian Electrical Code.
- .5 Use colour coded wires in communication cables, matched throughout system.

2.7 CONDUIT AND CABLE IDENTIFICATION

- .1 All new conduits to be factory painted, colour-coded EMT, type as follows:
 - .1 Fire alarm – red conduit
 - .2 Emergency power circuits – yellow conduit
 - .3 Voice/data – blue conduit
 - .4 Gas detection system – purple conduit
 - .5 Building Automation system – orange conduit
 - .6 Security system – green conduit
 - .7 Control system – black conduit
- .2 Apply paint to the covers of junction boxes and conduits of existing conduits as follows:
 - .1 Fire alarm – red
 - .2 Emergency power circuits – yellow
 - .3 Voice/data – blue
 - .4 Gas detection system – purple
 - .5 Building Automation system – orange
 - .6 Security system – green
 - .7 Control system - black
- .3 For system running with cable, half-lap wrap with dedicated coloured PVC tape to 100 mm width, tape every 5 m and both sides where cable penetrates a wall.
- .4 All other systems need not be coloured.

PART 3 EXECUTION

3.1 MANUFACTURER'S NAMEPLATES AND LABELS

- .1 Ensure that manufacturer's registration plates are properly affixed to all apparatus showing the size, name of equipment, serial number, and all information usually provided, including voltage, cycle, phase and the name and address of the manufacturer.

- .2 Do not paint over registration plates or approval labels. Leave openings through insulation for viewing the plates. Contractor's or sub-contractor's nameplate not acceptable.

3.2 LOCATION OF OUTLETS

- .1 Locate outlets in accordance with Section 26 27 26 – Wiring Devices.
- .2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.
- .3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.
- .4 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of door.

3.3 CONDUIT AND CABLE INSTALLATION

- .1 Sleeves through concrete: schedule 40 steel pipe, sized for free passage of conduit, and protruding 50 mm.
- .2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.
- .3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

3.4 MOUNTING HEIGHTS

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.
- .3 Install electrical at following heights unless indicated otherwise.
 - .1 Local switches: 1200 mm.
 - .2 Wall receptacles:
 - .1 General: 400 mm.
 - .2 Above top of continuous baseboard heater: 200mm.
 - .3 In mechanical rooms: 1050 mm.
 - .3 Panelboards: as required by Code or as indicated.
 - .4 Telephone and data outlets: 400 mm.
 - .5 Wall mounted telephone and interphone outlets: 1400 mm.
 - .6 Fire alarm stations: 1200 mm.
 - .7 Fire alarm bells: 2400 mm.

- .8 Exit lights: 2400 mm.
- .9 Emergency lighting heads: 2400 mm.

3.5 CO-ORDINATION OF PROTECTIVE DEVICES

- .1 Ensure circuit protective devices such as overcurrent trips, fuses, are installed to values and settings as indicated on the Drawings.

3.6 WORK ON LIVE EQUIPMENT & PANELS

- .1 NRC requires that work be performed on non-energized equipment, installation, conductors and power panels. For purposes of quotation assume that all work is to be done after normal working hours and that equipment, installation, conductors and power panels are to be de-energized when worked upon.

3.7 MOTOR ROTATION

- .1 For new motors, ensure that motor rotation matches the requirements of the driven equipment.
- .2 For existing motors, check rotation before making wiring changes in order to ensure correct rotation upon completion of the job.

3.8 FIELD QUALITY CONTROL

- .1 All electrical work to be carried out by qualified, licensed electricians or apprentices as per the conditions of the Provincial Act respecting manpower vocational training and qualification. Employees registered in a provincial apprentices program shall be permitted, under the direct supervision of a qualified licensed electrician, to perform specific tasks – the activities permitted shall be determined based on the level of training attained and the demonstration of ability to perform specific duties.
- .2 The work of this division to be carried out by a contractor who holds a valid Code 1 Electrical Contractor License as issued by the Province.
- .3 Perform tests in Accordance with this section as noted and Section 00 01 00 – General Instructions.
- .4 Load Balance:
 - .1 Measure phase current to new panelboards with normal loads operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes, and revise panelboard schedules.
 - .2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment.
- .5 Conduct and pay for following tests:

- .1 Provide any materials, equipment and labour required and make such tests deemed necessary to show proper execution of this work, in the presence of the NRC Departmental Representative.
- .2 Correct any defects or deficiencies discovered in the work in an approved manner at no additional expense to the Owner.
- .3 Megger all branch circuits and feeders using a 600V tester for 240V circuits and a 1000V tester for 600V circuits. If the resistance to ground is less than permitted by Table 24 of the Code, consider such circuits defective and do not energize.
- .4 The final approval of insulation between conductors and ground, and the efficiency of the grounding system is left to the discretion of the local Electrical Inspection Department.
- .6 **Grounding:**
 - .1 Thoroughly ground all electrical equipment, cabinets, metal supporting frames, ventilating ducts and other apparatus where grounding is required in accordance with the requirements of the latest edition of the Canadian Electrical Code Part 1, C.S.A. C22.1 and corresponding Provincial and Municipal regulations. Do not depend upon conduits to provide the ground circuits.
 - .2 Run separate green insulated stranded copper grounding conductors in all electrical conduits including those feeding toggle switches and receptacles.
- .7 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

3.9 CLEANING

- .1 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.
- .2 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 00 10 00 – General Instructions.
- .2 Section 26 05 00 – Common Work Results - Electrical.
- .3 Section 26 05 22 - Connectors and Terminations.

1.2 **REFERENCES**

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-C22.2 No. 131, Type TECK90 Cable.
 - .2 CAN/CSA-C61089, Round Wire Concentric Lay Overhead Electrical Stranded Conductors.
- .2 National Electrical Manufacturers' Association (NEMA)/Insulated Cable Engineers Association (ICEA)
 - .1 ICEA S-93-639/NEMA WC74, 5-46 KV Shielded Power Cable for Use in the Transmission and Distribution of Electrical Energy.

1.3 **SUBMITTALS**

- .1 Provided manufacturer's printed product literature, specifications, data sheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.4 **DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

PART 2 **PRODUCTS**

2.1 **TECK POWER CABLE 1001 - 15000 V**

- .1 Cable: to CAN/CSA-C22.2 No. 131.
- .2 Bare copper grounding conductor, size as indicated.
- .3 Copper circuit conductors, size and number as indicated.
- .4 Strand shielding
- .5 Insulation: chemically cross-linked thermosetting polyethylene rated RW90 15 kV to ICEA S-93-639/NEMA WC74.

- .6 Insulation shielding: semi-conducting non-metallic tape over insulation and served wire shield over tape to ICEA S-93-639/NEMA WC74.
- .7 Separator tape over conductor assembly.
- .8 Inner jacket of PVC.
- .9 Interlocked steel armour.
- .10 Overall PVC jacket rated minus 40C.

PART 3 **EXECUTION**

3.1 **INSTALLATION**

- .1 Provide supports and accessories for installation of high voltage power cable.
- .2 Install stress cones, terminations and splices in accordance with manufacturer's instructions.
- .3 Install grounding in accordance with local inspection authority having jurisdiction.
- .4 Provide cable identification tags and identify each phase conductor of power cable.

3.2 **FIELD QUANTITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results for Electrical.
- .2 Use of qualified tradespersons for installation, splicing, termination and testing oh high voltage power cables.

END OF SECTION

PART 1 **GENERAL**

1.1 **SECTION INCLUDES**

- .1 Materials and installation for wire and box connectors.

1.2 **RELATED SECTIONS**

- .1 Section 26 05 00 – Common Work Results - Electrical.

1.3 **REFERENCES**

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-C22.2 No.18, Outlet Boxes, Conduit Boxes, Fittings and Associated Hardware.
 - .2 CSA C22.2 No.65, Wire Connectors.
- .2 Electrical and Electronic Manufacturers' Association of Canada (EEMAC)
 - .1 EEMAC 1Y-2, Bushing Stud Connectors and Aluminum Adapters (1200 Ampere Maximum Rating).
- .3 National Electrical Manufacturers Association (NEMA)

PART 2 **PRODUCTS**

2.1 **MATERIALS**

- .1 Pressure type wire connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors as required.
- .2 Fixture type splicing connectors to: CSA C22.2 No.65, with current carrying parts of copper sized to fit copper conductors 10 AWG or less.
- .3 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
 - .1 Connector body and stud clamp for stranded copper conductors.
 - .2 Clamp for copper bar.
 - .3 Stud clamp bolts.
 - .4 Bolts for copper bar.
 - .5 Sized for conductors and bars as indicated.
- .4 Clamps or connectors for armoured cable, aluminum sheathed cable, mineral insulated cable, flexible conduit, non-metallic sheathed cable as required to: CAN/CSA-C22.2 No.18.

PART 3 **EXECUTION**

3.1 **INSTALLATION**

- .1 Remove insulation carefully from ends of conductors and:
 - .1 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.
 - .2 Install fixture type connectors and tighten. Replace insulating cap.
 - .3 Install bushing stud connectors in accordance with EEMAC 1Y-2.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 26 05 20 - Wire and Box Connectors - 0 - 1000 V.
- .2 Refer to drawings for wiring type required under different applications.

1.2 **REFERENCES**

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No .0.3, Test Methods for Electrical Wires and Cables.
 - .2 CAN/CSA-C22.2 No. 131, Type TECK 90 Cable.

PART 2 **PRODUCTS**

2.1 **BUILDING WIRES AND GENERAL REQUIREMENTS**

- .1 Conductor material for branch circuit wiring and grounding:
- .2 Stranded copper.
- .3 Neutral wire: continuous throughout its length without breaks.
- .4 Separate insulated green grounding conductors in all electrical conduits.
- .5 All wire and cable insulation shall meet the C.S.A. Standards for the types and services hereinafter specified. Colours as per section 4-036 of Electrical Code.
- .6 Where otherwise specified, use wire and cable types as follows:
 - .1 Type R90 XLPE cross-link polyethylene stranded for applications using wires sized No. 8 and larger.
 - .2 Type T90 stranded for applications using wires sized No. 10 and smaller.
 - .3 For fire alarm wiring refer to Section 283100.
 - .4 Approved heat resistant wire for wiring through and at lighting and heating fixtures. Where insulation types are shown on the drawings other types shall not be used unless the specification is more restrictive.
- .7 Use BX cable only under the following conditions:
 - .1 Wiring from a junction box to a recessed lighting fixture in suspended ceilings. Cable length not to exceed 1.5 m (5'), or
 - .2 Wiring or switches or 15 amp receptacles in partitions having removable wall panels, or
 - .3 When specifically called for on drawings.

- .8 Use stranded wire no smaller than No. 12 AWG for lighting and power and no smaller than No. 16 AWG for control wiring.
- .9 Conductors shall be soft copper properly refined and tinned having a minimum conductivity of 98%.

2.2 **TECK Cable**

- .1 Cable: to CAN/CSA-C22.2 No. 131.
- .2 Conductors:
 - .1 Grounding conductor: copper.
 - .2 Circuit conductors: copper and ACM alloy, size as indicated.
- .3 Insulation:
 - .1 Cross-linked polyethylene XLPE, rating – 1000 V.
- .4 Inner jacket: polyvinyl chloride material.
- .5 Armour: interlocking aluminum, compliant to applicable Building Code classification for this project.
- .6 Overall covering: thermoplastic polyvinyl chloride material.
- .7 Fastenings:
 - .1 One hole steel straps to secure surface cables 50 mm and smaller. Two hole steel straps for cables larger than 50 mm.
 - .2 Channel type supports for two or more cables at 1500 mm centers.
 - .3 Threaded rods: 6 mm dia. to support suspended channels.
- .8 Connectors:
 - .1 Watertight and/or type approved for TECK cable, as indicated.

2.3 **ARMOURED CABLES**

- .1 Conductors: insulated, copper, size as indicated.
- .2 Type: AC90.
- .3 Armour: interlocking type fabricated from aluminum strip.
- .4 Connectors: standard as required, complete with double split rings.

2.4 **CONTROL CABLES**

- .1 Type LVT: 2 soft annealed copper conductors, sized as indicated, with thermoplastic insulation, outer covering of thermoplastic jacket. Low energy 300 V control cable: stranded annealed copper conductors sized as indicated, with PVC insulation type TW -

40EC polyethylene insulation with shielding of tape coated with paramagnetic material wire braid over each conductor and overall covering of PVC jacket.

PART 3 **EXECUTION**

3.1 **FIELD QUALITY CONTROL**

- .1 Perform tests in accordance with Section 26 05 00 - Common Work Results for Electrical.
- .2 Perform tests using method appropriate to site conditions and to approval of NRC Department Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.

3.2 **GENERAL CABLE INSTALLATION**

- .1 Lay cable in cable trays in accordance with Section 26 05 36 - Cable Trays for Electrical Systems.
- .2 Terminate cables in accordance with Section 26 05 20 - Wire and Box Connectors - (0-1000 V).
- .3 Cable Colour Coding: to Section 26 05 00 Common Work Results for Electrical.
- .4 Conductor length for parallel feeders to be identical.
- .5 Lace or clip groups of feeder cables at distribution centres, pull boxes, and termination points.
- .6 Wiring in walls: typically drop or loop vertically from above to better facilitate future renovations. Generally wiring from below and horizontal wiring in walls to be avoided unless indicated.
- .7 Branch circuit wiring for surge suppression receptacles and permanently wired computer and electronic equipment to be 2-wire circuits only, i.e. common neutrals not permitted.
- .8 Provide numbered wire collars for control wiring. Numbers to correspond to control shop drawing legend. Obtain wiring diagram for control wiring.

3.3 **INSTALLATION OF BUILDING WIRES**

- .1 Install building wires as follows:
 - .1 Make joints, taps and splices in approved boxes with solderless connectors. Joints and/or splices are not acceptable inside a panelboard.
 - .2 Ensure the lugs accommodate all the strands of the conductor.
 - .3 Replace any wire or cable showing evidence of mechanical injury.

- .4 Use No. 10 AWG for branch circuit wiring extending more than 30 m (100 ft.) to farthest outlet from panel.
- .5 Circuit numbers indicated on the drawing are intended as a guide for the proper connection of multi-wire circuits at the panel.
- .6 Take care to keep the conductors free from twisting.
- .7 Use an approved lubricant for pulling in conduit.
- .8 Leave sufficient slack on all runs to permit proper splicing and connection of electrical devices.
- .9 Branch circuit wiring of 120 volt applications to be multi-wire utilizing common neutrals. Under no condition shall any switch break a neutral conductor.
- .10 Provide and install an approved fire- retardant wrap or coating for PVC jacketed cables installed in a grouped configuration of two or more.

3.4 INSTALLATION OF TECK CABLE 0 -1000 V

- .1 Install cables.
 - .1 Group cables wherever possible on channels.
- .2 Install cable concealed, securely supported by straps and hangers.

3.5 INSTALLATION OF ARMoured CABLES (AC-90)

- .1 Group cables wherever possible.
- .2 Use permitted only for work in movable partitions and vertical power supply drops to lighting fixtures.

3.6 INSTALLATION OF CONTROL CABLES

- .1 Install control cables in conduit as indicated.
- .2 Ground control cable shield.

END OF SECTION

PART 1 **GENERAL**

1.1 **SECTION INCLUDES**

- .1 Materials and installation for connectors and terminations.

1.2 **PRODUCT DATA**

- .1 Submit product data in accordance with Section 00 10 00 – General Instructions.

1.3 **CERTIFICATES**

- .1 Provide inspection certificate of compliance covering high voltage stress coning from and include it with maintenance manuals.
 - .1 ANSI/NETA ATS-2013 Standard Testing:
 - .1 Hi-Potential Test.
 - .2 Insulation Resistance Test
 - .2 DC Electric Test.
 - .3 Hi-Potential Test.
 - .4 Calibration Certificate for testing equipment.

PART 2 **PRODUCTS**

2.1 **CONNECTORS AND TERMINATIONS**

- .1 NEMA compression connectors as required sized for conductors.
- .2 Contact aid for aluminum cables where applicable.
- .3 Standard of acceptance: 3M, Thomas & Betts.

PART 3 **EXECUTION**

3.1 **INSTALLATION**

- .1 Install stress cones, terminations, and splices in accordance with manufacturer's instructions.
- .2 Bond and ground as required to CSA C22.2 No. 41.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 00 10 00 – General Instructions.
- .2 Section 26 05 00 - Common Work Results - Electrical.

1.2 **REFERENCES**

- .1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE).
 - .1 ANSI/IEEE 837, Qualifying Permanent Connections Used in Substation Grounding.
 - .2 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No.0.4, Bonding and Grounding of Electrical Equipment (Protective Grounding).

1.3 **SUBMITTALS**

- .1 Provided manufacturer's printed product literature, specifications, data sheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence and cleaning procedures.

1.4 **DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

PART 2 **PRODUCTS**

2.1 **MATERIALS**

- .1 Conductors: bare, stranded, un tinned soft annealed copper wire, size No 4/0 AWG and 2/0 AWG for ground bus, electrode interconnections, metal structures, gradient control mats, transformers, switchgear, motors, ground connections, or as indicated on the drawings.
- .2 Conductors: pvc insulated coloured green, stranded un tinned soft annealed copper wire, size No. 4 AWG for grounding cable sheaths, raceways, pipe work, screen guards, switchboards, potential transformers, or as indicated on the drawings.
- .3 Bolted removable test links.

- .4 Accessories: non-corroding, necessary for complete grounding system, type, size material as indicated, including:
 - .1 Grounding and bonding bushings,
 - .2 Protective type clamps,
 - .3 Bolted type conductor connectors,
 - .4 Thermit welded type conductor connectors,
 - .5 Bonding jumpers, straps,
 - .6 Pressure wire connectors.
- .5 Wire connectors and terminations: as indicated.

PART 3 EXECUTION

3.1 GROUNDING INSTALLATION

- .1 Install complete permanent, continuous, system and circuit, equipment, grounding systems including, conductors, compression connectors, accessories, as indicated, in accordance with CSA 22.2 No.0.4 and to the requirements of Engineer, and local authority having jurisdiction over installation. Where EMT is used, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Make buried connections, and connections to electrodes, structural steel work, using copper welding by thermit process.
- .5 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .6 Use conductors as indicated on the drawings.
- .7 Use tinned copper conductors for aluminum structures.
- .8 Soldered joints not permitted.
- .9 Do not use bare copper conductors near un-jacketed lead sheath cables.

3.2 EQUIPMENT GROUNDING

- .1 Install grounding connections as indicated to typical station equipment including: Non-current carrying parts of: transformers, and circuit breakers. Any exposed building metal, within or forming part of the new electrical station room.
- .2 Ground hinged doors to main frame of electrical equipment enclosure with flexible jumper.

3.3 NEUTRAL GROUNDING

- .1 Connect transformer neutral and distribution neutral together using 600 V insulated conductor to one side of ground test link, the other side of the test link being connected directly to main station ground.
- .2 Interconnect electrodes and neutrals at each grounding installation.

3.4 CABLE SHEATH GROUNDING

- .1 Bond single conductor, metallic sheathed cables together at one end only. Break sheath continuity by inserting insulating sleeves in cables.
- .2 Use No. 6 AWG flexible copper wire soldered, not clamped, to cable sheath.
- .3 Connect bonded cables to ground with No. 2/0 AWG copper conductor.

3.5 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and Section 00 10 00 – General Instructions.
- .2 Perform earth loop test and resistance tests using method appropriate to site conditions and local authority having jurisdiction.
- .3 Perform test before energizing electrical system.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 00 10 00 – General Instructions.
- .2 Section 26 05 00 – Common Work Results - Electrical.
- .3 Grounding conductors for all distribution grounding to be insulated copper, uninsulated where in contact with earth. Copper conductors shall, at a minimum, be used in the following areas: grounding of transformer neutrals, service entrance switch ground of neutral, padmount transformer grounding, ground rider conductors from main ground station to sub-closets, telephone and data system grounds and circuits rated less than 60 amps. Where type ACM conductors are used for circuits rated 60 amps or greater, type ACM bonding conductor is permitted.

1.2 **REFERENCES**

- .1 American National Standards Institute (ANSI)/Institute of Electrical and Electronics Engineers (IEEE)
 - .1 ANSI/IEEE 837, Qualifying Permanent Connections Used in Substation Grounding.
- .2 Canadian Standards Association, (CSA)
 - .1 CAN/CSA Z32, Electrical Safety and Essential Electrical Systems in Health Care Facilities, where applicable.

PART 2 **PRODUCTS**

2.1 **EQUIPMENT**

- .1 Clamps for grounding of conductor: size as indicated to electrically conductive underground water pipe.
- .2 Grounding conductors: bare stranded copper, soft annealed, size as indicated.
- .3 Insulated grounding conductors: green, type TW.
- .4 Ground bus: copper, size as indicated, complete with insulated supports, fastenings, connectors.
- .5 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:
 - .1 Grounding and bonding bushings.
 - .2 Protective type clamps.
 - .3 Bolted type conductor connectors, as indicated.
 - .4 Thermit welded type conductor connectors, as indicated.
 - .5 Bonding jumpers, straps.

- .6 Pressure wire connectors.

PART 3 **EXECUTION**

3.1 **INSTALLATION GENERAL**

- .1 Install complete permanent, continuous, system and circuit, equipment, grounding systems including, conductors, compression connectors, accessories, as indicated, to conform to requirements of Engineer, and local authority having jurisdiction over installation. Where EMT is used, run ground wire in conduit.
- .2 Install connectors in accordance with manufacturer's instructions.
- .3 Protect exposed grounding conductors from mechanical injury.
- .4 Use mechanical connectors for grounding connections to equipment provided with lugs.
- .5 Soldered joints not permitted.
- .6 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.
- .7 Install flexible ground straps for bus duct enclosure joints, where such bonding is not inherently provided with equipment.
- .8 Bond single conductor, metallic armoured cables to cabinet at supply end and load end.
- .9 Ground secondary service pedestals.

3.2 **SYSTEM AND CIRCUIT GROUNDING**

- .1 Install system and circuit grounding connections to neutral of primary 600 V system, secondary 208 V system.

3.3 **EQUIPMENT GROUNDING**

- .1 Install grounding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, and distribution panels.

3.4 **GROUNDING BUS**

- .1 Install copper grounding bus mounted on insulated supports on wall of electrical room.
- .2 Ground items of electrical equipment in electrical room to ground bus with individual bare stranded copper connections size as required by code, or as indicated.

3.5 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and Section 00 10 00 – General Instructions.
- .2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of NRC Departmental Representative and local authority having jurisdiction over installation.
- .3 Perform tests before energizing electrical system.
- .4 Disconnect ground fault indicator during tests.

END OF SECTION

PART 1 **GENERAL (NOT APPLICABLE)**

PART 2 **PRODUCTS**

2.1 **SUPPORT CHANNELS**

- .1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted suspended or set in poured concrete walls and ceilings as required.

PART 3 **EXECUTION**

3.1 **INSTALLATION**

- .1 Secure equipment to hollow or solid masonry, tile and plaster surfaces with lead anchors or nylon shields.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4 Secure surface mounted equipment with twist clip fasteners to inverted T bar ceilings. Ensure that T bars are adequately supported to carry weight of equipment specified before installation.
- .5 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .6 Fasten exposed conduit or cables to building construction or support system using straps.
 - .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
 - .2 Two-hole steel straps for conduits and cables larger than 50 mm.
 - .3 Beam clamps to secure conduit to exposed steel work.
 - .4 Strap AC-90 cable at box location plus every 900 mm.
- .7 Suspended support systems.
 - .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
 - .2 Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .8 For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.
- .9 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

- .10 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .11 Do not use wire lashing, wood blocking, plastic strap or perforated strap to support or secure raceways or cables.
- .12 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of NRC Departmental Representative.
- .13 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

END OF SECTION

PART 1 **GENERAL**

1.1 **REALTED SECTIONS**

- .1 Section 00 10 00 – General Instructions.
- .2 Section 26 05 00 – Common Work Results – Electrical.

1.2 **SUBMITTALS**

- .1 Submit shop drawings and product data for cabinets.
- .2 Provide manufacturer’s printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Provide drawings stamped and signed by professional engineer registered or licensed in the Province of Newfoundland and Labrador, Canada.

PART 2 **PRODUCTS**

2.1 **SPLITTERS**

- .1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.
- .2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.
- .3 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2 **JUNCTION AND PULL BOXES**

- .1 Welded steel construction with screw-on flat covers for surface mounting.
- .2 Covers with 25 mm minimum extension all around, for flush-mounted pull and junction boxes.

2.3 **CABINETS**

- .1 Type E: sheet steel, hinged door and return flange overlapping sides, handle, lock and catch, for surface mounting.
- .2 Type T: sheet steel cabinet, with hinged door, latch, lock, 2 keys, containing 19 mm fir plywood backboard for surface flush mounting.

PART 3 **EXECUTION**

3.1 **SPLITTER INSTALLATION**

- .1 Install splitters and mount plumb, true and square to the building lines.
- .2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 **JUNCTION, PULL BOXES AND CABINETS INSTALLATION**

- .1 Install pull boxes in inconspicuous but accessible locations.
- .2 Mount cabinets with top not higher than 2 m above finished floor.
- .3 Install terminal block as indicated in Type T cabinets.
- .4 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30 m of conduit run between pull boxes.

3.3 **IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Install size 2 identification labels indicating system name voltage and phase.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 26 05 00 – Common Work Results – Electrical.
- .2 Section 26 05 29 – Hangers and Supports for Electrical Systems.
- .3 Section 26 05 34 – Conduits, Conduit Fastenings and Fittings.

1.2 **REFERENCES**

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.1, Canadian Electrical Code, Part 1.

PART 2 **PRODUCTS**

2.1 **OUTLET AND CONDUIT BOXES GENERAL**

- .1 Size boxes in accordance with CSA C22.1.
- .2 102 mm square or larger outlet boxes as required for special devices.
- .3 Gang boxes where wiring devices are grouped.
- .4 Blank cover plates for boxes without wiring devices.
- .5 347 V outlet boxes for 347 V switching devices.
- .6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 **GALVANIZED STEEL OUTLET BOXES**

- .1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.
- .2 Electro-galvanized steel utility boxes for outlets connected to surface-mounted EMT conduit, minimum size 102 x 54 x 48 mm.
- .3 102 mm square or octagonal outlet boxes for lighting fixture outlets.
- .4 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster walls.

2.3 MASONRY BOXES

- .1 Electro-galvanized steel masonry single and multi gang boxes for devices flush mounted in exposed block walls.

2.4 CONCRETE BOXES

- .1 Electro-galvanized sheet steel concrete type boxes for flush mount in concrete with matching extension and plaster rings as required.

2.5 CONDUIT BOXES

- .1 Cast FS or FD aluminum boxes with factory-threaded hubs and mounting feet for surface wiring of switches and receptacle.

2.6 FITTINGS - GENERAL

- .1 Bushing and connectors with nylon insulated throats.
- .2 Knock-out fillers to prevent entry of debris.
- .3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.
- .4 Double locknuts and insulated bushings on sheet metal boxes.
- .5 Double split rings for AC-90 terminations.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.
- .5 Vacuum clean interior of outlet boxes before installation of wiring devices.
- .6 Identify systems for outlet boxes as required.

END OF SECTION

PART 1 **GENERAL**

1.1 **REFERENCES**

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA C22.2 No. 18, Outlet Boxes, Conduit Boxes, and Fittings and Associated Hardware, a National Standard of Canada.
 - .2 CSA C22.2 No. 45, Rigid Metal Conduit.
 - .3 CSA C22.2 No. 56, Flexible Metal Conduit and Liquid-Tight Flexible Metal Conduit.
 - .4 CSA C22.2 No. 83, Electrical Metallic Tubing.
 - .5 CSA C22.2 No. 211.2, Rigid PVC (Unplasticized) Conduit.
 - .6 CAN/CSA C22.2 No. 227.3, Nonmetallic Mechanical Protection Tubing (NMPT), a National Standard of Canada.

1.2 **SUBMITTALS**

- .1 Product data: submit manufacturer's printed product literature, specifications and datasheets.
 - .1 Submit cable manufacturing data.
- .2 Quality assurance submittals:
 - .1 Test reports: submit certified test reports.
 - .2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .3 Instructions: submit manufacturer's installation instructions.

PART 2 **PRODUCTS**

2.1 **CONDUITS**

- .1 Rigid metal conduit: to CSA C22.2 No. 45, hot dipped galvanized steel threaded.
- .2 Epoxy coated conduit: to CSA C22.2 No. 45, with zinc coating and corrosion resistant epoxy finish inside and outside.
- .3 Electrical metallic tubing (EMT): to CSA C22.2 No. 83, with couplings.
- .4 Rigid PVC conduit: to CSA C22.2 No. 211.2.
- .5 Flexible metal conduit: to CSA C22.2 No. 56, aluminum liquid-tight flexible metal.
- .6 FRE conduit: to CSA C22.2.
- .7 Flexible PVC conduit: to CAN/CSA-C22.2 No. 227.3,

2.2 CONDUIT FASTENINGS

- .1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.
- .2 Beam clamps to secure conduits to exposed steel work.
- .3 Channel type supports for two or more conduits at 1.5 m oc.
- .4 Threaded rods, 6 mm dia., to support suspended channels.

2.3 CONDUIT FITTINGS

- .1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2 Factory "ells" where 90°, 45 ° or 22.5 ° bends are required for 25 mm and larger conduits.
- .3 Ensure conduit bends other than factory "ells" are made with an approved bender. Making offsets and other bends by cutting and rejoining 90 degree bends are not permitted.
- .4 Connectors and couplings for EMT. Steel set-screw type, size as required.

2.4 EXPANSION FITTINGS FOR RIGID CONDUIT

- .1 Weatherproof expansion fittings with internal bonding assembly suitable for 100 mm linear expansion.
- .2 Watertight expansion fittings with integral bonding jumper suitable for linear expansion and 19 mm deflection in all directions.
- .3 Weatherproof expansion fittings for linear expansion at entry to panel.

2.5 FISH CORD

- .1 Polypropylene.

PART 3 EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

- .1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

- .1 Install all conduit, conduit fittings and accessories in accordance with the latest edition of the Canadian Electrical Code in a manner that does not alter, change or violate any

- part of the installed system components or the CSA/UL certification of these components.
- .2 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.
 - .3 Conceal conduits except in mechanical and electrical service rooms and in unfinished areas.
 - .4 Surface mount conduits except in finished areas or as indicated.
 - .5 Use rigid hot dipped galvanized steel threaded conduit for exposed work below 2.4 m above finished floor.
 - .6 Use epoxy coated conduit underground in corrosive areas and where exposed to exterior elements. (ie: pole mounted service entrance conduits)
 - .7 Use electrical metallic tubing (EMT) except in cast concrete and above 2.4 m not subject to mechanical injury, as well as concealed work in masonry construction.
 - .8 Use rigid PVC conduit underground and buried in or under concrete slab on grade.
 - .9 Use liquid tight flexible metal conduit for connection to motors or vibrating equipment in damp, wet or corrosive locations.
 - .10 Use AC-90 for vertical power supply drops to light fixtures.
 - .11 Minimum conduit size for lighting and power circuits: 19 mm. 12 mm conduit is acceptable for switch leg drops only where one two-wire circuit and ground is required.
 - .12 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
 - .13 Mechanically bend steel conduit over 19 mm dia.
 - .14 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.
 - .15 Install fish cord in empty conduits.
 - .16 Remove and replace blocked conduit sections. Do not use liquids to clean out conduits.
 - .17 Dry conduits out before installing wire.

3.3 SURFACE CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .3 Run conduits in flanged portion of structural steel.

- .4 Group conduits wherever possible on suspended channels.
- .5 Do not pass conduits through structural members except as indicated.
- .6 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.

3.4 CONCEALED CONDUITS

- .1 Run parallel or perpendicular to building lines.
- .2 Do not install horizontal runs in masonry walls.
- .3 Do not install conduits in terrazzo or concrete toppings.

3.5 CLEANING

- .1 Proceed in accordance with Section 00 10 00 – General Instructions.
- .2 On Completion and verification of performance of installation, remove surplus materials, excess materials rubbish, tools and equipment.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 00 10 00 – General Instructions.
- .2 Section 26 05 00 – Common Work Results - Electrical.

1.2 **REFERENCES**

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA C22.1 No. 126.1 – Metal Cable Tray Systems.
- .2 National Electrical Manufacturers Association (NEMA).
 - .1 NEMA VE 1, Metal Cable Tray Systems.

1.3 **SUBMITTALS**

- .1 Product Data: submit manufacturer's product data sheets for cable tray indicating dimensions, materials, and finishes, including classifications and certifications.
- .2 Shop Drawings: submit shop drawings showing materials, finish, dimensions, accessories, layout, and installation details.
- .3 Identify types of cable trays used.
- .4 Show actual cable tray installation details and suspension system.

PART 2 **PRODUCTS**

2.1 **CABLE TRAY**

- .1 Cable trays and fittings: to NEMA VE 1 as referenced in Item 1.2.2 above.
- .2 Ladder type, as indicated.
- .3 Trays: extruded aluminum, width and depth as indicated.
- .4 Fittings: horizontal elbows, end plates, drop outs, vertical risers and drops, tees, wyes, expansion joints and reducers where required, manufactured accessories for cable tray supplied.
- .5 Barriers where different voltage systems are in same cable tray.

2.2 **SUPPORTS**

- .1 Provide supports spaced in accordance with the manufacturer's requirements for loading.

2.3 ACCEPTABLE MANUFACTURERS

- .1 Standard of acceptance:
 - .1 Thomas & Betts.
 - .2 Eaton B-Line Series.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install complete cable tray system.
- .2 Support cable tray on both sides.
- .3 Remove sharp burrs or projections to prevent damage to cables or injury to personnel.

3.2 CABLES IN CABLE TRAY

- .1 Install cables individually.
- .2 Lay cables into cable tray. Use rollers when necessary to pull cables.
- .3 Secure cables in cable tray at 6 m centres, with nylon ties.
- .4 Identify cables every 30 m with size 2 nameplates in accordance with Section 26 05 00 – Common Work Results - Electrical.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED WORK**

- .1 Section 00 10 00 – General Instructions.
- .2 Section 03 30 00 - Cast-in-Place Concrete.

1.2 **REFERENCES**

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-C22.2 No.47, Air-Cooled Transformers (Dry Type).
 - .2 CSA C9, Dry-Type Transformers.
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA ST-20.
- .3 American National Standards Institute (ANSI)
 - .1 ANSI C57.12.01, C57.12.91, C57.110 for non-linear loads, C57.18.10 for rectifier duty, CSA C9.

1.3 **SOURCE QUALITY CONTROL**

- .1 Submit to NRC Departmental Representative standard factory test certificates of each transformer and type test of each transformer with high voltage accessories in accordance with CSA C9.

1.4 **SUBMITTALS**

- .1 Product Data for each type and size of transformer indicated.
 - .1 Physical: Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features.
 - .2 Product warranty.
- .2 Shop Drawings: Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - .1 Wiring Diagrams: Power, signal, and control wiring.
 - .2 Product Data including KVA rating, Temperature Rise, Detailed enclosure dimensions, Primary & Secondary nominal voltages, primary voltage taps, no load & full load losses, impedances, unit weight, warranty; Efficiency (where applicable) per Canadian Energy Efficiency Regulations.
- .3 Source quality-control test reports.
- .4 Field quality-control test reports.

- .5 Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

PART 2 **PRODUCTS**

2.1 **GENERAL CONSTRUCTION**

- .1 Transformer core shall be manufactured from quality non-aging, cold rolled, fully processed silicon steel laminations. Cores are to be precisely cut to close tolerances to eliminate burrs and improve performance. Typically, they would be step-lap, fully mitered construction for optimum energy efficiency and low noise level. Cores are to be carefully assembled and rigidly held secure with structural steel clamps to minimize gaps. Glass resin I beams that can withstand 2000lbs per square inch shall be used as blocking coil supports for superior resistance to axial short circuit forces. Primary and secondary terminations to be mounted on separate insulated supports

2.2 **800 KVA TRANSFORMER**

- .1 Product Line: Hammond Dry Type Power Transformer.
- .2 Altitude: 1000 meters.
- .3 Primary Connection: 12470D.
- .4 Duty: 6 Pulse Rectifier Duty.
- .5 Primary FCAN: 2 x 2.5%.
- .6 Primary FCBN: 2 x 2.5%.
- .7 Primary BIL: 95kV.
- .8 Secondary Connection: Wye-N.
- .9 Secondary Voltage: 440Y/254.
- .10 Secondary BIL: 10kV.
- .11 Material: Aluminum.
- .12 Frequency: 60Hz.
- .13 Cooling: ANN.
- .14 Ambient Temperature Rating: 40C.
- .15 Temperature Rise: 150C.
- .16 Insulation Class: 220C.

- .17 Sound at No Load: 64 db.
- .18 Impedance (NPL): 5.0% (NOM)
- .19 Impregnation: VPI-Polyester.
- .20 Approval: CSA.
- .21 Enclosure:
 - .1 Type 2 Sprinkler Proof.
 - .2 ANSI 61 Grey, UL50.
 - .3 Thickness: Standard (ANSI 61).
 - .4 PN: P6-N25.
 - .5 Dimensions: Maximum 91.5" (H) x 78" (W) x 69" (D).
- .22 Terminations:
 - .1 Primary Side Connection: Air Terminal Chamber (ATC) on left side as indicated.
 - .2 Primary Bus Bar: Straight Bus Bar
 - .3 Primary Flexible Connections: Braided.
 - .4 Secondary Bus Bar: Straight Bus Bar (Right side of transformer as indicated)
 - .5 Secondary Flexible Connections: Braided.
- .23 Seismic Zone: 1.
- .24 Testing:
 - .1 The following production tests must be completed on all transformers. Pass fail criteria will be per ANSI C57.12.01 and C57.12.91.
 - .1 Polarity.
 - .2 Ratio.
 - .3 Resistance of coils.
 - .4 Insulation resistance test.
 - .5 Power frequency voltage-withstand tests on each winding.
 - .6 Induced voltage test.
 - .7 No load loss.
 - .8 Load loss.
 - .9 Impedance test.

2.3 ACCEPTABLE PRODUCT AND MANUFACTURER

- .1 Hammond Power Solutions Inc.

- .2 Substitutions are permitted, subject to meeting all requirements of this specification and having written approval by NRC Departmental Representative 10 days prior to bid closing.

2.4 GROUNDING

- .1 Copper grounding bus size 4 x 6 mm.
- .2 Connectors for grounding conductor size as indicated.

2.5 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Nameplate showing information in accordance with CSA C9.

2.6 WARNING SIGNS

- .1 Provide warning signs in accordance with Section 26 05 00 – Common Work Results - Electrical.

PART 3 EXECUTION

3.1 INSPECTION

- .1 Check factory made connections of transformer unit for mechanical security and electrical continuity.

3.2 INSTALLATION

- .1 Electrical contractor is to include in their price, all requirements necessary to deconstruct the transformer and reassemble in final resting place.
 - .1 Include pricing to have transformer manufacturer's technicians to be on site to assist with installation, re-assembly, and re-connection of transformer equipment.
 - .2 Core and coil to fit through 77" square hole.
 - .3 Coordinate with NRC Departmental Representative for weight restrictions of existing overhead crane.
- .2 The installing contractor shall install the Dry-Type Medium Voltage (Power) Transformer per the manufacturer's recommended installation practices as found in the installation, operation, and maintenance manual and comply with all applicable codes.
- .3 Make sure that the transformer is level.
- .4 The transformer shall be mounted on a concrete pad unless otherwise indicated.
- .5 Check for damage and loose connections.

- .6 Mount transformer on suitable isolation pad to minimize vibrations.
- .7 Provide adequate clearance around transformer for ventilation.
- .8 Install seismic restraint where indicated on the drawing.
- .9 Coordinate all work in this section with all work of other sections.
- .10 Take Infrared Picture to verify connections accuracy or deficiencies.
- .11 Prior to energizing transformer, verify secondary voltages and if necessary adjust secondary taps.
- .12 Report of the Commission of the transformer shall include:
 - .1 Primary & Secondary Voltages.
 - .2 Primary & secondary THDi & THDv.
- .13 Ensure concrete pad is fully cured before transformer is installed.
- .14 Set and secure transformer unit in place, rigid, plumb and square.
- .15 Make primary and secondary connections shown on wiring diagram.
- .16 Connect transformer unit ground bus to system ground.
- .17 Provide equipment identification in accordance with Section 26 05 00.

3.3 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and Section 00 10 00 – General Instructions.
- .2 Inspect primary and secondary connections for tightness and for signs of overheating.
- .3 Set transformer taps to rated voltage as specified.
- .4 Check for grounding and neutral continuity between primary and secondary circuits of transformer.

3.4 CLEANING

- .1 Proceed in accordance with Section 00 10 00 – General Instructions.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 **GENERAL**

1.1 **SECTION INCLUDES**

- .1 Service equipment and installation.

1.2 **RELATED SECTIONS**

- .1 Section 26 05 28 - Grounding - Secondary.
- .2 Section 26 05 31 - Splitters, Junction, Pull Boxes and Cabinets.
- .3 Section 26 24 16.01 - Panelboards Breaker Type.
- .4 Section 26 24 16.02 - Panelboards Switch and Fuse Type.
- .5 Section 26 28 16.02 - Moulded Case Circuit Breakers.
- .6 Section 26 28 23 - Disconnect Switches - Fused and Non-Fused.

PART 2 **PRODUCTS**

2.1 **EQUIPMENT**

- .1 Fused disconnect switch: in accordance with Section 26 28 23 - Disconnect Switches - Fused and Non-Fused, rating as indicated.
- .2 Enclosed circuit breaker: in accordance with Section 26 28 16.02 - Moulded Case Circuit Breakers, rating as indicated.
- .3 Panelboard breaker type: in accordance with Section 26 24 16.01 - Panelboards Breaker Type Fusible type: in accordance with Section 26 28 16.02 - Panelboards Switch and Fuse Type, rating as indicated.

PART 3 **EXECUTION**

3.1 **INSTALLATION**

- .1 Install service equipment.
- .2 Connect to incoming service.
- .3 Connect to outgoing load circuits.
- .4 Install ground fault equipment.

- .5 Make grounding connections in accordance with Section 26 05 28 - Grounding –
Secondary.

END OF SECTION

PART 1 **GENERAL**

1.1 **SECTION INCLUDES**

- .1 Materials and installation for service entrance board.

1.2 **RELATED SECTIONS**

- .1 Section 00 10 00 – General Instructions.
- .2 Section 26 05 00 – Common Work Results - Electrical.

1.3 **REFERENCES**

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-C22.2 No.31, Switchgear Assemblies.

1.4 **SUBMITTALS**

- .1 Indicate on shop drawings.
 - .1 Floor anchoring method and foundation template.
 - .2 Dimensioned cable entry and exit locations.
 - .3 Dimensioned position and size of bus.
 - .4 Overall length, height and depth.
 - .5 Dimensioned layout of internal and front panel mounted components.
- .2 Include time-current characteristic curves for circuit breakers and fuses.

1.5 **QUALITY ASSURANCE**

- .1 Submit 3 copies of certified test results.

1.6 **CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for service entrance board for incorporation into manual specified in Section 00 10 00 – General Instructions.
- .2 Submit 3 copies maintenance data for complete assembly including components.

1.7 **MAINTENANCE MATERIALS**

- .1 Provide maintenance materials in accordance with Section 00 10 00 – General Instructions.
- .2 Include:
 - .1 3 fuses for each type up to and including 600A.

PART 2 **PRODUCTS**

2.1 **SERVICE ENTRANCE BOARD**

- .1 Service Entrance Board: to CAN/CSA-C22.2 No.31.
- .2 Rating: 600 V, 3 phase, 4 wire, 1600 A, short circuit current 25 kA (rms symmetrical) and/or as indicated on electrical drawings. Cubicles: wall-mounted, or free standing, dead front, size as indicated.
- .3 Barrier metering section from adjoining sections.
- .4 Distribution section.
- .5 Hinged access panels with captive knurled thumb screws.
- .6 Bus bars and main connections: tin plated aluminum.
- .7 Identify phases with colour coding.

2.2 **MOULDED CASE CIRCUIT BREAKERS**

- .1 Refer to Section 26 28 16.02 – Moulded Case Circuit Breakers.

2.3 **FUSIBLE DISCONNECTS AND FUSES**

- .1 Refer to Section 26 28 23 – Disconnect Switches – Fused and Non-fused.

2.4 **GROUNDING**

- .1 Copper ground bus extending full width of cubicles and located at bottom.
- .2 Lugs at each end for size 4/0 grounding cable.

2.5 **GROUND FAULT UNIT**

- .1 Refer to Section 26 28 18 – Ground Fault Equipment Protection.

2.6 **FINISHES**

- .1 Apply finishes in accordance with Section 26 05 00 – Common Work Results -Electrical.
 - .1 Service entrance board exterior: gray.

2.7 **EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Nameplates:

- .1 White plate, black letters, size 7.
- .2 Complete board labelled: as indicated.
- .3 Main disconnect labelled: as indicated.
- .4 Branch disconnects labelled: as indicated.

PART 3 **EXECUTION**

3.1 **INSTALLATION**

- .1 Locate service entrance board and fasten to wall or floor as indicated.
- .2 Connect main secondary service to line terminals of main breaker or disconnect switch.
- .3 Connect load terminals of distribution breaker's or switches to feeders.
- .4 Run grounding conductors as indicated on drawings.

3.2 **FIELD QUALITY CONTROL**

- .1 Perform tests in accordance Section 26 05 00 – Common Work Results - Electrical and Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 Check factory made connections for mechanical security and electrical continuity.

END OF SECTION

PART 1 **GENERAL**

1.1 **SECTION INCLUDES**

- .1 Materials and installation for standard and custom breaker type panelboards.

1.2 **RELATED SECTIONS**

- .1 Section 00 10 00 – General Instructions.
- .2 Section 26 05 00 – Common Work Results - Electrical.
- .3 Section 26 28 16.02 - Moulded Case Circuit Breakers.

1.3 **REFERENCES**

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No.29, Panelboards and enclosed Panelboards.

1.4 **SUBMITTALS**

- .1 Drawings to include electrical detail of panel, branch breaker type, quantity, ampacity and enclosure dimension.

PART 2 **PRODUCTS**

2.1 **PANELBOARDS**

- .1 Panelboards: to CSA C22.2 No.29 and product of one manufacturer.
 - .1 Install circuit breakers in panelboards before shipment.
 - .2 In addition to CSA requirements manufacturer's nameplate must show fault current that panel including breakers has been built to withstand.
- .2 600 volt rated power panelboards: bus and breakers rated for 25,000 amp r.m.s. symmetrical interrupting capacity at 600V or as indicated.
- .3 250 volt lighting panelboards to have minimum interrupting capacity of 10,000 amp r.m.s. symmetrical.
- .4 Panelboards that have a main breaker indicated on drawings shall be service entranced approved (i.e. barrier to separate main breaker from remainder of panels).
- .5 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .6 Panelboards: mains, number of circuits, and number and size of branch circuit breakers as indicated.

- .7 Two keys for each panelboard and key panelboards alike.
- .8 Copper bus, neutral and ground bar with neutral of same ampere rating as mains.
- .9 Suitable for: plug-in breaker for molded case circuit breaker, bolt-on breakers for miniature circuit breaker.
- .10 Hinged door, trim finish: baked grey enamel.
- .11 Drip shield.
- .12 Surface mount with hinge door, unless otherwise indicated on drawing.
- .13 Complete circuit directory with typewritten legend showing description of each circuit.
- .14 Manufacturer: Square D or approved equal
- .15 Trim with concealed front bolts and hinges.
- .16 Trim and door finish: baked grey enamel.

2.2 **BREAKERS**

- .1 Breakers: to Section 26 28 16.02 - Moulded Case Circuit Breakers.
- .2 Breakers with thermal and magnetic tripping in panelboards except as indicated otherwise.
- .3 Main breaker: separately mounted on top or bottom of panel to suit cable entry. When mounted vertically, down position should open breaker.
- .4 Lock-on devices for 10% of 15 to 30 A breakers installed as indicated. Turn over unused lock-on devices to NRC Departmental Representative.
- .5 Lock-on devices for receptacles, fire alarm clock outlet, emergency, door supervisory, intercom, stairway, exit and night light circuits as indicated.

2.3 **EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Nameplate for each panelboard size 4 engraved as indicated.
- .3 Nameplate for each circuit in distribution panelboards size 2 engraved as indicated.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit.

PART 3 **EXECUTION**

3.1 **INSTALLATION**

- .1 Locate panelboards as indicated and mount securely, plumb, true and square, to adjoining surfaces.
- .2 Install surface mounted panelboards on plywood backboards. Where practical, group panelboards on common backboard.
- .3 Mount panelboards to height specified in Section 26 05 00 – Common Work Results - Electrical or as indicated.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus with respective neutral identified.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 00 10 00 – General Instructions.
- .2 Section 26 05 00 – Common Work Results - Electrical.
- .3 Section 26 28 13.01 - Fuses - Low-Voltage.

1.2 **REFERENCES**

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No. 29, Panelboards and Enclosed Panelboards.

1.3 **SUBMITTALS**

- .1 Drawings to include electrical detail and dimensions of panel, branch switch type, ampacity and quantity.

PART 2 **PRODUCTS**

2.1 **PLANT ASSEMBLY**

- .1 Assemble panelboard interior before shipment. Ship fuses loose for on site installation.
- .2 In addition to CSA requirements, manufacturer's nameplates must show fault current that panelboard has been built to withstand.

2.2 **CONSTRUCTION FEATURES**

- .1 Panelboards: product of one manufacturer.
- .2 Sequence phase bussing with odd numbered sections on left and even on right, with each section identified by permanent number identification as to circuit number and phase.
- .3 Panelboards with mains, number of circuits, and number and size of branch sections as indicated.
- .4 Two keys for each panelboard and key panelboards alike.
- .5 Tin plated aluminum bus with neutral of same ampere rating as mains.
- .6 Suitable for bolt-on fusible sections.
- .7 Trim and door finish: baked grey enamel.

- .8 Fusible pull-outs or door-operated type switches not acceptable.
- .9 Fuse clips: suitable for type of fuses specified for each unit.
- .10 Fuses: to Section 26 28 13.01 - Fuses - Low Voltage, sizes as indicated.

2.3 EQUIPMENT IDENTIFICATION

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Nameplate for each panel size 4 engraved in indicated.
- .3 Nameplate for each circuit in distribution panels size 2 engraved "name of load" as indicated.
- .4 Complete circuit directory with typewritten legend showing location and load of each circuit. Install circuit directory under plastic protective cover on front of panel.

PART 3 EXECUTION

3.1 INSTALLATION GENERAL

- .1 Locate panelboards as indicated and mount securely, plumb, and square, to adjoining surfaces.
- .2 Install surface-mounted panelboards on plywood backboards. Where practical group panelboards on common backboard.
- .3 Mount panels to height specified in Section 26 05 00 – Common Work Results - Electrical or as indicated.
- .4 Connect loads to circuits.
- .5 Connect neutral conductors to common neutral bus.

END OF SECTION

PART 1 **GENERAL**

1.1 **SECTION INCLUDES**

- .1 Switches, receptacles, wiring devices, cover plates and their installation.

1.2 **RELATED SECTIONS**

- .1 Section 00 10 00 – General Instructions.
- .2 Section 26 05 00 – Common Work Results - Electrical.

1.3 **REFERENCES**

- .1 Canadian Standards Association (CSA)
 - .1 CSA-C22.2 No.42, General Use Receptacles, Attachment Plugs and Similar Devices.
 - .2 CSA-C22.2 No.42.1, Cover Plates for Flush-Mounted Wiring Devices (Bi-national standard, with UL 514D).
 - .3 CSA-C22.2 No.55, Special Use Switches.
 - .4 CSA-C22.2 No.111, General-Use Snap Switches (Bi-national standard, with UL 20, twelfth edition).

PART 2 **PRODUCTS**

2.1 **SWITCHES**

- .1 15 A, 120 V, single pole, double pole, three-way, four-way switches as indicated to: CSA-C22.2 No.55 and CSA-C22.2 No.111.
- .2 Manually-operated general purpose ac switches with following features:
 - .1 Terminal holes approved for No. 10 AWG wire.
 - .2 Silver alloy contacts.
 - .3 Urea or melamine moulding for parts subject to carbon tracking.
 - .4 Suitable for back and side wiring.
 - .5 White toggle.
 - .6 Specification grade.
 - .7 Hospital grade as indicated.
- .3 Toggle operated fully rated for tungsten filament and fluorescent lamps, and up to 80% of rated capacity of motor loads.
- .4 Switches of one manufacturer throughout project.

- .5 Acceptable products:
 - .1 Hubbel HBL 1201 W,
 - .2 Leviton 1201-2W,
 - .3 Pass and Seymour.

2.2 RECEPTACLES

- .1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, to: CSA-C22.2 No.42 with following features:
 - .1 Ivory thermoplastic moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Break-off links for use as split receptacles.
 - .4 Eight back wired entrances, four side wiring screws.
 - .5 Triple wipe contacts and rivetted grounding contacts.
 - .6 Specification grade.
 - .7 Hospital grade as indicated.
- .2 Single receptacles CSA type 5-15 R, 125 V, 15 A, U ground with following features:
 - .1 Ivory thermoplastic moulded housing.
 - .2 Suitable for No. 10 AWG for back and side wiring.
 - .3 Four back wired entrances, 2 side wiring screws.
- .3 Other receptacles with ampacity and voltage as indicated.
- .4 Receptacles of one manufacturer throughout project.
- .5 Acceptable products:
 - .1 Hubbel 5262-W,
 - .2 Leviton 5262-W,
 - .3 Pass and Seymour 5262-W.

2.3 COVER PLATES

- .1 Cover plates for wiring devices to: CSA-C22.2 No.42.1.
- .2 Cover plates from one manufacturer throughout project.
- .3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.
- .4 Nylon ivory or stainless steel cover plates as indicated, thickness 2.5 mm for wiring devices mounted in flush-mounted outlet box.
- .5 Sheet metal cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

- .6 Weatherproof double lift spring-loaded cast aluminum cover plates, complete with gaskets for duplex receptacles as indicated.
- .7 Weatherproof spring-loaded cast aluminum cover plates complete with gaskets for single receptacles or switches.
- .8 All wiring device cover plates to be labeled using clear adhesive strips with black type identifying panel and circuit number for each device.

PART 3 **EXECUTION**

3.1 **INSTALLATION**

- .1 Switches:
 - .1 Install single throw switches with handle in "UP" position when switch closed.
 - .2 Install switches in gang type outlet box when more than one switch is required in one location.
 - .3 Mount toggle switches at height in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Receptacles:
 - .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
 - .2 Mount receptacles at height in accordance with Section 26 05 00 – Common Work Results - Electrical.
 - .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.
- .3 Cover plates:
 - .1 Protect cover plate finish with paper or plastic film until painting and other work is finished.
 - .2 Install suitable common cover plates where wiring devices are grouped.
 - .3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 00 10 00 – General Instructions.
- .2 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .3 Section 26 05 00 – Common Work Results - Electrical.

1.2 **REFERENCES**

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2No.248.12, Low Voltage Fuses Part 12: Class R (Bi-National Standard with, UL 248-12 (1st Edition).

1.3 **SUBMITTALS**

- .1 Submit fuse performance data characteristics for each fuse type and size above 600 A. Performance data to include: average melting time-current characteristics.

1.4 **DELIVERY AND STORAGE**

- .1 Ship fuses in original containers.
- .2 Do not ship fuses installed in switchboard.
- .3 Store fuses in original containers in storage cabinet moisture free location.

1.5 **MAINTENANCE MATERIALS**

- .1 Provide maintenance materials in accordance with Section 00 10 00 – General Instructions.
- .2 Three spare fuses of each type and size installed up to and including 600 A.

PART 2 **PRODUCTS**

2.1 **FUSES GENERAL**

- .1 250V and 600V time delay, rejection style, HRC-I, Class RK5.
- .2 Standard of acceptance: Gould-Shawmut or approved equal.

2.2 FUSES FOR MCCS

- .1 Eaton Bussmann Series Low-Peak, Class J Current Limiting (HRC) Time Delay (gD) 110-amp fuse.
 - .1 Catalog number: LPJ-110SP
 - .2 No alternatives.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install fuses in mounting devices immediately before energizing circuit. Ensure correct fuses fitted to physically matched mounting devices.
- .2 Install fuses correctly sized to assigned electrical circuits.
- .3 Provide spare fuses to Owner.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 00 10 00 – General Instructions.
- .2 Section 26 05 00 - Common Work Results – Electrical.

1.2 **SUBMITTALS**

- .1 Include time-current characteristic curves for breakers with ampacity of 600 A and over or with interrupting capacity of 22,000 A symmetrical (rms) and over at system voltage.

PART 2 **PRODUCTS**

2.1 **MOLDED CASE CIRCUIT BREAKERS**

- .1 Thermal-magnetic moulded case circuit breakers, quick-make, quick-break type, for manual and automatic operation with temperature compensation for 40°C ambient.
- .2 Common-trip breakers: with single handle for multi-pole applications.
- .3 All new 120V to 600V circuit breakers installed on this project are to include the handle accessory, "Handle Padlock Attachment", which locks breakers on or off.
- .4 Magnetic instantaneous trip elements in circuit breakers to operate only when value of current reaches 10 times their setting.
- .5 Circuit breaker and panel to be of same manufacturer.
- .6 Circuit breakers minimum interrupt rating: 25KA for 600/347V or greater if indicated.
- .7 Electronic trip unit as indicated by drawing.
 - .1 LI: long time and instantaneous
 - .2 LSI: long time, short time and instantaneous
 - .3 LSIG: long time, short time, instantaneous and grounding
 - .4 A: with Ammeter
 - .5 E: with energy meter
- .8 On board control power for trip unit
- .9 Standard of acceptance: Square D or approved equal.

2.2 **ENCLOSURE**

- .1 Mounted in CSA Type 1 type enclosure, sprinkler proof as indicated.

PART 3 **EXECUTION**

3.1 **INSTALLATION**

- .1 Install circuit breakers as indicated.

END OF SECTION

PART 1 **GENERAL**

1.1 **SECTION INCLUDES**

- .1 Equipment, fabrication and installation for ground fault protection.

1.2 **RELATED SECTIONS**

- .1 Section 00 10 00 – General Instructions.
- .2 Section 26 05 00 – Common Work Results - Electrical.
- .3 Section 26 24 02 - Service Entrance Board.

1.3 **PAYMENT PROCEDURES**

- .1 Pay for field testing of ground fault equipment performed by equipment manufacturer.

1.4 **REFERENCES**

- .1 Canadian Standards Association (CSA)
 - .1 CAN/CSA-C22.2 No. 144, Ground Fault Circuit Interrupters.
- .2 National Electrical Manufacturers Association (NEMA)
 - .1 NEMA PG 2.2, Application Guide for Ground Fault Protection Devices for Equipment.

1.5 **SUBMITTALS**

- .1 Submit product data and shop drawings.
- .2 Submit test report for field testing of ground fault equipment to NRC Departmental Representative and certificate that system as installed meets criteria specified.

PART 2 **PRODUCTS**

2.1 **EQUIPMENT**

- .1 Ground fault protective equipment: components of one manufacturer.
- .2 Provide ground fault protection on 1000A, 600V, 4 wire, 3 phase service and 2000 A, 208V, 4 wire, 3 phase service and above: to NEMA PG 2.2 and CAN/CSA-C22.2 No. 144.

2.2 RELATED EQUIPMENT

- .1 Shunt trip breakers. Load break disconnect switch.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Do not ground neutral on load side of sensor.
- .2 Install phase conductors including neutral through zero sequence transformer.
- .3 Install ground fault protection system.
- .4 Make connections as indicated and in accordance with manufacturer's recommendations.

3.2 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and Section 00 10 00 – General Instructions.
- .2 Arrange and pay for field testing of ground fault equipment by ground fault equipment manufacturer before commissioning service.
- .3 Check trip unit settings to ensure proper working operation and protection of components.
- .4 Demonstrate simulated ground fault tests.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 00 10 00 – General Instructions.
- .2 Section 26 05 00 – Common Work Results - Electrical.

PART 2 **PRODUCTS**

2.1 **DISCONNECT SWITCHES**

- .1 Fusible and non-fusible, disconnect switch in CSA Enclosure type 1, size as indicated.
- .2 Provision for padlocking in "OFF" switch position.
- .3 Mechanical voidable door interlock in "ON" position.
- .4 Fuses: size and type as indicated, to Section 26 28 13.01 - Fuses - Low Voltage.
- .5 Fuseholders: in each switch to be suitable without adaptors, for type and size of fuse indicated.
- .6 Quick-make, quick-break action.
- .7 “ON-OFF” switch position indication on switch enclosure cover.
- .8 Standard of acceptance: Square D, Eaton, Siemens, ABB.

2.2 **EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 26 05 00 – Common Work Results - Electrical.
- .2 Indicate name of load controlled on size 4 nameplate.

PART 3 **EXECUTION**

3.1 **INSTALLATION**

- .1 Install disconnect switches complete with fuses as indicated.

END OF SECTION

PART 1 **GENERAL**

1.1 **REFERENCES**

- .1 American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)
 - .1 ANSI/IEEE C62.41, Surge Voltages in Low-Voltage AC Power Circuits.
- .2 American Society for Testing and Materials (ASTM)

1.2 **RELATED SECTIONS**

- .1 Section 00 10 00 – General Instructions.

1.3 **SUBMITTALS**

- .1 Provide manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Quality assurance submittals: provide the following in accordance with Section 00 10 00 – General Instructions.
 - .1 Manufacturer's instructions: provide manufacturer's written installation instructions and special handling criteria, installation sequence, cleaning procedures and relamping schedule.

1.4 **DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 00 10 00 – General Instructions.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Divert unused metal materials from landfill to metal recycling facility.
- .4 Disposal and recycling of fluorescent lamps as per local regulations.
- .5 Disposal of old PCB filled ballasts.

1.5 **ACCEPTABLE PRODUCTS**

- .1 Luminaires described in the Lighting Fixture Schedule identify quality, performance criteria and other parameters, as indicated for this project. Named fixtures are acceptable with modifications and accessories, as indicated.
- .2 Fixtures from other manufacturers may be acceptable provided:
 - .1 Appearance and lighting performance are similar.

- .2 Quality is equal or better.
- .3 Lamp and ballast criteria remain the same.
- .4 The fixture is provided with modifications and accessories to provide a complete product in keeping with the intent of the project.

PART 2 PRODUCTS

2.1 LAMPS

- .1 As indicated on drawings.

2.2 FINISHES

- .1 Light fixture finish and construction to meet ULC listings and CSA certifications related to intended installation.

2.3 LUMINAIRES

- .1 As indicated in luminaire schedule on drawings.

2.4 OPTICAL CONTROL DEVICES

- .1 As indicated in luminaire schedule on drawings.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Locate and install luminaires as indicated. Install lamps in all fixtures.
 - .1 Provide adequate support to suit ceiling system.

3.2 WIRING

- .1 Connect luminaires to lighting circuits.
 - .1 Install flexible conduit for vertical power supply drop to luminaires as indicated. Horizontal wiring using flexible conduit is not permitted.

3.3 LUMINAIRE SUPPORTS

- .1 For suspended ceiling installations support luminaires from ceiling grid in accordance with local inspection requirements.

3.4 LUMINAIRE ALIGNMENT

- .1 Align luminaires mounted in continuous rows to form straight uninterrupted line.
- .2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.5 FIELD QUALITY CONTROL

- .1 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and Section 00 10 00 – General Instructions.

END OF SECTION

PART 1 **GENERAL**

1.1 **SECTION INCLUDES**

- .1 Materials and installation for emergency lighting systems.

1.2 **RELATED SECTIONS**

- .1 Section 00 10 00 – General Instructions.
- .2 Section 26 05 00 - Common Work Results – Electrical.
- .3 Section 26 05 21 - Wires and Cables (0-1000 V).
- .4 Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.

1.3 **REFERENCES**

- .1 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No.141, Unit Equipment for Emergency Lighting.

1.4 **SUBMITTALS**

- .1 Data to indicate system components, mounting method, source of power and special attachments.

1.5 **WARRANTY**

- .1 For batteries, the ten years warranty period is extended to 120 months, with no-charge replacement during the first 5 years and pro-rate charge on the second 5 years from the date of Substantial Completion.

PART 2 **PRODUCTS**

2.1 **EQUIPMENT**

- .1 Emergency lighting equipment: to CSA C22.2 No.141.
- .2 Supply voltage: 120/347 VAC.
- .3 Output voltage: 12.
- .4 Operating time: 90 minutes, minimum
- .5 Battery: sealed, maintenance free.
- .6 Standard of Acceptance: Lumacell, as indicated on the drawings.

2.2 WIRING OF REMOTE HEADS

- .1 Conduit: type EMT, in accordance with Section 26 05 34 - Conduits, Conduit Fastenings and Conduit Fittings.
- .2 Conductors: RW90 type in accordance with Section 26 05 21 - Wires and Cables (0-1000 V) sized as indicated in accordance with manufacturer's recommendations.

PART 3 EXECUTION

3.1 INSTALLATION

- .1 Install unit equipment and remote mounted fixtures.
- .2 Direct heads.
- .3 Connect exit lights to unit equipment.
- .4 Perform tests in accordance with Section 26 05 00 – Common Work Results - Electrical and in accordance with Section 00 10 00 – General Instructions.

END OF SECTION

PART 1 **GENERAL**

1.1 **RELATED SECTIONS**

- .1 Section 00 10 00 – General Instructions.
- .2 Section 26 05 00 - Common Work Results – Electrical.

1.2 **REFERENCES**

- .1 Atomic Energy Control Board Regulations
- .2 Canadian Code for Preferred Packaging
- .3 Canadian Standards Association (CSA)
 - .1 CSA C22.2 No.141, Unit Equipment for Emergency Lighting.
 - .2 CSA C860, Performance of Internally-Lighted Exit Signs.
- .4 National Fire Protection Association (NFPA)
 - .1 NFPA 101, Life Safety Code.

1.3 **SUBMITTALS**

- .1 Product Data:
 - .1 Submit manufacturer’s printed product literature, specifications and datasheets and include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Manufacturer’s Instructions: Provide to indicate special handling criteria, installation sequence, cleaning procedures and disposal.

PART 2 **PRODUCTS**

2.1 **SELF-POWERED UNITS**

- .1 Exit lights: to CSA C22.2 No.141 and CSA C860, packaged in accordance with the Canadian Code for Preferred Packaging guidelines.
- .2 Finish: Factory White
- .3 Voltage: 120/347VAC.
- .4 90 minutes of operation, minimum.
- .5 Pictograms as indicated.

- .6 Universal Mounting.
- .7 Standard of Acceptance:
 - .1 Lumacell LA Series or approved equal.

PART 3 **EXECUTION**

3.1 **INSTALLATION**

- .1 Install exit lights to manufacturer's recommendations, listing requirements, NFPA standard and local regulatory requirements.
- .2 Connect fixtures to exit light circuits using RW90 wire in EMT conduit.
- .3 Connect emergency lamp sockets to emergency circuits.
- .4 Ensure that exit light circuit breaker is locked in on position.
- .5 Provide tests in accordance with Section 26 05 00 – Common Work Results - Electrical and Section 00 10 00 – General Instructions.

3.2 **CLEANING**

- .1 Proceed in accordance with Section 00 10 00 – General Instructions.
- .2 On completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 **GENERAL**

1.1 **SCOPE OF WORK**

- .1 Testing and commissioning are called for throughout the individual specifications. This does not relieve this trade from providing all testing and commissioning necessary to ensure that systems and equipment operate as required and that they interface with other systems and equipment as required.

1.2 **SECTION INCLUDES**

- .1 Commissioning of all building electrical systems and component including:
 - .1 Testing and adjustment.
 - .2 Demonstrations and Training.
 - .3 Instructions of all procedures for Owner's personnel.
 - .4 Updating as-built data.
 - .5 Co-ordination of Operation and Maintenance material.

1.3 **RELATED SECTION**

- .1 Section 00 10 00 – General Instructions.
- .2 Section 26 05 00 – Common Work Results - Electrical.

1.4 **REFERENCES**

- .1 CSA (Canadian Standards Association).
- .2 Underwriters Laboratories of Canada.

1.5 **QUALITY ASSURANCE**

- .1 Provide qualified trades persons, certified testing agencies, factory trained and approved by the Commissioning Team Leader.
- .2 Submit the names of all personnel to be used during the Commissioning activities for Owner Approval.

1.6 **COMMISSIONING**

- .1 The purpose of the commissioning process is to fully test all building systems including architectural, mechanical and electrical components and operating procedures by challenging these systems to realistic operation conditions.
- .2 The Commissioning activities shall be co-ordinated by the General Contractor.
- .3 Commissioning activities for the electrical systems must have available up to date as-built drawing information and accurate Operations and Maintenance Manuals. These documents shall be a major part of this activity.

- .4 Contractor shall be responsible to update all documentation with information and any changes duly noted during the Commissioning exercise.
- .5 Contractor shall arrange for all outside suppliers, equipment manufacturers, test agencies and others as identified in the commissioning sections of this specification. The cost associated with this requirement shall be included as part of the tender price.

1.7 SUBMITTALS

- .1 A commissioning document shall be prepared by the NRC Departmental Representative prior to conducting these activities for use by the Commissioning Team.
- .2 The electrical sub-contractor shall be responsible for ensuring all activities are properly documented in this manual and co-ordinated through the General Contractor.
- .3 As-built drawings and data books must be available two weeks prior to commissioning for review and use by the consultant and Commissioning Team prior to the start of the commissioning activities.

1.8 PREPARATION

- .1 Provide test instruments required for all activities as defined in the commissioning documents.
- .2 Verify all systems are in compliance with the requirements of the commissioning documents prior to the pre-commissioning check out operation.
- .3 Confirm all scheduled activities have identified personnel available.
- .4 Where systems or equipment do not operate as required, make the necessary corrections or modifications, re-test and re-commission.

1.9 SYSTEM DESCRIPTION

- .1 Perform all start up operations, control adjustment, trouble shooting, servicing and maintenance of each item of equipment as defined in the commissioning documentation.
- .2 NRC Departmental Representative will provide list of personnel to receive instructions and will co-ordinate their attendance at agreed upon times.
- .3 Prepare and insert additional data in the operations and maintenance manuals and update as-built drawings when need for additional data becomes apparent during the commissioning exercise.
- .4 Where instruction is specified in the commissioning manual, instruct personnel in all phases of operation and maintenance using operation and maintenance manuals as the basis of instruction.
- .5 Conduct presentation on Owner's premises. Owner will provide space.

1.10 FINAL REPORT

- .1 This trade shall assemble all testing data and commissioning reports and submit them to the NRC Departmental Representative.
- .2 Each form shall bear signature of recorder, and that of supervisor of reporting organizer.

1.11 SCHEDULE OF ACTIVITIES

- .1 Commissioning activities shall be conducted based on pre-established schedule with all members of the commissioning team, refer to Section 00 10 00 – General Instructions.
- .2 In addition, there will be two meetings held through the contract duration to introduce the parties of the commissioning team, establish the schedules and deadlines for the various activities and review the Commissioning Manual.
- .3 Adhering to the established schedule is very important as the co-ordination and scheduling of the participants will be difficult to alter once this is established. Close co-ordination of this schedule is important.
- .4 In the event project cannot be commissioned in the allotted time slot, the contractor shall pay for all costs associated with assembling the Commissioning Team at a later date. If the contractor has not performed his duties to reach commissioning stage as outlined earlier, he will incur all expenses of other trades and the Commissioning Team due to his non-compliance.

END OF SECTION

PART 1 **GENERAL**

1.1 **GENERAL**

- .1 This section describes the extent of services to be provided for wiring of equipment supplied by others.
- .2 Within the context of this section, Others means:
 - .1 Other divisions of this specification (i.e.: Division 25 – Integrated Automation).
 - .2 The Owner, as defined in the Contract.
 - .3 Other contractors supplying and installing equipment to the contract.

1.2 **EXTENT OF SERVICES PROVIDED**

- .1 The work of this contract is to include all power and control wiring of equipment which is provided by Division 26.
- .2 All power and control wiring above 50 V for equipment supplied by Division 25 will be the responsibility of this contractor. Coordinate with Integrated Automation contractor for exact requirements.
- .3 All control wiring 50 V and less for equipment supplied by Division 25 will be the responsibility of Division 25- Integrated Automation Contractor. Conduit and wire associated with this is the responsibility of Division 25.
- .4 All power and control wiring associated with equipment supplied by Division 01 will be the responsibility of this contractor. Coordinate with general contractor for exact requirements.
- .5 Final connection of all wiring to equipment provided by others (except control wiring below 50 V associated with Division 25 equipment) will be by division 26. Coordinate with the provider for connection instructions.

1.3 **RESPONSIBILITY OF DIVISION 26**

- .1 It is the responsibility of the Division 26 subcontractor to verify final requirements for wiring of all equipment noted. Verification of wiring requirements to include:
 - .1 Confirmation of electrical characteristics.
 - .2 Location of connection point.
 - .3 Method of connection (i.e. direct or plug-in etc.)
- .2 Obtain and become familiar with shop drawings for all relevant equipment.
- .3 No claim for extra will be entertained for wiring equipment which has been indicated, or changes to installed wiring where installation proceeded prior to verification of electrical requirements.

PART 2 **PRODUCTS (NOT APPLICABLE)**

PART 3 **EXECUTION (NOT APPLICABLE)**

END OF SECTION

APPENDIX A

TOWING TANK WAVE-MAKER – SAFETY NOTES



Towing Tank Wave-maker Replacement – Safety Notes

This briefing was prepared as a discussion note to prepare all parties involved in the OCRE towing tank wave maker replacement project planned for this year. It is not intended to be a full hazard assessment and safety plan for the work being contemplated, as there may be hazards involved in the assembly and installation of the equipment that are not familiar to OCRE. Instead, the purpose is to provide an overview of the hazards and mitigations related to working in empty tanks that have been identified through our internal hazard prevention program. All contractors or visiting workers are expected to perform their own workplace hazard assessment and safety planning in accordance with the laws of Canada and Newfoundland and Labrador. NRC-OCRE staff and management is available to monitor work and provide advice on safety issues as necessary, but the safety of each employee is primarily the responsibility of their own employer. No safety equipment (gas detection, fall protection, lifejackets, respirators, other PPE, etc.) will be provided by for use by non-NRC-OCRE staff members.

Legislation References:

Canada Labour Code Part II: Occupational Health and Safety
<http://laws-lois.justice.gc.ca/eng/acts/L-2/page-22.html#h-46>

NEWFOUNDLAND AND LABRADOR REGULATION 5/12.
Occupational Health and Safety Regulations, 2012 under the Occupational Health and Safety Act
<http://www.assembly.nl.ca/Legislation/sr/Regulations/rc120005.htm#516>

Summary of relevant requirements:

1. Confined Space Entry Procedures

When the towing tank is empty it meets the legal definition of a confined space, and access must be managed in accordance with legislation. In summary these state that an employer shall ensure that a worker does not enter a confined space until:

- (a) An adequate assessment of the hazards related to the confined space has been carried out;
- (b) A source containing a hazardous substance leading to the confined space is safely and completely blocked off or disconnected;
- (c) Appropriate tests and monitoring for harmful vapours, gasses, fumes, mists, dusts or explosive substances and oxygen deficiency shall be performed,
- (d) The worker is qualified to safely enter and perform duties within the confined space;
- (e) A written work permit documenting the tests and safety precautions has been completed; and
- (f) A set of written safe work procedures has been developed and a worker has been instructed in these procedures.

In addition, the employer shall ensure that emergency rescue procedures are established and followed where workers are trained in the event of an accident or other emergency in or near the confined space, including immediate evacuation of the confined space.

Further Info:

http://www.servicenl.gov.nl.ca/ohs/safety_info/pdf/confined_space_entry_faq.pdf
<http://www.workplacelnl.ca/CSEProviders.whsc>

2. Fall protection

Where a worker is exposed to the hazard of falling from a work area that is:

- (a) 2.6 metres or more above the nearest safe surface or water;
- (b) Above a surface or thing that could cause injury to the worker if the worker were to fall on the surface or thing; or
- (c) Above an open tank, pit or vat containing hazardous material,

The employer shall provide guardrails wherever possible, training in the use of fall arrest systems, and equipment that is appropriate for use for the work area and inspected by a qualified person. In addition, written fall protection plans with procedures for assembling and maintaining fall protection equipment and for the rescue of a suspended worker are required.

Further info:

http://www.servicenl.gov.nl.ca/ohs/guide/part_x.pdf

http://www.workplacenc.ca/PREV_FallProtectionTrainingProviders.whscc

3. Overhead Crane/Rigging

The 2 ton monorail crane currently installed in the tow tank wave maker area will be available for removing existing and installing new wave making equipment. This crane shall only be operated by a qualified person who has been authorized to operate the equipment.

NRC-OCRE will provide slings and rigging that have been inspected and certified. The crane operator is responsible for pre-use inspection and any rigging that fails inspection shall be immediately returned to NRC-OCRE for disposal and replacement. The rigging inventory is attached. If an item is required that is not included in this list it should be provided by the contractor, but we are available to support the procurement as necessary.

Further Info:

<http://www.puglisevich.com/safety-training-course-detail.php?id=497>

4. Scaffolds, Stages and Work Platforms

All scaffolds, stages and work platforms is to be assembled / inspected / tagged by certified scaffold erector only, and no user modifications are permitted. All scaffold users shall be authorized by the workplace supervisor prior to accessing a scaffold.

Users will ensure scaffolding is tagged as serviceable and that posted load category is within their needs. No user may exceed a scaffold's load limit nor leave / hang materials on that scaffold which results in a load derating for future users. All users are responsible to monitor the condition of scaffold in use and report any deficiencies.

Scaffolding having handrails / gates installed as per standard may not require fall arrest systems while working, however ascent / descent via open / portable ladders may, depending on height. All portable ladders are to Certified to CSA Z11, Grade 1 or higher and clearly labeled as such.

Further Info:

<http://ohsinsider.com/wp-content/uploads/2014/06/Scaffolding-Safety-Guide.pdf>

5. Working over water

Approved personal floatation devices (PFD) shall be worn by all staff working in, over, or near open water where the depth is above the ankles. In addition, appropriate rescue and evacuation procedures shall be developed and implemented. Any person exposed to open water above this

depth are also required to be monitored by an attendant in a safe area who is also wearing a PFD and qualified to perform the rescue and evacuation procedure.

6. Hazard Prevention

In addition to the safety areas outlined above, the tow tank replacement may require additional engineering or administrative controls and PPE to ensure workers safety. For example, noise monitoring, respiratory protection, lifting and manual handling, eye protection, machine safeguarding, etc. Every federally-regulated workplace must implement and maintain a hazard prevention program (HPP) according to the Canada Occupational Health and Safety Regulations. The goal of the program is to perform risk based assessments of tasks and to determine the appropriate risk mitigation and minimize the possibility of workplace accidents. The hazard prevention program is a tool that brings together all the efforts undertaken in support of occupational health and safety in the work place.

Further info:

http://publications.gc.ca/collections/collection_2010/rhdcc-hrsdc/HS24-27-2009-eng.pdf

During the project, any workplace safety incidents or near misses must be reported immediately after the immediate health and safety issue or emergency condition has been addressed. All questions and/or incident reports should be directed to NRC-OCRE contact below:

***Ian Robbins
Facilities Manager
NRC St. John's, S105
Tel.: 709-772-4755
Email: ian.robbins@canada.ca***

APPENDIX B

BOSCH INSTALLATION INSTRUCTIONS

Revisions

Rev.	By	Chapter	Description	Reason
00	LR		First version. Comments are welcome.	

Explanation of revision marks:

| aaaaaaa = Revised text

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1 Introduction

The NRC in St. John's Newfoundland has given Bosch Rexroth the project to upgrade the Wave Generator at their Tow Tank facility. The NRC Tow Tank is an indoor facility as shown in the following link.

http://www.nrc-cnrc.gc.ca/eng/solutions/facilities/marine_performance/towing_tank.html

Please note that the old existing wave generator equipment, including the waveboard and old hydraulic system, will be removed by NRC under a separate contract. The new, electric motor driven segments will have their corresponding motor drive panels located in the basement behind the segments (old hydraulic room).

The Segmented Wave Generator is to be installed in the Tow Tank of NRC- OCRE in St John's, Newfoundland, Canada. Address: *****

1.1 Purpose

This document describes the installation of the new wave generator equipment.



WARNING

All personnel involved with installation activities on/with the Tow Tank must have read and understood all safety precautions as provided in this document.



NOTE

This document only contains general instructions necessary for the handling and installation activities on/with the system.

1.2 Nomenclature & Abbreviations

END-USER : NRC-OCRE
CUSTOMER : NRC-OCRE
CONTRACTOR : BOSCH REXROTH
INSTALLER : **TBD**

DANGER ZONE : Any zone within and/or around the machinery in which an exposed person is subject to a risk to his health or safety.

EXPOSED PERSON : Any person wholly or partially in a danger zone.

OPERATOR : The person or persons given the task to install, operate, adjust, maintain, clean, repair or transport the machinery.

left : Left-hand side as seen looking (from the water) towards the wave board segments.
X-axis : Perpendicular to the row of waveboard segments.
Y-axis : Parallel to the face of the waveboard segments.
Z-axis : Pointing upwards.
Longitudinal : Direction in the length of the basin
Lateral : Direction in the width of the basin
Wave propagation angle : Counter clockwise positive relative to the X-axis.

CC : Control Computer
CDR : Critical Design Review
EL : Elevation Level
ESPS : Emergency Stop Pushbutton Station
FAT : Factory Acceptance Test
ICD : Interface Control Document
ITP : Inspection & Test Plan
JB : Junction Box
PDP : Power Distribution Panel
LS : Long Side
MCC : Motor Control Cabinet
NDE : Non Destructive Examination
OPS : Operator Station
PDP : Power Distribution Panel
PDR : Preliminary Design Review
SAT : Site Acceptance Test
SERCOS : SERial Realtime COmmunication System
SS : Short Side
SWG : Segmented Wave Generator
SWL : Still Water Line
TBD : To Be Determined
TBS : Technical Breakdown Structure
TOC : Taking Over Certificate
TT : Tow Tank
WA : Wave Absorber
WCC : Waveboard Control Cabinet
WHM : Wave Height Meter

1.3 Reference documents (all TBD)

[1]	System description – SWG	: NL002062-02-61-0000-SYD-0000
[2]	Technical breakdown structure – SWG	: NL002062-02-61-0000-TBS-0000
[3]	Overall system parts list – SWG	: NL002062-02-61-0000-OSP-0000
[4]	Global layout drawing – SWG	: NL002062-02-61-0000-GLO-0001
[5]	Interface drawing mechanical	: NL002062-02-61-0000-IDM-0000
[6]	Spare parts – SWG	: NL002062-02-61-0000-IML-0800
[7]	Hoisting plan – Section Assembly	: NL002062-02-61-1000-LDM-0001
[8]	Assembly drawing - Section Assembly 10SegW400	: NL002062-02-61-1100-ADM-0001
[9]	Assembly drawing – Anchor Set	: NL002062-02-61-1930-ADM-0001
[10]	Assembly drawing – Horizontal Rear Damper	: GENERIC-02-61-1950-ADM-0001
[11]	Assembly drawing – Anchor M12 Set	: GENERIC-02-61-1950-ADM-0002
[12]	Electrical block diagram – SWG	: NL002062-02-61-2000-BDE-0000

[13]	Cabling diagram – SWG	: NL002062-02-61-2000-CAD-0000
[14]	One line diagram – SWG	: NL002062-02-61-2000-OLD-0000
[15]	Connection diagram – MCC x	: NL002062-02-61-220x-COD-0000
[16]	Layout drawing – MCC x	: NL002062-02-61-220x-LDE-0000
[17]	Connection diagram – WCC	: NL002062-02-61-2300-COD-0000
[18]	Layout drawing – WCC	: NL002062-02-61-2300-LDE-0000
[19]	Assembly drawing – Wave Height Meter Mk II	: GENERIC-02-61-2510-ADM-1162
[20]	Cable list – Servomotor Cabling	: NL002062-02-61-2810-CLE-0000
[21]	Cable list – WHM Cabling	: NL002062-02-61-2820-CLE-0001
[22]	Cable list – S67 Cabling	: NL002062-02-61-2820-CLE-0002
[23]	Cable list – Earth Cabling	: NL002062-02-61-2830-CLE-0000
[24]	Grounding diagram – SWG	: NL002062-02-61-2830-GDE-0000
[25]	Parts list – Earth Cabling	: NL002062-02-61-2830-PLE-0000
[26]	Cable list – Miscellaneous Cabling	: NL002062-02-61-2840-CLE-0000
[27]	Parts list – Miscellaneous Cabling	: NL002062-02-61-2840-PLE-0000
[28]	Global layout drawing – Basin Cable Trays	: NL002062-02-61-2850-GLO-0001
[29]	Connection diagram – ESPS	: NL002062-02-61-2910-COD-0000
[30]	Layout drawing – ESPS	: NL002062-02-61-2910-LDE-0000
[31]	Connection diagram – Acoustic Warning Light	: NL002062-02-61-2920-COD-0000
[32]	Assembly drawing – Drilling Template	: NL002062-02-61-3120-ADM-0001
[33]	Assembly drawing – Grouting Tools	: NL002062-02-61-3140-ADM-0001
[34]	Assembly drawing – Locking Device	: NL002062-02-61-3150-ADM-0001
[35]	Commissioning spare parts	: NL002062-02-61-3300-CSP-0000
[36]	Installation requirements for low voltage switch gear and control gear assemblies	: GENERIC-02-390702
[37]	Assembly drawing - Wave height meter	: GENERIC-02-61-2510-ADM-2012
[38]	Mounting instructions WHM	: GENERIC-02-61-2510-INS-0001
[39]	Mounting instructions for electrical cabling	: NL001891-02-01-2800-INS-0000
[40]	Layout drawing – LPDC	: NL001891-02-60-2100-LDE-0000
[41]	Layout diagram – MCC	: NL001891-02-60-2200-LDE-0000
[42]	Cabling diagram	: NL001891-02-61-0000-CAD-0000
[43]	Interface drawing - SWG	: NL001891-02-61-0000-IDM-0001
[44]	Preservation specification	: NL001891-02-61-1000-PRS-0001
[45]	Timing belt - Tension procedure	: NL001891-02-61-1000-TSP-0000
[46]	Wittenstein Alpha - Operating manual gearbox	: SC+ SPC+ manual
[47]	Bosch Rexroth - Safety instructions for electrical drives	: DOK-GENERL-DRIVE****-SVS4MS-P

1.4 Conversion table

1 mm	=	0.0394 inch	(length)
1 cm ³	=	0.0610 cubic inch	(volume)
1 bar	=	14.5 psi	(pressure)
1 Nm	=	0.7375 ft.lb	(torque)
1 kg	=	2.2 lb	(mass)

Note: The decimal separator used in this document is a ‘.’ (dot).

1.5 Brief scope of supply

The segmented wave generator is described in system description [1] and visualized in technical breakdown structure [2].

The complete scope of supply of the segmented wave generator is quantified in overall system parts list [3]. In short form it is given here.

At the West end of the towing tank:

- 20x Section assembly 1SegW600, as shown on assembly drawing [8], each consisting of 1 segment of 600 mm width.
- 4x Motor Control Cabinets (MCC), as shown on layout drawing [16], to control the servomotors for a group of up to 5 segments. The MCCs are to be installed on basement level as indicated on global layout drawing [4].
- 1x Waveboard Control Cabinet (WCC), as shown on layout drawing [18], containing the control computer to control and monitor all the segments.

On towing carriage, inside control room:

- 1x Operator Station (OPS), to compute waves and to generate waves.

Further:

- 12m Horizontal Rear Damper, as shown on assembly drawings [10] and [11], to be installed on the basin wall at the back of the segment assemblies as indicated on global layout drawing [4] and mechanical interface drawing [5].
- 20x Wave Height Meter, as shown on assembly drawing [19], to be installed on front side of each segment.
- 4x Emergency Stop Pushbutton Stations (ESPS), as shown on layout drawing [30]. The ESPS are to be installed on floor level as indicated on global layout drawings [4] and [28].
- 1x Warning Light and Klaxon, to be installed on top of WCC1.
- 1x Set of Interconnecting Cabling, as shown on cabling diagram [13], consisting of:
 - 1x Set of servomotor cabling according cable list [20], between servomotors and MCCs, containing:
 - 20x Motor cables (prefab type)
 - 20x Feedback cables (prefab type)
 - 1x Set of WHM cabling according cable lists [21] and [22], between WHMs and WCC, containing:
 - 20x WHM cables (prefab type)
 - 1x Set of earth cabling according cable list [23], between drive lines and the MCCs as shown on grounding diagram [24], containing:
 - 20x Earth cables (16mm² cable between drive lines and the grounding bar inside the cable tray)
 - 1x Earth cables (25mm² cable between the grounding bar inside the cable tray and MCCs)

- 1x Set of miscellaneous cabling components according cable list [26], between the MCCs, WCC and OPS, containing:
 - Set Control cables for Emergency Stop and Remote Control circuit
 - Set Network cables for SERCOS III and Ethernet circuit (prefab type)

- 1x Instruction Manual (digital)

2 Safety precautions

This chapter gives a general overview of the health, safety and environmental aspects that are related to the installation of the system, including dangerous situations that can occur by foreseeable misuse of the system.

Read these instructions, including the safety instructions according the datasheets, in order to eliminate the risk of bodily harm or material damage. Obey these safety instructions at all times. Do not try to install or start the system without first reading all documentation supplied with the system.

Read and understand these safety instructions and all user documentation of the system before work on the system is started at any time. If the user documentation for this system is not available, contact Bosch Rexroth B.V. to send this documentation immediately to the person or persons responsible for safe operation of this equipment. If the system is resold, rented, transferred or passed on to others, supply these safety instructions with the system.

WARNING



- **Do not use the system without obeying all safety instructions.**
- **Do not disable any safety device or make changes to the system.**
- **Failure to obey the safety instructions or tampering with the system or safety devices can result in material damage, bodily harm, electric shock or even death!**

Bosch Rexroth B.V.'s guarantee expires when:

- the instructions in this manual are not obeyed properly;
- the system was overloaded or operated wrongly;
- the system was changed without written consent of Bosch Rexroth B.V.;
- non-Bosch Rexroth B.V. approved spare parts were used.

2.1 General safety aspects



WARNING

Wear a safety helmet, eye-protection and protective footwear during handling and installation activities on the segmented wave generator.



WARNING

- Do not work on the electrical system with power applied unless necessary. If maintenance must be done on the system with electrical power switched on, it is the responsibility of the individual to exercise proper caution when working near an electrical hazard (voltages higher than 30 Vrms or 50 VDC). A second person must always attend. Use a padlock to lock the main switch in the 'OFF' position.
- Make sure that it is safe to switch on the system, especially after maintenance or repair is performed. Make sure that all electrical and mechanical connections are properly made. Do not switch on the electric power if one or more cables are not connected.



WARNING

- Work on/with the system must only be performed by persons who are authorized to do so, based on their training and qualifications. In addition, the persons must be assigned by the operating company.
- Do not modify the settings of safety-related equipment without written consent of Bosch Rexroth B.V.
- Inform the persons in charge of modifications carried out on the system and changes in the operating behavior (i.e. excessive noise level).



WARNING

Never work on or in the vicinity of moving parts unless it is impossible to perform the task required in another way.



CAUTION

To prevent damage to interconnecting cabling, strictly adhere to the minimal bending radius according the supplied datasheets. When damage is found, immediately replace interconnecting cabling.

2.2 Specific safety aspects



WARNING

Wear a life jacket when working above the water.



WARNING

When the system is operated and people are in the basin (i.e. for testing swimming activities) additional safety measures should be taken.



WARNING

- Personnel that handle the system must never do such actions that cause damage to the installation or environment or that cause dangerous situations.
- Only press the emergency-stop button in case of a dangerous situation that involves injury of persons or damage to the equipment.
- Only reset the emergency-stop after the problem that causes the dangerous situation has been solved.



WARNING

Keep the system under close observation and keep away from the danger zone when the system is activated.



- Limbs are exposed to a shearing and/or crushing hazard at a moving segmented wave generator.
- Personnel can be drawn into the system by e.g. long hair, scarves or loose hanging cloths. Only trained personnel are permitted to be near the system during operation and maintenance.



WARNING

- Do not stand on the waveboard segments; waveboard segments have no brakes. The segments can suddenly move under gravity, wave action or a sudden relief of friction. This may cause the person standing on the waveboard segments to lose balance and fall in the basin in between the moving segments.
- When handling the waveboard segments by hand or foot (pushing forward/backward), there is a risk that the person is not strong enough or lets the segment slip. The falling segment - with its large kinetic energy and sharp edges - is very dangerous, especially when there is no water to reduce the falling speed. Therefore, use a suitable small wooden beam as a pushing aid.

WARNING



- The electrical system contains capacitors. Because of this, an electrical hazard can still exist 5 minutes after the electric power is switched off. Measure the voltage before work on the electrical system is started to make sure that the equipment is safe to touch. Do **not** attempt to actively discharge capacitors.
- The AC-servomotors act as a high-voltage generator when externally driven. Therefore, prior to detaching the orange motor cable, the concerning waveboard segments must be locked mechanically, e.g. with a locking strut, so they cannot drive their motor. The motor connections and any cable attached to it are considered to be a lethal AC-voltage source (200 ..1000 VAC).



CAUTION

The MCC contains parts and assemblies that are susceptible to damage by electrostatic discharge.



CAUTION

The section assemblies are delicate equipment. Please take care from unpacking until final installation of this equipment. Only lift the section assemblies with the use of suitable hoisting equipment.

2.2.1 *Precautions in use of the motor controller*

WARNING



- Refer to [47] "Bosch Rexroth - Safety instructions for electrical drives".
- High voltage and high discharge current!
Danger to life, risk of severe electrical shock and risk of injury!
- Dangerous movements! Danger to life and risk of injury or equipment damage by unintentional motor movements!
- High electrical voltages due to incorrect connections!
Danger to life, severe electrical shock and serious physical injury!
- Health hazard for persons with heart pacemakers, metal implants and hearing aids in proximity to electrical equipment!
- The surface of the machine housing can be extremely hot!
Danger of injury! Danger of burns!
- Risk of injury due to incorrect handling! Physical injury caused by crushing, shearing, cutting, and trusting movements!
- Risk of injury due to incorrect handling of batteries!

2.2.2 *Precautions in use of the computer monitor*

Since all important information to control the system is displayed on the screens, it is necessary to prevent failure of the computer monitor.



WARNING

Do not attempt to remove the back cover, as you will be exposed to a shock hazard. Only qualified service personnel should remove the back cover.



CAUTION

- Disconnect the monitor from the main supply if the monitor is not used for an extended period.
- Do not place objects on top of the monitor cabinet, which can fall into vents or which can cover them and prevent proper cooling of the monitors' electronic devices.
- Do not expose the monitor to rain or excessive moisture to avoid the risk of shock or permanent damage to the set.
- Do not use alcohol or ammonia based liquid to clean the monitor. If necessary, clean with a slightly damp cloth. Disconnect the monitor from the main supply before the monitor is cleaned.
- Make sure the AC-power to the computer is 'OFF' before any display peripheral is connected or disconnected.
- Consult a service technician if the monitor does not operate normally.

2.3 Safety symbols on the system

The system must be provided with several safety symbols as indicated in Figure 2-1 till Figure 2-3. The meaning of the signs is explained in the table below.






Warning sign	Dutch	English
	Automatisch startende installatie	Automatic starting installation
	Warm oppervlak	Hot surface
	Elektrische spanning	Electricity
	Draaiende tandwielen	Rotating pulley
	Val gevaar	Danger of falling



Figure 2-1: Safety symbols on entrance door

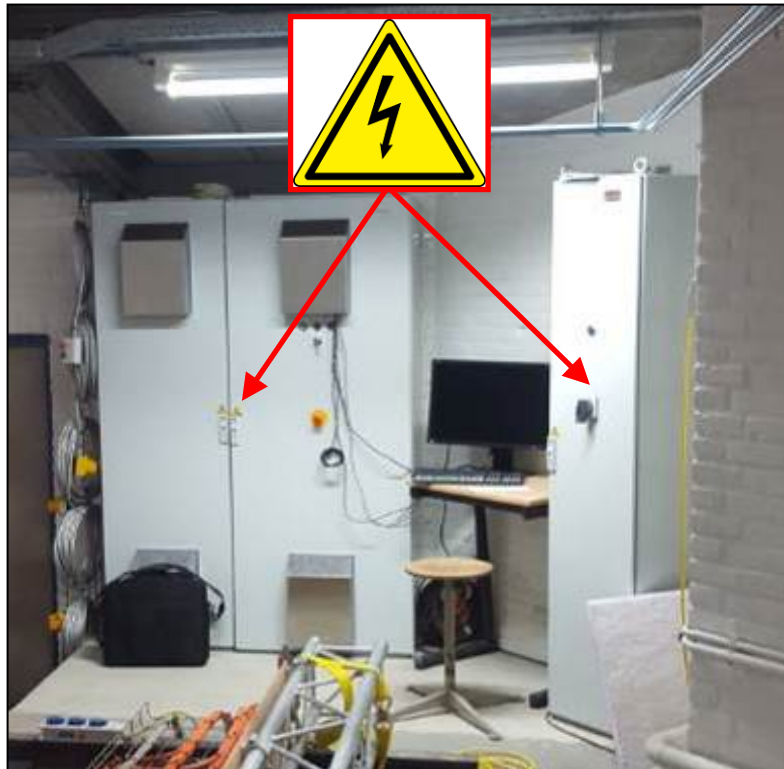



Figure 2-2: Safety symbols on control cabinets



Figure 2-3: Safety symbols on section assembly

2.4 **Safety measures by customer**

	<p>WARNING</p> <ul style="list-style-type: none">• Make sure that everyone and everything around the basin is ready before the system is started.• Do not operate the system without a proper safeguard that prevents access to the driveline.• An evacuation plan must be available to ensure that personnel can evacuate the area at all times.
---	--

2.4.1 ***Danger zone***

The area around the WGS is designated as a danger zone. For the most part fencing is provided. A safeguard must be installed to prevent access to the driveline. Measures shall be implemented to restrict access to authorized personnel only.

An evacuation plan for the restricted area and hazard zones shall be drawn up and implemented.

2.4.2 ***Non-slip floor***

A non-slip floor with suitable water drainage shall be present in the restricted area.

- Health and Safety Plan.
- Personal protection equipment
- At least two ladders from foundation floor to wall top, enabling people to egress if the floor area should flood.
- Do not work overhead of people.


3 Required personnel, material, equipment and tools

This chapter gives an overview of the required equipment, tools, materials etc. to be used during handling of the components of the segmented wave generator.

3.1 Personnel by Contractor

Contractor will provide personnel for supervision of mechanical and electric work. They are familiar with the drawings and the equipment to be installed, will direct the work and will ultimately be responsible for the correct execution of the works. They will operate the Mounting Motion Box.

3.2 Personnel

	<p>WARNING</p> <ul style="list-style-type: none">• Work on/with the system must only be performed by persons who are authorized to do so, based on their training and qualifications. In addition, the persons must be assigned by the operating company.• All personnel involved with installation activities on/with the Tow Tank must have read and understood all safety precautions as provided in this document.
---	--

This manual is written for skilled and qualified installation personnel. Make sure that the persons in charge have:

- knowledge of the English language to read and understand the instruction manual;
- sufficient technical education and training;
- experience with comparable systems or training in relation to this system.

3.2.1 Mechanical installation personnel

Foreman mechanical Installation, responsible for unloading the containers, transport of the mechanical parts into the building and mechanical installation of the wave generator, completely ready for use. The foreman takes care for the daily operation, communication and total manpower. The foreman shall also attend the completion check.

Measurement mechanics, needs to have experience to work with laser equipment and levelling equipment. He shall mark the holes (aided by the marking template provided by SUPPLIER, and after putting the Sections into the final location, the mechanics shall level and position each Section. He shall also mark the holes for the rear wave absorbers and the electric cabinets.

Drilling mechanics needs to drill the holes and place the anchors. The holes have to be drilled with diamond core bits. After drilling, the holes have to be cleaned and have to be dry before placing the anchors.

Mounting mechanics will unload the containers, transport the mechanical parts from the containers into the building, install Sections on the anchors, level (together with the measurement mechanics) the Sections. After levelling and grouting, put the anchors on torque. Install the rear absorber plates and put the anchors on torque, install the screening plates and rear extenders, repair any damaged painting and mount on each Section, one servomotor.

The mounting mechanics need to have experience with heavy lifting equipment.

3.2.2 *Electrical Installation personnel*

Foreman Electrical Installation is responsible for transport the electrical parts into the building, installing the electrical panels from the wave generator, mounting the cable trays, installing the cables.

The foreman takes care for the daily operation, communication and total manpower. The foreman shall also attend the completion check.

Electrical installation mechanics are responsible for installing the cabinets and the ESRB and Emergency Stop Pushbutton station, cable trays. The installation mechanics have to assist at unloading of the electrical cabinets. After unloading they have to transport and install the cabinets into the right position. After installation of the electrical cabinets they can install the cable trays. The Installation mechanics need to have experience with installing cable trays and control panels.

Cable installers are responsible for putting all the cables into the right cable tray according the cable list. The cables are prefabricated and connectors are already connected to these cables. Each cable shall get a cable number according the cable diagram. The cable installers must have experience with installing the cables used in this installation.

Electrical installers are responsible for connecting the cables into the panels and on the servomotors according the installation list. After installation a cold wire check for all the non-prefabricated cables will be done. The electrical installers are also responsible for installing the cables and the hardware in the control room.

The electrical installers must have experience with connecting cables, and need to be qualified for installing power cables, network cabling and sensor cables.

3.3 Logistics

See also section 6.3 “Resources at site”.

#	Logistics	Supplied by
1	Mobile crane (as currently present in the building).	CUSTOMER
1	Hoisting beam according TBD	
-	Hoisting equipment (lifting eyes, slings, D-connectors, etc.) for handling the sections.	
2	Chain hoist - 5 ton, 2x chain hoist - 2 ton.	
1	Pallet truck with a capacity of 1000 kg to lift the electrical panels on the concrete.	

3.4 Tools

#	Tools	Supplied by
1	Set of combination spanners, open end/ring (metric sizes).	INSTALLER
1	Set of normal tools (screwdrivers, wrenches, steel hammer, Torx key T8, T10, T15, T20, Set of Allen keys, etc.).	
2	Electric hammer drill, approx. 1000 Watt and diamond core bits 24 mm suitable for drill depth of 210 mm in concrete.	
1	Calibrated torque wrench with a range suitable for 60 - 120 Nm Note: always apply torque in two or more steps.	
1	Calibrated torque wrench with a range suitable for 100 - 800 Nm Note: always apply torque in three or more steps.	
1	Calibrated torque wrench with a range suitable for 750 - 1500 Nm Note: always apply torque in three or more steps.	
1	Belt tension measurement tool	CONTRACTOR
1	Mounting Motion Box	
1	Acceptance/rejection caliber for checking the waveboard sections clearance	
		INSTALLER
1	Laser level or spirit level length approx. 30 cm (= “water level”).	
2	Crowbar, medium length.	
1	Total Station Theodolite	
1	Rotating laser	
4	Locking strut according TBD	CONTRACTOR


3.5 Mounting materials

#	Mounting materials	Supplied by
16	Anchor set M20x310 according TBD	CONTRACTOR
16	Injection Mortar Hilti HIT-RE 500-SD Mortar (40 cc)	
1	Drilling template	CONTRACTOR

	Torque values [Nm]		
Bolt diam.	8.8	10.9	Anchor rod
M12	60	85	
M14	90	130	
M16	145	205	80
M20	285	400	150
M24	490	690	
M30	990	1390	300

**Torque value is for bolts mounted with grease.*

3.6 Grouting

	<p>CAUTION Before the grout is used, make sure that the supplier safety instructions are available. All persons working with the grout must observe the supplier safety instructions.</p>
---	---

#	Grouting	Supplied by
1	Set of grouting tools (moulds) to grout the sections assemblies simultaneously.	CONTRACTOR
500 gr	Vaseline for greasing the moulds.	INSTALLER
16	Grout, Pagel type V1 (2 liter)	
1	Stirring device to mix the grout. This stirring device should fit in the 20 liter bucket and be driven by the electrical drill.	
1	Flexible metal wire for distribution of grout under base frame	
1	Silicon sealant gun	
10	Tube of white silicon mastic.	

3.7 Paint



NOTE

- Use cleaning agents and solvents sparingly. Use of aggressive products can cause damage to parts.
- Only use recommended lubricants, tools and test equipment or permitted alternatives, according to original Bosch Rexroth B.V. instructions.

See Preservation specification [44].

3.8 Miscellaneous

#	Miscellaneous	Supplied by
1	Vacuum cleaner	INSTALLER
5	Waterproof marker pen.	
-	Sufficient rolls of isolation or grey duct tape, width approx. 2-7 cm.	

4 Handling & Transport



WARNING

Wear a safety helmet, eye-protection and protective footwear during installation activities on the segmented wave generator.



WARNING

Personnel that handle the system must never undertake such actions that cause damage to the installation or environment or that cause dangerous situations.

4.1 Equipment unloading

- 4x MCC control panels
- 1x WCC panel
- 20x Segments (600 mm [W] x 5000 mm [H] x 4000 m x 500 kg each) Each split in body, arc, two spokes.
- 20x Sets of bearing pillow blocks for mounting of the segments.
- 4x Bearing base plates 3m x 0.6m for mounting of segments 5x segments mounted on each based plate. Base plate are pre drilled for anchor bolts, as well as for bearing pillow blocks.
- 20x Triangular drive frames (500 kg each)
- 20x Gearboxes
- 20x Sprockets with clamping hub
- 20x Timing belts
- 20x Electric servo motors (125 kg each)
- 60x Glue type floor anchors (18 mm x 250 mm)
- 40x Glue type wall anchors (14 mm x 250 mm)
- 1x Template for marking of floor anchors
- 1x Template for marking of wall anchors
- 20x Servo motor power cable (40 mm OD) assemblies 25 meters long.
- 20x Servo motor signal (18 mm OD) cables 25 meters long.
- 20x Servo motor fan (14 mm OD) cables 25 meters long.
- 20x Water level transducer cables (50 meters x 10 mm OD)
- 1x Set of underwater cable trays for routing of the Water Level Transducer cabling.

Unload the equipment with the crane on the truck.

4.2 Hoisting



CAUTION

- Use the proper hoisting equipment to transport the components.
- Make sure that the center of gravity of the components is located in the center of the hoisting points to guarantee stability during hoisting.
- Use attachment points and shackles of sufficient strength and size to prevent components falling down.

Each large sub-assembly has connection points to hoist the equipment safely. If no hoisting provisions are supplied on the component, the installation/maintenance personnel must decide where and how the individual parts are hoisted. However, it is required to use common sense and caution when the components are handled. Connection points of components with a higher weight than 400 kg are indicated on the drawings. If any additional information is required, please contact Bosch Rexroth B.V.

4.2.1 *Local power distribution cabinet*

It is recommended to transport the Local Power Distribution Cabinet (LPDC) on a wooden pallet by means of a pallet truck and/or forklift. The layout of the LPDC is shown on [40] "Layout drawing - LPDC". Weight and dimensions are given in the following table.

Quantity	Dimensions (H x W x D) [mm]	Weight [kg]
1	2200 x 505 x 400	150

4.2.2 *Motor control cabinet*

It is recommended to transport the Motor Control Cabinet (MCC) on a wooden pallet by means of a pallet truck and/or forklift. The layout of the MCC is shown on [41] "Layout diagram - MCC". The weight and dimensions are given in the following table.


Quantity	Dimensions (H x W x D) [mm]	Weight [kg]
1	2200 x 1400 x 505	450

4.2.3 *Operator station*

Use the original box to protect the computer, monitor and other components of the operator station from damage during transportation.

4.3 Section assembly transport position

The width of each section assembly is smaller than 2.50 meter and is therefore under EEC transportation legislation and regulations not considered as an oversize load.

	<p>CAUTION</p> <ul style="list-style-type: none">• Lash down the section assembly securely to the provided dedicated transport frame to prevent it from tipping over and to restrain it in this position under all conceivable circumstances.• Always use the provided dedicated transport frame to prevent damage to the segments.
---	---

The layout, lifting points and dimensions of the section assemblies are shown on referenced document [8]. The weight and dimensions are given in the following table.

Section assembly	Quantity	Dimensions (H x W x D) [mm]	Weight [kg]
4SegW500	2	3200 x 2000 x 2700	2000

Adhere to the hoist plan disclosed in [7] for safe lifting and handling of the section assembly of the segmented wave generator.

4.4 Packaging & temporary storage

- Protect the equipment from damage during storage, handling and/or transportation by using adequate packaging, preferably the original packaging, and transportation frames.
- Check all delivered components for damage.
- If possible, distribute the sections inside the basin on suitable places for temporary storage.

5 Dimensions and measurements

5.1 Axis definition

See Figure 5-1:. The Z-axis is positive in the upward direction (against gravity).



Figure 5-1: Coordinate system for the Segmented Wave Generator

5.2 Facility reference axis

The facility reference axis is indicated in *****

5.3 Location of equipment

The location of equipment is indicated in *****

6 Site condition and preparation

6.1 Inspection

Before installation of the segmented wave generator is started, the following items have to be ready and reported to Bosch Rexroth:

- Civil activities have to be finished according to agreements.
- Building extension has to be free from materials and the concrete has to be dust free.
- Installation area is clean and free from obstacles;
- Mounting surfaces are clean;
- all components are not damaged;
- tools and materials as specified in section 3 are available.
- Electric power and ground connections, according to the cable diagram [42] are available;
- Sufficient working light in the working area have to be installed and must be in operation.
- There is sufficient space for placement of the MCC and LPDC.
- Check the flatness of the floor (in the vicinity of the final machine position). The area where the segments are moving (working range and buffer range) must be made flat and horizontal.
- Check the presence of reference marks/lines of CUSTOMER, as specified in section 9.1. The locations of the anchor holes will later be marked using these reference lines. The CUSTOMER shall indicate the meaning of the reference lines, for instance "location of front anchors".
- Check the measuring report of the install area, as provided by Customer.

6.2 General

The INSTALLER will need to decide the best installation sequence based on their own experience and the site conditions and must provide any and all additional cranes, scaffolds etc., which may be required. It is prudent to install the triangular drive frames first, so that the segments can be supported by their mechanical stops as they are installed. During the installation, the INSTALLER will be responsible for any and all temporary supports for the segments, required to ensure a safe work environment.

6.3 Resources at site

- 2 ton overhead crane
- Bay door size 2986 [W] x 3332 [H] mm
- 575 V / 3 p / 60 Hz
- 120 VAC

6.4 Materials provided by the INSTALLER

- Cable trays 4x between each MCC cabinets and the corresponding servo motors. (Note: In between the top of the wall, and servo motors, the cables can be run in the channel that makes up the top member of the triangular drive support. IE: no additional cable tray required between the wall and the servo motors). Each cable tray supports the cabling for 5x servo motor cable sets.
- Anchors and all supports needed for the cable trays on the outside of the tank.
- Tools, lifting shackles, scaffolds, etc. as require to complete the installation.
- GFI rated tools, as work area could be damp and will have wet floors.

6.5 Not included in work

- Power wiring between building power distribution and MCC cabinets (by others)
- Removal of old wave board equipment
- Draining the tank of water
- Cofferdam to isolate the main part of the tank.

7 Equipment pre-assembly



WARNING

Wear a safety helmet, eye-protection and protective footwear during installation activities on the segmented wave generator.

- Assemble the 20x segments (600 mm [W] x 5000 mm [H] x 4000 m x 500 kg each): body, arc, two spokes and two bearing blocks, acc drawing.*****. For this, segment can be placed face-down on two wooden beams or supports. Parts will have been preassembled, checked and marked by manufacturer.
- Mount the sprockets with clamping hubs on gearbox shaft, acc drawing.*****.

8 Install electric equipment



WARNING

Wear a safety helmet, eye-protection and protective footwear during installation activities on the segmented wave generator.

- Locate and secure the 4x MCC control panels in the basement, each with 5x motor drive controllers, acc drawing.*****. (Preliminary size 1.4 m [W] x 2.1 m [H] x 0.6 m [deep] x 600 kg).
- Locate and secure 1x WCC panel at ground level beside the wave tank, acc drawing.*****. (Preliminary size 0.8 m [W] x 2.1 m [H] x 0.8 m [deep] x 250 kg).
- Install cable trays 4x between MCCs and top of wall, acc drawing.*****. (cable trays will support, main motor power cables (40 mm OD), signal cables (18 mm OD), and fan cables (14 mm OD)).
- Install cable tray from top of tank wall to WCC panel on ground floor, acc drawing.*****, for level transducer cables.
- Lay, secure and terminate servo motor power cables (20x) between MCCs and servo motors, acc drawing.*****. Cables will be supplied with connectors on both ends (cables supplied by Bosch Rexroth). INSTALLER to connect cables to motors and MCC and route cables through cable trays. Excess cable shall be stored in the MCC base space.
- Lay, secure and terminate 20x signal cables between MCC and servo motors, acc drawing.*****. Cables will be supplied with connectors on both ends (cables supplied by Bosch Rexroth). INSTALLER to connect cables in MCC and at motor, and route cables through cable trays. Excess cable shall be stored in the MCC base space.
- Lay, secure and terminate 20x motor fan power cables, acc drawing.*****. Motor end has connector, MCC end has 3 leads that need to be terminated (cables supplied by Bosch Rexroth). INSTALLER to connect cables in MCC and at motor, and route cables through cable trays. Excess cable shall be stored in the MCC base space.
- Lay, secure and terminate 20x level transducer cables between the level transducers (mounted on the segments) and the WCC, acc drawing.*****. Cables will be supplied with connectors on both ends (cables supplied by Bosch Rexroth). Transducer cables exit the segments near their hinge, run along the foundation floor in the provided underwater cable trays, and then up the back of the tank wall in the provide cable tray. Excess cable shall be stored in the WCC base space.
- All cable ends to be provided with text labels, acc drawing.*****, labels will be provided by Bosch Rexroth.
- Cabling and labeling instructions: see document *****

8.1 Control cabinets

Place the control cabinets at their designated spaces inside the building; see the interface drawing according reference document [43] for details.

The rules according EN-60204 are applicable for all cabinets. Near and on every component a typed code is placed. All metal parts like cabinets, doors and mounting plates are earthed. The installation rules of the manufacturer of the components must be followed, in addition to the instructions in reference documents [36] and [39].

The cabinets are provided with a central earth bar located in the bottom of the cabinet. Make sure that all parts of the cabinet (doors, mounting plates, transformers, power supplies, etc.) are connected to this bar. The size of the ground conductor must be according the instruction manual provided with the components. To ensure a good connection on painted surfaces, remove the paint first.

When securing connections for current carrying parts (DC link, motor connections, bus bars, etc.), observe the tightening torques as specified in the table below.

Bolt size	M6	M8	M10	M12
Torque	6 Nm	13 Nm	25 Nm	50 Nm



CAUTION

To prevent damage to the cabling, strictly adhere to the minimal bending radius according the supplied datasheets. When damage is found, immediately replace interconnecting cabling.

Before installation is started, make sure that:

- all components are present;
- all delivered components have no damage and/or corrosion;
- electrical power and ground connections are available;
- the installation area is clean and free from obstacles;
- the mounting surfaces are clean;

All cables and cable trays must be installed by the CUSTOMER. The cabling diagram according reference document [42] and the instructions according [39] can be used for the cabling activities. General installation instructions of electrical cabling are given in reference documents [36] and [39]. An overview of all cabling between the assemblies is given in the cable diagram according reference document [42].

- Mount the cabinets in the correct position and orientation according the interface drawing [43].
- Make sure that the mounting bolts are tightened properly.
- All interconnecting cabling must be supported properly.
- Install, mount and connect all power cables and signal cables into the cabinets according the cable diagram [42] and the connection diagrams.

9 Prepare main foundation



WARNING

Wear a safety helmet, eye-protection and protective footwear during installation activities on the segmented wave generator.



WARNING

Wear a life jacket when working above the water.



WARNING

Make sure that there are no obstacles in the installation area of the system.

Access stair

- Laser locate 10x wall holes, using the template provided.
- Drill the wall holes in existing concrete 12 mm diameter and 150 mm deep. Plan for some embedded steel so diamond bits should be allowed for.
- Install wall anchors, see 9.1.
After curing randomly select 4 anchors for pull test.
- Install the access stair on the rear wall

Base plates:

- Laser locate and level 60x floor foundation holes, using the template provided.
- Drill the floor foundation holes in existing concrete 18 mm diameter and 250 mm deep. Plan for some embedded steel so diamond bits should be allowed for.
- Install the floor anchors, see 9.1.
After curing randomly select 4 anchors for pull test.
- Install 4x floor base plates, and align and level using the nuts, see ****

Triangular frames:

- Laser locate and level 60x wall holes, using the template provided.
- Drill 40x wall holes in existing concrete 14 mm diameter and 250 mm deep. Plan for some embedded steel so diamond bits should be allowed for.
- Install the wall anchors, see 9.1.
After curing randomly select 4 anchors for pull test.
- Drill 20x wall holes in existing concrete 100 mm diameter and 50 mm deep. Plan for some embedded steel so diamond bits should be allowed for. These holes serve to transmit shear forces; they will not receive any bolt.

9.1 Details on installation of adhesive anchors

1. Clean the floor by water jet blasting, at least 150 bar and less than 10 cm distance, to remove the weak surface skin of the concrete floor.
2. Mark the location of the anchor rods on the floor. Use the drilling template to mark all holes for each section assembly. Note the correct orientation of the section assemblies according to reference document [43].
3. Drill the anchor rod holes. Ensure the drilling will not cause leakage of the basin. See reference document [43] for the correct dimension of the drill and the drilling depth!
4. Before placing the anchors, make sure that all holes have the correct depth! This can easily be checked with an anchor rod. Sometimes, after drilling, a piece of concrete stays behind in the hole, then the contact length between anchor and concrete is not long enough to absorb the forces of the wave generator.
5. Follow the instructions from Hilti to clean the holes and mount the adhesive anchors. These anchors shall preferably make no electrical contact with the reinforcement bars within the concrete.
6. Mount the small hexagon M20 nut, the washer and finally the plastic ring on the anchor rod. Note that the height of the grout will be approximately 40 mm. Adjust all rings to the nominal height.

10 Install mechanical equipment



WARNING

Wear a safety helmet, eye-protection and protective footwear during installation activities on the segmented wave generator.



WARNING

Wear a life jacket when working above the water.



WARNING

Make sure that there are no obstacles in the installation area of the system.

The following subsections give the installation instructions for the main components of the system.

Remarks:

- Check the preservation and touch-up with paint (if necessary) according to reference document [44]. Apply Loctite 574 to all not-preserved contact faces.
- Mount all components in the correct position and orientation.
- Tighten all bolts with the required torques as specified on the drawings or by the CUSTOMER. Mount all bolts and screws with Loctite 243, unless specified otherwise.
- Apply Loctite 510 to the mounting surfaces.
- Seal all tapped holes with Loctite 510.

Assembled segments can be hoisted in horizontal pose over the wall top. Segments will be engineered with attachment points and center of gravity marks, so it can be handled, rotated vertically and mounted on the foundation with normal hoist tools/slings etc. Same for body, spokes and arc. (Any special tool for this handling will be needed by the manufacturer anyway, and he will ship it with the segments.)

Starting at segment 20, North wall:

1. Install one triangular drive frame on walls and adjust using provided "adjustment" nuts. Secure nuts when in position. Adjusting the triangle frames on the wall will cause the drive housing to mainly to translate in X,Y,Z. Use an optical instrument to verify the correct position of the frame tip. The connection between drive housing and triangle frame tip will have angular correction capabilities (maybe +/- 1 degree) for angular alignment above the arc face.
2. Install horizontal tie rods in between the segment triangular frames.
3. Hoist in segment, and install vertical by bolting bearing pillow block down to base plate.
4. Level segment as required using base plate leveling nuts. Lock nuts once board is level.

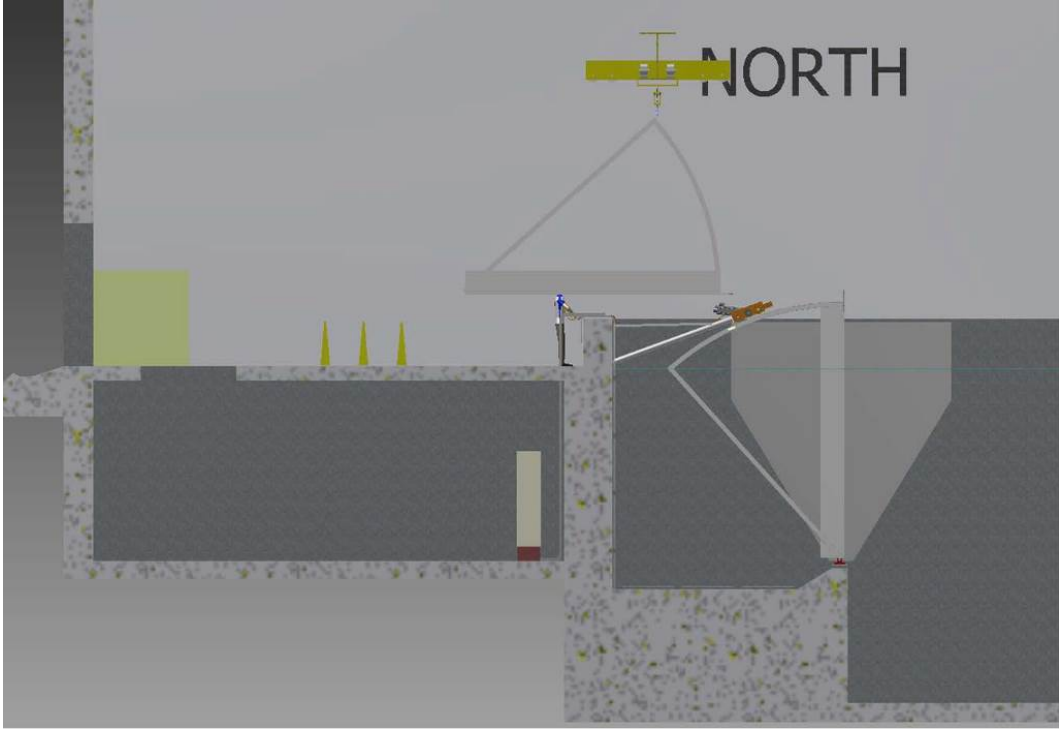
5. Ease the segment backward to the mechanical stop, using the overhead crane.
6. Gearbox with pulley attached can be mounted into the side of the drive housing; pulley is relatively small in diameter.
7. There is a timing belt along the top of the drive arc, which needs to be threaded through the servo sprocket head. After which, the timing belt tensions will need to be pre-adjusted. Note, that there are mechanical stops at both ends of the drive arc, which can be used to help support the segment positioning while the timing belts are being installed, and tensioned. At this point, the segment can still be moved.
8. Electric servo motor will need to be mounted to the gearboxes once the segments, and triangle drive frames have been secured. At this point, the segment can only be moved by the servo motor, because the motors have brakes.
7. Once segments are installed, drives will be operated (by Bosch Rexroth) in a de-rated mode with a Mounting Motion Box to ensure that the clearances between segments is maintained throughout the segment travel. The INSTALLER will need to make alignment adjustments as required. The alignment will be checked with adjacent segments in backward, vertical and forward pose. Keep a record of segment number, pose angle, gap data, where from the hinge, when and by who.
9. Record the gap measurements
10. Adjust the parallelism between adjacent segments. Arcs must travel parallel to drive sprocket on timing belt.

Proceed with the next segment.

10.1 Alignment of segments to drive sprockets

The alignment of the segments (mounted to foundation) to the drive units (mounted on triangular frames which need to be bolted to the tank wall) is critical. So alignment of these two assemblies in 3 planes is essential. As a guide the expected tolerance in each of the three planes (X, Y & Z) is +/- 2 mm. Adjusting the triangle frames on the wall will cause the drive housing mainly to translate in X, Y, Z. The connection between drive housing and triangle frame tip will have angular correction capabilities (maybe +/- 1 degree) for angular alignment above the arc face.

Drive housing will get features such as manipulation holes/guide strips for timing belt install/remove. Timing belt pre-stress features will be engineered into the system. Regular tools suffice. We will include a belt tension meter that can measure the resonance frequency of a free belt part (guitar string principle, more stress is higher tone). Adjust while segment is resting backward on the rubber hard stop.



10.2 **Alignment of section assemblies**

1. Clean the floor, if necessary with soap/solvent, in the area around the mounting plates thoroughly to ensure proper adhesion of grouting material. No grease or dirt is allowed.
2. Lift the section assembly, using the mobile crane, and remove the transportation support frame.
3. Clean the underside of the mounting feet by water jet blasting, at least 150 bar and less than 10 cm distance, to remove any paint, dirt and grease. Check the cleanliness.
4. Lower the section assembly over the 8 related anchor rods, using the mobile crane. Be aware that the segments shall never touch the floor (damage to the driving parts may occur).
5. Keep the load partly supported in the crane while adjusting and aligning the section assembly. Each waveboard segment can be moved forward/backward by hand. The gap between the segments of adjacent section assemblies shall be 4 mm.
6. Adjust the nuts on the anchor rods such that the above tolerances are met. Use the caliber to make sure that the gaps are not too large or too small.
7. Manually move the segments of adjacent section assemblies over its full stroke and check the distance fore and aft between the waveboard segments of the adjacent section assemblies. The distance shall be 4 mm. If required, slide to left or right (Y-direction) and/or rotate around Z-direction.
8. Mount the washer and tighten the hexagonal M20 nut on the four anchor rods on the backside of the section assembly with approximately 30 Nm.
9. Release the load from the overhead crane. Be aware that the section assembly will fall forward when the washer and nut are not installed on the backside of the section assembly.

11 Finish foundation



WARNING

Wear a safety helmet, eye-protection and protective footwear during installation activities on the segmented wave generator.



WARNING

Wear a life jacket when working above the water.



WARNING

Make sure that there are no obstacles in the installation area of the system.

On completion of successful alignment motion, the floor and wall base plates will need to be permanently grouted into position.

11.1 Pouring the grout

1. Make sure that all section assemblies are aligned correctly.
2. Prepare a mould around each pair of mounting supports of the section assemblies. First grease/wax the inside of the mould, to prevent the grout from glueing to it.
Warning: no grease/wax is allowed on the concrete floor or on the mounting plate.
3. Seal the outer circumference of the mould against the concrete floor with silicone sealant, to avoid grout leakage.



CAUTION

- Before the grout is used, make sure that the supplier safety instructions are available. All persons working with the grout must observe the supplier safety instructions.
- Mix the grouting components thoroughly by using a stirring device.

4. Prepare the grout (according "Pagel" instruction).
5. Pour the grout slowly (according "Pagel" instruction). Use the flexible metal wire to spread the grout under the mounting supports and to remove any air bubbles. The level of the grout should remain approximately **5 mm** above the underside of the frame foot (10 mm below the top surface of the frame foot).
6. After complete curing of the grout, remove the mould and all remains of grease/wax and sealant.

11.2 Horizontal rear absorber

- Laser locate and level 40x wall holes, using the template provided.
- Drill the wall holes in existing concrete 12 mm diameter and 150 mm deep. Plan for some embedded steel so diamond bits should be allowed for.
- Install wall anchors, see 9.1.
After curing randomly select 4 anchors for pull test.
- Install the horizontal rear dampers on the basin wall at the back of the section assemblies as indicated on the mechanical interface drawing [43].

11.3 Underwater cable trays

- Laser locate 30x floor holes, using the template provided.
- Drill the floor holes in existing concrete 12 mm diameter and 150 mm deep. Plan for some embedded steel so diamond bits should be allowed for.
- Install floor anchors, see 9.1.
After curing randomly select 4 anchors for pull test.
-
- Laser locate 10x wall holes, using the template provided.
- Drill the wall holes in existing concrete 12 mm diameter and 150 mm deep. Plan for some embedded steel so diamond bits should be allowed for.
- Install wall anchors, see 9.1.
After curing randomly select 4 anchors for pull test.
-
- Install all underwater cable trays on the foundation floor, and up the end wall for routing of the level transducer cables.

11.4 Tighten the anchor rods

1. Wait until the grout is completely cured, see Pagel instructions.
2. Torque the hexagon M20 nut on all 8 anchor rods of each section assembly with 100 Nm in at least 2 steps in 24h intervals; see also "Hilti" instructions. Keep a record which anchors were done, when, at what torque, and by who.

12 Finish and cleanup



WARNING

Wear a safety helmet, eye-protection and protective footwear during installation activities on the segmented wave generator.



WARNING

Wear a life jacket when working above the water.



WARNING

Make sure that there are no obstacles in the installation area of the system.

Clean and wash the area; no grease or oil should remain behind. Make sure nothing washes off into the tank area; pump everything out and use absorbing material for the remainder.

Paint the base plates and bearing blocks by hand in a three layer 2-component paint system (see ***); this serves to reduce any remaining galvanic action.
Leave the remaining paint behind (opened canisters), for possible touchup work.

13 Inspection and acceptance by CONTRACTOR

TBD

- Inspect the torque and gap reports
- Random selection of 3 segment pairs for gap measurements (backward, vertical, forward). For this, disconnect the motor cables and connect the Mounting Motion Box cables.
- Random check of bolt torques
- Inspect the voltage test reports
- Inspect the electrical cabling and finishing.

Touch up paint as required.

14 Pre-commissioning

WARNING



- Only use the system for its intended purpose. It is the responsibility of the operator that the system is operated in the right way. Unexpected movements of the system can cause injuries.
- Keep away from the danger zone when the system is activated. Personnel can be drawn into the system by e.g. long hair, scarves or loose hanging cloths. Only trained personnel are permitted to be near the system during operation.
- Personnel that operate the system must at all times keep the system under close observation especially during operation.



WARNING

Make sure that it is safe to start the system. Make sure that all electrical and mechanical connections are properly connected. If one or more cables are not connected, do not start the electrical power.

CAUTION



- During commissioning only local control is allowed.
- Do not start the equipment before the installation and the area around the installation are free of obstacles and persons.
- Make sure that the area around the system is illuminated properly.
- Never alter adjustments and parameters, unless it is disclosed in this instruction manual.
- Do not use the system if cracks or damage is observed in the mechanical construction. Replace damaged parts before the system is restarted.
- Use a controlled stop to end the operation as soon as possible if failures are observed. Do not restart the installation unless the failure is remedied.

Before the system is started for the first time, check that:

- all nuts and bolts are tightened with the correct torque;
- All segments have 0-5 mm clearance, left and right, over full working stroke over the full segment height;
- the machine area is properly indicated and free from obstacles and persons;
- the customer's safety features are properly installed and working;
- all electrical cables are connected properly;
- the interconnecting cabling is connected according the cabling diagram [42];
- the emergency-stop signals from the facility are connected;
- all installed emergency-stop buttons are working properly;
- all circuit breakers in the MCC and LPDC are switched on;
- all safety pictograms and instruction labels/stickers are provided, see chapter 2.



TP1 Amount Payable – General

1.1 Subject to any other provisions of the contract, Her Majesty shall pay the Contractor, at the times and in the manner hereinafter set out, the amount by which

1.1.1 the aggregate of the amounts described in TP2 exceeds

1.1.2 the aggregate of the amounts described in TP3

and the Contractor shall accept that amount as payment in full satisfaction for everything furnished and done by him in respect of the work to which the payment relates.

TP2 Amounts Payable to the Contractor

2.1 The amounts referred to in TP1.1.1 are the aggregate of

2.1.1 the amounts referred to in the Articles of Agreement, and

2.1.2 the amounts, if any, that are payable to the Contractor pursuant to the General Conditions.

TP3 Amounts Payable to Her Majesty

3.1 The amounts referred to in TP1.1.2 are the aggregate of the amounts, in any, that the Contractor is liable to pay Her Majesty pursuant to the contract.

3.2 When making any payments to the Contractor, the failure of Her Majesty to deduct an amount referred to in TP3.1 from an amount referred to in TP2 shall not constitute a waiver of the right to do so, or an admission of lack of entitlement to do so in any subsequent payment to the Contractor.

TP4 Time of Payment

4.1 In these Terms of Payment

4.1.1 The “payment period” means a period of 30 consecutive days or such other longer period as is agreed between the Contractor and the Departmental Representative.

4.1.2 An amount is “due and payable” when it is due and payable by Her Majesty to the Contractor according to TP4.4, TP4.7 or TP4.10.

4.1.3 An amount is overdue when it is unpaid on the first day following the day upon which it is due and payable.

4.1.4 The “date of payment” means the date of the negotiable instrument of an amount due and payable by the Receiver General for Canada and given for payment.

4.1.5 The “Bank Rate” means the discount rate of interest set by the Bank of Canada in effect at the opening of business on the date of payment.



- 4.2 The Contractor shall, on the expiration of a payment period, deliver to the Departmental Representative in respect of that payment period a written progress claim that fully describes any part of the work that has been completed, and any material that was delivered to the work site but not incorporated into the work during that payment period.
- 4.3 The Departmental Representative shall, not later than ten days after receipt by him of a progress claim referred to in TP4.2,
- 4.3.1 inspect the part of the work and the material described in the progress claim; and
- 4.3.2 issue a progress report, a copy of which the Departmental Representative will give to the Contractor, that indicates the value of the part of the work and the material described in the progress claim that, in the opinion of the Departmental Representative,
- 4.3.2.1 is in accordance with the contract, and
- 4.3.2.2 was not included in any other progress report relating to the contract.
- 4.4 Subject to TP1 and TP4.5 Her Majesty shall, not later than 30 days after receipt by the Departmental Representative of a progress claim referred to in TP4.2, pay the Contractor
- 4.4.1 an amount that is equal to 95% of the value that is indicated in the progress report referred to in TP4.3.2 if a labour and material payment bond has been furnished by the Contractor, or
- 4.4.2 an amount that is equal to 90% of the value that is indicated in the progress report referred to in TP4.3.2 if a labour and material payment bond has not been furnished by the Contractor.
- 4.5 It is a condition precedent to Her Majesty's obligation under TP4.4 that the Contractor has made and delivered to the Departmental Representative,
- 4.5.1 a statutory declaration described in TP4.6 in respect of a progress claim referred to in TP4.2,
- 4.5.2 in the case of the Contractor's first progress claim, a construction schedule in accordance with the relevant sections of the Specifications, and
- 4.5.3 if the requirement for a schedule is specified, an update of the said schedule at the times identified in the relevant sections of the Specifications.
- 4.6 A statutory declaration referred to in TP4.5 shall contain a deposition by the Contractor that
- 4.6.1 up to the date of the Contractor's progress claim, the Contractor has complied with all his lawful obligations with respect to the Labour Conditions; and
- 4.6.2 up to the date of the Contractor's immediately preceding progress claim, all lawful obligations of the Contractor to subcontractors and suppliers of material in respect of the



work under the contract have been fully discharged.

- 4.7 Subject to TP1 and TP4.8, Her Majesty shall, not later than 30 days after the date of issue of an Interim Certificate of Completion referred to in GC44.2, pay the Contractor the amount referred to in TP1 less the aggregate of
- 4.7.1 the sum of all payments that were made pursuant to TP4.4;
 - 4.7.2 an amount that is equal to the Departmental Representative's estimate of the cost to Her Majesty or rectifying defects described in the Interim Certificate of Completion; and
 - 4.7.3 an amount that is equal to the Departmental Representative's estimate of the cost to Her Majesty of completing the parts of the work described in the Interim Certificate of Completion other than the defects referred to in TP4.7.2.
- 4.8 It is a condition precedent to Her Majesty's obligation under TP4.7 that the Contractor has made and delivered to the Departmental Representative,
- 4.8.1 a statutory declaration described in TP4.9 in respect of an Interim Certificate of Completion referred to in GC44.2, and
 - 4.8.2 if so specified in the relevant sections of the Specifications, and update of the construction schedule referred to in TP4.5.2 and the updated schedule shall, in addition to the specified requirements, clearly show a detailed timetable that is acceptable to the Departmental Representative for the completion of any unfinished work and the correction of all defects.
- 4.9 A statutory declaration referred to in TP4.8 shall contain a deposition by the contractor that up to the date of the Interim Certificate of Completion the Contractor has
- 4.9.1 complied with all of the Contractor's lawful obligations with respect to the Labour Conditions;
 - 4.9.2 discharged all of the Contractor's lawful obligations to the subcontractors and suppliers of material in respect of the work under the contract; and
 - 4.9.3 discharged the Contractor's lawful obligations referred to in GC14.6.
- 4.10 Subject to TP1 and TP4.11, Her Majesty shall, not later than 60 days after the date of issue of a Final Certificate of Completion referred to in GC44.1, pay the Contractor the amount referred to in TP1 less the aggregate of
- 4.10.1 the sum of all payments that were made pursuant to TP4.4; and
 - 4.10.2 the sum of all payments that were made pursuant to TP4.7.
- 4.11 It is a condition precedent to Her Majesty's obligation under TP4.10 that the Contractor has made and delivered a statutory declaration described in TP4.12 to the Departmental Representative.



- 4.12 A statutory declaration referred to in TP4.11 shall, in addition to the depositions described in TP4.9, contain a deposition by the Contractor that all of the Contractor's lawful obligations and any lawful claims against the Contractor that arose out of the performance of the contract have been discharged and satisfied.

TP5 Progress Report and Payment Thereunder Not Binding on Her Majesty

- 5.1 Neither a progress report referred to in TP4.3 nor any payment made by Her Majesty pursuant to these Terms of Payment shall be construed as an admission by Her Majesty that the work, material or any part thereof is complete, is satisfactory or is in accordance with the contract.

TP6 Delay in Making Payment

- 6.1 Notwithstanding GC7 any delay by Her Majesty in making any payment when it is due pursuant to these Terms of Payment shall not be a breach of the contract by Her Majesty.
- 6.2 Her Majesty shall pay, without demand from the Contractor, simple interest at the Bank Rate plus 1 -1/4 per centum on any amount which is overdue pursuant to TP4.1.3, and the interest shall apply from and include the day such amount became overdue until the day prior to the date of payment except that
- 6.2.1 interest shall not be payable or paid unless the amount referred to in TP6.2 has been overdue for more that 15 days following
- 6.2.1.1 the date the said amount became due and payable, or
- 6.2.1.2 the receipt by the Departmental Representative of the Statutory Declaration referred to in TP4.5, TP4.8 or TP4.11,
- whichever is the later, and
- 6.6.2 interest shall not be payable or paid on overdue advance payments if any.

TP7 Right of Set-off

- 7.1 Without limiting any right of set-off or deduction given or implied by law or elsewhere in the contract, Her Majesty may set off any amount payable to Her Majesty by the Contractor under this contract or under any current contract against any amount payable to the Contractor under this contract.
- 7.2 For the purposes of TP7.1, "current contract" means a contract between Her Majesty and the Contractor
- 7.2.1 under which the Contractor has an undischarged obligation to perform or supply work, labour or material, or
- 7.2.2 in respect of which Her Majesty has, since the date of which the Articles of Agreement were made, exercised any right to take the work that is the subject of the contract out of the Contractor's hands.



TP8 Payment in Event of Termination

- 8.1 If the contract is terminated pursuant to GC41, Her Majesty shall pay the Contractor any amount that is lawfully due and payable to the Contractor as soon as is practicable under the circumstances.

TP9 Interest on Settled Claims

- 9.1 Her Majesty shall pay to the Contractor simple interest on the amount of a settled claim at an average Bank Rate plus 1 ¼ per centum from the date the settled claim was outstanding until the day prior to the date of payment.
- 9.2 For the purposes of TP9.1,
- 9.2.1 a claim is deemed to have been settled when an agreement in writing is signed by the Departmental Representative and the Contractor setting out the amount of the claim to be paid by Her Majesty and the items or work for which the said amount is to be paid.
- 9.2.2 an "average Bank Rate" means the discount rate of interest set by the Bank of Canada in effect at the end of each calendar month averaged over the period the settled claim was outstanding.
- 9.2.3 a settled claim is deemed to be outstanding from the day immediately following the date the said claim would have been due and payable under the contract had it not been disputed.
- 9.3 For the purposes of TP9 a claim means a disputed amount subject to negotiation between Her Majesty and the Contractor under the contract.



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GC1 Interpretation

1.1 In the contract

- 1.1.1 where reference is made to a part of the contract by means of numbers preceded by letters, the reference shall be construed to be a reference to the particular part of the contract that is identified by that combination of letters and numbers and to any other part of the contract referred to therein;
- 1.1.2 “contract” means the contract document referred to in the Articles of Agreement;
- 1.1.3 “contract security” means any security given by the Contractor to Her Majesty in accordance with the contract;
- 1.1.4 “Departmental Representative” means the officer or employee of Her Majesty who is designated pursuant to the Articles of Agreement and includes a person specially authorized by him to perform, on his behalf, any of his functions under the contract and is so designated in writing to the Contractor;
- 1.1.5 “material” includes all commodities, articles and things required to be furnished by or for the Contractor under the contract for incorporation into the work;
- 1.1.6 “Minister” includes a person acting for, or if the office is vacant, in place of the Minister and his successors in the office, and his or their lawful deputy and any of his or their representatives appointed for the purposes of the contract;
- 1.1.7 “person” includes, unless the context otherwise requires, a partnership, proprietorship, firm, joint venture, consortium and a corporation;
- 1.1.8 “plant” includes all animals, tools, implements, machinery, vehicles, buildings, structures, equipment and commodities, articles and things other than material, that are necessary for the due performance of the contract;
- 1.1.9 “subcontractor” means a person to whom the Contractor has, subject to GC4, subcontracted the whole or any part of the work;
- 1.1.10 “superintendent” means the employee of the Contractor who is designated by the Contractor to act pursuant to GC19;
- 1.1.11 “work includes, subject only to any express stipulation in the contract to the contrary, everything that is necessary to be done, furnished or delivered by the Contractor to perform the contract.

1.2 The headings in the contract documents, other than in the Plans and Specifications, form no part of the contract but are inserted for convenience of reference only.

1.3 In interpreting the contract, in the event of discrepancies or conflicts between anything in the Plans and Specifications and the General Conditions, the General Conditions govern.



- 1.4 In interpreting the Plans and Specifications, in the event of discrepancies or conflicts between
- 1.4.1 the Plans and Specifications, the Specifications govern;
 - 1.4.2 the Plans, the Plans drawn with the largest scale govern; and
 - 1.4.3 figured dimensions and scaled dimensions, the figured dimensions govern.

GC2 Successors and Assigns

- 2.1 The contract shall inure to the benefit of and be binding upon the parties hereto and their lawful heirs, executors, administrators, successors and assigns.

GC3 Assignment of Contract

- 3.1 The contract may not be assigned by the Contractor, either in whole or in part, without the written consent of the Minister.

GC4 Subcontracting by Contractor

- 4.1 Subject to this General Condition, the Contractor may subcontract any part of the work.
- 4.2 The Contractor shall notify the Departmental Representative in writing of his intention to subcontract.
- 4.3 A notification referred to in GC4.2 shall identify the part of the work, and the subcontractor with whom it is intended to subcontract.
- 4.4 The Departmental Representative may object to the intended subcontracting by notifying the Contractor in writing within six days of receipt by the Departmental Representative of a notification referred to in GC4.2.
- 4.5 If the Departmental Representative objects to a subcontracting pursuant to GC4.4, the Contractor shall not enter into the intended subcontract.
- 4.6 The contractor shall not, without the written consent of the Departmental Representative, change a subcontractor who has been engaged by him in accordance with this General Condition.
- 4.7 Every subcontract entered into by the Contractor shall adopt all of the terms and conditions of this contract that are of general application.
- 4.8 Neither a subcontracting nor the Departmental Representative's consent to a subcontracting by the Contractor shall be construed to relieve the Contractor from any obligation under the contract or to impose any liability upon Her Majesty.

GC5 Amendments



- 5.1 No amendment or change in any of the provisions of the contract shall have any force or effect until it is reduced to writing.

GC6 No Implied Obligations

- 6.1 No implied terms or obligations of any kind by or on behalf of Her Majesty shall arise from anything in the contract and the express covenants and agreements therein contained and made by Her Majesty are the only covenants and agreements upon which any rights against Her Majesty are to be founded.
- 6.2 The contract supersedes all communications, negotiations and agreements, either written or oral, relating to the work that were made prior to the date of the contract.

GC7 Time of Essence

- 7.1 Time is of the essence of the contract.

GC8 Indemnification by Contractor

- 8.1 The Contractor shall indemnify and save Her Majesty harmless from and against all claims, demand, losses, costs, damages, actions, suits, or proceedings by whomever made, brought or prosecuted and in any manner based upon, arising out of, related to, occasioned by or attributable to the activities of the Contractor, his servants, agents, subcontractors and sub-subcontractors in performing the work including an infringement or an alleged infringement of a patent of invention or any other kind of intellectual property.
- 8.2 For the purpose of GC8.1, "activities" includes any act improperly carried out, any omission to carry out an act and any delay in carrying out an act.

GC9 Indemnification by Her Majesty

- 9.1 Her Majesty shall, subject to the Crown Liability Act, the Patent Act, and any other law that affects Her Majesty's rights, powers, privileges or obligations, indemnify and save the Contractor harmless from and against all claims, demands, losses, costs, damage, actions, suits or proceedings arising out of his activities under the contract that are directly attributable to
- 9.1.1 lack of or a defect in Her Majesty's title to the work site whether real or alleged; or
- 9.1.2 an infringement or an alleged infringement by the Contractor of any patent of invention or any other kind of intellectual property occurring while the Contractor was performing any act for the purposes of the contract employing a model, plan or design or any other thing related to the work that was supplied by Her Majesty to the Contractor.

GC10 Members of House of Commons Not to Benefit



- 10.1 As required by the Parliament of Canada Act, it is an express condition of the contract that no member of the House of Commons shall be admitted to any share of part of the contract or to any benefit arising therefrom.

GC11 Notices

- 11.1 Any notice, consent, order, decision, direction or other communication, other than a notice referred to in GC11.4, that may be given to the Contractor pursuant to the contract may be given in any manner.
- 11.2 Any notice, consent, order, decision, direction or other communication required to be given in writing, to any party pursuant to the contract shall, subject to GC11.4, be deemed to have been effectively given
- 11.2.1 to the Contractor, if delivered personally to the Contractor or the Contractor's superintendent, or forwarded by mail, telex or facsimile to the Contractor at the address set out in A4.1, or
- 11.2.2 to Her Majesty, if delivered personally to the Departmental Representative, or forwarded by mail, telex or facsimile to the Departmental Representative at the address set out in A1.2.1.
- 11.3 Any such notice, consent, order, decision, direction or other communication given in accordance with GC11.2 shall be deemed to have been received by either party
- 11.3.1 if delivered personally, on the day that it was delivered,
- 11.3.2 if forwarded by mail, on the earlier of the day it was received and the sixth day after it was mailed, and
- 11.3.3 if forwarded by telex or facsimile, 24 hours after it was transmitted.
- 11.4 A notice given under GC38.1.1, GC40 and GC41, if delivered personally, shall be delivered to the Contractor if the Contractor is doing business as sole proprietor or, if the Contractor is a partnership or corporation, to an officer thereof.

GC12 Material, Plant and Real Property Supplied by Her Majesty

- 12.1 Subject to GC12.2, the Contractor is liable to Her Majesty for any loss of or damage to material, plant or real property that is supplied or placed in the care, custody and control of the Contractor by Her Majesty for use in connection with the contract, whether or not that loss or damage is attributable to causes beyond the Contractor's control.
- 12.2 The Contractor is not liable to Her Majesty for any loss or damage to material, plant or real property referred to in GC12.1 if that loss or damage results from and is directly attributable to reasonable wear and tear.
- 12.3 The Contractor shall not use any material, plant or real property referred to in GC12.1 except for



the purpose of performing this contract.

- 12.4 When the Contractor fails to make good any loss or damage for which he is liable under GC12.1 within a reasonable time after being required to do so by the Departmental Representative, the Departmental Representative may cause the loss or damage to be made good at the Contractor's expense, and the Contractor shall thereupon be liable to Her Majesty for the cost thereof and shall, on demand, pay to Her Majesty an amount equal to that cost.
- 12.5 The Contractor shall keep such records of all material, plant and real property referred to in GC12.1 as the Departmental Representative from time to time requires and shall satisfy the Departmental Representative, when requested, that such material, plant and real property are at the place and in the condition which they ought to be.

GC13 Material, Plant and Real Property Become Property of Her Majesty

- 13.1 Subject to GC14.7 all material and plant and the interest of the Contractor in all real property, licenses, powers and privileges purchased, used or consumed by the Contractor for the contract shall, after the time of their purchase, use or consumption be the property of Her Majesty for the purposes of the work and they shall continue to be the property of Her Majesty.
- 13.1.1 in the case of material, until the Departmental Representative indicates that he is satisfied that it will not be required for the work, and
- 13.1.2 in the case of plant, real property, licenses, powers and privileges, until the Departmental Representative indicates that he is satisfied that the interest vested in Her Majesty therein is no longer required for the purposes of the work.
- 13.2 Material or plant that is the property of Her Majesty by virtue of GC13.1 shall not be taken away from the work site or used or disposed of except for the purposes of the work without the written consent of the Departmental Representative.
- 13.3 Her Majesty is not liable for loss of or damage from any cause to the material or plant referred to in GC13.1 and the Contractor is liable for such loss or damage notwithstanding that the material or plant is the property of Her Majesty.

GC14 Permits and Taxes Payable

- 14.1 The Contractor shall, within 30 days after the date of the contract, tender to a municipal authority an amount equal to all fees and charges that would be lawfully payable to that municipal authority in respect of building permits as if the work were being performed for a person other than Her Majesty.
- 14.2 Within 10 days of making a tender pursuant to GC14.1, the Contractor shall notify the Departmental Representative of his action and of the amount tendered and whether or not the municipal authority has accepted that amount.
- 14.3 If the municipal authority does not accept the amount tendered pursuant to GC14.1 the Contractor shall pay that amount to Her Majesty within 6 days after the time stipulated in GC14.2.



- 14.4 For the purposes of GC14.1 to GC14.3 “municipal authority” means any authority that would have jurisdiction respecting permission to perform the work if the owner were not Her Majesty.
- 14.5 Notwithstanding the residency of the Contractor, the Contractor shall pay any applicable tax arising from or related to the performance of the work under the contract.
- 14.6 In accordance with the Statutory Declaration referred to in TP4.9, a Contractor who has neither residence nor place of business in the province in which work under the contract is being performed shall provide Her Majesty with proof of registration with the provincial sales tax authorities in the said province.
- 14.7 For the purpose of the payment of any applicable tax or the furnishing of security for the payment of any applicable tax arising from or related to the performance of the work under the contract, the Contractor shall, notwithstanding the fact that all material, plant and interest of the Contractor in all real property, licenses, powers and privileges, have become the property of Her Majesty after the time of purchase, be liable, as a user or consumer, for the payment or for the furnishing of security for the payment of any applicable tax payable, at the time of the use or consumption of that material, plant or interest of the Contractor in accordance with the relevant legislation.

GC15 Performance of Work under Direction of Departmental Representative

- 15.1 The Contractor shall
- 15.1.1 permit the Departmental Representative to have access to the work and its site at all times during the performance of the contract;
 - 15.1.2 furnish the Departmental Representative with such information respecting the performance of the contract as he may require; and
 - 15.1.3 give the Departmental Representative every possible assistance to enable the Departmental Representative to carry out his duty to see that the work is performed in accordance with the contract and to carry out any other duties and exercise any powers specially imposed or conferred on the Departmental Representative under the contract.

CG16 Cooperation with Other Contractors

- 16.1 Where, in the opinion of the Departmental Representative, it is necessary that other contractors or workers with or without plant and material, be sent onto the work or its site, the Contractor shall, to the satisfaction of the Departmental Representative, allow them access and cooperate with them in the carrying out of their duties and obligation.
- 16.2 If
- 16.2.1 the sending onto the work or its site of other contractors or workers pursuant to GC16.1 could not have been reasonably foreseen or anticipated by the Contractor when entering into the contract, and



16.2.2 the Contractor incurs, in the opinion of the Departmental Representative, extra expense in complying with GC16.1, and

16.2.3 The Contractor has given the Departmental Representative written notice of his claim for the extra expense referred to in GC16.2.2 within 30 days of the date that the other contractors or workers were sent onto the work or its site,

Her Majesty shall pay the Contractor the cost, calculated in accordance with GC48 to GC50, of the extra labour, plant and material that was necessarily incurred.

GC17 Examination of Work

17.1 If, at any time after the commencement of the work but prior to the expiry of the warranty or guarantee period, the Departmental Representative has reason to believe that the work or any part thereof has not been performed in accordance with the contract, the Departmental Representative may have that work examined by an expert of his choice.

17.2 If, as a result of an examination of the work referred to in GC17.1, it is established that the work was not performed in accordance with the contract, then, in addition to and without limiting or otherwise affecting any of Her Majesty's rights and remedies under the contract either at law or in equity, the Contractor shall pay Her Majesty, on demand, all reasonable costs and expenses that were incurred by Her Majesty in having that examination performed.

GC18 Clearing of Site

18.1 The Contractor shall maintain the work and its site in a tidy condition and free from the accumulation of waste material and debris, in accordance with any directions of the Departmental Representative.

18.2 Before the issue of an interim certificate referred to in GC44.2, the Contractor shall remove all the plant and material not required for the performance of the remaining work, and all waste material and other debris, and shall cause the work and its site to be clean and suitable for occupancy by Her Majesty's servants, unless otherwise stipulated in the contract.

18.3 Before the issue of a final certificate referred to in GC44.1, the Contractor, shall remove from the work and its site all of the surplus plant and material and any waste material and other debris.

18.4 The Contractor's obligations described in GC18.1 to GC18.3 do not extend to waste material and other debris caused by Her Majesty's servants or contractors and workers referred to in GC16.1.

GC19 Contractor's Superintendent

19.1 The Contractor shall, forthwith upon the award of the contract, designate a superintendent.

19.2 The Contractor shall forthwith notify the Departmental Representative of the name, address and telephone number of a superintendent designate pursuant to GC19.1.



- 19.3 A superintendent designated pursuant to GC19.1 shall be in full charge of the operations of the Contractor in the performance of the work and is authorized to accept any notice, consent, order, direction, decision or other communication on behalf of the Contractor that may be given to the superintendent under the contract.
- 19.4 The Contractor shall, until the work has been completed, keep a competent superintendent at the work site during working hours.
- 19.5 The Contractor shall, upon the request of the Departmental Representative, remove any superintendent who, in the opinion of the Departmental Representative, is incompetent or has been conducting himself improperly and shall forthwith designate another superintendent who is acceptable to the Departmental Representative.
- 19.6 Subject to GC19.5, the Contractor shall not substitute a superintendent without the written consent of the Departmental Representative.
- 19.7 A breach by the Contractor of GC19.6 entitles the Departmental Representative to refuse to issue any certificate referred to in GC44 until the superintendent has returned to the work site or another superintendent who is acceptable to the Departmental Representative has been substituted.

GC20 National Security

- 20.1 If the Minister is of the opinion that the work is of a class or kind that involves the national security, he may order the Contractor
- 20.1.1 to provide him with any information concerning persons employed or to be employed by him for purposes of the contract; and
 - 20.1.2 to remove any person from the work and its site if, in the opinion of the Minister, that person may be a risk to the national security.
- 20.2 The Contractor shall, in all contracts with persons who are to be employed in the performance of the contract, make provision for his performance of any obligation that may be imposed upon him under GC19 to GC21.
- 20.3 The Contractor shall comply with an order of the Minister under GC20.1

GC21 Unsuitable Workers

- 21.1 The Contractor shall, upon the request of the Departmental Representative, remove any person employed by him for purposes of the contract who, in the opinion of the Departmental Representative, is incompetent or has conducted himself improperly, and the Contractor shall not permit a person who has been removed to return to the work site.

GC22 Increased or Decreased Costs



- 22.1 The amount set out in the Articles of Agreement shall not be increased or decreased by reason of any increase or decrease in the cost of the work that is brought about by an increase or decrease in the cost of labour, plant or material or any wage adjustment arising pursuant to the Labour Conditions.
- 22.2 Notwithstanding GC22.1 and GC35, an amount set out in the Articles of Agreement shall be adjusted in the manner provided in GC22.3, if any change in a tax imposed under the Excise Act, the Excise Tax Act, the Old Age Security Act, the Customs Act, the Customs Tariff or any provincial sales tax legislation imposing a retail sales tax on the purchase of tangible personal property incorporated into Real Property
- 22.2.1 occurs after the date of the submission by the Contractor of his tender for the contract,
- 22.2.2 applies to material, and
- 22.2.3 affects the cost to the Contractor of that material.
- 22.3 If a change referred to in GC22.2 occurs, the appropriate amount set out in the Articles of Agreement shall be increased or decreased by an amount equal to the amount that is established by an examination of the relevant records of the Contractor referred to in GC51 to be the increase or decrease in the cost incurred that is directly attributable to that change.
- 22.4 For the purpose of GC22.2, where a tax is changed after the date of submission of the tender but public notice of the change has been given by the Minister of Finance before that date, the change shall be deemed to have occurred before the date of submission of the tender.

GC23 Canadian Labour and Material

- 23.1 The Contractor shall use Canadian labour and material in the performance of the work to the full extent to which they are procurable, consistent with proper economy and expeditious carrying out of the work.
- 23.2 Subject to GC23.1, the Contractor shall, in the performance of the work, employ labour from the locality where the work is being performed to the extent to which it is available, and shall use the offices of the Canada Employment Centres for the recruitment of workers wherever practicable.
- 23.3 Subject to GC23.1 and GC23.2, the Contractor shall, in the performance of the work, employ a reasonable proportion of persons who have been on active service with the armed forces of Canada and have been honourably discharged therefrom.

GC24 Protection of Work and Documents

- 24.1 The Contractor shall guard or otherwise protect the work and its site, and protect the contract, specifications, plans, drawings, information, material, plant and real property, whether or not they are supplied by Her Majesty to the Contractor, against loss or damage from any cause, and he shall not use, issue, disclose or dispose of them without the written consent of the Minister, except as may be essential for the performance of the work.



- 24.2 If any document or information given or disclosed to the Contractor is assigned a security rating by the person who gave or disclosed it, the Contractor shall take all measures directed by the Departmental Representative to be taken to ensure the maintenance of the degree of security that is ascribed to that rating.
- 24.3 The Contractor shall provide all facilities necessary for the purpose of maintaining security, and shall assist any person authorized by the Minister to inspect or to take security measures in respect of the work and its site.
- 24.4 The Departmental Representative may direct the Contractor to do such things and to perform such additional work as the Departmental Representative considers reasonable and necessary to ensure compliance with or to remedy a breach of GC24.1 to GC24.3.

GC25 Public Ceremonies and Signs

- 25.1 The Contractor shall not permit any public ceremony in connection with the work without the prior consent of the Minister.
- 25.2 The Contractor shall not erect or permit the erection of any sign or advertising on the work or its site without the prior consent of the Departmental Representative.

GC26 Precautions against Damage, Infringement of Rights, Fire, and Other Hazards

- 26.1 The Contractor shall, at his own expense, do whatever is necessary to ensure that
- 26.1.1 no person, property, right, easement or privilege is injured, damaged or infringed by reasons of the Contractor's activities in performing the contract;
 - 26.1.2 pedestrian and other traffic on any public or private road or waterway is not unduly impeded, interrupted or endangered by the performance or existence of the work or plant;
 - 26.1.3 fire hazards in or about the work or its site are eliminated and, subject to any direction that may be given by the Departmental Representative, any fire is promptly extinguished;
 - 26.1.4 the health and safety of all persons employed in the performance of the work is not endangered by the method or means of its performance;
 - 26.1.5 adequate medical services are available to all persons employed on the work or its site at all times during the performance of the work;
 - 26.1.6 adequate sanitation measures are taken in respect of the work and its site; and
 - 26.1.7 all stakes, buoys and marks placed on the work or its site by or under the authority of the Departmental Representative are protected and are not removed, defaced, altered or destroyed.
- 26.2 The Departmental Representative may direct the Contractor to do such things and to perform such additional work as the Departmental Representative considers reasonable and necessary to ensure



compliance with or to remedy a breach of GC26.1.

- 26.3 The Contractor shall, at his own expense, comply with a direction of the Departmental Representative made under GC26.2.

GC27 Insurance

- 27.1 The Contractor shall, at his own expense, obtain and maintain insurance contracts in respect of the work and shall provide evidence thereof to the Departmental Representative in accordance with the requirements of the Insurance Conditions "E".

- 27.2 The insurance contracts referred to in GC27.1 shall

27.2.1 be in a form, of the nature, in the amounts, for the periods and containing the terms and conditions specified in Insurance Conditions "E", and

27.2.2 provide for the payment of claims under such insurance contracts in accordance with GC28.

GC28 Insurance Proceeds

- 28.1 In the case of a claim payable under a Builders Risk/Installation (All Risks) insurance contract maintained by the Contractor pursuant to GC27, the proceeds of the claim shall be paid directly to Her Majesty, and

28.1.1 the monies so paid shall be held by Her Majesty for the purposes of the contract, or

28.1.2 if Her Majesty elects, shall be retained by Her Majesty, in which event they vest in Her Majesty absolutely.

- 28.2 In the case of a claim payable under a General Liability insurance contract maintained by the Contractor pursuant to GC27, the proceeds of the claim shall be paid by the insurer directly to the claimant.

- 28.3 If an election is made pursuant to GC28.1, the Minister may cause an audit to be made of the accounts of the Contractor and of Her Majesty in respect of the part of the work that was lost, damaged or destroyed for the purpose of establishing the difference, if any, between

28.3.1 the aggregate of the amount of the loss or damage suffered or sustained by Her Majesty, including any cost incurred in respect of the clearing and cleaning of the work and its site and any other amount that is payable by the Contractor to Her Majesty under the contract, minus any monies retained pursuant to GC28.12, and

28.3.2 the aggregate of the amounts payable by Her Majesty to the Contractor pursuant to the contract up to the date of the loss or damage.

- 28.4 A difference that is established pursuant to GC28.3 shall be paid forthwith by the party who is determined by the audit to be the debtor to the party who is determined by the audit to be the



creditor.

- 28.5 When payment of a deficiency has been made pursuant to GC28.4, all rights and obligations of Her Majesty and the Contractor under the contract shall, with respect only to the part of the work that was the subject of the audit referred to in GC28.3, be deemed to have been expended and discharged.
- 28.6 If an election is not made pursuant to GC28.1.2 the Contractor shall, subject to GC28.7, clear and clean the work and its site and restore and replace the part of the work that was lost, damaged or destroyed at his own expense as if that part of the work had not yet been performed.
- 28.7 When the Contractor clears and cleans the work and its site and restores and replaces the work referred to in GC 28.6, Her Majesty shall pay him out of the monies referred to in GC28.1 so far as they will thereunto extend.
- 28.8 Subject to GC28.7, payment by Her Majesty pursuant to GC28.7 shall be made in accordance with the contract but the amount of each payment shall be 100% of the amount claimed notwithstanding TP4.4.1 and TP4.4.2.

GC29 Contract Security

- 29.1 The Contractor shall obtain and deliver contract security to the Departmental Representative in accordance with the provisions of the Contract Security Conditions.
- 29.2 If the whole or a part of the contract security referred to in GC29.1 is in the form of a security deposit, it shall be held and disposed of in accordance with GC43 and GC45.
- 29.3 If a part of the contract security referred to in GC29.1 is in the form of a labour and material payment bond, the Contractor shall post a copy of that bond on the work site.

GC30 Changes in the Work

- 30.1 Subject to GC5, the Departmental Representative may, at any time before he issues his Final Certificate of Completion,
- 30.1.1 order work or material in addition to that provided for in the Plans and Specifications;
and
- 30.1.2 delete or change the dimensions, character, quantity, quality, description, location or position of the whole or any part of the work or material provided for in the Plans and Specifications or in any order made pursuant to GC30.1.1,
- if that additional work or material, deletion, or change is, in his opinion, consistent with the general intent of the original contract.
- 30.2 The Contractor shall perform the work in accordance with such orders, deletions and changes that are made by the Departmental Representative pursuant to GC30.1 from time to time as if they had appeared in and been part of the Plans and Specifications.



- 30.3 The Departmental Representative shall determine whether or not anything done or omitted by the Contractor pursuant to an order, deletion or change referred to in GC30.1 increased or decreased the cost of the work to the Contractor.
- 30.4 If the Departmental Representative determines pursuant to GC30.3 that the cost of the work to the Contractor has been increased, Her Majesty shall pay the Contractor the increased cost that the Contractor necessarily incurred for the additional work calculated in accordance with GC49 or GC50.
- 30.5 If the Departmental Representative determines pursuant to GC30.3 that the cost of the work to the Contractor has been decreased, Her Majesty shall reduce the amount payable to the Contractor under the contract by an amount equal to the decrease in the cost caused by the deletion or change referred to in GC30.1.2 and calculated in accordance with GC49.
- 30.6 GC30.3 to GC30.5 are applicable only to a contract or a portion of a contract for which a Fixed Price Arrangement is stipulated in the contract.
- 30.7 An order, deletion or change referred to in GC30.1 shall be in writing, signed by the Departmental Representative and given to the Contractor in accordance with GC11.

GC31 Interpretation of Contract by Departmental Representative

- 31.1 If, at any time before the Departmental Representative has issued a Final Certificate of Completion referred to in GC44.1, any question arises between the parties about whether anything has been done as required by the contract or about what the Contractor is required by the contract to do, and, in particular but without limiting the generality of the foregoing, about
- 31.1.1 the meaning of anything in the Plans and Specification,
 - 31.1.2 the meaning to be given to the Plans and Specifications in case of any error therein, omission therefrom, or obscurity or discrepancy in their working or intention,
 - 31.1.3 whether or not the quality or quantity of any material or workmanship supplied or proposed to be supplied by the Contractor meets the requirements of the contract,
 - 31.1.4 whether or not the labour, plant or material provided by the Contractor for performing the work and carrying out the contract are adequate to ensure that the work will be performed in accordance with the contract and that the contract will be carried out in accordance with its terms,
 - 31.1.5 what quantity of any kind of work has been completed by the Contractor, or
 - 31.1.6 the timing and scheduling of the various phases of the performance of the work,
- the question shall be decided by the Departmental Representative whose decision shall be final and conclusive in respect of the work.
- 31.2 The Contractor shall perform the work in accordance with any decisions of the Departmental



Representative that are made under GC31.1 and in accordance with any consequential directions given by the Departmental Representative.

GC32 Warranty and Rectification of Defects in Work

32.1 Without restricting any warranty or guarantee implied or imposed by law or contained in the contract documents, the Contractor shall, at his own expense,

32.1.1 rectify and make good any defect or fault that appears in the work or comes to the attention of the Minister with respect to those parts of the work accepted in connection with the Interim Certificate of Completion referred to GC44.2 within 12 months from the date of the Interim Certificate of Completion;

32.1.2 rectify and make good any defect or fault that appears in or comes to the attention of the Minister in connection with those parts of the work described in the Interim Certificate of Completion referred to in GC44.2 within 12 months from the date of the Final Certificate of Completion referred to in GC44.1.

32.2 The Departmental Representative may direct the Contractor to rectify and make good any defect or fault referred to in GC32.1 or covered by any other expressed or implied warranty or guarantee.

32.3 A direction referred to in GC32.2 shall be in writing, may include a stipulation in respect of the time within which a defect or fault is required to be rectified and made good by the Contractor, and shall be given to the Contractor in accordance with GC11.

32.4 The Contractor shall rectify and make good any defect or fault described in a direction given pursuant to GC32.2 within the time stipulated therein.

GC33 Non-Compliance by Contractor

33.1 If the Contractor fails to comply with any decision or direction given by the Departmental Representative pursuant to GC18, GC24, GC26, GC31 or GC32, the Departmental Representative may employ such methods as he deems advisable to do that which the Contractor failed to do.

33.2 The Contractor shall, on demand, pay Her Majesty an amount that is equal to the aggregate of all cost, expenses and damage incurred or sustained by Her Majesty by reason of the Contractor's failure to comply with any decision or direction referred to in GC33.1, including the cost of any methods employed by the Departmental Representative pursuant to GC33.1.

GC34 Protesting Departmental Representative's Decisions

34.1 The Contractor may, within ten days after the communication to him of any decision or direction referred to in GC30.3 or GC33.1, protest that decision or direction.

34.2 A protest referred to in GC34.1 shall be in writing, contain full reasons for the protest, be signed



by the Contractor and be given to Her Majesty by delivery to the Departmental Representative.

- 34.3 If the Contractor gives a protest pursuant to GC34.2, any compliance by the Contractor with the decision or direction that was protested shall not be construed as an admission by the Contractor of the correctness of that decision or direction, or prevent the Contractor from taking whatever action he considers appropriate in the circumstances.
- 34.4 The giving of a protest by the Contractor pursuant to GC34.2 shall not relieve him from complying with the decision or direction that is the subject of the protest.
- 34.5 Subject to GC34.6, the Contractor shall take any action referred to in GC34.3 within three months after the date that a Final Certificate of Completion is issued under GC44.1 and not afterwards.
- 34.6 The Contractor shall take any action referred to in GC34.3 resulting from a direction under GC32 within three months after the expiry of a warranty or guarantee period and not afterwards.
- 34.7 Subject to GC34.8, if Her Majesty determines that the Contractor's protest is justified, Her Majesty shall pay the Contractor the cost of the additional labour, plant and material necessarily incurred by the Contractor in carrying out the protested decision or direction.
- 34.8 Costs referred to in GC34.7 shall be calculated in accordance with GC48 to GC50.

GC35 Changes in Soil Conditions and Neglect or Delay by Her Majesty

- 35.1 Subject to GC35.2 no payment, other than a payment that is expressly stipulated in the contract, shall be made by Her Majesty to the Contractor for any extra expense or any loss or damage incurred or sustained by the Contractor.
- 35.2 If the Contractor incurs or sustains any extra expense or any loss or damage that is directly attributable to
- 35.2.1 a substantial difference between the information relating to soil conditions at the work site that is contained in the Plans and Specifications or other documents supplied to the Contractor for his use in preparing his tender or a reasonable assumption of fact based thereon made by the Contractor, and the actual soil conditions encountered by the Contractor at the work site during the performance of the contract, or
- 35.2.2 any neglect or delay that occurs after the date of the contract on the part of Her Majesty in providing any information or in doing any act that the contract either expressly requires Her Majesty to do or that would ordinarily be done by an owner in accordance with the usage of the trade,

he shall, within ten days of the date the actual soil conditions described in GC35.2.1 were encountered or the neglect or delay described in GC35.2.2 occurred, give the Departmental Representative written notice of his intention to claim for that extra expense or that loss or damage.

- 35.3 When the Contractor has given a notice referred to in GC35.2, he shall give the Departmental Representative a written claim for extra expense or loss or damage within 30 days of the date that



a Final Certificate of Completion referred to in GC44.1 is issued and not afterwards.

- 35.4 A written claim referred to in GC35.3 shall contain a sufficient description of the facts and circumstances of the occurrence that is the subject of the claim to enable the Departmental Representative to determine whether or not the claim is justified and the Contractor shall supply such further and other information for that purpose as the Departmental Representative requires from time to time.
- 35.5 If the Departmental Representative determines that a claim referred to in GC35.3 is justified, Her Majesty shall make an extra payment to the Contractor in an amount that is calculated in accordance with GC47 to GC50.
- 35.6 If, in the opinion of the Departmental Representative, an occurrence described in GC35.2.1 results in a savings of expenditure by the Contractor in performing the contract, the amount set out in the Articles of Agreement shall, subject to GC35.7, be reduced by an amount that is equal to the saving.
- 35.7 The amount of the saving referred to in GC35.6 shall be determined in accordance with GC47 to GC49.
- 35.8 If the Contractor fails to give a notice referred to in GC35.2 and a claim referred to in GC35.3 within the times stipulated, an extra payment shall not be made to him in respect of the occurrence.

GC36 Extension of Time

- 36.1 Subject to GC36.2, the Departmental Representative may, on the application of the Contractor made before the day fixed by the Articles of Agreement for completion of the work or before any other date previously fixed under this General Condition, extend the time for its completion by fixing a new date if, in the opinion of the Departmental Representative, causes beyond the control of the Contractor have delayed its completion.
- 36.2 An application referred to in GC36.1 shall be accompanied by the written consent of the bonding company whose bond forms part of the contract security.

GC37 Assessments and Damages for Late Completion

- 37.1 For the purposes of this General Condition
- 37.1.1 the work shall be deemed to be completed on the date that an Interim Certificate of Completion referred to in GC44.2 is issued, and
- 37.1.2 "period of delay" means the number of days commencing on the day fixed by the Articles of Agreement for completion of the work and ending on the day immediately preceding the day on which the work is completed but does not include any day within a period of extension granted pursuant to GC36.1, and any other day on which, in the opinion of the Departmental Representative, completion of the work was delayed for reasons beyond the control of the Contractor.



- 37.2 If the Contractor does not complete the work by the day fixed for its completion by the Articles of Agreement but completes it thereafter, the Contractor shall pay Her Majesty an amount equal to the aggregate of
- 37.2.1 all salaries, wages and travelling expenses incurred by Her Majesty in respect of persons overseeing the performance of the work during the period of delay;
 - 37.2.2 the cost incurred by Her Majesty as a result of the inability to use the completed work for the period of delay; and
 - 37.2.3 all other expenses and damages incurred or sustained by Her Majesty during the period of delay as a result of the work not being completed by the day fixed for its completion.
- 37.3 The Minister may waive the right of Her Majesty to the whole or any part of the amount payable by the Contractor pursuant to GC37.2 I, in the opinion of the Minister, it is in the public interest to do so.

GC38 Taking the Work Out of the Contractor's Hands

- 38.1 The Minister may, at his sole discretion, by giving a notice in writing to the Contractor in accordance with GC11, take all or any part of the work out of the Contractor's hands, and may employ such means as he sees fit to have the work completed if the Contractor
- 38.1.1 Has not, within six days of the Minister or the Departmental Representative giving notice to the Contractor in writing in accordance with GC11, remedied any delay in the commencement or any default in the diligent performance of the work to the satisfaction of the Departmental Representative;
 - 38.1.2 has defaulted in the completion of any part of the work within the time fixed for its completion by the contract;
 - 38.1.3 has become insolvent;
 - 38.1.4 has committed an act of bankruptcy;
 - 38.1.5 has abandoned the work;
 - 38.1.6 has made an assignment of the contract without the consent required by GC3.1; or
 - 38.1.7 has otherwise failed to observe or perform any of the provisions of the contract.
- 38.2 If the whole or any part of the work is taken out of the Contractor's hands pursuant to GC38.1,
- 38.2.1 the Contractor's right to any further payment that is due or accruing due under the contract is, subject only to GC38.4, extinguished, and
 - 38.2.2 the Contractor is liable to pay Her Majesty, upon demand, an amount that is equal to the amount of all loss and damage incurred or sustained by Her Majesty in respect of the



Contractor's failure to complete the work.

- 38.3 If the whole or any part of the work that is taken out of the Contractor's hands pursuant to GC38.1 is completed by Her Majesty, the Departmental Representative shall determine the amount, if any, of the holdback or a progress claim that had accrued and was due prior to the date on which the work was taken out of the Contractor's hands and that is not required for the purposes of having the work performed or of compensating Her Majesty for any other loss or damage incurred or sustained by reason of the Contractor's default.
- 38.4 Her Majesty may pay the Contractor the amount determined not to be required pursuant to GC38.3.

GC39 Effect of Taking the Work Out of the Contractor's Hands

- 39.1 The taking of the work or any part thereof out of the Contractor's hands pursuant to GC38 does not operate so as to relieve or discharge him from any obligation under the contract or imposed upon him by law except the obligation to complete the performance of that part of the work that was taken out of his hands.
- 39.2 If the work or any part thereof is taken out of the Contractor's hands pursuant to GC38, all plant and material and the interest of the Contractor is all real property, licenses, powers and privileges acquired, used or provided by the Contractor under the contract shall continue to be the property of Her Majesty without compensation to the Contractor.
- 39.3 When the Departmental Representative certifies that any plant, material, or any interest of the Contractor referred to in GC39.2 is no longer required for the purposes of the work, or that it is not in the interest of Her Majesty to retain that plant, material or interest, it shall revert to the Contractor.

G40 Suspension of Work by Minister

- 40.1 The Minister may, when in his opinion it is in the public interest to do so, require the Contractor to suspend performance of the work either for a specified or an unspecified period by giving a notice of suspension in writing to the Contractor in accordance with GC11.
- 40.2 When a notice referred to in GC40.1 is received by the Contractor in accordance with GC11, he shall suspend all operations in respect of the work except those that, in the opinion of the Departmental Representative, are necessary for the care and preservation of the work, plant and material.
- 40.3 The Contractor shall not, during a period of suspension, remove any part of the work, plant or material from its site without the consent of the Departmental Representative.
- 40.4 If a period of suspension is 30 days or less, the Contractor shall, upon the expiration of that period, resume the performance of the work and he is entitled to be paid the extra cost, calculated in accordance with GC48 to GC50, of any labour, plant and material necessarily incurred by him as a result of the suspension.



- 40.5 If, upon the expiration of a period of suspension of more than 30 days, the Minister and the Contractor agree that the performance of the work will be continued by the Contractor, the Contractor shall resume performance of the work subject to any terms and conditions agreed upon by the Minister and the Contractor.
- 40.6 If, upon the expiration of a period of suspension of more than 30 days, the Minister and the Contractor do not agree that performance of the work will be continued by the Contractor or upon the terms and conditions under which the Contractor will continue the work, the notice of suspension shall be deemed to be a notice of termination pursuant to GC41.

GC41 Termination of Contract

- 41.1 The Minister may terminate the contract at any time by giving a notice of termination in writing to the Contractor in accordance with GC11.
- 41.2 When a notice referred to in GC41.1 is received by the Contractor in accordance with GC11, he shall, subject to any conditions stipulated in the notice, forthwith cease all operations in performance of the contract.
- 41.3 If the contract is terminated pursuant to GC41.1, Her Majesty shall pay the Contractor, subject to GC41.4, an amount equal to
- 41.3.1 the cost to the contractor of all labour, plant and material supplied by him under the contract up to the date of termination in respect of a contract or part thereof for which a Unit Price Arrangement is stipulated in the contract, or
 - 41.3.2 the lesser of
 - 41.3.2.1 an amount, calculated in accordance with the Terms and Payment, that would have been payable to the Contractor had he completed the work, and
 - 41.3.2.2 an amount that is determined to be due to the Contractor pursuant to GC49 in respect of a contract or part thereof for which a Fixed Price Arrangement is stipulated in the contract
- less the aggregate of all amounts that were paid to the Contractor by Her Majesty and all amounts that are due to Her Majesty from the Contractor pursuant to the contract.
- 41.4 If Her Majesty and the Contractor are unable to agree about an amount referred to in GC41.3 that amount shall be determined by the method referred to in GC50.

GC42 Claims Against and Obligations of the Contractor or Subcontractor

- 42.1 Her Majesty may, in order to discharge lawful obligations of and satisfy claims against the Contractor or a subcontractor arising out of the performance of the contract, pay any amount that is due and payable to the Contractor pursuant to the contract directly to the obligees of and the claimants against the Contractor or the subcontractor but such amount if any, as is paid by Her Majesty, shall not exceed that amount which the Contractor would have been obliged to pay to



such claimant had the provisions of the Provincial or Territorial lien legislation, or, in the Province of Quebec, the law relating to privileges, been applicable to the work. Any such claimant need not comply with the provisions of such legislation setting out the steps by way of notice, registration or otherwise as might have been necessary to preserve or perfect any claim for lien or privilege which claimant might have had;

42.2 Her Majesty will not make any payment as described in GC42.1 unless and until that claimant shall have delivered to Her Majesty:

42.2.1 a binding and enforceable Judgment or Order of a court of competent jurisdiction setting forth such amount as would have been payable by the Contractor to the claimant pursuant to the provisions of the applicable Provincial or Territorial lien legislation, or, in the Province of Quebec, the law relating to privileges, had such legislation been applicable to the work; or

42.2.2 a final and enforceable award of an arbitrator setting forth such amount as would have been payable by the Contractor to the claimant pursuant to the provisions of the applicable Provincial or Territorial lien legislation, or, in the Province of Quebec, the law relating to privileges, had such legislation been applicable to the work; or

42.2.3 the consent of the Contractor authorizing a payment.

For the purposes of determining the entitlement of a claimant pursuant to GC42.2.1 and GC42.2.2, the notice required by GC42.8 shall be deemed to replace the registration or provision of notice after the performance of work as required by any applicable legislation and no claim shall be deemed to have expired, become void or unenforceable by reason of the claimant not commencing any action within the time prescribed by any applicable legislation.

42.3 The Contractor shall, by the execution of his contract, be deemed to have consented to submit to binding arbitration at the request of any claimant those questions that need be answered to establish the entitlement of the claimant to payment pursuant to the provisions of GC42.1 and such arbitration shall have as parties to it any subcontractor to whom the claimant supplied material, performed work or rented equipment should such subcontractor wish to be adjoined and the Crown shall not be a party to such arbitration and, subject to any agreement between the Contractor and the claimant to the contrary, the arbitration shall be conducted in accordance with the Provincial or Territorial legislation governing arbitration applicable in the Province or Territory in which the work is located.

42.4 A payment made pursuant to GC42.1 is, to the extent of the payment, a discharge of Her Majesty's liability to the Contractor under the contract and may be deducted from any amount payable to the Contractor under the contract.

42.5 To the extent that the circumstances of the work being performed for Her Majesty permit, the Contractor shall comply with all laws in force in the Province or Territory where the work is being performed relating to payment period, mandatory holdbacks, and creation and enforcement of mechanics' liens, builders' liens or similar legislation or in the Province of Quebec, the law relating to privileges.

42.6 The Contractor shall discharge all his lawful obligations and shall satisfy all lawful claims against him arising out of the performance of the work at least as often as the contract requires Her



Majesty to pay the Contractor.

- 42.7 The Contractor shall, whenever requested to do so by the Departmental Representative, make a statutory declaration deposing to the existence and condition of any obligations and claims referred to in GC42.6.
- 42.8 GC42.1 shall only apply to claims and obligations
- 42.8.1 the notification of which has been received by the Departmental Representative in writing before payment is made to the Contractor pursuant to TP4.10 and within 120 days of the date on which the claimant
- 42.8.1.1 should have been paid in full under the claimant's contract with the Contractor or subcontractor where the claim is for money that was lawfully required to be held back from the claimant; or
- 42.8.1.2 performed the last of the services, work or labour, or furnished the last of the material pursuant to the claimant's contract with the Contractor or subcontractor where the claim is not for money referred to in GC42.8.1.1, and
- 42.8.2 the proceedings to determine the right to payment of which, pursuant to GC42.2. shall have commenced within one year from the date that the notice referred to in GC42.8.1 was received by the Departmental Representative, and
- the notification required by GC42.8.1 shall set forth the amount claimed to be owing and the person who by contract is primarily liable.
- 42.9 Her Majesty may, upon receipt of a notice of claim under GC42.8.1, withhold from any amount that is due and payable to the Contractor pursuant to the contract the full amount of the claim or any portion thereof.
- 42.10 The Departmental Representative shall notify the Contractor in writing of receipt of any claim referred to in GC42.8.1 and of the intention of Her Majesty to withhold funds pursuant to GC42.9 and the Contractor may, at any time thereafter and until payment is made to the claimant, be entitled to post, with Her Majesty, security in a form acceptable to Her Majesty in an amount equal to the value of the claim, the notice of which is received by the Departmental Representative and upon receipt of such security Her Majesty shall release to the Contractor any funds which would be otherwise payable to the Contractor, that were withheld pursuant to the provisions of GC42.9 in respect of the claim of any claimant for whom the security stands.

GC43 Security Deposit – Forfeiture or Return

- 43.1 If
- 43.1.1 the work is taken out of the Contractor's hands pursuant to GC38,
- 43.1.2 the contract is terminated pursuant to GC41, or
- 43.1.3 the Contractor is in breach of or in default under the contract,



Her Majesty may convert the security deposit, if any, to Her own use.

- 43.2 If Her Majesty converts the contract security pursuant to GC43.1, the amount realized shall be deemed to be an amount due from Her Majesty to the Contractor under the contract.
- 43.3 Any balance of an amount referred to in GC43.2 that remains after payment of all losses, damage and claims of Her Majesty and others shall be paid by Her Majesty to the Contractor if, in the opinion of the Departmental Representative, it is not required for the purposes of the contract.

GC44 Departmental Representative's Certificates

44.1 On the date that

44.1.1 the work has been completed, and

44.1.2 the Contractor has complied with the contract and all orders and directions made pursuant thereto,

both to the satisfaction of the Departmental Representative, the Departmental Representative shall issue a Final Certificate of Completion to the Contractor.

44.2 If the Departmental Representative is satisfied that the work is substantially complete he shall, at any time before he issues a certificate referred to in GC44.1, issue an Interim Certificate of Completion to the Contractor, and

44.2.1 for the purposes of GC44.2 the work will be considered to be substantially complete,

44.2.1.1 when the work under the contract or a substantial part thereof is, in the opinion of the Departmental Representative, ready for use by Her Majesty or is being used for the purpose intended; and

44.2.1.2 when the work remaining to be done under the contract is, in the opinion of the Departmental Representative, capable of completion or correction at accost of not more than

44.2.1.2.1 -3% of the first \$500,000, and

44.2.1.2.2 -2% of the next \$500,000, and

44.2.1.2.3 -1% of the balance

of the value of the contract at the time this cost is calculated.

44.3 For the sole purpose of GC44.2.1.2, where the work or a substantial part thereof is ready for use or is being used for the purposes intended and the remainder of the work or a part thereof cannot be completed by the time specified in A2.1, or as amended pursuant to GC36, for reasons beyond the control of the Contractor or where the Departmental Representative and the Contractor agree not to complete a part of the work within the specified time, the cost of that part of the work



which was either beyond the control of the Contractor to complete or the Departmental Representative and the Contractor have agreed not to complete by the time specified shall be deducted from the value of the contract referred to GC44.2.1.2 and the said cost shall not form part of the cost of the work remaining to be done in determining substantial completion.

44.4 An Interim Certificate of Completion referred to in GC44.2 shall describe the parts of the work not completed to the satisfaction of the Departmental Representative and all things that must be done by the Contractor

44.4.1 before a Final Certificate of Completion referred to in GC44.1 will be issued, and

44.4.2 before the 12-month period referred to in GC32.1.2 shall commence for the said parts and all the said things.

44.5 The Departmental Representative may, in addition to the parts of the work described in an Interim Certificate of Completion referred to in GC44.2, require the Contractor to rectify any other parts of the work not completed to his satisfaction and to do any other things that are necessary for the satisfactory completion of the work.

44.6 If the contract or a part thereof is subject to a Unit Price Arrangement, the Departmental Representative shall measure and record the quantities of labour, plant and material, performed, used and supplied by the Contractor in performing the work and shall, at the request of the Contractor, inform him of those measurements.

44.7 The Contractor shall assist and co-operate with the Departmental Representative in the performance of his duties referred to in GC44.6 and shall be entitled to inspect any record made by the Departmental Representative pursuant to GC44.6.

44.8 After the Departmental Representative has issued a Final Certificate of Completion referred to in GC44.1, he shall, if GC44.6 applies, issue a Final Certificate of Measurement.

44.9 A Final Certificate of Measurement referred to in GC44.8 shall

44.9.1 contain the aggregate of all measurements of quantities referred to in GC44.6, and

44.9.2 be binding upon and conclusive between Her Majesty and the Contractor as to the quantities referred to therein.

GC45 Return of Security Deposit

45.1 After an Interim Certificate of Completion referred to in GC44.2 has been issued, Her Majesty shall, if the Contractor is not in breach of or in default under the contract, return to the Contractor all or any part of the security deposit that, in the opinion of the Departmental Representative, is not required for the purposes of the contract.

45.2 After a Final Certificate of Completion referred to in GC44.1 has been issued, Her Majesty shall return to the Contractor the remainder of any security deposit unless the contract stipulates otherwise.



- 45.3 If the security deposit was paid into the Consolidated Revenue Fund of Canada, Her Majesty shall pay interest thereon to the Contractor at a rate established from time to time pursuant to section 21(2) of the Financial Administration Act.

GC46 Clarification of Terms in GC47 to GC50

- 46.1 For the purposes of GC47 to GC50,
- 46.1.1 "Unit Price Table" means the table set out in the Articles of Agreement, and
- 46.1.2 "plant" does not include tools customarily provided by a tradesman in practicing his trade.

GC47 Additions or Amendments to Unit Price Table

- 47.1 Where a Unit Price Arrangement applies to the contract or a part thereof the Departmental Representative and the Contractor may, by an agreement in writing,
- 47.1.1 add classes of labour or material, and units of measurement, prices per unit and estimated quantities to the Unit Price Table if any labour, plant or material that is to be included in the Final Certificate of Measurement referred to in GC44.8 is not included in any class of labour, plant or material set out in the Unit Price Table; or
- 47.1.2 subject to GC47.2 and GC47.3, amend a price set out in the Unit Price Table for any class of labour, plant or material included therein if the Final Certificate of Measurement referred to in GC44.8 shows or is expected to show that the total quantity of that class of labour, plant or material actually performed, used or supplied by the Contractor in performing the work is
- 47.1.2.1 less than 85% of that estimated total quantity, or
- 47.1.2.2 in excess of 115% of that estimated total quantity.
- 47.2 In no event shall the total cost of an item set out in the Unit Price Table that has been amended pursuant to GC47.1.2.1 exceed the amount that would have been payable to the Contractor had the estimated total quantity actually been performed, used or supplied.
- 47.3 An amendment that is made necessary by GC47.1.2.2 shall apply only to the quantities that are in excess of 115%.
- 47.4 If the Departmental Representative and the Contractor do not agree as contemplated in GC47.1, the Departmental Representative shall determine the class and the unit of measurement of the labour, plant or material and, subject to GC47.2 and GC47.3, the price per unit therefore shall be determined in accordance with GC50.

GC48 Determination of Cost – Unit Price Table



- 48.1 Whenever, for the purposes of the contract, it is necessary to determine the cost of labour, plant or material, it shall be determined by multiplying the quantity of that labour, plant or material expressed in the unit set out in column 3 of the Unit Price Table by the price of that unit set out in column 5 of the Unit Price Table.

GC49 Determination of Cost – Negotiation

- 49.1 If the method described in GC48 cannot be used because the labour, plant or material is of a kind or class that is not set out in the Unit Price Table, the cost of that labour, plant or material for the purposes of the contract shall be the amount agreed upon from time to time by the Contractor and the Departmental Representative.
- 49.2 For the purposes of GC49.1, the Contractor shall submit to the Departmental Representative any necessary cost information requested by the Departmental Representative in respect of the labour, plant and material referred to in GC49.1

GC50 Determination of Cost – Failing Negotiation

- 50.1 If the methods described in GC47, GC48 or GC49 fail for any reason to achieve a determination of the cost of labour, plant and material for the purposes referred to therein, that cost shall be equal to the aggregate of
- 50.1.1 all reasonable and proper amounts actually expended or legally payable by the Contractor in respect of the labour, plant and material that falls within one of the classes of expenditure described in GC50.2 that are directly attributable to the performance of the contract,
 - 50.1.2 an allowance for profit and all other expenditures or costs, including overhead, general administration cost, financing and interest charges, and every other cost, charge and expenses, but not including those referred to in GC50.1.1 or GC50.1.3 or a class referred to in GC50.2, in an amount that is equal to 10% of the sum of the expenses referred to in GC50.1.1, and
 - 50.1.3 interest on the cost determined under GC50.1.1 and GC50.1.2, which interest shall be calculated in accordance with TP9,

provide that the total cost of an item set out in the Unit Price Table that is subject to the provisions of GC47.1.2.1 does not exceed the amount that would have been payable to the Contractor had the estimated total quantity of the said item actually be performed, used or supplied.

- 50.2 For purposes of GC50.1.1 the classes of expenditure that may be taken into account in determining the cost of labour, plant and material are,
- 50.2.1 payments to subcontractors;
 - 50.2.2 wages, salaries and travelling expenses of employees of the Contractor while they are actually and properly engaged on the work, other than wages, salaries, bonuses, living



and travelling expenses of personnel of the Contractor generally employed at the head office or at a general office of the Contractor unless they are engaged at the work site with the approval of the Departmental Representative,

- 50.2.3 assessments payable under any statutory authority relating to workmen's compensation, unemployment insurance, pension plan or holidays with pay;
- 50.2.4 rent that is paid for plant or an amount equivalent of the said rent if the plant is owned by the Contractor that is necessary for and used in the performance of the work, if the rent of the equivalent amount is reasonable and use of that plant has been approved by the Departmental Representative;
- 50.2.5 payments for maintaining and operating plant necessary for and used in the performance of the work, and payments for effecting such repairs thereto as, in the opinion of the Departmental Representative, are necessary to the proper performance of the contract other than payments for any repairs to the plant arising out of defects existing before its allocation to the work;
- 50.2.6 payments for material that is necessary for and incorporated in the work, or that is necessary for and consumed in the performance of the contract;
- 50.2.7 payments for preparation, delivery, handling, erection, installation, inspection protection and removal of the plant and material necessary for and used in the performance of the contract; and
- 50.2.8 any other payments made by the Contractor with the approval of the Departmental Representative that are necessary for the performance of the contract.

GC51 Records to be kept by Contractor

51.1 The Contractor shall

- 51.1.1 maintain full records of his estimated and actual cost of the work together with all tender calls, quotations, contracts, correspondence, invoices, receipts and vouchers relating thereto.
- 51.1.2 make all records and material referred to in GC5.1.1 available to audit and inspection by the Minister and the Deputy Receiver General for Canada or by persons acting on behalf of either of both of them, when requested;
- 51.1.3 allow any of the person referred to in GC51.1.2 to make copies of and to take extracts from any of the records and material referred to in GC51.1.1; and
- 51.1.4 furnish any person referred to in GC51.1.2 with any information he may require from time to time in connection with such records and material.

- 51.2 The records maintained by the Contractor pursuant to GC51.1.1 shall be kept intact by the Contractor until the expiration of two years after the date that a Final Certificate of Completion referred to in GC44.1 was issued or until the expiration of such other period of time as the



Minister may direct.

- 51.3 The Contractor shall cause all subcontractors and all other persons directly or indirectly controlled by or affiliated with the Contractor and all persons directly or indirectly having control of the Contractor to comply with GC51.1 and GC51.2 as if they were the Contractor.

GC52 Conflict of Interest

- 52.1 It is a term of this contract that no former public office holder who is not in compliance with the Conflict of Interest and Post-Employment Code for Public Office Holders shall derive a direct benefit from this contract.

GC53 Contractor Status

- 53.1 The Contractor shall be engaged under the contract as an independent contractor.
- 53.2 The Contractor and any employee of the said Contractor is not engaged by the contract as an employee, servant or agent of Her Majesty.
- 53.3 For the purposes of GC53.1 and GC53.2 the Contractor shall be solely responsible for any and all payments and deductions required to be made by law including those required for Canada or Quebec Pension Plans, Unemployment Insurance, Worker's Compensation or Income Tax.



GENERAL CONDITONS

- IC 1 Proof of Insurance**
- IC 2 Risk Management**
- IC 3 Payment of Deductible**
- IC 4 Insurance Coverage**

GENERAL INSUANCE COVERAGES

- GCI 1 Insured**
- GIC 2 Period of Insurance**
- GIC 3 Proof of Insurance**
- GIC 4 Notification**

COMMERCIAL GENERAL LIABILITY

- CGL 1 Scope of Policy**
- CGL 2 Coverages/Provisions**
- CGL 3 Additional Exposures**
- CGL 4 Insurance Proceeds**
- CGL 5 Deductible**

BUILDER'S RISK – INSTALLATION FLOATER – ALL RISKS

- BR 1 Scope of Policy**
- BR 2 Property Insured**
- BR 3 Insurance Proceeds**
- BR 4 Amount of Insurance**
- BR 5 Deductible**
- BR 6 Subrogation**
- BR 7 Exclusion Qualifications**

INSURER'S CERTIFICATE OF INSURANCE



General Conditions

IC 1 Proof of Insurance (02/12/03)

Within thirty (30) days after acceptance of the Contractor's tender, the Contractor shall, unless otherwise directed in writing by the Contracting Officer, deposit with the Contracting Officer an Insurer's Certificate of Insurance in the form displayed in this document and, if requested by the Contracting Officer, the originals or certified true copies of all contracts of insurance maintained by the Contractor pursuant to the Insurance Coverage Requirements shown hereunder.

IC 2 Risk Management (01/10/94)

The provisions of the Insurance Coverage Requirements contained hereunder are not intended to cover all of the Contractor's obligations under GC8 of the General Conditions "C" of the contract. Any additional risk management measures or additional insurance coverages the Contractor may deem necessary to fulfill its obligations under GC8 shall be at its own discretion and expense.

IC 3 Payment of Deductible (01/10/94)

The payment of monies up to the deductible amount made in satisfaction of a claim shall be borne by the Contractor.

IC 4 Insurance Coverage (02/12/03)

The Contractor has represented that it has in place and effect the appropriate and usual liability insurance coverage as required by these Insurance Conditions and the Contractor has warranted that it shall obtain, in a timely manner and prior to commencement of the Work, the appropriate and usual property insurance coverage as required by these Insurance Conditions and, further, that it shall maintain all required insurance policies in place and effect as required by these Insurance Conditions.



INSURANCE COVERAGE REQUIREMENTS

PART I GENERAL INSURANCE COVERAGES (GIC)

GCI 1 Insured (02/12/03)

Each insurance policy shall insure the Contractor, and shall include, as an Additional Named Insured, Her Majesty the Queen in right of Canada, represented by the National Research Council Canada.

GIC 2 Period of Insurance (02/12/03)

Unless otherwise directed in writing by the Contracting Officer or otherwise stipulated elsewhere in these Insurance Conditions, the policies required hereunder shall be in force and be maintained from the date of the contract award until the day of issue of the Departmental Representative's Final Certificate of Completion.

GIC 3 Proof of Insurance (01/10/94)

Within twenty five (25) days after acceptance of the Contractor's tender, the Insurer shall, unless otherwise directed by the Contractor, deposit with the Contractor an Insurer's Certificate of Insurance in the form displayed in the document and, if requested, the originals or certified true copies of all contracts of insurance maintained by the Contractor pursuant to the requirements of these Insurance Coverages.

GIC 4 Notification (01/10/94)

Each Insurance policy shall contain a provision that (30) days prior written notice shall be given by the Insurer to Her Majesty in the event of any material change in or cancellation of coverage. Any such notice received by the Contractor shall be transmitted forthwith to Her Majesty.

PART II COMMERCIAL GENERAL LIABILITY

CGL 1 Scope of Policy (01/10/94)

The policy shall be written on a form similar to that known and referred to in the insurance industry as IBC 2100 – Commercial General Liability policy (Occurrence form) and shall provide for limit of liability of not less than \$2,000,000 inclusive for Bodily Injury and Property Damage for any one occurrence or series of occurrences arising out of one cause. Legal or defence cost incurred in respect of a claim or claims shall not operate to decrease the limit of liability.

CGL 2 Coverages/Provisions (01/10/94)



The policy shall include but not necessarily be limited to the following coverages/provisions.

- 2.1 Liability arising out of or resulting from the ownership, existence, maintenance or use of premises by the Contractor and operations necessary or incidental to the performance of this contract.
- 2.2 "Broad Form" Property Damage including the loss of use of property.
- 2.3 Removal or weakening of support of any building or land whether such support be natural or otherwise.
- 2.4 Elevator liability (including escalators, hoists and similar devices).
- 2.5 Contractor's Protective Liability
- 2.6 Contractual and Assumed Liabilities un this contact.
- 2.7 Completed Operations Liability – The insurance, including all aspects of this Part II of these Insurance Conditions shall continue for a period of at least one (1) year beyond the date of the Departmental Representative's Final Certificate of Completion for the Completed Operations.
- 2.8 Cross Liability – The Clause shall be written as follows:

Cross Liability – The insurance as is afforded by this policy shall apply in respect to any claim or action brought against any one Insured by any other Insured. The coverage shall apply in the same manner and to the same extent as though a separate policy had been issued to each Insured. The inclusion herein of more than one Insured shall not increase the limit of the Insurer's liability.

- 2.9 Severability of Interests – The Clause shall be written as follows:

Severability of Interests – This policy, subject to the limits of liability stated herein, shall apply separately to each Insured in the same manner and to the same extent as if a separate policy had been issued to each. The inclusion herein of more than one insured shall not increase the limit of the Insurer's liability.

CGL 3 Additional Exposures (02/12/03)

The policy shall either include or be endorsed to include the following exposures of hazards if the Work is subject thereto:

- 3.1 Blasting
- 3.2 Pile driving and calsson work
- 3.3 Underpinning
- 3.4 Risks associated with the activities of the Contractor on an active airport



- 3.5 Radioactive contamination resulting from the use of commercial isotopes
- 3.6 Damage to the portion of an existing building beyond that directly associated with an addition, renovation or installation contract.
- 3.7 Marine risks associated with the contraction of piers, wharves and docks.

**CGL 4 Insurance Proceeds
(01/10/94)**

Insurance Proceeds from this policy are usually payable directly to a Claimant/Third Party.

**CGL 5 Deductible
(02/12/03)**

This policy shall be issued with a deductible amount of not more than \$10,000 per occurrence applying to Property Damage claims only.

**PART III
BUILDER'S RISK – INSTALLATION FLOATER – ALL RISKS**

**BR 1 Scope of Policy
(01/10/94)**

The policy shall be written on an "All Risks" basis granting coverages similar to those provided by the forms known and referred to in the insurance industry as "Builder's Risk Comprehensive Form" or "Installation Floater – All Risks".

**BR 2 Property Insured
(01/10/94)**

The property insured shall include:

- 2.1 The Work and all property, equipment and materials intended to become part of the finished Work at the site of the project while awaiting, during and after installation, erection or construction including testing.
- 2.2 Expenses incurred in the removal from the construction site of debris of the property insured, including demolition of damaged property, de-icing and dewatering, occasioned by loss, destruction or damage to such property and in respect of which insurance is provided by this policy.

**BR 3 Insurance Proceeds
(01/10/94)**

- 3.1 Insurance proceeds from this policy are payable in accordance with GC28 of the General Conditions "C" of the contract.
- 3.2 This policy shall provide that the proceeds thereof are payable to Her Majesty or as the Minister may direct.



- 3.3 The Contractor shall do such things and execute such documents as are necessary to effect payment of the proceeds.

BR 4 Amount of Insurance
(01/10/94)

The amount of insurance shall not be less than the sum of the contract value plus the declared value (if any) set forth in the contract documents of all material and equipment supplied by Her Majesty at the site of the project to be incorporated into and form part of the finished Work.

BR 5 Deductible
(02/12/03)

The Policy shall be issued with a deductible amount of not more than \$10,000.

BR 6 Subrogation
(01/10/94)

The following Clause shall be included in the policy:

"All rights of subrogation or transfer of rights are hereby waived against any corporation, firm, individual or other interest, with respect to which, insurance is provided by this policy".

BR 7 Exclusion Qualifications
(01/10/94)

The policy may be subject to the standard exclusions but the following qualifications shall apply:

- 7.1 Faulty materials, workmanship or design may be excluded only to the extent of the cost of making good thereof and shall not apply to loss or damage resulting therefrom.
- 7.2 Loss or damage caused by contamination by radioactive material may be excluded except for loss or damage resulting from commercial isotopes used for industrial measurements, inspection, quality control radiographic or photographic use.
- 7.3 Use and occupancy of the project or any part of section thereof shall be permitted where such use and occupancy is for the purpose for which the project is intended upon completion.



INSURER'S CERTIFICATE OF INSURANCE

(TO BE COMPLETED BY INSURER (NOT BOKER) AND DELIVERD TO NATIONAL RESEARCH COUNCIL CANADA WITH 30 DAYS FOLLOWING ACCEPTANCE OF TENDER)

CONTRACT

DESCRIPTION OF WORK	CONTRACT NUMBER	AWARD DATE
LOCATION		

INSURER

NAME
ADDRESS

BROKER

NAME
ADDRESS

INSURED

NAME OF CONTRACTOR
ADDRESS

ADDITIONAL INSURED

HER MAJESTY THE QUEEN IN RIGHT OF CANADA AS REPRESENTED BY THE NATIONAL RESEARCH COUNCIL CANADA

THIS DOCUENT CERTIFIES THAT THE FOLLOWING POLICES OF INSURANCE ARE AT PRESENT IN FORCE COVERING ALL OPERATIONS OF THE INSURE IN CONNECTION WITH THE CONTRACT MADE BETWEEN THE NAMED INSURED AND THE NATIONAL RESEARCH COUNCIL CANADA AND IN ACCORDANCE WITH THE INSURANCE CONDITIONS "E"

POLICY					
TYPE	NUMBER	INCEPTION DATE	EXPIRY DATE	LIMITS OF LIABILITY	DEDUCTIBLE
COMMERCIAL GENERAL LIABILITY					
BUILDERS RISK "AL RISKS"					
INSTALLATION FLOATER "ALL RISKS"					

THE INSURER AGREES TO NOTIFY THE NATIONAL RESEARCH COUNCIL CANADA IN WRITING 30 DAYS PRIOR TO ANY MATERIAL CHANGE IN OR CANCELLATION OF ANY POLICY OR COVERAGE SPECIFICALLY RELATED TO THE CONTRACT

NAME OF INSURER'S OFFICER OR AUTHORIZED EMPLOYEE	SIGNATURE	DATE:
		TELEPHONE NUMBER:

ISSUANCE OF THIS CERTIFIATE SHALL NOT LIMIT OR RESTRICT THE RIGHT OF THE NATIONAL RESEARCH COUNCIL CANADA TO REQUEST AT ANY TIME DUPLICATE COPIES OF SAID INSURANCE POLICIES



CS1 Obligation to provide Contract Security

- 1.1 The Contractor shall, at the Contractor's own expense, provide one or more of the forms of contract security prescribed in CS2.
- 1.2 The Contractor shall deliver to the Departmental Representative the contract security referred to in CS1.1 within 14 days after the date that the Contractor receives notice that the Contractor's tender or offer was accepted by Her Majesty.

CS2 Prescribed Types and Amounts of Contract Security

- 2.1 The Contractor shall deliver to the Departmental Representative pursuant to CS1
 - 2.1.1 a performance bond and a labour and material payment bond each in an amount that is equal to not less than 50% of the contract amount referred to in the Articles of Agreement, or
 - 2.1.2 a labour and material payment bond in an amount that is equal to not less than 50% of the contract amount referred to in the Articles of Agreement, and a security deposit in an amount that is equal to
 - 2.1.2.1 not less than 10% of the contract amount referred to in the Articles of Agreement where that amount does not exceed \$250,000, or
 - 2.1.2.2 \$25,000 plus 5% of the part of the contract amount referred to in the Articles of Agreement that exceeds \$250,000, or
 - 2.1.3 a security deposit in an amount prescribed by CS2.1.2 plus an additional amount that is equal to 10% of the contract amount referred to in the Articles of Agreement.
- 2.2 A performance bond and a labour and material payment bond referred to in CS2.1 shall be in a form and be issued by a bonding or surety company that is approved by Her Majesty.
- 2.3 The amount of a security deposit referred to in CS2.1.2 shall not exceed \$250,000 regardless of the contract amount referred to in the Articles of Agreement.
- 2.4 A security deposit referred to in CS2.1.2 and CS2.1.3 shall be in the form of
 - 2.4.1 a bill of exchange made payable to the Receiver General of Canada and certified by an approved financial institution or drawn by an approved financial institution on itself, or
 - 2.4.2 bonds of or unconditionally guaranteed as to principal and interest by the Government of Canada.
- 2.5 For the purposes of CS2.4
 - 2.5.1 a bill of exchange is an unconditional order in writing signed by the Contractor and addressed to an approved financial institution, requiring the said institution to pay, on demand, at a fixed or determinable future time a sum certain of money to, or to the order



of, the Receiver General for Canada, and

- 2.5.2 If a bill of exchange is certified by a financial institution other than a chartered bank then it must be accompanied by a letter or stamped certification confirming that the financial institution is in at least one of the categories referred to in CS2.5.3
- 2.5.3 an approved financial institution is
 - 2.5.3.1 any corporation or institution that is a member of the Canadian Payments Association,
 - 2.5.3.2 a corporation that accepts deposits that are insured by the Canada Deposit Insurance Corporation or the Régie de l'assurance-dépôts du Québec to the maximum permitted by law,
 - 2.5.3.3 a credit union as defined in paragraph 137(6)(b) of the *Income Tax Act*,
 - 2.5.3.4 a corporation that accepts deposits from the public, if repayment of the deposit is guaranteed by Her Majesty in right of a province, or
 - 2.5.3.5 The Canada Post Corporation.
- 2.5.4 the bonds referred to in CS2.4.2 shall be
 - 2.5.4.1 made payable to bearer, or
 - 2.5.4.2 accompanied by a duly executed instrument of transfer of the bonds to the Receiver General for Canada in the form prescribed by the Domestic Bonds of Canada Regulations, or
 - 2.5.4.3 registered, as to principal or as to principal and interest in the name of the Receiver General for Canada pursuant to the Domestic Bonds of Canada Regulations, and
 - 2.5.4.4 provided on the basis of their market value current at the date of the contract.



Contract Number / Numéro du contrat P.R. 770821
Security Classification / Classification de sécurité UNCLASSIFIED

**SECURITY REQUIREMENTS CHECK LIST (SRCL)
LISTE DE VÉRIFICATION DES EXIGENCES RELATIVES À LA SÉCURITÉ (LVERS)**

PART A - CONTRACT INFORMATION / PARTIE A - INFORMATION CONTRACTUELLE

1. Originating Government Department or Organization / Ministère ou organisme gouvernemental d'origine National Research Council	2. Branch or Directorate / Direction générale ou Direction OCRE
3. a) Subcontract Number / Numéro du contrat de sous-traitance	3. b) Name and Address of Subcontractor / Nom et adresse du sous-traitant

4. Brief Description of Work / Brève description du travail
Construction Services for the installation of the new Tow Tank Wavemaker equipment including: Removal of existing wavemaker, site preparations, electrical upgrades, and installation support. (St John's)

5. a) Will the supplier require access to Controlled Goods? / Le fournisseur aura-t-il accès à des marchandises contrôlées? No / Non Yes / Oui

5. b) Will the supplier require access to unclassified military technical data subject to the provisions of the Technical Data Control Regulations? / Le fournisseur aura-t-il accès à des données techniques militaires non classifiées qui sont assujetties aux dispositions du Règlement sur le contrôle des données techniques? No / Non Yes / Oui

6. Indicate the type of access required / Indiquer le type d'accès requis

6. a) Will the supplier and its employees require access to PROTECTED and/or CLASSIFIED information or assets? / Le fournisseur ainsi que les employés auront-ils accès à des renseignements ou à des biens PROTÉGÉS et/ou CLASSIFIÉS? (Specify the level of access using the chart in Question 7. c) / Préciser le niveau d'accès en utilisant le tableau qui se trouve à la question 7. c) No / Non Yes / Oui

6. b) Will the supplier and its employees (e.g. cleaners, maintenance personnel) require access to restricted access areas? No access to PROTECTED and/or CLASSIFIED information or assets is permitted. / Le fournisseur et ses employés (p. ex. nettoyeurs, personnel d'entretien) auront-ils accès à des zones d'accès restreintes? L'accès à des renseignements ou à des biens PROTÉGÉS et/ou CLASSIFIÉS n'est pas autorisé. No / Non Yes / Oui

6. c) Is this a commercial courier or delivery requirement with no overnight storage? / S'agit-il d'un contrat de messagerie ou de livraison commerciale sans entreposage de nuit? No / Non Yes / Oui

7. a) Indicate the type of information that the supplier will be required to access / Indiquer le type d'information auquel le fournisseur devra avoir accès

Canada <input checked="" type="checkbox"/>	NATO / OTAN <input type="checkbox"/>	Foreign / Étranger <input type="checkbox"/>
--	--------------------------------------	---

7. b) Release restrictions / Restrictions relatives à la diffusion

No release restrictions / Aucune restriction relative à la diffusion <input checked="" type="checkbox"/>	All NATO countries / Tous les pays de l'OTAN <input type="checkbox"/>	No release restrictions / Aucune restriction relative à la diffusion <input type="checkbox"/>
Not releasable / À ne pas diffuser <input type="checkbox"/>		
Restricted to: / Limité à: <input type="checkbox"/>	Restricted to: / Limité à: <input type="checkbox"/>	Restricted to: / Limité à: <input type="checkbox"/>
Specify country(ies): / Préciser le(s) pays:	Specify country(ies): / Préciser le(s) pays:	Specify country(ies): / Préciser le(s) pays:

7. c) Level of information / Niveau d'information

PROTECTED A / PROTÉGÉ A <input type="checkbox"/>	NATO UNCLASSIFIED / NATO NON CLASSIFIÉ <input type="checkbox"/>	PROTECTED A / PROTÉGÉ A <input type="checkbox"/>
PROTECTED B / PROTÉGÉ B <input type="checkbox"/>	NATO RESTRICTED / NATO DIFFUSION RESTREINTE <input type="checkbox"/>	PROTECTED B / PROTÉGÉ B <input type="checkbox"/>
PROTECTED C / PROTÉGÉ C <input type="checkbox"/>	NATO CONFIDENTIAL / NATO CONFIDENTIEL <input type="checkbox"/>	PROTECTED C / PROTÉGÉ C <input type="checkbox"/>
CONFIDENTIAL / CONFIDENTIEL <input type="checkbox"/>	NATO SECRET / NATO SECRET <input type="checkbox"/>	CONFIDENTIAL / CONFIDENTIEL <input type="checkbox"/>
SECRET / SECRET <input type="checkbox"/>	COSMIC TOP SECRET / COSMIC TRÈS SECRET <input type="checkbox"/>	SECRET / SECRET <input type="checkbox"/>
TOP SECRET / TRÈS SECRET <input type="checkbox"/>		TOP SECRET / TRÈS SECRET <input type="checkbox"/>
TOP SECRET (SIGINT) / TRÈS SECRET (SIGINT) <input type="checkbox"/>		TOP SECRET (SIGINT) / TRÈS SECRET (SIGINT) <input type="checkbox"/>



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PART A (continued) / PARTIE A (suite)

8. Will the supplier require access to PROTECTED and/or CLASSIFIED COMSEC information or assets?
Le fournisseur aura-t-il accès à des renseignements ou à des biens COMSEC désignés PROTÉGÉS et/ou CLASSIFIÉS? No / Non Yes / Oui
If Yes, indicate the level of sensitivity:
Dans l'affirmative, indiquer le niveau de sensibilité :

9. Will the supplier require access to extremely sensitive INFOSEC information or assets?
Le fournisseur aura-t-il accès à des renseignements ou à des biens INFOSEC de nature extrêmement délicate? No / Non Yes / Oui

Short Title(s) of material / Titre(s) abrégé(s) du matériel :
Document Number / Numéro du document :

PART B - PERSONNEL (SUPPLIER) / PARTIE B - PERSONNEL (FOURNISSEUR)

10. a) Personnel security screening level required / Niveau de contrôle de la sécurité du personnel requis

- | | | | |
|---|---|---|--|
| <input checked="" type="checkbox"/> RELIABILITY STATUS
COTE DE FIABILITÉ | <input type="checkbox"/> CONFIDENTIAL
CONFIDENTIEL | <input type="checkbox"/> SECRET
SECRET | <input type="checkbox"/> TOP SECRET
TRÈS SECRET |
| <input type="checkbox"/> TOP SECRET - SIGINT
TRÈS SECRET - SIGINT | <input type="checkbox"/> NATO CONFIDENTIAL
NATO CONFIDENTIEL | <input type="checkbox"/> NATO SECRET
NATO SECRET | <input type="checkbox"/> COSMIC TOP SECRET
COSMIC TRÈS SECRET |
| <input type="checkbox"/> SITE ACCESS
ACCÈS AUX EMPLACEMENTS | | | |

Special comments:
Commentaires spéciaux : _____

NOTE: If multiple levels of screening are identified, a Security Classification Guide must be provided.
REMARQUE : Si plusieurs niveaux de contrôle de sécurité sont requis, un guide de classification de la sécurité doit être fourni.

10. b) May unscreened personnel be used for portions of the work?
Du personnel sans autorisation sécuritaire peut-il se voir confier des parties du travail? No / Non Yes / Oui
If Yes, will unscreened personnel be escorted?
Dans l'affirmative, le personnel en question sera-t-il escorté? No / Non Yes / Oui

PART C - SAFEGUARDS (SUPPLIER) / PARTIE C - MESURES DE PROTECTION (FOURNISSEUR)

INFORMATION / ASSETS / RENSEIGNEMENTS / BIENS

11. a) Will the supplier be required to receive and store PROTECTED and/or CLASSIFIED information or assets on its site or premises?
Le fournisseur sera-t-il tenu de recevoir et d'entreposer sur place des renseignements ou des biens PROTÉGÉS et/ou CLASSIFIÉS? No / Non Yes / Oui

11. b) Will the supplier be required to safeguard COMSEC information or assets?
Le fournisseur sera-t-il tenu de protéger des renseignements ou des biens COMSEC? No / Non Yes / Oui

PRODUCTION

11. c) Will the production (manufacture, and/or repair and/or modification) of PROTECTED and/or CLASSIFIED material or equipment occur at the supplier's site or premises?
Les installations du fournisseur serviront-elles à la production (fabrication et/ou réparation et/ou modification) de matériel PROTÉGÉ et/ou CLASSIFIÉ? No / Non Yes / Oui

INFORMATION TECHNOLOGY (IT) MEDIA / SUPPORT RELATIF À LA TECHNOLOGIE DE L'INFORMATION (TI)

11. d) Will the supplier be required to use its IT systems to electronically process, produce or store PROTECTED and/or CLASSIFIED information or data?
Le fournisseur sera-t-il tenu d'utiliser ses propres systèmes informatiques pour traiter, produire ou stocker électroniquement des renseignements ou des données PROTÉGÉS et/ou CLASSIFIÉS? No / Non Yes / Oui

11. e) Will there be an electronic link between the supplier's IT systems and the government department or agency?
Disposera-t-on d'un lien électronique entre le système informatique du fournisseur et celui du ministère ou de l'agence gouvernementale? No / Non Yes / Oui



PART C - (continued) / PARTIE C - (suite)

For users completing the form manually use the summary chart below to indicate the category(ies) and level(s) of safeguarding required at the supplier's site(s) or premises.

Les utilisateurs qui remplissent le formulaire manuellement doivent utiliser le tableau récapitulatif ci-dessous pour indiquer, pour chaque catégorie, les niveaux de sauvegarde requis aux installations du fournisseur.

For users completing the form online (via the Internet), the summary chart is automatically populated by your responses to previous questions.

Dans le cas des utilisateurs qui remplissent le formulaire en ligne (par Internet), les réponses aux questions précédentes sont automatiquement saisies dans le tableau récapitulatif.

SUMMARY CHART / TABLEAU RÉCAPITULATIF

Category / Catégorie	PROTECTED / PROTÉGÉ			CLASSIFIED / CLASSIFIÉ			NATO				COMSEC					
	A	B	C	CONFIDENTIAL / CONFIDENTIEL	SECRET	TOP SECRET / TRÈS SECRET	NATO RESTRICTED / NATO DIFFUSION RESTREINTE	NATO CONFIDENTIAL / NATO CONFIDENTIEL	NATO SECRET	COSMIC TOP SECRET / COSMIC TRÈS SECRET	PROTECTED / PROTÉGÉ			CONFIDENTIAL / CONFIDENTIEL	SECRET	TOP SECRET / TRÈS SECRET
											A	B	C			
Information / Assets / Renseignements / Biens / Production																
IT Media / Support TI																
IT Link / Lien électronique																

12. a) Is the description of the work contained within this SRCL PROTECTED and/or CLASSIFIED?

La description du travail visé par la présente LVERS est-elle de nature PROTÉGÉE et/ou CLASSIFIÉE?

No / Non Yes / Oui

If Yes, classify this form by annotating the top and bottom in the area entitled "Security Classification".

Dans l'affirmative, classifiez le présent formulaire en indiquant le niveau de sécurité dans la case intitulée « Classification de sécurité » au haut et au bas du formulaire.

12. b) Will the documentation attached to this SRCL be PROTECTED and/or CLASSIFIED?

La documentation associée à la présente LVERS sera-t-elle PROTÉGÉE et/ou CLASSIFIÉE?

No / Non Yes / Oui

If Yes, classify this form by annotating the top and bottom in the area entitled "Security Classification" and indicate with attachments (e.g. SECRET with Attachments).

Dans l'affirmative, classifiez le présent formulaire en indiquant le niveau de sécurité dans la case intitulée « Classification de sécurité » au haut et au bas du formulaire et indiquez qu'il y a des pièces jointes (p. ex. SECRET avec des pièces jointes).



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PART D - AUTHORIZATION / PARTIE D - AUTORISATION

13. Organization Project Authority / Chargé de projet de l'organisme

Name (print) - Nom (en lettres moulées) Alexander Thorsten Nitsche	Title - Titre Project Manager	Signature 	Date July 5, 2017
Telephone No. - N° de téléphone (519) 430-7114	Facsimile No. - N° de télécopieur	E-mail address - Adresse courriel alexander.nitsche@nrc-cnrc.gc.ca	Date July 5, 2017

14. Organization Security Authority / Responsable de la sécurité de l'organisme

Name (print) - Nom (en lettres moulées) Richard Bramucci	Title - Titre Analyst, Security in Contracting	Signature 	Date JUL 05 2017
Telephone No. - N° de téléphone (613) 991-1093	Facsimile No. - N° de télécopieur (613) 990-0946	E-mail address - Adresse courriel richard.bramucci@nrc-cnrc.gc.ca	Date JUL 05 2017

15. Are there additional instructions (e.g. Security Guide, Security Classification Guide) attached?
Des instructions supplémentaires (p. ex. Guide de sécurité, Guide de classification de la sécurité) sont-elles jointes?

No / Non Yes / Oui

16. Procurement Officer / Agent d'approvisionnement

Name (print) - Nom (en lettres moulées) <i>Alain Levesque</i>	Title - Titre <i>Senior Proc. Officer</i>	Signature 	Date <i>12-7-2017</i>
Telephone No. - N° de téléphone <i>613 991-9900</i>	Facsimile No. - N° de télécopieur	E-mail address - Adresse courriel <i>alain.levsq@nrc-cnrc.gc.ca</i>	Date <i>12-7-2017</i>

17. Contracting Security Authority / Autorité contractante en matière de sécurité

Name (print) - Nom (en lettres moulées)	Title - Titre	Signature	Date
Telephone No. - N° de téléphone	Facsimile No. - N° de télécopieur	E-mail address - Adresse courriel	Date