



## SPECIFICATION

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**SOLICITATION #:13-22089**

**BUILDING:** M-36  
1200 Montreal Road Campus  
Ottawa, ON

**PROJECT:** Renovate Kelvin Room

**PROJECT #:** M-36-3876

**Date:** November 2013



National Research  
Council Canada

Conseil national  
de recherches Canada

Canada

# **SPECIFICATION**

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National Research Council Canada	Conseil national de recherches Canada
Administrative Services & Property management Branch (ASPM)	Direction des services administratif et gestion de l'immobilier (SAGI)

## Construction Tender Form

**Project Identification     M-36 Renovate Kelvin Room**

**Tender No.:     13-22089**

**1.2     Business Name and Address of Tenderer**

Name \_\_\_\_\_

Address \_\_\_\_\_

Contact Person(Print Name) \_\_\_\_\_

Telephone (\_\_\_\_\_) \_\_\_\_\_ Fax: (\_\_\_\_\_) \_\_\_\_\_

**1.3 Offer**

I/We the Tenderer, hereby offer to Her Majesty the Queen in Right of Canada (hereinafter referred to as "Her Majesty") represented by the National Research Council Canada to perform and complete the work for the above named project in accordance with the Plans and Specifications and other Tender Documents, at the place and in the manner set out therein for the Total Tender Amount (to be expressed in numbers only) of: \$ \_\_\_\_\_ in lawful money of Canada (excluding GST/HST)

The above amount is inclusive of all applicable (\*) Federal, Provincial and Municipal taxes except that in the event of a change in any 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, that occurs

- .1     after the date this tender was mailed or delivered, or
- .2     if this tender is revised, after the date of the last revision

the amount of this offer shall be decreased or decreased in the manner provided for in GC22 of the General Conditions of the Contract Documents.

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### 1.3.1 **Offer** (continued)

(\*) For the purpose of this tender, the Goods and Services Tax (GST) is not to be considered as an applicable tax.

In the province of Quebec, the Quebec Sales Tax is not to be included in the tender amount because the Federal Government is exempt from this tax. Tenderers shall make arrangements directly with the provincial Revenue Department to recover any tax they may pay on good and services acquired in the performance of this contract. However, tenderers should include in their tender amount Quebec Sales Tax for which an Input Tax Refund is not available.

### 1.4 **Acceptance and Entry into Contract**

I/We undertake, within fourteen (14) days of notification of acceptance of my/our offer, to sign a contract for the performance of the work provided I/we are notified, by the Department, of the acceptance of my/our offer within 30 days of the tender closing date.

### 1.5 **Construction Time**

I/We Agree to complete the work within the time stipulated in the specification from the date of notification of acceptance of my/our offer.

### 1.6 **Bid Security**

I/We herewith enclose tender security in accordance with Article 5 of the General Instruction to Tenderers.

I/We understand that if a security deposit is furnished as tender security and if I/we refuse to enter into a contract when called upon to do so, my/our security deposit shall be forfeited but the Minister may, if it is in the public interest, waive the right of Her Majesty to forfeit the security deposit.

I/We understand that if the security furnished is not in the approved form as described in Article 5 of the General Instructions to Tenderers, my/our tender is subject to disqualification.

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**1.7 Contract Security**

Within fourteen (14) days after receipt of written notification of the acceptance of my/our offer, I/we will furnish contract security in accordance with the Contract Conditions "F" of the Contract Documents.

I/We understand that the contract security referred to herein, if provided in the form of a bill of exchange, will be deposited into the Consolidated Revenue Fund of Canada.

**1.8 Appendices**

This Tender Form includes Appendix No. \_\_\_\_\_ N/A \_\_\_\_\_.

**1.9 Addenda**

The Total Tender Amount provides for the Work described in the following Addenda:

NUMBER	DATE	NUMBER	DATE

**(Tenderers shall enter numbers and dates of addenda)**

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**1.10 Execution of Tender**

The Tenderer shall refer to Article 2 of the General Instructions to Tenderers.

**SIGNED, ATTESTED TO AND DELIVERED on the \_\_\_\_\_ day of  
\_\_\_\_\_ on behalf of**

\_\_\_\_\_  
(Type or print the business name of the Tenderer)

AUTHORIZED SIGNATORY (IES)

\_\_\_\_\_  
(Signature of Signatory)

\_\_\_\_\_  
(Print name & Title of Signatory)

\_\_\_\_\_  
(Signature of Signatory)

\_\_\_\_\_  
(Print name & Title of Signatory)

**SEAL**

## BUYANDSELL NOTICE

### M-36 Renovate Kelvin Room

The National Research Council Canada, 1200 Montreal Road Campus, Ottawa, ON has a requirement for a project that includes:

Renovate Kelvin Room (1100A) at M-36, replace existing ceiling system, lighting, mechanical heating and cooling; demolish existing audio-visual room and make provisions for new videoconference system.

#### 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 December 10th and December 11<sup>th</sup>, 2013 at 9:00. Meet Noel Fagan at Building M-21, cafeteria, 1200 Montreal Road Campus, Ottawa, ON. 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 December 23rd, 2013 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:

This procurement contains a mandatory security requirement as follows:

- .1 The Contractor must, at all times during the performance of the Contract, hold a valid Designated Organization Screening (DOS), issued by the Canadian Industrial Security Director (CISD), Public Works Government Services Canada.
- .2 The Contractor personnel requiring access to sensitive work site(s) must EACH hold a valid RELIABILITY STATUS, granted or approved by CISD/PWGSC.
- .3 The Contractor must comply with the provisions of the:
  - a. Security Requirements Checklist attached at Appendix "D"
  - b. Industrial Security Manual (Latest Edition) available at: <http://ssi-iss.tpsgc-pwgsc.gc.ca/msi-ism/msi-ism-eng.html>

### 5.2 VERIFICATION OF SECURITY CLEARANCE AT BID CLOSING

- .1 The Bidder must hold a valid Designated Organization Screening (DOS) issued by the Canadian Industrial Security Directorate (CISD), Public Works and Government Services Canada (PWGSC), **TO BE INCLUDED WITH THEIR TENDER OR PROVIDED WITHIN 48 HOURS FROM THE DATE AND TIME OF TENDER CLOSING**. Verifications will be made through CISD to confirm the security clearance status of the Bidder. Failure to comply with this requirement will render the bid non-compliant and no further consideration will be given to the bid.
- .2 Within 72 hours of tender closing, the General Contractor must name all of his sub-contractors, each of whom **must hold a valid RELIABILITY STATUS**, granted or approved by CISD/PWGSC, or any other Federal Department or Agency along with the names and birthdates or security clearance certificate numbers of all personnel who will be assigned to the project.
- .3 It is to be noted that any subcontractor required to perform any part of the work during the performance of the subsequent contract must also adhere to the mandatory security requirement of the contract. As well, no personnel without the required level of security will be allowed on site. It will be the responsibility of the successful bidder to ensure that the security requirement is met throughout the performance of the contract. The Crown will not be held liable or accountable for any delays or additional costs associated with the contractor's non-compliance to the mandatory security requirement. Failure to comply with the mandatory security requirement will be grounds for being declared in default of contract.
- .4 For any enquiries concerning the project security requirement during the bidding period, the Bidder/Tenderer must contact the Security Officer @ 613-993-8956.

### 6.0 WSIB (WORKPLACE SAFETY AND INSURANCE BOARD)

- .1 All Bidders must provide a valid WSIB 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](mailto: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](mailto: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](mailto: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](http://www.opo-boa.gc.ca).

The Departmental Representative or his designate for this project is: **Noel Fagan**  
Telephone: **613 990-9073**

Contracting Authority for this project is: **Marc Bédard**  
Telephone: **613 993-2274**

## 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 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  
1200 Montreal Road  
Building M-22  
Ottawa, ON K1A 0R6

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.

# Non-Resident Contractors

RST Guide 804

Published: August 2006

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## Publication Archived

**Notice to the reader: For Retail Sales Tax (RST)** – On July 1, 2010 the 13 per cent Harmonized Sales Tax (HST) took effect in Ontario replacing the existing provincial Retail Sales Tax (RST) and combining it with the federal Goods and Services Tax (GST). As a result, RST provisions described on this page and in other publications ended on June 30, 2010.

Effective July 1, 2010 this publication was archived for RST purposes **only**. Use caution when you refer to it, since it reflects the law in force for RST at the time it was released and may no longer apply.

- The information in this Guide explains the Retail Sales Tax (RST) responsibilities of a non-resident contractor who is awarded a construction contract to perform work in Ontario and their Ontario customers. Please note that this Guide replaces the previous version dated March 2001.

## Non-Resident Contractor Defined

A non-resident contractor is a contractor located outside Ontario who has been awarded a construction contract to perform work in Ontario, and who has not maintained a permanent place of business in Ontario continuously for twelve months immediately prior to signing the contract, or which is not a company incorporated under the laws of Ontario. A construction contract is a contract for the erection, remodelling or repair of a building or other structure on land.

A contractor is a person who is in the business of constructing, altering, repairing or improving real property and includes, but is not limited to,

1. a general contractor and subcontractor,
2. a carpenter, bricklayer, stonemason, electrician, plasterer, plumber, painter, decorator, paver, and bridge builder,
3. a sheet metal, tile and terrazzo, heating, air conditioning, insulation, ventilating, papering, road, roofing and cement contractor,

who installs or incorporates items into real property. (See RST [Guide 206 - Real Property and Fixtures](#)).

## Registration and Guarantee Deposit

Non-resident contractors who are awarded a construction contract in Ontario are required to register with the Ministry of Finance (ministry), Centralized Programs Unit and post a guarantee equal to 4 per cent of the total of each Ontario contract. The guarantee can be paid in cash, by certified cheque (payable to the Minister of Finance), letter of credit or by a guarantee bond.

To register with the ministry and to obtain further information on posting a guarantee, contractors should contact the ministry's Centralized Programs Unit, 33 King Street West, PO Box 623, Oshawa, Ontario, L1H 8H7, toll-free 1 866 ONT-TAXS (1 866 668-8297) or fax to 905 435-3617.

Non-resident contractors who sell taxable goods on a supply only basis to Ontario customers, or provide taxable services in Ontario, may obtain a regular Vendor Permit to collect and remit RST on their sales. Non-resident contractors who have been issued a regular Vendor Permit must still register separately with the ministry and post a guarantee if they are awarded a construction contract in Ontario.

## Letter of Compliance

After receiving the guarantee, the ministry mails out two copies of a "letter of compliance" to the contractor certifying the Retail Sales Tax (RST) requirements have been met. Contractors must give a copy of the letter to their customers.

If a copy of the compliance letter is not provided, the customer must withhold 4 per cent of all amounts payable to the non resident contractor and pay the withheld amounts to the Minister of Finance (minister). Details relating to the contract should be sent along with the payments to the Centralized Programs Unit. Customers may give the minister a guarantee bond equal to 4 per cent of the total contract price instead of making the 4 per cent payments.

Note: Customers who do not follow these requirements may be held liable for 4 per cent of all amounts payable to the non resident contractor or any other amount that the Ministry deems to be the RST payable resulting from the performance of the contract.

## Calculation of RST

### *Fair Value*

RST is payable on the "fair value" of materials, purchased or brought into Ontario, to be used for work performed in Ontario. "Fair value" includes:

- the purchase price in Canadian funds;
- all charges by the supplier for handling and delivery, and
- any federal customs duties and excise taxes paid (but not the federal Goods and Services Tax (GST)).



Contractors are also required to pay RST to Ontario suppliers on the purchase, rental or lease of taxable services, materials, machinery, or equipment.

#### ***Machinery and Equipment - Leased***

If machinery or equipment is leased from a supplier outside Ontario and brought into the province, RST is payable on the lease payments for the period the machinery or equipment is in Ontario.

#### ***Machinery and Equipment - Owned by Contractor***

If machinery or equipment is owned by the contractor, RST may be calculated in one of the following ways:

- a. If a contractor brings machinery and equipment into Ontario for less than 12 months' use, RST is to be calculated using the following formula:

$$1/36 \times \text{net book value at date of import} \times \text{number of months in Ontario} \times \text{tax rate}$$

For the purpose of this formula, RST is payable for each month or part of a month that the goods are in Ontario. A month is considered 31 consecutive days and a part month is considered more than 12 days. The RST payable is based on the number of days the machinery and equipment are located in Ontario and not the number of days the items are actually used.

Example: Equipment is brought into Ontario on March 28 and taken out on May 8. The items were in the province for 41 days. RST is payable on the first 31 days' temporary stay in Ontario vs. use of the equipment. Since the remainder (10 days) is not considered part of a month, no RST is payable on this portion.

- b. If, at the time the goods are brought into Ontario, it is expected that the machinery or equipment will be in Ontario for more than twelve months, contractors must pay Retail Sales Tax (RST) on the following basis:

$$\text{net book value at date of import} \times \text{tax rate}$$

If, at the time of import, the length of time is not known, vendors may use the formula under (a). If they later find it necessary to keep the machinery and equipment in Ontario for more than 12 months, the RST paid under (a) may be deducted from the RST payable under (b).

Using formula (a) or (b) above, contractors will calculate and remit the RST payable on the return that is filed when the contract is finished.

[\(See Completion of Contract section\)](#)

## **Manufacturing for Own Use**

Contractors may need to manufacture items, such as doors and windows, for their construction contracts. Manufacturing is work done in a factory away from a construction

site, or in a mobile unit or workshop that is on or near the construction site. Manufacturing occurs when raw materials are changed into manufactured goods for use in real property contracts.

Contractors are considered to be manufacturing contractors if they produce goods:

1. for their own use in real property contracts, and
2. the manufactured cost of the goods is more than \$50,000 a year.

(See RST [Guide 401 - Manufacturing Contractors](#))

## Contracts with the Federal Government

Where a non-resident contractor enters into a construction contract with the federal government, for the construction of a building and/or the installation of equipment, the nature of the equipment will determine whether the contract should be let on a tax-included or tax excluded basis.

Contracts for the construction of a building and the installation of equipment that directly services that building (i.e., elevators, escalators, light fixtures, central heating and air conditioning, etc.) should be tendered on a tax -included basis. Contractors are the consumers of the materials used in fulfilling these contracts and must pay or account for RST on the materials used to complete the contracts. There is NO exemption just because the contract is with the federal government.

Contracts for the installation of equipment that becomes a fixture and does not directly service a building (i.e., material handling equipment, production machinery, communication equipment, training equipment) may be tendered on a tax-excluded basis. Contractors engaged in contracts of this nature are permitted to make tax exempt purchases of such equipment by issuing a valid Purchase Exemption Certificate (PEC) to their supplier. Only non-resident contractors who have registered with the ministry and posted a guarantee may issue a PEC.

## Exemptions

Contractors may supply and install equipment or materials for certain customers that may be entitled to an exemption from RST (e.g., manufacturers, Indian band councils, farmers and diplomatic organizations). The equipment or materials, when installed, becomes real property if it is permanently attached to land, or a fixture if it is permanently attached to a building or real property structure. Since contractors are liable for RST, they should contact the ministry to find out if the customer qualifies for exemption before tendering the contract on a tax-excluded basis.

## Status Indians, Indian Bands and Band Councils

Non-resident contractors may purchase building materials exempt from Retail Sales Tax (RST) for certain buildings and structures situated on reserves. The cost of such projects must be paid by the band council, and the buildings must provide a community service for

the reserve. Contracts for the construction of an exempt community building project should be made on an RST-excluded basis. Non-resident contractors may purchase the materials exempt from RST by providing suppliers with a valid Purchase Exemption Certificate (PEC). As noted previously, only non-resident contractors who have registered with the ministry and posted a guarantee may issue a PEC. (See RST Guide [204 - Purchase Exemption Certificates](#)).

Non-resident contractors must pay RST on items purchased for incorporation into a building or structure built for individual status Indians on a reserve. (See RST [Guide 808 - Status Indians, Indian Bands and Band Councils](#)).

### Completion of Contract

When a contract is completed, non-resident contractors who were required to post a guarantee must complete a [Non-Resident Contractor Retail Sales Tax Return \[PDF - 92 KB\]](#) that is provided by the ministry.

If a contractor's guarantee was given in cash or by certified cheque, the amount of the deposit can be deducted from the RST liability owed by the contractor. If the liability is greater than the deposit, the amount remaining must be paid by the contractor. If the deposit is more than the liability, the contractor will receive a refund.

If a guarantee bond was posted instead of cash, the bond will be discharged once the RST liability is paid in full.

All returns are subject to audit.

### Legislative References

- Retail Sales Tax Act, Subsections 19(2) and 39(3)(4) and (5)
- Regulation 1012 under the Act, Subsections 15.3(1)(2)(5)(6) and (7)
- Regulation 1013 under the Act, Sections 1 and 3

### For More Information

The information contained in this publication is only a guideline. For more information, please contact the Ontario Ministry of Finance at 1 866 ONT-TAXS (1 866 668-8297) or visit our website at [ontario.ca/finance](http://ontario.ca/finance).

## 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



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## Articles of Agreement

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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



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## Articles of Agreement

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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



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## Articles of Agreement

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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,





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## Articles of Agreement

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**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:





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## Articles of Agreement

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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**

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**1. SCOPE OF WORK**

- .1 Work under this contract covers the Kelvin Room (1100A) in the Council's Building M-36 of the National Research Council.

**2. 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 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.

**3. LABOUR CONDITIONS AND FAIR WAGE SCHEDULE**

- .1 Comply with all labour conditions as specified by the Human Resources Development Canada, Labour Program, including those outlined in Appendix "D", Labour Conditions and Fair Wage Schedule.

**4. WORKPLACE HAZARDOUS MATERIAL INFORMATION SYSTEM (WHMIS)**

- .1 The 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; and



- .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.

**5. EXAMINATION REQUIREMENTS OF BILL 208, SECTION 18(a)**

- .1 Under the requirements of Bill 208 of the Ministry of Labour Occupational Health & Safety Act, the following designated substances may be encountered while performing the work described in these contract documents:

- .1 Lead, Asbestos, Silica
  - .1 It is the responsibility of the general contractor to ensure that each prospective subcontractor for this project has received a copy of the above list.
  - .2 In addition to the above designated substances, the following may also be present:
  - .3 The contractor is advised to take the following precautions when dealing with the above substances:

**6. GENERAL**

- .1 The word "provide" indicated in this Specification means to supply and install. Site Examination

**7. COMPLETION**

- .1 All work is to be completed within 8 week(s) upon receipt of notification of acceptance of tender.

**8. COST BREAKDOWN**

- .1 Submit, for approval by the Departmental Representative, a breakdown of tender before submitting the first request for progress payment.
- .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.

**9. 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. Security Deposit.

**10. SUB-TRADES**

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

**11. SITE VISITS**

- .1 For tendering purposes, the site visit(s) must be attended in the presence of the Departmental Representative.

**12. 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.

**13. FIRE AND GENERAL SAFETY**

- .1 Comply with the requirements of Fire Commissioner of Canada Standards No. 301 and 302.
- .2 Comply with the requirements of the National Research Council, Fire Prevention Officer including those outlined in Section 01545.
- .3 Comply with safety related instructions from the Departmental Representative or the National Research Council, Fire Prevention Officer.
- .4 Comply with the National Building Code (Part 8, Construction Safety Measures) and the Provincial Construction Safety Act.

**14. 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 Secure working area at the end of each day's work and be responsible for the same.
- .9 Provide and maintain adequate safety barricades around the work sites to protect NRC personnel and the public from injury during the carrying out of work.
- .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.

**15. FASTENING DEVICES**

- .1 Do not use explosive actuated tools, unless permitted expressly by 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.

**16. BILINGUALISM**

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

**17. 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 of the structure 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 NRC Fire Prevention Officer including provision of full-time watchmen services when directed.
  - .3 Enforce safe practices.
  - .4 Vent direct-fired combustion units to outside.
- .7 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 and maintenance, 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.

## **18. DISCREPANCIES & INTERFERENCES**

- .1 Before tender closing, examine drawings and specifications. Report at once to the Departmental Representative, any defects, discrepancies, omissions or interferences affecting the work.
- .2 Provide items mentioned in either the drawings or the specification.
- .3 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.
- .4 Any work done after such a discovery, until authorized, is at the contractor's risk.
- .5 Where special interferences 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.
- .6 Arrange all work so as not to interfere in any way with other work being carried out.
- .7 Commencement of work will imply an acceptance of existing conditions.

**19. 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.

**20. 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.

**21. 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.

**22. 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.

**23. WORKING HOURS AND SECURITY**

- .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 Obtain permission from the Departmental Representative to perform the specific tasks before scheduling any work outside normal working hours.
- .4 An escort may be required whenever working outside normal hours. Contractor to bear the associated costs.

- .5 All persons employed by the contractor, or by any subcontractor, and working on the site must wear and keep visible identification badges issued by the Council.

**24. 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.

Notify Departmental Representative in writing of any changes in schedule.

- .2 7 day(s) before the scheduled completion date arrange to do an interim inspection with the Departmental Representative.

**25. SERVICE INTERRUPTIONS**

- .1 Arrange for all service interruptions with the Departmental Representative. Do not operate any NRC equipment or plant.
- .2 Allow 72 hours notice prior to cutting into any existing service.
- .3 All service interruptions are to be of minimum duration.
- .4 Protect existing services as required and immediately make repairs if damage occurs.
- .5 Provide detours, bridges, alternate feeds, etc., as required to minimize disruptions.
- .6 Plan and perform work in advance in order to minimize disruption and service interruption.

**26. SHOP DRAWINGS**

- .1 Submit to Departmental Representative for review, shop drawings, product data and samples specified within 2 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 1 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 5 copies 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.

**27. SAMPLES AND MOCK-UPS**

- .1 Submit samples in sizes and quantities 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 project.

**28. 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.

**29. SPECIFICATIONS, "AS BUILTS"**

- .1 The contractor shall keep on the site, one (1) up-to-date copy of all specifications, drawings and bulletins pertaining to the work, in good order, available to the Departmental Representative and to his representatives at all times.
- .2 At least one (1) copy of such specifications and drawings shall be marked by the contractor to show all work "As Built" and shall be handed over to the Departmental Representative with the Application for Payment and for the Final Certificate of Completion.

**30. 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.

**31. PARTIAL OCCUPANCY**

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

**32. USE OF SITE**

- .1 Restrict operations on site to the areas approved by the Departmental Representative at the time of tendering.
- .2 Locate all temporary structures, equipment, storage, etc., to the designated areas.
- .3 Restrict parking to the designated areas.
- .4 Do not restrict access to the building, routes, and services.
- .5 Do not encumber the site with materials or equipment.

**33. 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.

**34. 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.

**35. 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.

**36. 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 not permitted unless in the case of an emergency.

**37. SANITARY FACILITIES**

- .1 Obtain permission from the Departmental Representative to use the existing washroom facilities in the building.
- .2 The contractor is responsible for keeping facilities clean at all times.

**38. PROJECT MEETINGS**

- .1 Hold regular project 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 and assume responsibility for recording and distributing minutes.

**39. 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 NRC Fire Prevention Officer.

**40. DRAINAGE**

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

**41. 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 weathertight 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.

**42. LAYOUT OF WORK**

- .1 Lay out the work carefully and accurately.
- .2 Verify all dimensions and be responsible for them.
- .3 Locate and preserve general reference points.
- .4 Employ competent person to lay out work in accordance with control lines and grades provided by the Departmental Representative.

**43. CONCEALING**

- .1 Conceal all services, piping, wiring, ductwork, etc., in floors, walls or ceilings except where indicated otherwise.

**44. SPACE CONFLICT**

- .1 Maintain an awareness of responsibility to avoid space conflict with other trades.
- .2 Throughout the course of construction, keep continuously acquainted with field conditions, and the work being developed by all trades involved in the project.

**45. 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 Departmental Representative's satisfaction.
- .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 caulking in accordance with CAN/CGSB-19.13-M87 AND NBC 3.1.7.

**46. 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.

**47. FINAL CLEAN-UP**

- .1 Upon completion do a final clean-up to the satisfaction of the Departmental Representative.
- .2 Clean all new surfaces, lights, existing surfaces affected by this work, replace filters, etc.
- .3 Clean all resilient flooring and prepare to receive protective finish. Protective finish applied by NRC

**48. DISPOSAL OF WASTES**

- .1 Dispose of waste materials including volatiles, safely off NRC property. Refer to the article entitled "Fire & General Safety" of this section.

**49. WARRANTY**

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

**51. IDENTIFICATION BADGES**

- .1 Use of Identification Badges is mandatory in NRC buildings.
- .2 Obtain all badges from the Security office.

**52. 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.

**53. DRAWINGS**

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

3876-A01 – DEMOLITION PLANS AND DETAILS

3876-A02 – NEW CONSTRUCTION FLOOR PLANS AND SECTIONS

3876-M01 – MECHANICAL: LEGENDM DRAWING LIST AND EQUIPMENT SCHEDULES

3876-M02 – MECHANICAL: DEMOLITION

3876-M03 – MECHANICAL: NEW WORK

3876-M04 – MECHANICAL: ELEVATIONS, DETAILS AND SCHEMATICS

3876-E01 – ELECTRICAL: DEMOLITION

3876-E02 – ELECTRICAL: NEW WORK

**END OF SECTION**

**Part 1           General**

**1.1           AUTHORITIES**

- .1       The Fire Commissioner of Canada (F.C.) 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.
- .3       The Departmental Representative will consult with the Fire Prevention Officer (FPO) as and when required.
- .4       The Departmental Representative will enforce these Fire Safety Requirements.
- .5       Comply with the following standards as published by the Office of the Fire Commissioner of Canada:
  - .1       Standard No. 301 - June 1982 "Standard for Construction Operations";
  - .2       Standard No. 302 - June 1982 "Standard for Welding and Cutting".

**1.2           Hot Work**

- .1       Permit:
  - .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       Site Review:
  - .1       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.

**1.3           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 following emergency phone number:

<b>CELLULAR OR</b>		
<b><u>NRC LOCATION</u></b>	<b><u>NON-NRC PHONES</u></b>	<b><u>NRC PHONES</u></b>
<b>Montreal Road Campus</b>	<b>613-993-2411</b>	<b>333</b>
<b>Uplands</b>	<b>613-993-2411</b>	<b>333</b>
<b>Carleton Place</b>	<b>613-993-2411 OR</b>	<b>993-2411</b>

**Greenbank  
Sussex Drive**

**613-993-2411 OR  
613-993-2411**

**993-2411  
333**

- .3 When reporting a fire by phone, give the location of fire, building number and be prepared to verify location.
- .4 The person activating fire alarm pull station must remain at the scene of fire to provide information and direction to the Fire Department personnel.

#### **1.4 INTERIOR AND EXTERIOR FIRE PROTECTION & ALARM SYSTEMS**

- .1 DO NOT OBSTRUCT OR SHUT OFF FIRE PROTECTION EQUIPMENT OR ALARM 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.

#### **1.5 FIRE EXTINGUISHERS**

- .1 Provide a minimum of 1-20 lb. ABC Dry Chemical Fire Extinguisher for every hot work operation.
- .2 Provide fire extinguishers for hot asphalt and roofing operations as follows:
  - .1 Pot area - 1-20 lb. ABC Dry Chemical;
  - .2 Roof - 2-20 lb. ABC Dry Chemical.
- .3 Provide fire extinguishers equipped as below:
  - .1 Pinned and sealed;
  - .2 With a pressure gauge;
  - .3 With an extinguisher tag signed by a fire extinguisher servicing company.
- .4 Carbon Dioxide (CO<sub>2</sub>) extinguishers will not be considered as substitutes for the above.

#### **1.6 ROOFING**

- .1 Kettles:

- .1 Arrange for the safe location of asphalt kettles and material storage with the Departmental Representative before moving them on site. Do not locate kettles on any roof or structure and keep them at least 10m away from a building and at a safe distance from parked automobiles.
  - .2 Equip kettles with thermometers or gauges that are in good working order.
  - .3 Do not operate kettles at temperatures in excess of 232°C.
  - .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 12.
  - .5 Advise the Departmental Representative of container capacities prior to start of work.
  - .6 Keep compressed gas cylinders secured in an upright position and a minimum of 20 feet away from any 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 Provide a fire watch as required by article 13 of this section.
- .4 Materials Storage:
- .1 Store all combustible roofing materials at least 3m away from any structure and 6m from any kettle.

## **1.7 FIRE WATCH**

- .1 Provide a fire watch for a minimum of one hour after the termination of a hot work operation.
- .2 Temporary heating, refer to General Instructions Section 01000.
- .3 Equip fire watch personnel with fire extinguishers as required by article 5.

## **1.8 OBSTRUCT 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 the Fire Department personnel and their apparatus. This includes violation of minimum overhead clearance, erecting 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.

## **1.9 SMOKING**

- .1 Smoking is prohibited inside all NRC buildings.
- .2 Obey all "NO SMOKING" signs.

## **1.10 RUBBISH AND WASTE MATERIALS**

- .1 Keep rubbish and waste materials to a minimum and a minimum of 20 feet from any kettle or torches.
- .2 Do not burn rubbish on site.
- .3 Removal:
  - .1 Remove all rubbish from work site at the end of the work day or shift, or as directed.
- .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 as required in 10.3.1.
- .5 Dumpsters:
  - .1 Consult the Departmental Representative to determine an acceptable safe location before bringing the dumpster on site.

## **1.11 FLAMMABLE LIQUIDS**

- .1 The handling, storage and use of flammable liquids are 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, provided they are stored in approved safety cans bearing the ULC seal of approval. Storage of quantities of flammable liquids exceeding 45 litres for work purposes, require the permission of the Departmental Representative.
- .3 Transfer of flammable liquids is prohibited within buildings.
- .4 Do not transfer flammable liquids in the vicinity of open flames or any type of heat producing device.
- .5 Do not use flammable liquids having a flash point below 38 °C such as naphtha or gasoline as solvents or cleaning agents.



- .6 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.
- .7 Where flammable liquids, such as lacquers or urethane are used, assure proper ventilation and eliminate all sources of ignition. Inform the Departmental Representative prior to, and at the cessation of such work.

**1.12 QUESTIONS AND/OR CLARIFICATION**

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

**END OF SECTION**

**Part 1 GENERAL**

**1.1 Protection**

- .1 Protect existing items designated to remain and materials designated for salvage. In event of damage, immediately replace such items or make repairs to approval of Departmental Representative and at no additional cost to Departmental Representative.

**1.2 Measurement for Payment**

- .1 N/a

**Part 2 PRODUCTS**

**2.1 N/A**

**Part 3 EXECUTION**

**3.1 Preparation**

- .1 Inspect site and verify with Departmental Representative items designated for removal and items to be preserved.
- .2 Locate and protect utility lines. Preserve in operating condition active utilities traversing site.

**3.2 Removal**

- .1 Remove items indicated.
- .2 Do not disturb adjacent items designated to remain in place.

**3.3 Salvage**

- .1 Carefully dismantle items containing materials directed or indicated for salvage. Store salvaged materials at locations directed or indicated.

**3.4 Disposal of Material**

- .1 Dispose of materials not designated for salvage or re-use in work, off-site.

**3.5 Restoration**

- .1 Upon completion of work, remove debris, trim surfaces and leave work site clean.
- .2 Reinstate areas and existing works outside areas of demolition to match condition of adjacent, undisturbed areas.

**END OF SECTION**

**Part 1 GENERAL**

**1.1 Scope of Work**

- .1 Provide interior protection prior to demolition work.
- .2 Protection to be constructed in such a fashion so as to afford security and dust resistance.
- .3 Barriers to be constructed continuously on the exterior of room 1100A (at doorways used during construction), to reduce contamination of adjacent spaces.

**Part 2 PRODUCTS**

**2.1 Materials**

- .1 3-5/8" metal studding.
- .2 6 mil. polyethylene.

**2.2 Erection**

- .1 Construct barriers full height and line with polyethylene to ensure dust and watertightness.

**Part 3 SECONDARY PROTECTION**

**3.1 Dust Walls**

- .1 Inspect walls on a regular basis to ensure integrity of the assembly and to avoid dust and water infiltration to the adjacent rooms of the building.
- .2 Remove interior protections only when approved by the Departmental Representative.

**Part 4 REINSTATEMENTS**

**4.1 Finishes**

- .1 Reinstall the interior finishes affected by this work to the satisfaction of the Departmental Representative.

**END OF SECTION**

## **Part 1           GENERAL**

### **1.1            Outline of Work**

.1           Comply with the requirements of this section when performing the following work:

.1           Installing or removing non-friable asbestos containing products: vinyl tiles, acoustic tiles, gaskets, seals, packings, manufactured cement products containing asbestos such as boards or ceiling tiles.

### **1.2            Definitions**

.1           HEPA vacuum: Vacuum equipment with a high efficiency particulate air filter system capable of collecting and retaining fibres greater than 0.3 microns in length at 99.97% efficiency.

.2           Amended water: water with a non-ionic surfactant wetting agent added to reduce water tension to allow thorough wetting of asbestos fibres.

.3           Non-Friable Material: Material that when dry cannot be crumbled, pulverized or powdered by hand pressure. Includes, but is not limited to the following asbestos containing products: vinyl asbestos floor tiles, resilient sheet flooring, acoustic ceiling and wall tiles, gaskets, seals, packings, friction products, drywall joint compounds and asbestos cement boards, shingles, tiles and piping.

### **1.3            Regulatory Agencies**

.1           Comply with Federal, Provincial, and local requirements pertaining to asbestos, provided that in any case of conflict among these requirements or with these specifications the more stringent requirement shall apply.

.2           Comply with:

.1           Canada Labour Code Part IV, Canada Occupational Safety and Health Regulation Part X, "Dangerous Substances".

.2           Ontario Ministry of Labour Occupational Health and Safety Division Ontario Regulation 278/05 "Asbestos on Construction Projects and in Buildings & Repair Operation".

.3           Ontario Ministry of the Environment Regulation RRO 1990, Reg. 347 as amended to O. Reg.461/05, "Asbestos Waste Disposal".

.3           Compliance with Regulation 278/05 on every project is the responsibility of the owner and of every contractor, employer and worker engaged in or on the project.

#### **1.4 Submittals**

- .1 Submit proof satisfactory to the Departmental Representative that suitable arrangements have been made with, and permission has been given by, the authority having jurisdiction to transport and to dispose of asbestos-containing waste in accordance with their requirements.
- .2 Submit copies of dumping slips to confirm disposal of asbestos-containing waste in accordance with requirements of the authority having jurisdiction.

#### **1.5 Existing Conditions**

- .1 Results of tests of asbestos-containing materials taken from surfaces within the scope of this project are available for inspection upon request. These are for general information only and are not necessarily representative of all asbestos-containing materials contained within the scope of this project.
- .2 Notify the Departmental Representative of friable and non-friable material discovered during the work and not apparent from the drawings, specifications, or report, pertaining to the work. Do not disturb such material pending instructions from the Departmental Representative.

#### **1.6 Instruction and Training**

- .1 Before commencing the work, provide every worker with instruction and training in the hazards of asbestos exposure, in personal protective measures and work practices, and in the use, cleaning, and disposal of respirators and protective clothing.
- .2 Instruction and training related to respirators shall include:
  - .1 The limitations of the equipment.
  - .2 The inspection and maintenance of the equipment.
  - .3 The fitting of the equipment.
  - .4 The disinfecting of the equipment. Outline of Work

#### **1.7 Worker Protection**

- .1 Workers shall wear respirators, protective clothing and footwear while in the work area.
- .2 Respirators shall be non-powered, reusable, with a replaceable filter cartridge that is suitable for protection against asbestos, and shall be acceptable to the Provincial Authority having jurisdiction.

- .3 Protective clothing shall consist of full body covering including head covering and snug fitting cuffs at the wrists, ankles and neck; constructed of a material which will not permit penetration of asbestos fibres. Clothing shall be of disposable type, capable of withstanding damp wiping, and/or limited washing. Protective clothing shall be made of either a polyolefin or a polypropylene fabric type, or of an approved equal material.
- .4 Footwear shall be of a type that will prevent fibre penetration and shall be capable of being damp wiped.
- .5 Eating, drinking, chewing, and smoking are not permitted in the work area.
- .6 Before leaving the work area, workers shall decontaminate their protective clothing using a HEPA vacuum or by damp wiping and dispose of as contaminated waste. Waste containers shall be closed using appropriate industry standard methods.
- .7 Workers shall wash hands and face when leaving the work area.

## **1.8 Hours of Work**

- .1 Work shall be performed outside of normal working hours.

## **Part 2 PRODUCTS**

### **2.1 Materials**

- .1 Drop Sheets: As specified.
  - .1 Polyethylene: 0.15 mm (6 mil) thick.
  - .2 FR Polyethylene: 0.15 mm (6 mil) thick woven fibre reinforced fabric bonded both sides with polyethylene.
- .2 Wetting Agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with water in a concentration to provide thorough wetting of asbestos-containing material.
- .3 Waste Containers: waste shall be contained in two separate containers, one inside the other. Both containers shall be 0.15mm (6 mil) thick sealable polyethylene waste bags. Waste containers shall have a preprinted cautionary asbestos warning in both official languages, clearly visible when ready for removal to the disposal site, identified as follows:

**DANGER (50 mm lettering) (2")**

**CONTAINS ASBESTOS FIBRES**

**AVOID CREATING DUST (25 mm lettering) CANCER**

**AND LUNG (1") DISEASE HAZARD**

**DANGER (50 mm lettering) (2")**

**CONTIENT DES FIBRES D'AMIANTE**

**EVITETER DE FAIRE DE LA POUSSIÈRE (25 mm lettering)**

**RISQUE DE CANCER ET DE MALADIES PULMONAIRES**

- .4 Tape: Tape suitable for sealing polyethylene to surfaces under both wet conditions using amended water, and dry conditions.

### **Part 3 EXECUTION**

#### **3.1 Procedures**

- .1 Before beginning work, at each access to work areas, install warning signs approved by Departmental Representative and reading as follows:

**CAUTION ASBESTOS HAZARD AREA (25 mm) (1")**

**NO UNAUTHORIZED ENTRY (20 mm) (3/4")**

**WEAR ASSIGNED PROTECTIVE EQUIPMENT.**

**BREATHING ASBESTOS DUST MAY CAUSE**

**SERIOUS BODILY HARM.**

**ATTENTION, PRÉSENCE D'AMIANTE (25 mm) (1")**

**ENTRÉE INTERDITE AUX PERSONNES NON**

**AUTORISÉES (20 mm) (3/4")**

**PORT OBLIGATOIRE DE VÊTEMENTS PROTECTEURS.**

**L'INHALATION DE POUSSIÈRE D'AMIANTE PEUT**

**CAUSER DES LÉSIONS CORPORELLES GRAVES.**

- .2 Before beginning the work remove visible dust from the surfaces in the work area, where dust is likely to be disturbed during the course of the work. Use a HEPA vacuum, or damp cloths, where damp cleaning does not create a hazard and is otherwise appropriate. Do not use compressed air to clean up or remove dust from any surface.
- .3 Prevent the spread of dust from the work area using measures appropriate to the work to be done. Use [polyethylene][Fibre Reinforced] drop sheets over flooring, such as carpeting, that absorbs dust, and over all flooring in work areas where dust and contamination cannot otherwise be safely contained. Drop sheets cannot be reused and



must be disposed of as asbestos waste. The spread of asbestos in the work area shall be prevented where practicable by disabling the ventilation system(s) or sealing the ducts to and from the work area.

.4 Removal of vinyl asbestos tile

.1 Start removal by wedging heavy duty scraper in seam of 2 adjoining tiles and gradually forcing edge of 1 tile up and away from floor. Do not break off pieces of tile, but continue to force balance of tile up.

.2 When first tile is removed, place it, without breaking into smaller pieces, into asbestos waste receptor. If tiles break use amended water from pump sprayer.

.3 Continue removal of tiles using hand tools and removing tiles intact wherever possible. When adhesive is spread heavily or is quite hard, it may prove easier to force scraper through tightly adhered areas by striking scraper handle with hammer using blows of moderate force while maintaining scraper at 25° to 30° angle to floor. When even this technique cannot loosen tile, removal can be simplified by heating tile with hot air gun or infrared heaters until heat penetrates through tile and softens adhesive. Do not use powered electric scrapers.

.4 After removal of small area scrape up adhesive remaining on floor with hand scraper until only thin smooth film remains. Where deposits are heavy or difficult to scrape, hot air gun or infra-red heaters may be used. Deposit scrapings into asbestos waste receptors. Do not dry scrape surface of adhering pieces of tile.

.5 On completion of area, clean floor with HEPA vacuum.

.5 Removal of asbestos sheet flooring

.1 Remove binding strips or other restrictive moldings.

.2 Make series of knife cuts 100 to 200 mm (4" to 8") apart through top layer and about halfway through asbestos felt backing, parallel to wall.

.3 Start at end of room farthest from door and pry up corner of strip to separate top sheet from backing layer using amended water to ensure backing layer is kept wet at all times. Pull top layer back upon itself slowly and evenly. Roll up top layer with vinyl face out into tight roll and tape or tie securely, and place in asbestos waste receptor.

.4 Continue with successive strips. Avoid walking on exposed asbestos felt backing. Remove maximum of 3 strips (ie., less than 600 mm (24")) before removing exposed felt backing.

.5 Remove adhered felt backing by wet scraping. Soak area with amended water applied by sprayer. Allow water to penetrate felt and scrape off adhered felt. Keep material wet. Place scrapings in asbestos waste receptor.

.6 Continue this procedure alternately removing top sheet and then wet-scraping felt, maximum of 3 strips at a time.

.7 When floor has been cleaned of felt, allow it to dry and vacuum up any residue with HEPA vacuum. Do not dry sweep.

- .8 Thoroughly clean tools and equipment before reusing.
- .6 Installing, cutting or drilling non-friable asbestos materials
  - .1 Wet all materials to be disturbed unless wetting creates a hazard or causes damage.
  - .2 Use a garden reservoir type, low velocity, fine mist sprayer. Perform work in a manner to reduce dust creation to lowest levels practicable.
  - .3 As necessary, use only hand tools for cutting and shaping.
  - .4 Immediately place waste in asbestos waste receptor. Clean area frequently during work with HEPA vacuum or with wet methods.
  - .5 Dispose of drop sheets as asbestos waste. Do not reuse.
- .7 Removal of other non-friable asbestos materials
  - .1 This applies only to material which can be removed intact, or in sections, without producing pulverized or powdered waste. This is applicable to asbestos-cement board products, asbestos-containing drywall compound (less than 1 square meter) and gaskets, and similar items. This is also applicable to asbestos-containing lay-in acoustic tile provided it is minor and not involving more than 7.5 m<sup>2</sup> (80 sq. ft.).
  - .2 Where possible, wet all material to be disturbed.
  - .3 Undo fasteners if necessary to remove material. Whenever possible remove materials intact. Break only if unavoidable. If broken, wet freshly exposed edges.
  - .4 Wet material and use hand scraping to remove material adhering to substrate.
  - .5 Immediately place removed material except gypsum board, in asbestos waste receptor. Clean surrounding surfaces and asbestos work area frequently with HEPA vacuum or with wet methods.
  - .6 Asbestos cement board shall be completely wrapped with (FR) polyethylene and sealed with an approved tape.
  - .7 Dispose of drop sheets as asbestos waste. Do not reuse.
- .8 Cleanup:
  - .1 Frequently during the work and immediately after completion, clean up dust and waste containing asbestos using a HEPA vacuum or by damp mopping.
  - .2 Place dust and waste containing asbestos in sealed, dust-tight waste bags. Drop sheets shall be wetted and folded to contain dust and then placed in waste bags.
  - .3 Immediately before their removal and disposal from the work area, clean each filled waste container using damp cloths or a HEPA vacuum and place in a second clean waste container.

- .4 Seal and remove waste containers from site. Dispose of waste in accordance with requirements of Provincial and Federal authority having jurisdiction.
- .5 Perform a final thorough cleanup of the work area and the adjacent areas affected by the work using a HEPA vacuum.
- .6 Any contamination of surrounding areas noticed by visual inspection and/or air monitoring will require the complete enclosure and clean-up of the affected areas.
- .7 Upon completion of the work, power tools, hand tools and equipment shall be damp wiped or vacuum cleaned using a HEPA vacuum. Wiping cloths shall be disposed of as asbestos waste.

**END OF SECTION**

**Part 1            General**

**1.1                SUMMARY**

- .1 Comply with requirements of this Section when performing following Work:
  - .1 Removal or disturbance as specified of more than one square metre of friable asbestos containing material during the repair, alteration, maintenance or demolition of a building or any machinery or equipment located at site.
  - .2 The spray application of a sealant to friable asbestos containing material.
  - .3 Cleaning or removing air handling equipment, including rigid ducting but not including filters, in a building that has asbestos containing sprayed fireproofing.
  - .4 Repairing, altering or demolishing all or part of a kiln, metallurgical furnace or similar structure that is made in part of refractory materials that are asbestos containing materials.
  - .5 Breaking, cutting, drilling, abrading, grinding, sanding or vibrating non-friable asbestos containing material, if the work is done by means of power tools that are not attached to dust-collecting devices equipped with HEPA filters.
  - .6 Repairing, altering or demolishing all or part of any building in which asbestos is or was used in the manufacture of products.

**1.2                SECTION INCLUDES**

- .1 Requirements and procedures for asbestos abatement of asbestos containing materials of the type described within.

**1.3                REFERENCES**

- .1 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.205-[94], Sealer for Application to Asbestos-Fibre-Releasing Materials.
- .2 Canadian Standards Association (CSA International)
- .3 Department of Justice Canada
  - .1 Canadian Environmental Protection Act (CEPA), 1999.
- .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, 1992 (TDGA).
- .6 Underwriters' Laboratories of Canada (ULC)
- .7 U.S. Department of Health and Human Services/Centers for Disease Control and Prevention (CDC)/National Institute for Occupational Safety and Health (NIOSH)
  - .1 NIOSH 94-113-[August 1994], NIOSH Manual of Analytical Methods (NMAM), 4th Edition.
- .8 U.S. Department of Labour - Occupational Safety and Health Administration - Toxic and Hazardous Substances
  - .1 29 CFR 1910.1001-[2001], Asbestos Regulations.

#### 1.4 DEFINITIONS

- .1 Airlock: system for permitting ingress or egress without permitting air movement between contaminated area and uncontaminated area, typically consisting of two curtained doorways at least 2 m apart.
- .2 Amended Water: water with a non-ionic surfactant wetting agent added to reduce water tension to allow wetting of fibres.
- .3 Asbestos Containing Materials (ACMs): materials that contain provincial regulated amount or more asbestos by dry weight and are identified under existing conditions including fallen materials and settled dust.
- .4 Asbestos Work Areas: area where work takes place which will, or may disturb ACMs.
- .5 Authorized Visitors: Departmental Representative or designated representatives, and representatives of regulatory agencies.
- .6 Competent worker: in relation to specific work, means a worker who:
  - .1 Is qualified because of knowledge, training and experience to perform the work.
  - .2 Is familiar with the provincial and federal laws and with the provisions of the regulations that apply to the work.
  - .3 Has knowledge of all potential or actual danger to health or safety in the work.
- .7 Curtained doorway: arrangement of closures to allow ingress and egress from one room to another while permitting minimal air movement between rooms, typically constructed as follows:
  - .1 Place two overlapping sheets of polyethylene over existing or temporarily framed doorway, secure each along top of doorway, secure vertical edge of one sheet along one vertical side of doorway, and secure vertical edge of other sheet along opposite vertical side of doorway.
  - .2 Reinforce free edges of polyethylene with duct tape and weight bottom edge to ensure proper closing.
  - .3 Overlap each polyethylene sheet at openings not less than 1.5 m on each side.
- .8 DOP Test: testing method used to determine integrity of Negative Pressure unit using dioctyl phthalate (DOP) HEPA-filter leak test.
- .9 Friable Materials: material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.
- .10 Glove Bag: prefabricated glove bag as follows:
  - .1 Minimum thickness 0.25 mm (10 mil) polyvinyl-chloride bag.
  - .2 Integral 0.25 mm (10 mil) thick polyvinyl-chloride gloves and elastic ports.
  - .3 Equipped with reversible double pull double throw zipper on top and at approximately mid-section of the bag.
  - .4 Straps for sealing ends around pipe.
- .11 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.
- .12 Negative pressure: system that extracts air directly from work area, filters such extracted air through High Efficiency Particulate Air filtering system, and discharges this air directly outside work area to exterior of building.

- .1 System to maintain minimum pressure differential of 5 Pa relative to adjacent areas outside of work areas, be equipped with alarm to warn of system breakdown, and be equipped with instrument to continuously monitor and automatically record pressure differences.
- .13 Non-Friable Materials: material that when dry cannot be crumbled, pulverized or powdered by hand pressure.
- .14 Occupied Areas: any area of building or work site that is outside Asbestos Work Area.
- .15 Polyethylene sheeting sealed with tape: polyethylene sheeting of type and thickness specified sealed with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide continuous polyethylene membrane to protect underlying surfaces from water damage or damage by sealants, and to prevent escape of asbestos fibres through sheeting into clean area.
- .16 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of work.

## 1.5 SUBMITTALS

- .1 Submittals in accordance with Section 00 10 00 – General Instructions.
- .2 Before beginning work:
  - .1 Obtain from appropriate agency and submit to Departmental Representative necessary permits for transportation and disposal of asbestos waste. Ensure that dump operator is fully aware of hazardous nature of material being dumped, and proper methods of disposal. Submit proof satisfactory to Departmental Representative that suitable arrangements have been made to receive and properly dispose of asbestos waste.
  - .2 Submit proof satisfactory to Departmental Representative that all asbestos workers have received appropriate training and education by a competent person on hazards of asbestos exposure, good personal hygiene, entry and exit from Asbestos Work Area, aspects of work procedures and protective measures while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing. Submit proof of attendance in form of certificate.
  - .3 Ensure supervisory personnel have attended asbestos abatement course, of not less than two days duration, approved by Departmental Representative. Submit proof of attendance in form of certificate. Minimum of one (1) supervisor for every ten (10) workers.
  - .4 Submit layout of proposed enclosures and decontamination facilities to Departmental Representative for review.
  - .5 Submit documentation including test results for sealer proposed for use.
  - .6 Submit Provincial/Territorial and/or local requirements for Notice of Project form.
  - .7 Submit proof of Contractor's Asbestos Liability Insurance.
  - .8 Submit proof satisfactory to Departmental Representative that employees have respirator fitting and testing. Workers must be fit tested (irritant smoke test) with respirator that is personally issued.
  - .9 Submit Worker's Compensation Board status and transcription of insurance.
  - .10 Submit documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) for chemicals or materials including but not limited to following:
    - .1 Encapsulants.
    - .2 Amended water.

.3 Slow drying sealer.

## 1.6 QUALITY ASSURANCE

- .1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to asbestos, provided that in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time work is performed.
- .2 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 00 15 45 – Fire and Safety General Requirements.
  - .2 Safety Requirements: worker and visitor protection.
    - .1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area includes:
      - .1 Air purifying full face-mask respirator, powered air purifying respirator (PAPR), supplied air respirator with N-100, R-100 or P-100 particulate filter, personally issued to worker and marked as to efficiency and purpose, suitable for protection against asbestos and acceptable to Provincial Authority having jurisdiction. The respirator to be fitted so that there is an effective seal between the respirator and the worker's face, unless the respirator is equipped with a hood or helmet. The respirator to be cleaned, disinfected and inspected after use on each shift, or more often if necessary, when issued for the exclusive use of one worker, or after each use when used by more than one worker. The respirator to have damaged or deteriorated parts replaced prior to being used by a worker; and, when not in use, to be stored in a convenient, clean and sanitary location. The employer to establish written procedures regarding the selection, use and care of respirators, and a copy of the procedures to be provided to and reviewed with each worker who is required to wear a respirator. A worker not to be assigned to an operation requiring the use of a respirator unless he or she is physically able to perform the operation while using the respirator.
      - .2 Disposable type protective clothing that does not readily retain or permit penetration of asbestos fibres. Protective clothing to be provided by the employer and worn by every worker who enters the work area, and the protective clothing to consist of a head covering and full body covering that fits snugly at the ankles, wrists and neck, in order to prevent asbestos fibres from reaching the garments and skin under the protective clothing. It includes suitable footwear, and it to be repaired or replaced if torn. Requirements for each worker:
        - .1 Remove street clothes in clean change room and put on respirator with new filters or reusable filters that have been tested as satisfactory, clean coveralls and head covers before entering Equipment and Access Rooms or Asbestos Work Area. Store street clothes, uncontaminated footwear, towels, and similar uncontaminated articles in clean change room.
        - .2 Remove gross contamination from clothing before leaving work area then proceed to Equipment and Access Room and remove clothing except respirators. Place contaminated work suits in receptacles for disposal with other asbestos - contaminated materials. Leave reusable items except respirator in Equipment and Access Room. Still wearing the respirator proceed naked to showers.

Using soap and water wash body and hair thoroughly. Clean outside of respirator with soap and water while showering; remove respirator; remove filters and wet them and dispose of filters in container provided for purpose; and wash and rinse inside of respirator. When not in use in work area, store work footwear in Equipment and Access Room. Upon completion of asbestos abatement, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from work area or from Equipment and Access Room.

- .3 After showering and drying off, proceed to clean change room and dress in street clothes at end of each day's work, or in clean coveralls before eating, smoking, or drinking. If re-entering work area, follow procedures outlined in paragraphs above.
- .4 Enter unloading room from outside dressed in clean coveralls to remove waste containers and equipment from Holding Room of Container and Equipment Decontamination Enclosure system. Workers must not use this system as means to leave or enter work area.
- .2 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.
- .3 Ensure workers are fully protected with respirators and protective clothing during preparation of system of enclosures prior to commencing actual asbestos abatement.
- .4 Provide and post in Clean Change Room and in Equipment and Access Room the procedures described in this Section, in both official languages.
- .5 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.
- .6 Visitor Protection:
  - .1 Provide protective clothing and approved respirators to Authorized Visitors to work areas.
  - .2 Instruct Authorized Visitors in the use of protective clothing, respirators and procedures.
  - .3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Asbestos Work Area.

## 1.7 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 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling.
- .4 Separate for reuse and recycling and place in designated containers steel, metal and plastic waste.
- .5 Place materials defined as hazardous or toxic in designated containers.
- .6 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.
- .7 Fold up metal banding, flatten and place in designated area for recycling.



- .8 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 6ml bags or leak proof drums. Label containers with appropriate warning labels.
- .9 Provide manifests describing and listing waste created. Transport containers by approved means to licenced landfill for burial.

## **1.8 EXISTING CONDITIONS**

- .1 Results of tests of asbestos containing materials to be handled, removed, or otherwise disturbed and disposed of during this Project are available for inspection. These are for general information only and are not necessarily representative of asbestos containing materials covered within scope of this Project.
- .2 Notify Departmental Representative of suspect asbestos containing material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by Departmental Representative.

## **1.9 SCHEDULING**

- .1 Not later than ten (10) days before beginning Work on this Project notify following in writing:
  - .1 Appropriate Regional or Zone Director of Medical Services Branch, Health Canada.
  - .2 Regional Office of Labour Canada.
  - .3 Provincial/Territorial, Department of Labour.
  - .4 Disposal Authority.
- .2 Inform sub-trades of presence of asbestos containing materials identified in Existing Conditions.
- .3 Submit to Departmental Representative copy of notifications prior to start of Work.
- .4 Hours of Work: perform work during normal working hours. Include in Contract Sum additional costs due to this requirement.

## **1.10 OWNER'S INSTRUCTIONS**

- .1 Before beginning Work, provide to Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene including dress and showers, in entry and exit from Asbestos Work Area, in aspects of work procedures including glove bag procedures, and in use, cleaning, and disposal of respirators and protective clothing.
- .2 Instruction and training related to respirators includes, at minimum:
  - .1 Proper fitting of equipment.
  - .2 Inspection and maintenance of equipment.
  - .3 Disinfecting of equipment.
  - .4 Limitations of equipment.
- .3 Instruction and training must be provided by competent, qualified person.
- .4 Supervisory personnel to complete required training.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Polyethylene: minimum 0.15mm thick unless otherwise specified; in sheet size to minimize joints.
- .2 FR polyethylene: minimum 0.15mm thick, woven fibre reinforced fabric bonded both sides with polyethylene.
- .3 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under both dry conditions and wet conditions using amended water.
- .4 Wetting agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether, or other material approved by Departmental Representative, mixed with water in concentration to provide adequate penetration and wetting of asbestos containing material.
- .5 Waste Containers: contain waste in two separate containers.
  - .1 Inner container: 0.15mm thick sealable polyethylene bag or where glove bag method is used, glove bag itself.
  - .2 Outer container: sealable metal or fibre type where there are sharp objects included in waste material; otherwise outer container may be sealable metal or fibre type or second 0.15 mm thick sealable polyethylene bag.
  - .3 Labelling requirements: affix preprinted cautionary asbestos warning, in both official languages, that is visible when ready for removal to disposal site. Label containers in accordance with Asbestos Regulations 29 CFR 1910.1001. Label in both official languages.
- .6 Glove bag:
  - .1 Acceptable materials: safe-T-Strip products in configuration suitable for Work, or Alternative material approved by addendum during tendering period in accordance with Instructions to Tenderers.

- .2 The glove bag to be equipped with:
  - .1 Sleeves and gloves that are permanently sealed to the body of the bag to allow the worker to access and deal with the insulation and maintain a sealed enclosure throughout the work period.
  - .2 Valves or openings to allow insertion of a vacuum hose and the nozzle of a water sprayer while maintaining the seal to the pipe, duct or similar structure.
  - .3 A tool pouch with a drain.
  - .4 A seamless bottom and a means of sealing off the lower portion of the bag.
  - .5 A high strength double throw zipper and removable straps, if the bag is to be moved during the removal operation.
- .7 Tape: tape suitable for sealing polyethylene to surfaces under both dry and wet conditions using amended water.
- .8 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.
- .9 Sealer: flame spread and smoke developed rating less than 50 and be compatible with new fireproofing.
- .10 Encapsulants:[Type 2 surface film forming, Type 1 penetrating type Class A water based conforming to CAN/CGSB-1.205 and approved by the Fire Commissioner of Canada, having following characteristics:
  - .1 Sprayed fireproofing: ULC labelled and listed asbestos-free cementitious or mineral fibre to provide degree of fire or thermal protection required.

### **Part 3 Execution**

#### **3.1 PREPARATION**

- .1 Do construction occupational health and safety in accordance with Section 00 15 45 – Heather and Safety and Fire General Requirements.
- .2 Work Areas:
  - .1 Shut off and isolate air handling and ventilation systems to prevent fibre dispersal to other building areas during work phase. Conduct smoke tests to ensure that duct work is airtight. Seal and caulk joints and seams of active return air ducts within Asbestos Work Area.
  - .2 Pre-clean moveable furniture and carpeting within proposed work areas using HEPA vacuum and remove from work areas to temporary location as directed by Departmental Representative.
  - .3 Pre-clean fixed casework, plant, and equipment within proposed work areas, using HEPA vacuum and cover with polyethylene sheeting sealed with tape.
  - .4 Clean proposed work areas using, where practicable, HEPA vacuum cleaning equipment. If not practicable, use wet cleaning method. Do not use methods that raise dust, such as dry sweeping, or vacuuming using other than HEPA vacuum equipment.

- .5 The spread of dust from the work area to be prevented by:
  - .1 Using enclosures of polyethylene or other suitable material that is impervious to asbestos (including, if the enclosure material is opaque, one or more transparent window areas to allow observation of the entire work area from outside the enclosure), if the work area is not enclosed by walls.
  - .2 Using curtains of polyethylene sheeting or other suitable material that is impervious to asbestos, fitted on each side of each entrance or exit from the work area.
- .6 Put negative pressure system in operation and operate continuously from time first polyethylene is installed to seal openings until final completion of work including final cleanup. Provide continuous monitoring of pressure difference using automatic recording instrument. The system to maintain a negative air pressure of 0.02 inches (5 Pa) of water, relative to the area outside the enclosed area. The system to be inspected and maintained by a competent person prior each use to ensure that there is no air leakage, and if the filter is found to be damaged or defective, it to be replaced before the ventilation system is used.
- .7 Seal off openings such as corridors, doorways, windows, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with tape.
- .8 Cover floor and wall surfaces with polyethylene sheeting sealed with tape. Use two (2) layers of FR polyethylene on floors]. Cover floors first so that polyethylene extends at least 300mm up walls then cover walls to overlap floor sheeting.
- .9 Build airlocks at entrances to and exits from work areas so that work areas are always closed off by one curtained doorway when workers enter or exit.
- .10 At each access to work areas install warning signs in both official languages in upper case "Helvetica Medium" letters reading as follows where number in parentheses indicates font size to be used: "CAUTION ASBESTOS HAZARD AREA (25mm) NO UNAUTHORIZED ENTRY (19mm) WEAR ASSIGNED PROTECTIVE EQUIPMENT (19mm) BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7mm)".
- .11 After work area isolation, remove heating, ventilating, and air conditioning filters, pack in sealed plastic bags 0.15mm minimum thick and treat as contaminated asbestos waste. Remove ceiling - mounted objects such as lights, partitions, other fixtures not previously sealed off, and other objects that interfere with asbestos removal, as directed by Departmental Representative. Use localized water spraying during fixture removal to reduce fibre dispersal.
- .12 Maintain emergency and fire exits from work areas, or establish alternative exits satisfactory to Fire Commissioner of Canada and Provincial/Territorial Fire Marshall.
- .13 Where application of water is required for wetting asbestos containing materials, shut off electrical power, provide 24V safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical lines and equipment.
- .14 After preparation of work areas and Decontamination Enclosure Systems, remove designated asbestos containing ceiling tiles within work areas progressively and carefully,[clean using HEPA vacuum and damp sponge, wrap clean panels in 0.10mm minimum thick polyethylene, and store in building as directed by Departmental Representative, and dispose of as contaminated waste. Clean "T" grid suspension system within work areas using wet sponge, disconnect grid from hangers, wrap grid members in 0.1 mm minimum thick polyethylene and store in building as directed by Departmental Representative.
- .15 After preparation of work areas and Decontamination Enclosure Systems, remove plaster ceilings, including lath, furring, channels, hangers, wires, clips, and dispose of as contaminated waste in specified containers. Spray asbestos debris and immediate work area with amended water to reduce dust, as work progresses.

- .16 After preparation of work area[s] and Decontamination Enclosure Systems, for the removal of all other asbestos containing materials, remove within work area and dispose of as contaminated waste in specified containers. Spray asbestos debris and immediate work area with amended water to reduce dust, as work progresses.
- .3 Worker Decontamination Enclosure System:
  - .1 Worker Decontamination Enclosure System includes Equipment and Access Room, Shower Room, and Clean Room, as follows:
    - .1 Equipment and Access Room: build Equipment and Access Room between Shower Room and work areas, with two curtained doorways, one to Shower Room and one to work area]. Install portable toilet, waste receptor, and storage facilities for workers' shoes and protective clothing to be reworn in work areas. Build Equipment and Access Room large enough to accommodate specified facilities, other equipment needed, and at least one worker allowing him /her sufficient space to undress comfortably.
    - .2 Shower Room: build Shower Room between Clean Room and Equipment and Access Room, with two curtained doorways, one to Clean Room and one to Equipment and Access Room. Provide one shower for every five workers. Provide constant supply of hot and cold or warm water. Confirm sources of hot and cold water and nearest sanitary drain connections with Departmental Representative. Provide piping and connect to water sources and drains. Pump waste water through 5 micrometre filter system acceptable to Departmental Representative before directing into drains. Provide soap, clean towels, and appropriate containers for disposal of used respirator filters.
    - .3 Clean Room: build Clean Room between Shower Room and clean areas outside of enclosures, with two curtained doorways, one to outside of enclosures and one to Shower Room. Provide lockers or hangers and hooks for workers' street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install mirror to permit workers to fit respiratory equipment properly.
- .4 Container and Equipment Decontamination Enclosure System:
  - .1 Container and Equipment Decontamination Enclosure System consists of Staging Area within work area, Washroom, Holding Room, and Unloading Room. Purpose of system is to provide means to decontaminate waste containers, scaffolding, waste and material containers, vacuum and spray equipment, and other tools and equipment for which Worker Decontamination Enclosure System is not suitable.
    - .1 Staging Area: designate Staging Area in work area for gross removal of dust and debris from waste containers and equipment, labelling and sealing of waste containers, and temporary storage pending removal to Washroom. Equip Staging Area with curtained doorway to Washroom.
    - .2 Washroom: build Washroom between Staging Area and Holding Room with two curtained doorways, one to Staging Area and one to Holding Room. Provide high - pressure low - volume sprays for washing of waste containers and equipment. Pump waste water through 5 micrometre filter system before directing into drains. Provide piping and connect to water sources and drains.

- .3 Holding Room: build Holding Room between Washroom and Unloading Room, with two curtained doorways, one to Washroom and one to Unloading Room. Build Holding Room sized to accommodate at least two waste containers and largest item of equipment used.
- .4 Unloading Room: build Unloading Room between Holding Room and outside, with two curtained doorways, one to Holding Room and one to outside.
- .5 Construction of Decontamination Enclosures:
  - .1 Build suitable framing for enclosures or use existing rooms where convenient, and line with polyethylene sheeting sealed with tape. Use two (2) layers of FR polyethylene on floors.
  - .2 Build curtained doorways between enclosures so that when people move through or when waste containers and equipment are moved through doorway, one of two closures comprising doorway always remains closed.
- .6 Separation of Work Areas from Occupied Areas:
  - .1 Separate parts of building required to remain in use from parts of building used for asbestos abatement by means of airtight barrier system constructed as follows:
    - .1 Build suitable floor to ceiling lumber or metal stud framing, cover with polyethylene sheeting sealed with tape, and apply 9mm minimum thick plywood. Seal joints between plywood sheets and between plywood and adjacent materials with surface film forming type sealer, to create airtight barrier.
    - .2 Cover plywood barrier with polyethylene sealed with tape, as specified for work areas.
- .7 Maintenance of Enclosures:
  - .1 Maintain enclosures in tidy condition.
  - .2 Ensure that barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery.
  - .3 Visually inspect enclosures at beginning of each working period.
  - .4 Use smoke methods to test effectiveness of barriers when directed by Departmental Representative.
- .8 Do not begin Asbestos Abatement work until:
  - .1 Arrangements have been made for disposal of waste.
  - .2 For wet stripping techniques, arrangements have been made for containing, filtering, and disposal of waste water.
  - .3 Work areas and decontamination enclosures and parts of building required to remain in use are effectively segregated.
  - .4 Tools, equipment, and materials waste containers are on hand.
  - .5 Arrangements have been made for building security.
  - .6 Warning signs are displayed where access to contaminated areas is possible.
  - .7 Notifications have been completed and other preparatory steps have been taken.

### 3.2 SUPERVISION

- .1 Minimum of one (1) supervisor for every ten (10) workers is required.
- .2 Approved Supervisor must remain within Asbestos Work Area during disturbance, removal, or other handling of asbestos containing materials.

### 3.3 ASBESTOS REMOVAL

- .1 Before removing asbestos:
  - .1 Prepare site.
  - .2 Spray asbestos material with water containing specified wetting agent, using airless spray equipment capable of providing "mist" application to prevent release of fibres. Saturate asbestos material sufficiently to wet it to substrate without causing excess dripping. Spray asbestos material repeatedly during work process to maintain saturation and to minimize asbestos fibre dispersion.
- .2 Remove saturated asbestos material in small sections. Do not allow saturated asbestos to dry out. As it is being removed pack material in sealable plastic bags 0.15 mm minimum thick and place in labelled containers for transport.
- .3 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove from immediate working area to Staging Area. Clean external surfaces thoroughly again by wet sponging before moving containers to decontamination Washroom. Wash containers thoroughly in decontamination Washroom, and store in Holding Room pending removal to Unloading Room and outside. Ensure that containers are removed from Holding Room by workers who have entered from uncontaminated areas dressed in clean coveralls.
- .4 After completion of stripping work, wire brushed and wet sponged surfaces from which asbestos has been removed to remove visible material. During this work keep surfaces wet.
- .5 Where Departmental Representative decides complete removal of asbestos containing material is impossible due to obstructions such as structural members or major service elements, or because asbestos containing material was originally applied to asphaltic coating, and provides written direction, encapsulate material as follows:
  - .1 Apply surface film forming type sealer to provide 0.635mm minimum dry film thickness over sprayed asbestos surfaces. Apply using airless spray equipment to avoid blowing off fibres. Use different colour for each coat. Apply penetrating type sealer to penetrate existing sprayed asbestos surfaces to uniform depth of 25mm minimum. Apply penetrating type sealer to penetrate existing sprayed asbestos surfaces uniformly to substrate.
- .6 After wire brushing and wet sponging to remove visible asbestos,[and after encapsulating asbestos containing material impossible to remove, wet clean entire work area including Equipment and Access Room, and equipment used in process. After 24 hour period to allow for dust settling, wet clean these areas and objects again. During this settling period no entry, activity, or ventilation will be permitted. After second 24 hour period under same conditions, clean these areas and objects again using HEPA vacuum followed by wet cleaning. After inspection by Departmental Representative apply continuous coat of slow drying sealer to surfaces of work area. Allow at least 16 hours with no entry, activity, ventilation, or disturbance other than operation of negative pressure units during this period.
- .7 Work is subject to visual inspection and air monitoring. Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas.

- .8 Cleanup:
- .1 Frequently during Work and immediately after completion of work, clean up dust and asbestos containing waste using HEPA vacuum or by damp mopping.
  - .2 Place dust and asbestos containing waste in sealed dust tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste and wet and fold to contain dust and then place in waste bags.
  - .3 Immediately before their removal from Asbestos Work Area and disposal, clean each filled waste bag using damp cloths or HEPA vacuum and place in second clean waste bag.
  - .4 Seal and remove double bagged waste from site. Dispose of in accordance with requirements of Provincial/Territorial and Federal authority having jurisdiction. Supervise dumping and ensure that dump operator is fully aware of hazardous nature of material to be dumped and that guidelines and regulations for asbestos disposal are followed.
  - .5 Perform final thorough clean-up of Asbestos Work Areas and adjacent areas affected by Work using HEPA vacuum.

### 3.4 FINAL CLEANUP

- .1 Following cleaning specified above, and when air sampling shows that asbestos levels on both sides of seals do not exceed 0.01 fibres/cc as determined by membrane filter method at 400-500X magnification phase contrast illumination, as described in NIOSH Method 94-113 or equivalent, proceed with final cleanup.
- .2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible asbestos containing particles observed during cleanup, immediately, using HEPA vacuum equipment.
- .3 Place polyethylene seals, tape, cleaning material, clothing, and other contaminated waste in plastic bags and sealed labelled waste containers for transport.
- .4 Include in clean-up Work areas, Equipment and Access Room, Washroom, Shower Room, and other contaminated enclosures.
- .5 Include in clean-up sealed waste containers and equipment used in Work and remove from work areas, via Container and Equipment Decontamination Enclosure System, at appropriate time in cleaning sequence.
- .6 Conduct final check to ensure that no dust or debris remains on surfaces as result of dismantling operations and carry out air monitoring again to ensure that asbestos levels in building do not exceed 0.01 fibres/cc. Repeat cleaning using HEPA vacuum equipment, or wet cleaning methods where feasible, in conjunction with sampling until levels meet this criteria.
- .7 As work progresses, and to prevent exceeding available storage capacity on site, remove sealed and labelled containers containing asbestos waste and dispose of to authorized disposal area in accordance with requirements of disposal authority. Ensure that each shipment of containers transported to dump is accompanied by Contractor's representative to ensure that dumping is done in accordance with governing regulations.

### 3.5 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS

- .1 When cleanup is complete:
  - .1 Re-establish objects and furniture moved to temporary locations in course of Work, in their proper positions.



- .2 Re-secure mounted objects removed in course of Work in their former positions.
- .3 Re-establish mechanical and electrical systems in proper working order. Install new filters.
- .4 Repair or replace objects damaged in the course of Work, as directed by Departmental Representative.

### **3.6 AIR MONITORING**

- .1 From beginning of Work until completion of cleaning operations, Departmental Representative to take air samples on daily basis outside of work area enclosure in accordance with Health Canada recommendations.
  - .1 Contractor will be responsible for monitoring inside enclosure in accordance with applicable Provincial/Territorial Occupational Health and Safety Regulations.
- .2 Use results of air monitoring inside work area to establish type of respirators to be used. Workers may be required to wear sample pumps for up to full-shift periods.
  - .1 If fibre levels are above safety factor of respirators in use, stop abatement, apply means of dust suppression, and use higher safety factor in respiratory protection for persons inside enclosure.
  - .2 If air monitoring shows that areas outside work area enclosures are contaminated, enclose, maintain and clean these areas, in same manner as that applicable to work areas.
- .3 During course of Work, Departmental Representative to measure fibre content of air outside work areas by means air samples analyzed by Phase Contrast Microscopy (PCM).
  - .1 Stop Work when PCM measurements exceed 0.05 f/cc and correct procedures.
- .4 Final air monitoring to be conducted as follows: After Asbestos Work Area has passed visual inspection and acceptable coat of lock-down agent has been applied to surfaces within enclosure, and appropriate setting period has passed, Departmental Representative will perform air monitoring within Asbestos Work Area by aggressive methods, where provincial regulations require.
  - .1 Final air monitoring results must show fibre levels of less than 0.01 f/cc.
  - .2 If air monitoring results show fibre levels in excess of 0.01 f/cc, re-clean work area and apply another acceptable coat of lock-down agent to surfaces.
  - .3 Repeat as necessary until fibre levels are less than 0.01 f/cc.

### **3.7 INSPECTION**

- .1 Perform inspection of Asbestos Work Area to confirm compliance with specification and governing authority requirements. Deviations from these requirements that have not been approved in writing by Departmental Representative may result in Work stoppage, at no cost to Owner.

- .2 Departmental Representative will inspect Work for:
  - .1 Adherence to specific procedures and materials.
  - .2 Final cleanliness and completion.
  - .3 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.
- .3 When asbestos leakage from Asbestos Work Area has occurred or is likely to occur Departmental Representative may order Work shutdown.
  - .1 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

**END OF SECTION**

**Part 1 GENERAL**

**1.1 Protection & Storage**

- .1 Store doors in a dry temperature controlled room, laid face down on wood sleepers spaced not less than 12" (300mm) apart. Do not stack higher than eight doors per area.
- .2 Provide scab wood corner strip protectors on all four corners of stack doors.
- .3 Loose lay cardboard on face of top door in each stack.

**1.2 Guarantee**

- .1 Written guarantee to be supplied against all defects for a period of not less than three (3) years.

**1.3 Reference Standards**

- .1 Door material and construction in accordance with CAN/CSA-0132.2.

**Part 2 PRODUCTS**

**2.1 Materials**

- .1 Core; solid particle in mat formed.
- .2 Stiles; soft wood.
- .3 Rails; softwood.
- .4 Crossband 1/16" (1.5mm) fir veneer overlay.
- .5 Faces; rotary cut birch, stain/paint grade.
- .6 Adhesive; water resistant.
- .7 Edges; birch hardwood.

**2.2 Fabrication**

- .1 All door components to be of first class composition with exposed components being of select grading of wood as per industry standards. Reinforced for openings and hardware.
- .2 All doors to have finished dimensional thickness of 1 3/4" (45mm).
- .3 Stiles and rails to be glued to particle core center.
- .4 Hardwood edge strips to be glued to end stiles.
- .5 Bond crossband sheets on faces of doors with grain running horizontal.
- .6 Bond rotary cut face veneer to crossband with grain running vertically.

- .7 Stiles to be not less than 4 1/2" (112mm).
- .8 Top and bottom rails to be 2 3/4" (70mm).
- .9 Crossband not less than 1/16" (1.5mm) thick veneered, sanded or bonding of face veneer.
- .10 Edge strips not less than 5/8" (16mm) thick.

**Part 3 EXECUTION**

**3.1 Installation**

- .1 Install plumb, level, straight, rigid and in accordance with manufacturer's instruction.
- .2 Install no damaged material.
- .3 Install all hardware supplied by hardware contractor.

**END OF SECTION**

**Part 1 GENERAL**

**Part 2 PRODUCTS**

**2.1 Materials**

- .1 Non-loadbearing channel stud framing: to ASTM C645-83; stud sizes as indicated on drawings; roll formed from 18 gauge electrogalvanized steel sheet; for screw attachment of gypsum board. Knock-out service holes at 460 mm (1'-6") centres.
- .2 Floor and ceiling tracks: to ASTM C645-92b; in widths to suit stud sizes, 32 mm (1-1/4") flange height.
- .3 Metal channel stiffener: 38 x 20mm (1-1/2" x 3/4") size, 1.52 mm (16 gauge) thick cold rolled steel, coated with rust inhibitive coating.
- .4 Acoustical sealant: to CAN/CGSB-19.21-M87.
- .5 Insulating strip: rubberized, moisture resistant 3 mm (1/8") thick cork strip, 12 mm (1/2") wide, with self sticking adhesive on one face, lengths as required.

**Part 3 EXECUTION**

**3.1 Erection**

- .1 Align partition tracks at floor and ceiling and secure at 600 mm (2'-0") oc maximum.
- .2 Place studs vertically at spacings notes on drawings, and not more than 50 mm (2") from abutting walls and at each side of openings and corners. Position studs in tracks at floor and ceiling. Cross brace steel studs as required to provide rigid installation to manufacturer's instructions.
- .3 Erect metal studding to tolerance of 1:1000.
- .4 Attach studs to bottom using screws.
- .5 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
- .6 Co-ordinate erection of studs with installation of door frames and special supports or anchorage for work specified in other Sections.
- .7 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified. Secure studs together, using column clips or other approved means of fastening placed alongside frame anchor clips.
- .8 Erect track at head of door openings and sills of sidelight/window openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.
- .9 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- .10 Extend partitions to ceiling height except where noted otherwise on drawings.

- .11 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs. Use double track slip joints.
- .12 Install continuous insulating strips to isolate studs from uninsulated surfaces.
- .13 Install two continuous beads of acoustical sealant behind studs and tracks around perimeter of sound control partitions.

**END OF SECTION**

**Part 1 GENERAL**

**1.1 Reference Standards**

- .1 Installation: to ASTM C636-92 except where specified otherwise.

**1.2 Design Criteria**

- .1 Maximum deflection: 1/360th of span to ASTM C635-83 deflection test.

**1.3 Samples**

- .1 Submit one representative sample of ceiling suspension system in accordance with Section 001000.
- .2 Ceiling system to show basic construction and assembly, treatment at walls, recessed fixtures, splicing, interlocking, finishes, acoustical unit installation.

**Part 2 PRODUCTS**

**2.1 Materials**

- .1 Light duty system to ASTM C635-91.
- .2 Basic materials for suspension system: commercial quality cold rolled steel, conforming to ASTM A525-91b and ASTM A526/A526M-90, zinc coated to Z275.
- .3 Suspension system: As noted on drawings.
- .4 Exposed tee bar grid components to be die cut.
- .5 Hanger wire: galvanized soft annealed steel 3.0 mm (1/8") dia. (12 gauge).
- .6 Hangers: self-drilling type anchors similar to Phillips "Red Head" T-32.
- .7 Accessories: splices, clips, wire ties, retainers and wall moulding, flush, to complement suspension system components, as recommended by system manufacturer.

**Part 3 EXECUTION**

**3.1 Installation**

- .1 Install suspension system to manufacturer's instruction.

- .2 Secure hangers to overhead structure using attachment methods acceptable to engineer. Install hangers spaced at maximum 1200 mm (4'-0") centres and within 150 mm (6") from ends of main tees.
- .3 Do not erect ceiling suspension system until work above ceiling has been inspected by Engineer.
- .4 Lay out system according to reflected ceiling plan.
- .5 Ensure suspension system is co-ordinated with location of related components.
- .6 Install wall mould to provide correct ceiling height. Finished ceiling system to be level within 1:1000.
- .7 Completed suspension system to support superimposed loads, such as lighting fixtures, diffusers and grilles, etc.
- .8 Support light fixtures, diffusers, with additional ceiling suspension hangers within 150 mm (6") of each corner and at 600 mm (2'-0") around perimeter of fixture, also install at splices.
- .9 Interlock cross member to main runner to provide rigid assembly.
- .10 Frame at openings for light fixtures, air diffusers, speakers and at changes in ceiling heights.

### **3.2 Cleaning**

- .1 Touch up scratches, abrasions, voids and other defects in painted surfaces to the satisfaction of the Engineer.

**END OF SECTION**



**Part 1 GENERAL**

**1.1 Reference Standards**

- .1 Do work in accordance with CAN/CSA-A82.31-M91 except where specified otherwise.

**Part 2 PRODUCTS**

**2.1 Gypsum Board**

- .1 Regular board: to CAN/CSA A82.27-M91 16mm (5/8") x 1200 mm (4'-0") wide x maximum practical length, edges tapered with round edge.

**2.2 Metal Furring**

- .1 Metal furring, runners, hangers, tie wires & suspension to CSA A82.30-M1980, galvanized systems.
- .2 Hangers: self-drilling type anchors similar to Phillips "Red Head" T-32.
- .3 Drywall furring channels: 0.5 mm (0.02") core thickness galvanized steel channels for screw attachment of gypsum board.

**2.3 Fastenings and Adhesives**

- .1 Nails, screws and staples: CAN/CSA- A82.31-M91.
- .2 Laminating compound: to CAN/CSA-A82.31-M91, asbestos-free.
- .3 Stud adhesive: to CAN/CGSB-71.25.

**2.4 Accessories**

- .1 Casing beads, corner beads: 0.5 mm (0.02") base thickness commercial grade sheet steel with Z275 zinc finish to ASTM A525-91b, perforated flanges; one piece length per location.
- .2 Acoustic sealant: to CAN/CGSB-19.21-M87.
- .3 Sealants acceptable for use on this project must be listed on CGSB Qualified Products List issued by CGSB Qualification Panel for joint sealants.
- .4 Insulating strip: rubberized, moisture resistant, 3 mm (1/8") thick closed cell neoprene strip, 12 mm (1/2") wide, with self sticking permanent adhesive on one face; lengths as required.
- .5 Joint compound: to CAN/CSA-A82.31-M91, asbestos-free.

**Part 3 EXECUTION**

**3.1 Wall Furring**

- .1 Install wall furring for gypsum board wall finishes in accordance with CAN/CSA-A82.31-M91, except where specified otherwise.
- .2 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.
- .3 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

**3.2 Gypsum Board Application**

- .1 Do not apply gypsum board until bucks, anchors, blocking, electrical and mechanical work are approved.
- .2 Apply single layer gypsum board as indicated to metal furring or framing using screw fasteners. Maximum spacing of screws 300 mm (1'-0") oc.

**3.3 Sound Attenuation Blanket**

- .1 N/a.

**3.4 Control Joints**

- .1 N/a.

**3.5 Access Doors**

- .1 Install access doors to electrical and mechanical fixtures specified in respective Sections.
- .2 Rigidly secure frames to furring or framing systems.

**3.6 Taping and Filling**

- .1 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape and taping compound installed according to manufacturer's directions and feathered out onto panel faces.
- .2 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.
- .3 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after painting is completed.
- .4 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

- .5 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for painting.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
  - .1 ASHRAE Standard 90.1-[01], Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).
- .2 American Society for Testing and Materials International (ASTM)
  - .1 ASTM B209M-[04], Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate [Metric].
  - .2 ASTM C335-[04], Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
  - .3 ASTM C411-[04], Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
  - .4 ASTM C449/C449M-[00], Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - .5 ASTM C533-[2004], Calcium Silicate Block and Pipe Thermal Insulation.
  - .6 ASTM C547-[2003], Mineral Fiber Pipe Insulation.
  - .7 ASTM C795-[03], Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
  - .8 ASTM C921-[03a], Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
  - .1 CGSB 51-GP-52Ma-[89], Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
  - .2 CAN/CGSB-51.53-[95], Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts.
- .4 Department of Justice Canada (Jus)
  - .1 Canadian Environmental Assessment Act (CEAA), 1995, c. 37.
  - .2 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
  - .3 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .6 Manufacturer's Trade Associations
  - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards (Revised 2004).
- .7 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC-S102-[03], Surface Burning Characteristics of Building Materials and Assemblies.
  - .2 CAN/ULC-S701-[01], Thermal Insulation, Polystyrene, Boards and Pipe Covering.
  - .3 CAN/ULC-S702-[1997], Thermal Insulation, Mineral Fibre, for Buildings
  - .4 CAN/ULC-S702.2-[03], Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

## 1.2 DEFINITIONS

- .1 For purposes of this section:
  - .1 "CONCEALED" - insulated mechanical services in suspended ceilings and non-accessible chases and furred-in spaces.
  - .2 "EXPOSED" - will mean "not concealed" as specified.
- .2 TIAC ss:
  - .1 CRF: Code Rectangular Finish.
  - .2 CPF: Code Piping Finish.

## 1.3 SUBMITTALS

- .1 Submittals: in accordance with Section 00 10 00 – General Instructions.
- .2 Product Data/Shop Drawings:
  - .1 Submit manufacturer's printed product literature, specifications shop drawings and datasheet in accordance with Section 00 10 00 - General Instructions.

## 1.4 QUALITY ASSURANCE

- .1 Health and Safety: do construction occupational health and safety in accordance with Sections 0010 00 – General Instructions and 00 15 45 – General Safety Section and Fire Requirements.
- .2 Qualifications: installer shall be specialist in performing work of this Section, and have at least three (3) years successful experience in this size and type of project, qualified to standards of TIAC.

## 1.5 DELIVERY, STORAGE AND HANDLING

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
  - .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Storage and Protection:
  - .1 Protect from weather, construction traffic.
  - .2 Protect against damage.
  - .3 Store at temperatures and conditions required 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.
  - .2 Place excess or unused insulation and insulation accessory materials in designated containers.
  - .3 Divert unused metal materials from landfill to metal recycling facility.
  - .4 Dispose of unused adhesive material at official hazardous material collections site.

**Part 2 Products**

**2.1 FIRE AND SMOKE RATING**

- .1 In accordance with CAN/ULC-S102.
  - .1 Maximum flame spread rating: 25.
  - .2 Maximum smoke developed rating: 50.

**2.2 INSULATION**

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
  - .1 Mineral fibre: to CAN/ULC-S702, ASTM C547.
  - .2 Maximum "k" factor: to CAN/ULC-S702, ASTM C547.

**2.3 INSULATION SECUREMENT**

- .1 Tape: self-adhesive, aluminum, plain, 50mm wide minimum.
- .2 Contact adhesive: quick setting.
- .3 Canvas adhesive: washable.
- .4 Tie wire: 1.5mm diameter stainless steel.
- .5 Bands: stainless steel, 19mm wide, 0.5mm thick.

**2.4 CEMENT**

- .1 Thermal insulating and finishing cement:
  - .1 Hydraulic setting or air drying on mineral wool, to ASTM C449/C449M.

**2.5 VAPOUR RETARDER LAP ADHESIVE**

- .1 Water based, fire retardant type, compatible with insulation.

**2.6 INDOOR VAPOUR RETARDER FINISH**

- .1 Vinyl emulsion type acrylic, compatible with insulation.

**2.7 OUTDOOR VAPOUR RETARDER FINISH**

- .1 Vinyl emulsion type acrylic, compatible with insulation.
- .2 Reinforcing fabric: fibrous glass, untreated 305 g/m<sup>2</sup>.

## **2.8 JACKETS**

- .1 Canvas:
  - .1 220 gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
  - .2 Lagging adhesive: compatible with insulation.
- .2 Polyvinyl Chloride (PVC):
  - .1 One-piece moulded type to CAN/CGSB-51.53 with pre-formed shapes as required.
  - .2 Colours: to match adjacent finish paint.
  - .3 Minimum service temperatures: -20 degrees C.
  - .4 Maximum service temperature: 65 degrees C.
  - .5 Moisture vapour transmission: 0.02 perm.
  - .6 Fastenings:
    - .1 Use solvent weld adhesive compatible with insulation to seal laps and joints.
    - .2 Tacks.
    - .3 Pressure sensitive vinyl tape of matching colour.

## **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 PRE-INSTALLATION REQUIREMENT**

- .1 Pressure testing of piping systems and adjacent equipment to be complete, witnessed and certified.
- .2 Surfaces clean, dry, free from foreign material.

### **3.3 INSTALLATION**

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturer's instructions and this specification.
- .3 Use two layers with staggered joints when required nominal wall thickness exceeds 75mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Install hangers, supports outside vapour retarder jacket.
- .5 Supports, Hangers:
  - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

### **3.4 PIPING INSULATION SCHEDULES**

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 TIAC Code: A-1.

- .1 Securements: stainless steel wire at 300mm on centre.
- .2 Seals: VR lap seal adhesive, VR lagging adhesive.
- .3 Installation: TIAC Code: 1501-C.
- .3 Thickness of insulation as listed in following table.
  - .1 Run-outs to individual units and equipment not exceeding 4000mm long.
  - .2 Do not insulate exposed run outs to plumbing fixtures, chrome plated piping, valves, fittings.

Application	Temperature (degrees C)	TIAC Code	Pipe sizes (NPS) and Insulation Thickness (mm)					
			Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over
Hot Water Heating	60 - 94	A-1	25	38	38	38	38	38

- .4 Finishes:
  - .1 Exposed indoors: PVC jacket.
  - .2 Exposed in mechanical rooms: jacket to match existing.
  - .3 Concealed, indoors: canvas on valves, fittings. No further finish.
  - .4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
  - .5 Outdoors: waterproof aluminum jacket.
  - .6 Finish attachments: stainless steel bands, at 150mm on centre. Seals: closed.
  - .7 Installation: to appropriate TIAC code CRF/1 through CPF/5.

**3.5 CLEANING**

- .1 Proceed in accordance with Section 00 10 00 – General Instructions.
- .2 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        Submittals: in accordance with Section 00 10 00 – General Instructions.
- .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, 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.
    - .4        Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

- .6 Approvals:
  - .1 Submit two (2) copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
  - .2 Make changes as required and re-submit as directed by Departmental Representative.
- .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 Departmental Representative will provide one (1) set of reproducible mechanical drawings. 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 monthly to reproducibles, revising reproducibles to show work as actually installed.
  - .3 Use different colour waterproof ink for each service.
  - .4 Make available for reference purposes and inspection.
- .9 As-built drawings:
  - .1 Prior to start of Testing, Adjusting and Balancing for HVAC, finalize production of as-built drawings.
  - .2 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).
  - .3 Submit to Departmental Representative for approval and make corrections as directed.
  - .4 Perform testing, adjusting and balancing for HVAC using as-built drawings.
  - .5 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 Quality Assurance in accordance with Section 0010 00 – General Instructions.
- .2 Health and Safety Requirements to construction occupational health and safety in accordance with Sections 0010 00 – General Instructions and 00 15 45 – General Safety Section and Fire Requirements.

## **1.3 MAINTENANCE**

- .1 Furnish spare parts in accordance with manufacturer's recommendations.

**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 NOT USED**

- .1 Not Used.

**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 including strainers. Vacuum interior of ductwork and air handling equipment in area of construction.

**3.3 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.

**3.4 DEMONSTRATION**

- .1 Departmental Representative will use equipment and systems for test purposes prior to acceptance. 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 Departmental Representative will 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                REFERENCES**

- .1            Canadian General Standards Board (CGSB)
  - .1            CAN/CGSB-1.181-[99], Ready-Mixed Organic Zinc-Rich Coating.

**1.2                SUBMITTALS**

- .1            Provide submittals in accordance with Section 00 10 00 – General Instructions.

**1.3                QUALITY ASSURANCE**

- .1            Health and Safety: do construction occupational health and safety in accordance with Sections 0010 00 – General Instructions and 00 15 45 – General Safety Section and Fire Requirements.

**1.4                DELIVERY, STORAGE AND HANDLING**

- .1            Deliver, store and handle in accordance with manufacturer's recommendations.
- .2            Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3            Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, paddling and packaging materials in accordance with Section 00 10 00 – General Instructions.

**Part 2            Products**

**2.1                NOT USED**

- .1            Not Used.

**Part 3            Execution**

**3.1                APPLICATION**

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

**3.2                CONNECTIONS TO EQUIPMENT**

- .1            In accordance with manufacturer's instructions unless otherwise indicated.
- .2            Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
- .3            Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.

### **3.3 CLEARANCES**

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment, components.

### **3.4 DRAINS**

- .1 Install piping with grade in direction of flow except as indicated.
- .2 Install drain valve at low points in piping systems, at equipment and at section isolating valves.
- .3 Pipe each drain valve discharge separately to above floor drain. Discharge to be visible.
- .4 Drain valves: NPS 3/4 gate or globe valves unless indicated otherwise, with hose end male thread, cap and chain.

### **3.5 AIR VENTS**

- .1 Install manual air vents at high points in piping systems.
- .2 Install isolating valve at each automatic air valve.
- .3 Install drain piping to approved location and terminate where discharge is visible.

### **3.6 DIELECTRIC COUPLINGS**

- .1 General: compatible with system, to suit pressure rating of system.
- .2 Locations: where dissimilar metals are joined.
- .3 NPS 2 and under: isolating unions or bronze valves.
- .4 Over NPS 2: isolating flanges.

### **3.7 PIPEWORK INSTALLATION**

- .1 Screwed fittings jointed with yellow gas line Teflon tape.
- .2 Protect openings against entry of foreign material.
- .3 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .4 Assemble piping using fittings manufactured to ANSI standards.
- .5 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.
  - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

- .7 Install concealed pipework to minimize furring space, maximize headroom, conserve space.
- .8 Slope piping, except where indicated, in direction of flow for positive drainage and venting.
- .9 Install, except where indicated, to permit separate thermal insulation of each pipe.
- .10 Group piping wherever possible.
- .11 Ream pipes, remove scale and other foreign material before assembly.
- .12 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .13 Provide for thermal expansion as indicated.
- .14 Valves:
  - .1 Install in accessible locations.
  - .2 Remove interior parts before soldering.
  - .3 Install with stems above horizontal position unless otherwise indicated.
  - .4 Valves accessible for maintenance without removing adjacent piping.
  - .5 Install globe valves in bypass around control valves.
  - .6 Use ball valves at branch take-offs for isolating purposes except where otherwise specified.
  - .7 Use chain operators on valves NPS 2 1/2 and larger where installed more than 2400mm (95 inches) above floor in Mechanical Rooms.
- .15 Check Valves:
  - .1 Install silent check valves on discharge of pumps and in vertical pipes with downward flow and elsewhere as indicated.
  - .2 Install swing check valves in horizontal lines on discharge of pumps and elsewhere as indicated.

### **3.8 SLEEVES**

- .1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and elsewhere as indicated.
- .2 Material: schedule 40 black steel pipe.
- .3 Construction: foundation walls and where sleeves extend above finished floors to have annular fins continuously welded on at mid-point.
- .4 Sizes: 6mm (1/4 inch) minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Installation:
  - .1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.
  - .2 Other floors: terminate 25mm (1 inch) above finished floor.
  - .3 Before installation, paint exposed exterior surfaces with heavy application of zinc-rich paint to CAN/CGSB-1.181.
- .6 Sealing:

- .1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.
- .2 Elsewhere: Provide space for firestopping. Maintain fire rating integrity.
- .3 Sleeves installed for future use: fill with lime plaster or other easily removable filler.
- .4 Ensure no contact between copper pipe or tube and sleeve.

### **3.9 ESCUTCHEONS**

- .1 Install on pipes passing through walls, partitions, floors, and ceilings in finished areas.
- .2 Construction: one piece type with set screws. Chrome or nickel plated brass or type 302 stainless steel.
- .3 Sizes: outside diameter to cover opening or sleeve. Inside diameter to fit around pipe or outside of insulation if so provided.

### **3.10 PREPARATION FOR FIRE STOPPING**

- .1 Material and installation within annular space between pipes, ducts, insulation and adjacent fire separation to be fire stopped.
- .2 Uninsulated unheated pipes not subject to movement: No special preparation.
- .3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe movement without damaging fires topping material or installation.
- .4 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers.

### **3.11 FLUSHING OUT OF PIPING SYSTEMS**

- .1 Flush system in accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.
- .2 Before start-up, clean interior of piping systems in accordance with requirements of Section 00 10 00 – General Instructions supplemented as specified in relevant mechanical sections.
- .3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

### **3.12 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK**

- .1 Advise Departmental Representative 48h minimum prior to performance of pressure tests.
- .2 Test piping for leaks after piping has been placed in position and all branch piping installed, but before the piping has been concealed, and before equipment, fixture and fittings have been connected.
- .3 Hydronic Piping: test as specified in relevant mechanical sections.
- .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.



- .5 Conduct tests in presence of Departmental Representative.
- .6 Contractor to pay costs for repairs or replacement, retesting, and making good of any leaks or deficiencies found during testing of piping system. Departmental Representative to determine whether repair or replacement is appropriate.
- .7 Insulate or conceal work only after approval and certification of tests by Departmental Representative.
- .8 Safety precautions in the event of pipe rupture should be in place to eliminate hazards to personnel in the proximity of piping being testing.

**3.13 EXISTING SYSTEMS**

- .1 Connect into existing piping systems at times approved by Departmental Representative.
- .2 Request written approval 10 days minimum, prior to commencement of work.
- .3 Be responsible for damage to existing plant by this work.
- .4 Ensure daily clean-up of existing areas.

**3.14 CLEANING**

- .1 Clean in accordance with Section 00 10 00 – General Instructions. Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 00 10 00 – General Instructions.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME)
  - .1 ANSI/ASME B1.20.1-[1983(R2001)], Pipe Threads, General Purpose (Inch).
  - .2 ANSI/ASME B16.18-[2001], Cast Copper Alloy Solder Joint Pressure Fittings.
- .2 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM A276-[04], Specification for Stainless Steel Bars and Shapes.
  - .2 ASTM B62-[02], Specification for Composition Bronze or Ounce Metal Castings.
  - .3 ASTM B283-[99a], Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).
  - .4 ASTM B505/B505M-[02], Specification for Copper-Base Alloy Continuous Castings.
- .3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
  - .1 MSS-SP-25-[1998], Standard Marking System for Valves, Fittings, Flanges and Unions.
  - .2 MSS-SP-80-[2003], Bronze Gate Globe, Angle and Check Valves.
  - .3 MSS-SP-110-[1996], Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

**1.2                SUBMITTALS**

- .1 Submittals in accordance with Section 00 10 00 – General Instructions.

**1.3                QUALITY ASSURANCE**

- .1 Health and Safety: do construction occupational health and safety in accordance with Sections 0010 00 – General Instructions and 00 15 45 – General Safety Section and Fire Requirements.

**1.4                DELIVERY STORAGE AND DISPOSAL**

- .1 Waste Management and Disposal:
  - .2 Separate and recycle waste materials in accordance with Section 00 10 00 – General Instructions.
  - .3 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling.

**Part 2 Products**

**2.1 MATERIALS**

- .1 Valves:
  - .1 Except for specialty valves, to be single manufacturer.
  - .2 All products to have CRN registration numbers.
- .2 End Connections:
  - .1 Connection into adjacent piping/tubing:
    - .1 Steel pipe systems: Screwed ends to ANSI/ASME B1.20.1.
    - .2 Copper tube systems: Solder ends to ANSI/ASME B16.18.
- .3 Lockshield Keys:
  - .1 Where lockshield valves are specified, provide 10 keys of each size: malleable iron cadmium plated.
- .4 Gate Valves:
  - .1 Requirements common to gate valves, unless specified otherwise:
    - .1 Standard specification: MSS SP-80.
    - .2 Bonnet: union with hexagonal shoulders.
    - .3 Connections: screwed with hexagonal shoulders.
    - .4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.
    - .5 Packing: non-asbestos.
    - .6 Handwheel: non-ferrous.
    - .7 Handwheel Nut: bronze to ASTM B62.
  - .2 NPS 2 and under, non-rising stem, solid wedge disc, Class 125
    - .1 Body: with long disc guides, screwed bonnet with stem retaining nut.
    - .2 Operator: Handwheel.
  - .3 NPS 2 and under, non-rising stem, solid wedge disc, Class 150:
    - .1 Body: with long disc guides, screwed bonnet with stem retaining nut.
    - .2 Operator: Handwheel.
  - .4 NPS 2 and under, rising stem, split wedge disc, Class 125:
    - .1 Body: with long disc guides, screwed bonnet.
    - .2 Disc: split wedge, bronze to ASTM B283, loosely secured to stem.
    - .3 Operator: Handwheel.
  - .5 NPS 2 and under, rising stem, solid wedge disc, Class 125:
    - .1 Body: with long disc guides, screwed bonnet.
    - .2 Operator: Handwheel.
  - .6 NPS 2 and under, rising stem, solid wedge disc, Class 150:
    - .1 Body: with long disc guides, screwed bonnet.
    - .2 Operator: Handwheel.

- .5 Globe Valves:
  - .1 Requirements common to globe valves, unless specified otherwise:
    - .1 Standard specification: MSS SP-80.
    - .2 Bonnet: union with hexagonal shoulders.
    - .3 Connections: screwed with hexagonal shoulders.
    - .4 Pressure testing: to MSS SP-80. Tests to be hydrostatic.
    - .5 Stuffing box: threaded to bonnet with gland follower, packing nut, high grade non-asbestos packing.
    - .6 Handwheel: non-ferrous.
    - .7 Handwheel Nut: bronze to ASTM B62.
  - .2 NPS 2 and under, composition disc, Class 125:
    - .1 Body and bonnet: screwed bonnet.
    - .2 Disc and seat: renewable rotating PTFE disc, composition to suit service conditions, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.
    - .3 Operator: Handwheel.
  - .3 NPS 2 and under, composition disc, Class 150:
    - .1 Body and bonnet: union bonnet.
    - .2 Disc and seat: renewable rotating PTFE disc in easily removable disc holder, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.
    - .3 Operator: Handwheel.
  - .4 NPS 2 and under, plug disc, Class 150, screwed ends:
    - .1 Body and bonnet: union bonnet.
    - .2 Disc and seat ring: tapered plug type with disc stem ring of AISI S420 stainless steel to ASTM A276, loosely secured to stem.
    - .3 Operator: Handwheel.
  - .5 Angle valve, NPS 2 and under, composition disc, Class 150:
    - .1 Body and bonnet: union bonnet.
    - .2 Disc and seat: renewable rotating PTFE disc in slip-on easily removable disc holder having integral guides, regrindable bronze seat, loosely secured to stem.
    - .3 Operator: Handwheel.
- .6 Check Valves:
  - .1 Requirements common to check valves, unless specified otherwise:
    - .1 Standard specification: MSS SP-80.
    - .2 Connections: screwed with hexagonal shoulders.
  - .2 NPS 2 and under, swing type, bronze disc, Class 125:
    - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
    - .2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.

- .3 NPS 2 and under, swing type, bronze disc:
  - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
  - .2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.
- .4 NPS 2 and under, swing type, composition disc, Class 200:
  - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
  - .2 Disc: renewable rotating disc composition to suit service conditions, bronze two-piece hinge disc construction.
- .5 NPS 2 and under, horizontal lift type, composition disc, Class 150:
  - .1 Body: with integral seat, union bonnet ring with hex shoulders, cap.
  - .2 Disc: renewable PTFE rotating disc in disc holder having guides top and bottom, of bronze to ASTM B62.
- .6 NPS 2 and under, vertical lift type, bronze disc, Class 125:
  - .1 Disc: rotating disc having guides top and bottom, disc guides, retaining rings.
- .7 Silent Check Valves:
  - .1 NPS 2 and under:
    - .1 Body: cast high tensile bronze to ASTM B62 with integral seat.
    - .2 Pressure rating: Class 125.
    - .3 Connections: screwed ends to ANSI B1.20.1 and with hex. shoulders.
    - .4 Disc and seat: renewable rotating disc.
    - .5 Stainless steel spring, heavy duty.
    - .6 Seat: regrindable.
- .8 Ball Valves:
  - .1 NPS 2 and under:
    - .1 Body and cap: cast high tensile bronze to ASTM B62.
    - .2 Pressure rating: Class 125.
    - .3 Connections: Screwed ends to ANSI B1.20.1 and with hexagonal shoulders.
    - .4 Stem: tamperproof ball drive.
    - .5 Stem packing nut: external to body.
    - .6 Ball and seat: replaceable stainless steel solid ball and teflon seats.
    - .7 Stem seal: TFE with external packing nut.
    - .8 Operator: removable lever handle.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1            Install rising stem valves in upright position with stem above horizontal.
- .2            Remove internal parts before soldering.
- .3            Install valves with unions at each piece of equipment arranged to allow servicing, maintenance, and equipment removal.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
  - .1 ANSI/ASME B31.1-[04], Power Piping.
- .2 American Society for Testing and Materials International (ASTM)
  - .1 ASTM A125-[1996(R2001)], Specification for Steel Springs, Helical, Heat-Treated.
  - .2 ASTM A307-[04], Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .3 ASTM A563-[04a], Specification for Carbon and Alloy Steel Nuts.
- .3 Factory Mutual (FM).
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .5 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
  - .1 MSS SP58-[2002], Pipe Hangers and Supports - Materials, Design and Manufacture.
  - .2 ANSI/MSS SP69-[2003], Pipe Hangers and Supports - Selection and Application.
  - .3 MSS SP89-[2003], Pipe Hangers and Supports - Fabrication and Installation Practices.
- .6 Underwriter's Laboratories of Canada (ULC).

**1.2 SYSTEM DESCRIPTION**

- .1 Design Requirements:
  - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
  - .2 Base maximum load ratings on allowable stresses prescribed by MSS SP58.ASME B31.1 or :
    - .1 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.
  - .3 Design hangers and supports to support systems under conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
  - .4 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.

**1.3 SUBMITTALS**

- .1 Submittals in accordance with Section 00 10 00 – General Instructions.

#### 1.4 QUALITY ASSURANCE

- .1 Health and Safety: do construction occupational health and safety in accordance with Sections 00 10 00 – General Instructions and 00 15 45 – Fire Safety and General Requirements.

#### 1.5 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 GENERAL

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP58.
- .2 Use components for intended design purpose only. Do not use for rigging or erection purposes.

#### 2.2 PIPE HANGERS

- .1 Finishes:
  - .1 Pipe hangers and supports: galvanized after manufacture.
  - .2 Use electro-plating galvanizing process or hot dipped galvanizing process.
  - .3 Ensure steel hangers in contact with copper piping are epoxy coated.
- .2 Upper attachment structural: suspension from lower flange of I-Beam:
  - .1 Cold piping NPS 2 maximum: malleable iron C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip.
    - .1 Rod: 9 mm UL listed.
  - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed and FM approved to MSS-SP58 and MSS-SP69.
- .3 Upper attachment structural: suspension from upper flange of I-Beam:
  - .1 Cold piping NPS 2 maximum: ductile iron top-of-beam C-clamp with hardened steel cup point setscrew, locknut and carbon steel retaining clip, UL listed and FM approved to MSS SP69.
  - .2 Cold piping NPS 2 1/2 or greater, hot piping: malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed and FM approved.



- .4 Upper attachment to concrete:
  - .1 Ceiling: carbon steel welded eye rod, clevis plate, clevis pin and cotters with weldless forged steel eye nut. Ensure eye 6mm (1/4") minimum greater than rod diameter.
  - .2 Concrete inserts: wedge shaped body with knockout protector plate UL listed and FM approved to MSS SP69.
- .5 Hanger rods: threaded rod material to MSS SP58:
  - .1 Ensure that hanger rods are subject to tensile loading only.
  - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
- .6 Pipe attachments: material to MSS SP58:
  - .1 Attachments for steel piping: carbon steel black.
  - .2 Attachments for copper piping: copper plated black steel.
  - .3 Use insulation shields for hot pipework.
  - .4 Oversize pipe hangers and supports.
- .7 Adjustable clevis: material to MSS SP69 UL listed and FM approved, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis.
  - .1 Ensure "U" has hole in bottom for riveting to insulation shields.
- .8 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP69.
- .9 U-bolts: carbon steel to MSS SP69 with 2 nuts at each end to ASTM A563.
  - .1 Finishes for steel pipework: black.
  - .2 Finishes for copper, glass, brass or aluminum pipework: black], with formed portion epoxy coated.
- .10 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP69.

### **2.3 RISER CLAMPS**

- .1 Steel or cast iron pipe: black carbon steel to MSS SP58, type 42, UL listed and FM approved.
- .2 Copper pipe: carbon steel copper plated to MSS SP58, type 42.
- .3 Bolts: to ASTM A307.
- .4 Nuts: to ASTM A563.

### **2.4 INSULATION PROTECTION SHIELDS**

- .1 Insulated hot piping:
  - .1 Curved plate 300mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP69.

### **2.5 EQUIPMENT SUPPORTS**

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel.

## **2.6 EQUIPMENT ANCHOR BOLTS AND TEMPLATES**

- .1 Provide templates to ensure accurate location of anchor bolts.

## **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 manufacturer's instructions and recommendations.
- .2 Vibration Control Devices:
  - .1 Install on piping systems at pumps, boilers, chillers, cooling towers, and as indicated.
- .3 Clamps on riser piping:
  - .1 Support independent of connected horizontal pipework using riser clamps and riser clamp lugs welded to riser.
  - .2 Bolt-tightening torques to industry standards.
  - .3 Steel pipes: install below coupling or shear lugs welded to pipe.
  - .4 Cast iron pipes: install below joint.
- .4 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .5 Use approved constant support type hangers where:
  - .1 Vertical movement of pipework is 13mm or more,
  - .2 Transfer of load to adjacent hangers or connected equipment is not permitted.
- .6 Use variable support spring hangers where:
  - .1 Transfer of load to adjacent piping or to connected equipment is not critical.
  - .2 Variation in supporting effect does not exceed 25 % of total load.

### **3.3 HANGER SPACING**

- .1 Plumbing piping: to Canadian Plumbing Code, Provincial Code and authority having jurisdiction.
- .2 Fire protection: to applicable fire code.
- .3 Gas and fuel oil piping: up to NPS 1/2: every 1.8 m.
- .4 Copper piping: up to NPS 1/2: every 1.5 m.
- .5 Flexible joint roll groove pipe: in accordance with table below, but not less than one hanger at joints.
- .6 Within 300mm of each elbow.

Maximum Pipe Size : NPS	Maximum Spacing Steel	Maximum Spacing Copper
up to 1-1/4	2.1 m	1.8 m
1-1/2	2.7 m	2.4 m
2	3.0 m	2.7 m
2-1/2	3.6 m	3.0 m
3	3.6 m	3.0 m
3-1/2	3.9 m	3.3 m
4	4.2 m	3.6 m
5	4.8 m	
6	5.1 m	
8	5.7 m	
10	6.6 m	
12	6.9 m	

- .7 Pipework greater than NPS 12: to MSS SP69.

**3.4 HANGER INSTALLATION**

- .1 Install hanger so that rod is vertical under operating conditions.
- .2 Adjust hangers to equalize load.
- .3 Support from structural members. Where structural bearing does not exist or inserts are not in suitable locations, provide supplementary structural steel members.

**3.5 HORIZONTAL MOVEMENT**

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4 degrees from vertical.
- .2 Where horizontal pipe movement is less than 13 mm, offset pipe hanger and support so that rod hanger is vertical in the hot position.

**3.6 FINAL ADJUSTMENT**

- .1 Adjust hangers and supports:
  - .1 Ensure that rod is vertical under operating conditions.
  - .2 Equalize loads.
- .2 Adjustable clevis:
  - .1 Tighten hanger load nut securely to ensure proper hanger performance.
  - .2 Tighten upper nut after adjustment.
- .3 C-clamps:
  - .1 Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.

- .4 Beam clamps:
  - .1 Hammer jaw firmly against underside of beam.

**END OF SECTION**

**Part 1           General**

**1.1           REFERENCES**

- .1 Canadian Gas Association (CGA)
  - .1 CSA/CGA B149.1-05, Natural Gas and Propane Installation Code.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.60-97, Interior Alkyd Gloss Enamel.
  - .2 CAN/CGSB-24.3-92, Identification of Piping Systems.
- .3 National Fire Protection Association (NFPA)
  - .1 NFPA 13-2005, Standard for the Installation of Sprinkler Systems.
  - .2 NFPA 14-2003, Standard for the Installation of Standpipe and Hose Systems.

**1.2           SUBMITTALS**

- .1 Product data submittals in accordance with Section 00 10 00 – General Instructions.

**1.3           QUALITY ASSURANCE**

- .1 Quality assurance submittals: submit following in accordance with Section 00 10 00 – General Instructions.
- .2 Health and Safety: do construction occupational health and safety in accordance with Section 00 10 00 – General Instructions and 00 15 45 – General Safety Section and Fire Requirements.

**1.4           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.

**Part 2           Products**

**2.1           MANUFACTURER'S EQUIPMENT NAMEPLATES**

- .1 Metal or plastic laminate nameplate fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers raised or recessed.
- .3 Information to include, as appropriate:
  - .1 Equipment: manufacturer's name, model, size, serial number, capacity.
  - .2 Motor: voltage, Hz, phase, power factor, duty, frame size.

**2.2           SYSTEM NAMEPLATES**

- .1 Colours:

- .1 Hazardous: red letters, white background.
- .2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).
- .2 Construction:
  - .1 3 mm thick laminated plastic, matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .3 Sizes:
  - .1 Conform to following table:

Size # mm	Sizes (mm)	No. of Lines	Height of Letters (mm)
1	10 x 50	1	3
2	13 x 75	1	5
3	13 x 75	2	3
4	20 x 100	1	8
5	20 x 100	2	5
6	20 x 200	1	8
7	25 x 125	1	12
8	25 x 125	2	8
9	35 x 200	1	20

- .2 Use maximum of 25 letters/numbers per line.
- .4 Locations:
  - .1 Terminal cabinets, control panels: use size # 5.
  - .2 Equipment in Mechanical Rooms: use size # 9.
- .5 Identification for PWGSC Preventive Maintenance Support System (PMSS):
  - .1 Use arrangement of Main identifier, Source identifier, Destination identifier.
  - .2 Equipment in Mechanical Room:
    - .1 Main identifier: size #9.
    - .2 Source and Destination identifiers: size #6.
    - .3 Terminal cabinets, control panels: size #5.
  - .3 Equipment elsewhere: sizes as appropriate.

**2.3 EXISTING IDENTIFICATION SYSTEMS**

- .1 Apply existing identification system to new work.
- .2 Where existing identification system does not cover for new work, use identification system specified this section.
- .3 Before starting work, obtain written approval of identification system from Departmental Representative.

**2.4 PIPING SYSTEMS GOVERNED BY CODES**

- .1 Identification:

- .1 Standpipe and hose systems: to NFPA 14.
- .2 Sprinklers: to NFPA 13.
- .3 Natural Gas: to CAN/CGA B149.1 or authority having jurisdiction.

**2.5 IDENTIFICATION OF PIPING SYSTEMS**

- .1 Identify contents by background colour marking, pictogram (as necessary), legend; direction of flow by arrows. To CAN/CGSB 24.3 except where specified otherwise.
- .2 Pictograms:
  - .1 Where required: Workplace Hazardous Materials Information System (WHMIS) regulations.
- .3 Legend:
  - .1 Block capitals to sizes and colours listed in CAN/CGSB 24.3.
- .4 Arrows showing direction of flow:
  - .1 Outside diameter of pipe or insulation less than 75 mm: 100 mm long x 50 mm high.
  - .2 Outside diameter of pipe or insulation 75 mm and greater: 150 mm long x 50 mm high.
  - .3 Use double-headed arrows where flow is reversible.
- .5 Extent of background colour marking:
  - .1 To full circumference of pipe or insulation.
  - .2 Length to accommodate pictogram, full length of legend and arrows.
- .6 Materials for background colour marking, legend, arrows:
  - .1 Pipes and tubing 20 mm and smaller: waterproof and heat-resistant pressure sensitive plastic marker tags.
  - .2 Other pipes: pressure sensitive vinyl with protective over coating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 150 degrees C and intermittent temperature of 200 degrees C.
- .7 Colours and Legends:
  - .1 Where not listed, obtain direction from Departmental Representative.
  - .2 Colours for legends, arrows: to following table:

<b>Background Colour</b>	<b>Legend, Arrows</b>
Yellow	Black
Green	White
Red	White

.3 Background colour marking and legends for piping systems:

<b>Contents</b>	<b>Background Colour Marking</b>	<b>Legend</b>
Hot Water Heating Supply	Yellow	HEATING SUPPLY
Hot Water Heating Return	Yellow	HEATING RETURN

**2.6 VALVES, CONTROLLERS**

- .1 Laminated identification data.
- .2 Include flow diagrams for each system, of approved size, showing charts and schedules with identification of each tagged item, valve type, service, function, normal position, location of tagged item.

**2.7 CONTROLS COMPONENTS IDENTIFICATION**

- .1 Identify all systems, equipment, components, controls, sensors with system nameplates specified in this section.
- .2 Inscriptions to include function and (where appropriate) fail-safe position.
- .3 Number valves consecutively.

**2.8 LANGUAGE**

- .1 Identification in both English and French.
- .2 Use one nameplate and label for both languages.

**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 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC or CSA registration plates as required by respective agency.
- .3 Identify systems, equipment to conform to PWGSC PMSS.



### 3.3 NAMEPLATES

- .1 Locations:
  - .1 In conspicuous location to facilitate easy reading and identification from operating floor.
- .2 Standoffs:
  - .1 Provide for nameplates on hot and/or insulated surfaces.
- .3 Protection:
  - .1 Do not paint, insulate or cover.

### 3.4 LOCATION OF IDENTIFICATION ON PIPING

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: at not more than 17 m intervals and more frequently if required to ensure that at least one is visible from any one viewpoint in operating areas and walking aisles.
- .2 Adjacent to each change in direction.
- .3 At least once in each small room through which piping or ductwork passes.
- .4 On both sides of visual obstruction or where run is difficult to follow.
- .5 On both sides of separations such as walls, floors, partitions.
- .6 Where system is installed in pipe chases, ceiling spaces, galleries, confined spaces, at entry and exit points, and at access openings.
- .7 At beginning and end points of each run and at each piece of equipment in run.
- .8 At point immediately upstream of major manually operated or automatically controlled valves, and dampers. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .9 Identification easily and accurately readable from usual operating areas and from access points.
  - .1 Position of identification approximately at right angles to most convenient line of sight, considering operating positions, lighting conditions, risk of physical damage or injury and reduced visibility over time due to dust and dirt.

### 3.5 VALVES, CONTROLLERS

- .1 Valves and operating controllers, except as plumbing fixtures, radiation, or where in plain sight of equipment they serve: secure tags with non-ferrous chains or closed "S" hooks.
- .2 Install one copy of flow diagrams, valve schedules mounted in frame behind non-glare glass where directed by Departmental Representative. Provide one copy (reduced size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively.

**3.6 CLEANING**

- .1 Proceed in accordance with Section 00 10 00 – General Instructions.
- .2 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   TAB is used throughout this Section to describe the process, methods and requirements of testing, adjusting and balancing for HVAC.
- .2   TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do other work as specified in this section.

**1.2           QUALIFICATIONS OF TAB PERSONNEL**

- .1   Submit names of personnel to perform TAB to Departmental Representative within 10 days of award of contract.
- .2   Provide documentation confirming qualifications, successful experience.
- .3   TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved.
- .4   Recommendations and suggested practices contained in the TAB Standard: mandatory.
- .5   Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
- .6   Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
- .7   Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .8   TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
  - .1   For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
  - .2   Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

**1.3           PURPOSE OF TAB**

- .1   Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.
- .2   Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- .3   Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

#### **1.4 EXCEPTIONS**

- .1 TAB of systems and equipment regulated by codes, standards to satisfaction of authority having jurisdiction.

#### **1.5 CO-ORDINATION**

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule to ensure completion before acceptance of project.
- .2 Do TAB of each system independently and subsequently, where interlocked with other systems, in unison with those systems.

#### **1.6 PRE-TAB REVIEW**

- .1 Review contract documents before project construction is started and confirm in writing to Departmental Representative adequacy of provisions for TAB and other aspects of design and installation pertinent to success of TAB.
- .2 Review specified standards and report to Departmental Representative in writing proposed procedures which vary from standard.
- .3 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

#### **1.7 START-UP**

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in Division 23.

#### **1.8 OPERATION OF SYSTEMS DURING TAB**

- .1 Operate systems for length of time required for TAB and as required by Departmental Representative for verification of TAB reports.

#### **1.9 START OF TAB**

- .1 Notify Departmental Representative 7 days prior to start of TAB.
- .2 Start TAB when building is essentially completed, including:
  - .1 Installation of ceilings, doors, windows, other construction affecting TAB.
  - .2 Application of weather-stripping, sealing, and caulking.
  - .3 Pressure, leakage, other tests specified elsewhere Division 23.
  - .4 Provisions for TAB installed and operational.
- .3 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
  - .1 Proper thermal overload protection in place for electrical equipment.

- .2 Air systems:
  - .1 Filter in place, clean.
  - .2 Duct systems clean.
  - .3 Ducts, air shafts, ceiling plenums are airtight to within specified tolerances.
  - .4 Correct fan rotation.
  - .5 Fire, smoke, volume control dampers installed and open.
  - .6 Coil fins combed, clean.
  - .7 Access doors, installed, closed.
  - .8 Outlets installed, volume control dampers open.
- .3 Liquid systems:
  - .1 Flushed, filled, vented.
  - .2 Correct pump rotation.
  - .3 Strainers in place, baskets clean.
  - .4 Isolating and balancing valves installed, open.
  - .5 Calibrated balancing valves installed, at factory settings.
  - .6 Chemical treatment systems complete, operational.

#### **1.10 APPLICATION TOLERANCES**

- .1 Do TAB to following tolerances of design values:
  - .1 HVAC systems: plus or minus 5%.
  - .2 Hydronic systems: plus or minus 5%.

#### **1.11 ACCURACY TOLERANCES**

- .1 Measured values accurate to within plus or minus 2% of actual values.

#### **1.12 INSTRUMENTS**

- .1 Prior to TAB, submit to Departmental Representative list of instruments used together with serial numbers.
- .2 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.
- .3 Calibrate within 3 months of TAB. Provide certificate of calibration to Departmental Representative upon request.

#### **1.13 SUBMITTALS**

- .1 Submit, prior to commencement of TAB submit proposed methodology and procedures for performing TAB if different from referenced standard.

#### **1.14 PRELIMINARY TAB REPORT**

- .1 Submit for checking and approval of Departmental Representative, prior to submission of formal TAB report, sample of rough TAB sheets. Include:
  - .1 Details of instruments used.
  - .2 Details of TAB procedures employed.
  - .3 Calculations procedures.

.4 Summaries.

**1.15 TAB REPORT**

- .1 TAB report to show results in SI units and to include:
  - .1 Project record drawings.
  - .2 System schematics.
- .2 Submit one (1) electronic copy of TAB Report to Departmental Representative for verification and approval.

**1.16 VERIFICATION**

- .1 Reported results subject to verification by Departmental Representative.
- .2 Provide personnel and instrumentation to verify up to 30% of reported results.
- .3 Number and location of verified results as directed by Departmental Representative.
- .4 Pay costs to repeat TAB as required to satisfaction of Departmental Representative.

**1.17 SETTINGS**

- .1 After TAB is completed to satisfaction of Departmental Representative, replace drive guards, close access doors, lock devices in set positions, ensure sensors are at required settings.
- .2 Permanently mark settings to allow restoration at any time during life of facility. Do not eradicate or cover markings.

**1.18 COMPLETION OF TAB**

- .1 TAB considered complete when final TAB Report received and approved by Departmental Representative.

**1.19 AIR SYSTEMS**

- .1 Standard: TAB to most stringent of TAB standards of AABC, NEBB, SMACNA and ASHRAE.
- .2 Do TAB of the following systems, equipment, components, controls:
  - .1 Existing ventilation system, supply and return.
  - .2 New force flow heating units.
- .3 Qualifications: personnel performance TAB current member in good standing with AABC or NEBB.
- .4 Quality Assurance: perform TAB under direction of supervisor qualified to standards of AABC or NEBB.
- .5 Measurements: to include as appropriate for systems, equipment, controls: air velocity, static pressure, flow rate, pressure drop (or loss), temperatures (dry bulb, wet bulb, dew point), duct cross-sectional area, RPM, electrical power, voltage, noise and vibration.

- .6 Locations of equipment measurements, to include as appropriate:
  - .1 Inlet and outlet of dampers, filters, coil, humidifier, fan, other equipment causing changes in conditions.
  - .2 At controllers, controlled devices.
- .7 Locations of system measurements to include as appropriate: main ducts, main branch, sub-branch, run outs (grille, register or diffuser).

**1.20 POST-OCCUPANCY TAB**

- .1 Emergency evacuation: participate in full scale emergency evacuation exercises.
- .2 Participate in systems checks twice during Warranty Period - #1 approximately 3 months after acceptance and #2 within 1 month of termination of Warranty Period.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not used.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1        Definitions:
  - .1        For purposes of this section:
    - .1        "CONCEALED" - insulated mechanical services and equipment in suspended ceilings and non-accessible chases and furred-in spaces.
    - .2        "EXPOSED" - means "not concealed" as previously defined.
    - .3        Insulation systems - insulation material, fasteners, jackets, and other accessories.
  - .2        TIAC Codes:
    - .1        CRD: Code Round Ductwork,
    - .2        CRF: Code Rectangular Finish.
- .2        Reference Standards:
  - .1        American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
    - .1        ANSI/ASHRAE/IESNA 90.1-[04], SI; Energy Standard for Buildings Except Low-Rise Residential Buildings.
  - .2        ASTM International Inc.
    - .1        ASTM B209M-[07], Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric).
    - .2        ASTM C335-[05ae1], Standard Test Method for Steady State Heat Transfer Properties of Pipe Insulation.
    - .3        ASTM C411-[05], Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
    - .4        ASTM C449/C449M-[00], Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
    - .5        ASTM C547-[07e1], Standard Specification for Mineral Fiber Pipe Insulation.
    - .6        ASTM C553-[02e1], Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
    - .7        ASTM C612-[04e1], Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
    - .8        ASTM C795-[03], Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
    - .9        ASTM C921-[03a], Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
  - .3        Canadian General Standards Board (CGSB)
    - .1        CGSB 51-GP-52Ma-[89], Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
  - .4        Thermal Insulation Association of Canada (TIAC): National Insulation Standards (2005).
  - .5        Underwriters Laboratories of Canada (ULC)
    - .1        CAN/ULC-S102-[03], Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
    - .2        CAN/ULC-S701-[05], Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.



## 1.2 SUBMITTALS

- .1 Provide submittals in accordance with Section 00 10 00 – General Instructions.
- .2 Product Data:
  - .1 Provide manufacturer's printed product literature and datasheets for duct insulation, and include product characteristics, performance criteria, physical size, finish and limitations.
    - .1 Description of equipment giving manufacturer's name, type, model, year and capacity.
    - .2 Details of operation, servicing and maintenance.
    - .3 Recommended spare parts list.

## 1.3 QUALITY ASSURANCE

- .1 Health and Safety: do construction occupational health and safety in accordance with Sections 0010 00 – General Instructions and 00 15 45 – General Safety Section and Fire Requirements.
- .2 Qualifications: installer to be specialist in performing work of this section, and have at least 3 years successful experience in this size and type of project, qualified to standards of TIAC.

## 1.4 DELIVERY, STORAGE AND HANDLING

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

## 1.5 WASTE MANAGEMENT AND DISPOSAL

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

## Part 2 Products

### 2.1 FIRE AND SMOKE RATING

- .1 To CAN/ULC-S102:
  - .1 Maximum flame spread rating: 25.
  - .2 Maximum smoke developed rating: 50.

### 2.2 INSULATION

- .1 Mineral fibre: as specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code C-1: Rigid mineral fibre board to ASTM C612, with and without factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this Section).

- .4 TIAC Code C-2: Mineral fibre blanket to ASTM C553 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).
  - .1 Mineral fibre: to ASTM C553.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: to ASTM C553.

### **2.3 JACKETS**

- .1 Canvas:
  - .1 220 gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .2 Lagging adhesive: compatible with insulation.

### **2.4 ACCESSORIES**

- .1 Vapour retarder lap adhesive:
  - .1 Water based, fire retardant type, compatible with insulation.
- .2 Indoor Vapour Retarder Finish:
  - .1 Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.
- .4 ULC Listed Canvas Jacket:
  - .1 220 gm/m<sup>2</sup> cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.
- .5 Contact adhesive: quick-setting
- .6 Canvas adhesive: washable.
- .7 Tape: self-adhesive, aluminum, plain, 50mm wide minimum.
- .8 Tie wire: 1.5mm stainless steel.
- .9 Banding: 19mm wide, 0.5mm thick stainless steel.
- .10 Facing: 25mm stainless or galvanized steel hexagonal wire mesh stitched on one face of insulation.
- .11 Fasteners: 2mm diameter pins with 35mm clips, length to suit thickness of insulation.

## **Part 3 Execution**

### **3.1 APPLICATION**

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

**3.2 PRE-INSTALLATION REQUIREMENTS**

- .1 Pressure test ductwork systems complete, witness and certify.
- .2 Ensure surfaces are clean, dry, free from foreign material.

**3.3 INSTALLATION**

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturer’s instructions and as indicated.
- .3 Use 2 layers with staggered joints when required nominal thickness exceeds 75mm.
- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Ensure hangers, and supports are outside vapour retarder jacket.
- .5 Hangers and supports in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
  - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .6 Fasteners: install at 300mm on centre in horizontal and vertical directions, minimum 2 rows each side.

**3.4 DUCTWORK INSULATION SCHEDULE**

- .1 Insulation types and thicknesses: conform to following table:

	TIAC Code	Vapour Retarder	Thickness (mm)
Warm Air Supply Air Ducts	C-1	no	25
Acoustically Lined Ducts	NONE	N/A	25

- .2 Exposed round ducts 600mm and larger, smaller sizes where subject to abuse:
  - .1 Use TIAC code C-1 insulation, scored to suit diameter of duct.
    - .1 Finishes: conform to following table:

	TIAC Code	
	Rectangular	Round
Indoor, concealed	none	none
Indoor, exposed within mechanical room	CRF/1	CRD/2
Indoor, exposed elsewhere	CRF/2	CRD/3
Outdoor, exposed to precipitation	CRF/3	CRD/4
Outdoor, elsewhere	CRF/4	CRD/5

**3.5**

**CLEANING**

- .1 Clean in accordance with Section 00 10 00 – General Instructions and manufacturer's written instructions.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM E202-[04], Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

**1.2 CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS**

- .1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

**1.3 HYDRONIC SYSTEMS - PERFORMANCE VERIFICATION (PV)**

- .1 Perform hydronic systems performance verification after cleaning is completed and system is in full operation.
- .2 When systems are operational, perform following tests:
  - .1 Conduct full scale tests at maximum design flow rates, temperatures and pressures for continuous consecutive period of 24 hours to demonstrate compliance with design criteria.
  - .2 Verify performance of hydronic system circulating pumps as specified, recording system pressures, temperatures, fluctuations by simulating maximum design conditions and varying.
    - .1 Pump operation.
    - .2 Boiler operation.
    - .3 Pressure bypass open/closed.
    - .4 Control pressure failure.
    - .5 Maximum heating demand.
    - .6 Boiler failure.
    - .7 Outdoor reset. Re-check heat exchanger output supply temperature at 100% and 50% reset, maximum water temperature.

**1.4 HYDRONIC SYSTEM CAPACITY TEST**

- .1 Perform hydronic system capacity tests after:
  - .1 TAB has been completed
  - .2 Verification of operating, limit, safety controls.
  - .3 Verification of primary and secondary pump flow rates.
  - .4 Verification of accuracy of temperature and pressure sensors and gauges.
- .2 Calculate system capacity at test conditions.
- .3 Using manufacturer's published data and calculated capacity at test conditions, extrapolate system capacity at design conditions.
- .4 When capacity test is completed, return controls and equipment status to normal operating conditions.
- .5 Submit sample of system water to approved testing agency to determine if chemical treatment is correct. Include cost.

- .6 Heating system capacity test:
  - .1 Perform capacity test when ambient temperature is within 10% of design conditions. Simulate design conditions by:
    - .1 Increasing OA flow rates through heating coils (in this case, monitor heating coil discharge temperatures to ensure that coils are not subjected to freezing conditions) or
    - .2 Reducing space temperature by turning of heating system for sufficient period of time before starting testing.
  - .2 Test procedures:
    - .1 Open fully heat exchanger, heating coil and radiation control valves.
    - .2 With boilers on full firing and hot water heating supply temperature stabilized, record flow rates and supply and return temperatures simultaneously.
    - .3 Conduct flue gas analysis test on boilers at full load and at low fire conditions.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1 General**

- .1 American Society for Testing and Materials International (ASTM)
  - .1 ASTM E202-[00], Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

**1.2 SUBMITTALS**

- .1 Product Data / Shop Drawings:
  - .1 Submit manufacturer's printed product literature, specifications, shop drawings and datasheet in accordance with Section 00 10 00 – General Instructions. Include product characteristics, performance criteria, and limitations.

**1.3 QUALITY ASSURANCE**

- .1 Health and Safety: do construction occupational health and safety in accordance with Sections 0010 00 – General Instructions and 00 15 45 – General Safety Section and Fire Requirements.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle 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 CLEANING SOLUTIONS**

- .1 Tri-sodium phosphate: 0.40 kg per 100 L water in system.
- .2 Sodium carbonate: 0.40 kg per 100 L water in system.
- .3 Low-foaming detergent: 0.01 kg per 100 L water in system.

**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 CLEANING HYDRONIC

- .1 Timing: systems operational, hydrostatically tested and with safety devices functional, before cleaning is carried out.
- .2 Cleaning Agency:
  - .1 Retain qualified water treatment specialist to perform system cleaning.
- .3 Install instrumentation such as flow meters, orifice plates, pitot tubes, flow metering valves only after cleaning is certified as complete by water treatment specialist.
- .4 Cleaning procedures:
  - .1 Provide detailed report outlining proposed cleaning procedures at least 1 week prior to proposed starting date. Report to include:
    - .1 Cleaning procedures, flow rates, elapsed time.
    - .2 Chemicals and concentrations used.
    - .3 Inhibitors and concentrations.
    - .4 Specific requirements for completion of work.
    - .5 Special precautions for protecting piping system materials and components.
    - .6 Complete analysis of water used to ensure water will not damage systems or equipment.
- .5 Conditions at time of cleaning of systems:
  - .1 Systems: free from construction debris, dirt and other foreign material.
  - .2 Control valves: operational, fully open to ensure that terminal units can be cleaned properly.
  - .3 Strainers: clean prior to initial fill.
  - .4 Install temporary filters on pumps not equipped with permanent filters.
  - .5 Install pressure gauges on strainers to detect plugging.
- .6 Report on Completion of Cleaning:
  - .1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.
- .7 Hydronic Systems:
  - .1 Fill system with water, ensure air is vented from system.
  - .2 Fill expansion tanks 1/3 to 1/2 full, charge system with compressed air to at least 35 kPa (does not apply to diaphragm type expansion tanks).
  - .3 Use water metre to record volume of water in system to +/- 0.5%.
  - .4 Add chemicals under direct supervision of chemical treatment supplier.
  - .5 Closed loop systems: circulate system cleaner at 60 degrees C for at least 36h. Drain as quickly as possible. Refill with water and inhibitors. Test concentrations and adjust to recommended levels.
  - .6 Flush velocity in system mains and branches to ensure removal of debris. System pumps may be used for circulating cleaning solution provided that velocities are adequate.
  - .7 Add chemical solution to system.
  - .8 Establish circulation, raise temperature slowly to maximum design. Circulate for 12h, ensuring flow in all circuits. Remove heat, continue to circulate until temperature is below 38 degrees C. Drain as quickly as possible. Refill with clean water. Circulate for 6h at design temperature. Drain and repeat procedures specified above. Flush



through low point drains in system. Refill with clean water adding to sodium sulphite (test for residual sulphite).

### **3.3 START-UP OF HYDRONIC SYSTEMS**

- .1 After cleaning is completed and system is filled:
  - .1 Establish circulation and expansion tank level, set pressure controls.
  - .2 Ensure air is removed.
  - .3 Check pumps to be free from air, debris, possibility of cavitation when system is at design temperature.
  - .4 Dismantle system pumps used for cleaning, inspect, replace worn parts, install new gaskets and new set of seals.
  - .5 Clean out strainers repeatedly until system is clean.
  - .6 Check water level in expansion tank with cold water with circulating pumps OFF and again with pumps ON.
  - .7 Repeat with water at design temperature.
  - .8 Check pressurization to ensure proper operation and to prevent water hammer, flashing, cavitation. Eliminate water hammer and other noises.
  - .9 Bring system up to design temperature and pressure slowly.
  - .10 Perform TAB as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
  - .11 Adjust pipe supports, hangers, springs as necessary.
  - .12 Monitor pipe movement, performance of expansion joints, loops, guides, anchors.
  - .13 Re-tighten bolts using torque wrench, to compensate for heat-caused relaxation. Repeat several times during commissioning.
  - .14 Check operation of drain valves.
  - .15 Adjust valve stem packings as systems settle down.
  - .16 Fully open balancing valves (except those that are factory-set).
  - .17 Check operation of over-temperature protection devices on circulating pumps.
  - .18 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission.

### **3.4 CLEANING**

- .1 Proceed in accordance with Section 00 10 00 – General Instructions.
- .2 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 REFERENCES**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME B16.1-[98], Cast Iron Pipe Flanges and Flanged Fittings.
  - .2 ASME B16.3-[98], Malleable Iron Threaded Fittings.
  - .3 ASME B16.5-[03], Pipe Flanges and Flanged Fittings.
  - .4 ASME B16.9-[01], Factory-Made Wrought Butt welding Fittings.
  - .5 ASME B18.2.1-[03], Square and Hex Bolts and Screws (Inch Series).
  - .6 ASME B18.2.2-[87(R1999)], Square and Hex Nuts (Inch Series).
- .2 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM A47/A47M-[99], Standard Specification for Ferritic Malleable Iron Castings.
  - .2 ASTM A53/A53M-[02], Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
  - .3 ASTM A536-[84(1999)e1], Standard Specification for Ductile Iron Castings.
  - .4 ASTM B61-[02], Standard Specification for Steam or Valve Bronze Castings.
  - .5 ASTM B62-[02], Standard Specification for Composition Bronze or Ounce Metal Castings.
  - .6 ASTM E202-[00], Standard Test Method for Analysis of Ethylene Glycols and Propylene Glycols.
- .3 American Water Works Association (AWWA).
  - .1 AWWA C111-[00], Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .4 Canadian Standards Association (CSA International).
  - .1 CSA B242-[M1980(R1998)], Groove and Shoulder Type Mechanical Pipe Couplings.
  - .2 CAN/CSA W48-[01], Filler Metals and Allied Materials for Metal Arc Welding (Developed in cooperation with the Canadian Welding Bureau).
- .5 Manufacturer's Standardization of the Valve and Fittings Industry (MSS).
  - .1 MSS-SP-67-[025], Butterfly Valves.
  - .2 MSS-SP-70-[98], Cast Iron Gate Valves, Flanged and Threaded Ends.
  - .3 MSS-SP-71-[97], Cast Iron Swing Check Valves Flanged and Threaded Ends.
  - .4 MSS-SP-80-[03], Bronze Gate, Globe, Angle and Check Valves.
  - .5 MSS-SP-85-[02], Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

**1.2 SUBMITTALS**

- .1 Submit shop drawings in accordance with Section 00 10 00 – General Instructions.

**1.3 QUALITY ASSURANCE**

- .1 Health and Safety: do construction occupational health and safety in accordance with Sections 0010 00 – General Instructions and 00 15 45 – General Safety Section and Fire Requirements.

#### **1.4 DELIVERY, STORAGE AND HANDLING**

- .1 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 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard and packaging material in appropriate on-site bins for recycling.
  - .4 Fold up metal, and plastic banding, flatten and place in designated area for recycling.

#### **1.5 MAINTENANCE**

- .1 Provide spare parts and extra materials in accordance with Section 00 10 00 – General Instructions.

### **Part 2 Products**

#### **2.1 PIPE**

- .1 Steel pipe: to ASTM A53/A53M, Grade B, welded or seamless as follows:
  - .1 To NPS10: schedule 40.
  - .2 NPS 10 and above: standard weight.

#### **2.2 PIPE JOINTS**

- .1 NPS2 and under: screwed fittings with PTFE tape or lead-free pipe dope.
- .2 NPS2-1/2 and over: welding fittings and flanges to CAN/CSA W48.
- .3 Roll grooved: rigid coupling to CSA B242.
- .4 Flanges: raised face slip-on or weld neck to AWWA C111.
- .5 Orifice flanges: slip-on raised face, 2100 kPa.
- .6 Flange gaskets: to AWWA C111.
- .7 Pipe thread: taper.
- .8 Bolts and nuts: to ASME B18.2.1 and ASME B18.2.2.
- .9 Roll grooved coupling gaskets: type EPDM.

#### **2.3 FITTINGS**

- .1 Screwed fittings: malleable iron, to ASME B16.3, Class 150.
- .2 Pipe flanges and flanged fittings:
  - .1 Cast iron: to ASME B16.1, Class 150.
  - .2 Steel: to ASME B16.5.

- .3 Butt-welding fittings: steel, to ASME B16.9.
- .4 Unions: malleable iron, to ASTM A47/A47M and ASME B16.3.
- .5 Fittings for roll grooved piping: ductile iron to ASTM A536.

## 2.4 VALVES

- .1 Connections:
  - .1 NPS2 and smaller: screwed or flanged ends.
  - .2 NPS21/2 and larger: flanged ends.
- .2 Gate valves: to MSS-SP-70 or MSS-SP-80. Application: Isolating equipment, control valves, and pipelines:
  - .1 NPS2 and under:
    - .1 As specified Section 23 05 23.01 - Valves - Bronze.
  - .2 NPS21/2 and over:
    - .1 As specified Section 23 05 23.02 - Valves - Cast Iron: Gate, Globe, Check.
- .3 Globe valves: to MSS-SP-80 or MSS-SP-85. Application: Throttling, flow control, emergency by-pass.
  - .1 NPS2 and under:
    - .1 Mechanical Rooms: with PTFE disc, as specified Section 23 05 23.01 - Valves – Bronze.
    - .2 Elsewhere: globe, with composition disc, as specified Section 23 05 23.01 - Valves – Bronze.
  - .2 NPS21/2 and over:
    - .1 As specified Section 23 05 23.01 - Valves - Bronze.
- .4 Balancing, for TAB:
  - .1 Sizes: Calibrated balancing valves, as specified this section.
  - .2 NPS2 and under:
    - .1 As specified Section 23 05 23.01 - Valves - Bronze.
- .5 Drain valves: Gate, Class 125, non-rising stem, solid wedge disc, as specified Section 23 05 23.01 - Valves - Bronze.
- .6 Swing check valves: to MSS-SP-71.
  - .1 NPS2 and under:
    - .1 As specified Section 23 05 23.01 - Valves - Bronze.
  - .2 NPS21/2 and over:
    - .1 As specified Section 23 05 23.02 - Valves - Cast Iron: Gate, Globe, Check.
- .7 Silent check valves:
  - .1 NPS2 and under:
    - .1 As specified Section 23 05 23.01 - Valves - Bronze.
  - .2 NPS21/2 and over:
    - .1 As specified Section 23 05 23.02 - Valves - Cast Iron: Gate, Globe, Check.

- .8 Ball valves:
  - .1 NPS2 and under:
    - .1 As specified Section 23 05 23.01 - Valves - Bronze.

**Part 3 Execution**

**3.1 PIPING INSTALLATION**

- .1 Install pipework in accordance with Section 23 05 05 - Installation of Pipe Work.

**3.2 CIRCUIT BALANCING VALVES**

- .1 Install flow measuring stations, and flow balancing valves as indicated.
- .2 Remove handwheel after installation and when TAB is completed.

**3.3 CLEANING, FLUSHING AND START-UP**

- .1 In accordance with Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems.

**3.4 TESTING**

- .1 Test system in accordance with appropriate mechanical specification.
- .2 Contractor to conduct leak test in presence of Departmental Representative and pay costs for repairs or replacement, re-testing and making good of all leaks. Departmental Representative to determine whether repair or replacement is appropriate.

**3.5 BALANCING**

- .1 Balance water systems to within plus or minus 5% of design output.
- .2 Refer to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC for applicable procedures.

**3.6 PERFORMANCE VERIFICATION**

- .1 Refer to Section 23 08 01 – Performance Verification of Mechanical Piping Systems for applicable procedures.

**END OF SECTION**

**Part 1            General**

**1.1                REFERENCES**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME-[04(2007)], Boiler and Pressure Vessel Code.
- .2 ASTM International Inc.
  - .1 ASTM A47/A47M-[99(2004)], Standard Specification for Ferritic Malleable Iron Castings.
  - .2 ASTM A278/A278M-[01(2006)], Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650 degrees F (350 degrees C).
  - .3 ASTM A516/A516M-[06], Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower - Temperature Service.
  - .4 ASTM A536-[84(2004)], Standard Specification for Ductile Iron Castings.
  - .5 ASTM B62-[02], Standard Specification for Composition Bronze or Ounce Metal Castings.
- .3 Canadian Standards Association (CSA International)
  - .1 CSA B51-[03(R2003)], Boiler, Pressure Vessel, and Pressure Piping Code.
  - .2 CSA B51-[03(R2005)], Boiler, Pressure Vessel, and Pressure Piping Code, Supplement #1.

**1.2                SUBMITTALS**

- .1 Product Data:
  - .1 Provide manufacturer's printed product literature and datasheets and shop drawings for expansion tanks, air vents, separators, valves, and strainers in accordance with section 00 10 00 – General Instructions. Include product characteristics, performance criteria, physical size, finish and limitations.

**1.3                DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle in accordance with manufacturer's recommendations.
- .2 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .3 Packaging Waste Management: remove for reuse and return by manufacturer of pallets, crates, padding and packaging materials in accordance with Section 00 10 00 – General Instructions.

**Part 2            Products**

**2.1                AUTOMATIC AIR VENT**

- .1 Industrial float vent: cast iron body and NPS 1/2 connection and rated at 690kPa working pressure.
- .2 Float: solid material suitable for 115 degrees C working temperature.

**Part 3 Execution**

**3.1 APPLICATION**

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

**3.2 GENERAL**

- .1 Run drain lines to terminate above nearest drain.
- .2 Maintain adequate clearance to permit service and maintenance.
- .3 Should deviations beyond allowable clearances arise, request and follow Departmental Representative's directive.
- .4 Check shop drawings for conformance of tappings for ancillaries and for equipment operating weights.

**3.3 AIR VENTS**

- .1 Install at high points of systems.
- .2 Install gate valve on automatic air vent inlet. Run discharge to nearest drain.

**3.4 CLEANING**

- .1 Clean in accordance with Section 00 10 00 – General Instructions. Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 00 10 00 – General Instructions.

**END OF SECTION**

**Part 1 General**

**1.1 REFERENCES**

- .1 American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE).
- .2 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM A480/A480M-[03c], Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
  - .2 ASTM A635/A635M-[02], Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Carbon, Hot Rolled.
  - .3 ASTM A653/A653M-[03], Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
- .3 Department of Justice Canada (Jus).
  - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33 .
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  - .1 Material Safety Data Sheets (MSDS).
- .5 National Fire Protection Association (NFPA).
  - .1 NFPA 90A-[02], Standard for the Installation of Air-Conditioning and Ventilating Systems.
  - .2 NFPA 90B-[02], Standard for the Installation of Warm Air Heating and Air-Conditioning Systems.
  - .3 NFPA 96-[01], Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations.
- .6 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
  - .1 SMACNA HVAC Duct Construction Standards - Metal and Flexible, 2nd Edition [1995] and Addendum No. 1, [1997].
  - .2 SMACNA HVAC Air Duct Leakage Test Manual, [1985], 1st Edition.
  - .3 IAQ Guideline for Occupied Buildings Under Construction [1995], 1st Edition.
- .7 Transport Canada (TC).
  - .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

**1.2 SUBMITTALS**

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

**1.3 QUALITY ASSURANCE**

- .1 Health and Safety: do construction occupational health and safety in accordance with Sections 0010 00 – General Instructions and 00 15 45 – General Safety Section and Fire Requirements.



- .2 Certification of Ratings: catalogue or published ratings shall be those obtained from tests carried out by manufacturer or independent testing agency signifying adherence to applicable codes and standards.
- .3 Indoor Air Quality (IAQ) Management Plan: during construction meet or exceed the requirements of SMACNA IAQ Guideline for Occupied Buildings under Construction.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Protect on site stored or installed absorptive material from moisture damage.
- .2 Store and manage hazardous materials in accordance with manufacturer's written instructions.

**1.5 WASTE MANAGEMENT AND DISPOSAL**

- .1 The disposal of packaging waste into landfill site demonstrates an inefficient use of natural resources and consumes valuable landfill space.
- .2 Separate waste materials for reuse and recycling in accordance with Section 00 10 00 – General Instructions.
- .3 Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .4 Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling.
- .5 Separate for reuse and recycling and place in designated containers steel, metal, and plastic waste.
- .6 Place materials defined as hazardous or toxic in designated containers.
- .7 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal regulations.
- .8 Fold up metal and plastic banding, flatten and place in designated area for recycling.

**Part 2 Products**

**2.1 SEAL CLASSIFICATION**

- .1 Classification as follows:

Maximum Pressure (Pa)	SMACNA Seal Class
500	C
250	C
125	C
125	Unsealed

- .2 Seal classification:
  - .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant and tape.

- .2 Class B: longitudinal seams, transverse joints and connections made airtight with sealant, tape or combination thereof.
- .3 Class C: transverse joints and connections made air tight with gaskets, sealant, tape or combination thereof. Longitudinal seams unsealed.
- .4 Unsealed seams and joints.

## **2.2 SEALANT**

- .1 Sealant: oil resistant, water borne, polymer type flame resistant duct sealant. Temperature range of minus 30 degrees C to plus 93 degrees C.

## **2.3 TAPE**

- .1 Tape: polyvinyl treated, open weave fiberglass tape, 50mm wide.

## **2.4 DUCT LEAKAGE**

- .1 In accordance with SMACNA HVAC Air Duct Leakage Test Manual.

## **2.5 FITTINGS**

- .1 Fabrication: to SMACNA.
- .2 Radiused elbows.
  - .1 Rectangular: standard radius.
  - .2 Round: smooth radius.
- .3 Mitred elbows, rectangular:
  - .1 To 400 mm: with single thickness turning vanes.
  - .2 Over 400mm: with double thickness turning vanes.
- .4 Branches:
  - .1 Rectangular main and branch: with radius on branch at 45 degrees entry on branch.
  - .2 Round main and branch: enter main duct at 45 degrees with conical connection.
  - .3 Provide volume control damper in branch duct near connection to main duct.
  - .4 Main duct branches: with splitter damper.
- .5 Transitions:
  - .1 Diverging: 20 degrees maximum included angle.
  - .2 Converging: 30 degrees maximum included angle.
- .6 Offsets:
  - .1 Full radiused elbows.
- .7 Obstruction deflectors: maintain full cross-sectional area.
  - .1 Maximum included angles: as for transitions.

**2.6 FIRE STOPPING**

- .1 Retaining angles around duct, on both sides of fire separation.
- .2 Fire stopping material and installation must not distort duct.

**2.7 GALVANIZED STEEL**

- .1 Lock forming quality: to ASTM A653/A653M, Z90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to ASHRAE and SMACNA.
- .3 Joints: to ASHRAE and SMACNA. Proprietary manufactured flanged duct joint to be considered to be a class A seal.

**2.8 HANGERS AND SUPPORTS**

- .1 Hangers and Supports: in accordance with Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment.
  - .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct.
    - .1 Maximum size duct supported by strap hanger: 500mm.
  - .2 Hanger configuration: to ASHRAE and SMACNA.
  - .3 Hangers: to ASHRAE and SMACNA per the following table:

Duct Size (mm)	Angle Size (mm)	Rod Size (mm)
up to 750	25 x 25 x 3	6
751 to 1050	40 x 40 x 3	6
1051 to 1500	40 x 40 x 3	10
1501 to 2100	50 x 50 x 3	10
2101 to 2400	50 x 50 x 5	10
2401 and over	50 x 50 x 6	10

- .4 Upper hanger attachments:
  - .1 For concrete: manufactured concrete inserts.
  - .2 For steel joist: manufactured joist clamp with steel plate washer.
  - .3 For steel beams: manufactured beam clamps.

**Part 3 Execution**

**3.1 GENERAL**

- .1 Do work in accordance with NFPA 90A, NFPA 90B, ASHRAE and SMACNA
- .2 Do not break continuity of insulation vapour barrier with hangers or rods.
  - .1 Insulate strap hangers 100mm beyond insulated duct. Ensure diffuser is fully seated.
- .3 Support risers in accordance with ASHRAE and SMACNA.
- .4 Install breakaway joints in ductwork on sides of fire separation.

- .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .6 Manufacture duct in lengths and diameter to accommodate installation of acoustic duct lining where indicated.

**3.2 HANGERS**

- .1 Strap hangers: install in accordance with SMACNA.
- .2 Angle hangers: complete with locking nuts and washers.
- .3 Hanger spacing: in accordance with ASHRAE and SMACNA as follows:

Duct Size (mm)	Spacing (mm)
to 1500	3000
1501 and over	2500

**3.3 SEALING AND TAPING**

- .1 Apply sealant to outside of joint to manufacturer's recommendations.
- .2 Bed tape in sealant and recoat with minimum of one coat of sealant to manufacturers recommendations.

**3.4 LEAKAGE TESTS**

- .1 Refer to Section 23 05 94 - Pressure Testing of Ducted Air Systems.
- .2 In accordance with SMACNA HVAC Duct Leakage Test Manual.
- .3 Do leakage tests in sections.
- .4 Make trial leakage tests as instructed to demonstrate workmanship.
- .5 Do not install additional ductwork until trial test has been passed.
- .6 Test section minimum of 30m long with not less than one branch takeoffs and two 90 degrees elbows.
- .7 Complete test before performance insulation or concealment Work.

**END OF SECTION**

**Part 1            General**

**1.1            REFERENCES**

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  - .1 Material Safety Data Sheets (MSDS).
- .2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).
  - .1 SMACNA - HVAC Duct Construction Standards - Metal and Flexible, [95].

**1.2            SUBMITTALS**

- .1 Submittals in accordance with Section 00 10 00 – General Instructions.
- .2 Product Data/Shop Drawings:
  - .1 Submit manufacturer's printed product literature, specifications and data sheet. Indicate the following:
    - .1 Flexible connections.

**1.3            DELIVERY, STORAGE AND HANDLING**

- .1 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 Collect and separate for disposal paper, plastic, polystyrene, and corrugated cardboard packaging material in appropriate on-site bins for recycling off-site.
  - .4 Separate for reuse and recycling and place in designated containers steel, metal and plastic waste.
  - .5 Divert unused metal materials from landfill to metal recycling facility.

**Part 2            Products**

**2.1            GENERAL**

- .1 Manufacture in accordance with SMACNA - HVAC Duct Construction Standards.

**2.2            FLEXIBLE CONNECTIONS**

- .1 Frame: galvanized sheet metal frame with fabric clenched by means of double locked seams.
- .2 Material:
  - .1 Fire resistant, self extinguishing, neoprene coated glass fabric, temperature rated at minus 40 degrees C to plus 90 degrees C, density of 1.3 kg/m<sup>2</sup>.

**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 INSTALLATION**

- .1 Flexible Connections:
  - .1 Install in following locations:
    - .1 Supply outlet of forced flow heaters.
  - .2 Length of connection: minimum 100mm.
  - .3 Minimum distance between metal parts when system in operation: 75mm.
  - .4 Install in accordance with recommendations of SMACNA.
  - .5 When fan is running:
    - .1 Ducting on sides of flexible connection to be in alignment.
    - .2 Ensure slack material in flexible connection.

**3.3 CLEANING**

- .1 Perform cleaning operations as specified in Section 00 10 00 – General Instructions and in accordance with manufacturer's recommendations.
- .2 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           REFERENCES**

- .1 Sheet Metal and Air Conditioning National Association (SMACNA)
  - .1 SMACNA HVAC Duct Construction Standards, Metal and Flexible-[1985].
- .2 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).

**1.2           SUBMITTALS**

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and datasheet in accordance with Section 00 10 00 – General Instructions.

**1.3           QUALITY ASSURANCE**

- .1 Health and Safety: do construction occupational health and safety in accordance with Sections 0010 00 – General Instructions and 00 15 45 – General Safety Section and Fire Requirements.

**1.4           DELIVERY, STORAGE, AND HANDLING**

- .1 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle in accordance with Section 00 10 00 – General Instructions.

**1.5           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           GENERAL**

- .1 Manufacture to SMACNA standards.

**2.2           SPLITTER DAMPERS**

- .1 Fabricate from same material as duct but one sheet metal thickness heavier, with appropriate stiffening.
- .2 Single thickness construction.
- .3 Control rod with locking device and position indicator.
- .4 Rod configuration to prevent end from entering duct.
- .5 Pivot: piano hinge.
- .6 Folded leading edge.

- .7 Acceptable Material: Nailor-Hart Industries Inc., Controlled Air Manufacturing Ltd., Ruskin Ltd., Air Specialties Manufacturing Ltd., or approved equal.

### **2.3 SINGLE BLADE DAMPERS**

- .1 Fabricate from same material as duct, but one sheet metal thickness heavier. V-groove stiffened.
- .2 Size and configuration to recommendations of SMACNA, except maximum height 100mm.
- .3 Locking quadrant with shaft extension to accommodate insulation thickness.
- .4 Inside and outside nylon or bronze end bearings.
- .5 Channel frame of same material as adjacent duct, complete with angle stop.
- .6 Acceptable Material: Nailor-Hart Industries Inc., Controlled Air Manufacturing Ltd., Ruskin Ltd., Air Specialties Manufacturing Ltd., or approved equal.

### **2.4 MULTI-BLADED DAMPERS**

- .1 Factory manufactured of material compatible with duct.
- .2 Opposed blade: configuration, metal thickness and construction to recommendations of SMACNA.
- .3 Maximum blade height: 100mm.
- .4 Bearings: pin in bronze bushings or self-lubricating nylon.
- .5 Linkage: shaft extension with locking quadrant.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.
- .7 Acceptable Material: Nailor-Hart Industries Inc., Controlled Air Manufacturing Ltd., Ruskin Ltd., Air Specialties Manufacturing Ltd., or approved equal.

## **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 where indicated.
- .2       Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .3       Locate balancing dampers in each branch duct, for supply, return and exhaust systems.
- .4       Run outs to registers and diffusers: install single blade damper located as close as possible to main ducts.
- .5       Dampers: vibration free.
- .6       Ensure damper operators are observable and accessible.
- .7       Corrections and adjustments conducted by Contractor.

**3.3           CLEANING**

- .1       Proceed in accordance with Section 00 10 00 – General Instructions.
- .2       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 REFERENCES**

- .1 American Society for Testing and Materials International, (ASTM).
  - .1 ASTM C423-[02a], Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
  - .2 ASTM C916-[85(2001)e1], Standard Specification for Adhesives for Duct Thermal Insulation.
  - .3 ASTM C1071-[00], Standard specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material).
  - .4 ASTM C1338-[00], Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
  - .5 ASTM G21-[96(2002)], Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.
- .2 Department of Justice Canada (Jus).
  - .1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
  - .1 Material Safety Data Sheets (MSDS).
- .4 National Fire Protection Association (NFPA).
  - .1 NFPA 90A-[02], Standard for the Installation of Air Conditioning and Ventilating Systems.
  - .2 NFPA 90B-[02], Standard for the Installation of Warm Air Heating and Air Conditioning Systems.
- .5 North American Insulation Manufacturers Association (NAIMA).
  - .1 NAIMA AH116-[5th Edition], Fibrous Glass Duct Construction Standards.
- .6 Sheet Metal and Air Conditioning Contractor's National Association (SMACNA).
  - .1 SMACNA, HVAC DCS, HVAC, Duct Construction Standards, Metal and Flexible-[95 (Addendum No.1, Nov. 97)].
  - .2 SMACNA IAQ Guideline for Occupied Buildings 95.
- .7 Transport Canada (TC).
  - .1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.
- .8 Underwriter's Laboratories of Canada (ULC).
  - .1 CAN/ULC-S102-[03-EN], Methods of Test for Surface Burning Characteristics of Building Materials and Assemblies.

**1.2 SUBMITTALS**

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

**1.3 QUALITY ASSURANCE**

- .1 Health and Safety: do construction occupational health and safety in accordance with Sections 0010 00 – General Instructions and 00 15 45 – General Safety Section and Fire Requirements.

#### 1.4 DELIVERY, STORAGE AND HANDLING

- .1 Store and manage hazardous materials in accordance with Section 00 10 00 – General Instructions.
- .2 Protect on site stored or installed absorptive material from moisture damage.

#### 1.5 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 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, and packaging material in appropriate on-site bins for recycling.
- .4 Place materials defined as hazardous or toxic in designated containers.
- .5 Handle and dispose of hazardous materials in accordance with CEPA, TDGA and Regional and Municipal regulations.
- .6 Ensure emptied containers are sealed and stored safely.
- .7 Fold up metal banding, flatten and place in designated area for recycling.

### Part 2 Products

#### 2.1 DUCT LINER

- .1 General:
  - .1 Mineral Fibre duct liner: air surface coated.
  - .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50 when tested in accordance with AN/ULC-S102 and NFPA 90A and [NFPA 90B.
  - .3 Fungi resistance: to ASTM C1338 and ASTM G21.
- .2 Rigid:
  - .1 Use on flat surfaces[where indicated.
  - .2 25mm thick, to [ASTM C1071, Type 2, fibrous glass rigid board duct liner.
  - .3 Density: 48kg/m<sup>3</sup>minimum.
  - .4 Thermal resistance to be minimum 0.76 (m<sup>2</sup>. degrees C)/W for 25 mm thickness when tested in accordance with ASTM C177, at 24 degrees C mean temperature.
  - .5 Maximum velocity on faced air side: 20.3m/sec.
  - .6 Minimum NRC of 0.60 at 25mm thickness based on Type A mounting to ASTM C423.
- .3 Flexible:
  - .1 Use on [round or oval surfaces.
  - .2 25 mm thick, to ASTM C1071 Type 1, fibrous glass blanket duct liner.
  - .3 Density: 24kg/m<sup>3</sup> minimum.
  - .4 Thermal resistance to be minimum 0.37 (m<sup>2</sup>.degrees C)/W for 12 mm thickness when tested in accordance with ASTM C177, at 24 degrees C mean temperature.

- .5 Maximum velocity on coated air side: 30.5m/sec.
- .6 Minimum NRC of 0.60 at 25mm thickness based on Type A mounting to ASTM C423.

## **2.2 ADHESIVE**

- .1 Adhesive: to NFPA 90A and NFPA 90B, and ASTM C916.
- .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 29 degrees C to plus 93 degrees C.
- .3 Water-based fire retardant type.

## **2.3 FASTENERS**

- .1 Weld pins 2.0mm diameter, length to suit thickness of insulation. Polymer, nylon or metal retaining clips, 32mm square.

## **2.4 JOINT TAPE**

- .1 Poly-Vinyl treated open weave fiberglass membrane 50mm wide.

## **2.5 SEALER**

- .1 Meet requirements of NFPA 90A and NFPA 90B.
- .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus 68 degrees C to plus 93 degrees C.

## **Part 3 Execution**

### **3.1 GENERAL**

- .1 Do work in accordance with SMACNA HVAC DCS except as specified otherwise.
- .2 Line inside of ducts where indicated.
- .3 Duct dimensions, as indicated, are clear inside duct lining.

### 3.2 DUCT LINER

- .1 Install in accordance with manufacturer's recommendations, and as follows:
  - .1 Fasten to interior sheet metal surface with 100% coverage of adhesive to ASTM C916.
    - .1 Exposed leading edges and transverse joints to be factory coated or coated with adhesive during fabrication.
  - .2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 425mm on centres to compress duct liner sufficiently to hold it firmly in place.
    - .1 Spacing of mechanical fasteners in accordance with SMAC HVAC DCS.
- .2 In systems, where air velocities exceed 20.3m/sec, install galvanized sheet metal nosing to leading edges of duct liner.

### 3.3 JOINTS

- .1 Seal butt joints, exposed edges, weld pin and clip penetrations and damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's written recommendations, and as follows:
  - .1 Bed tape in sealer.
  - .2 Apply two coats of sealer over tape.
- .2 Replace damaged areas of liner at discretion of Departmental Representative.
- .3 Protect leading and trailing edges of duct sections with sheet metal nosing having 15mm overlap and fastened to duct.

**END OF SECTION**

**Part 1 General**

**1.1 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.

**1.2 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.
- .2 Indicate following:
  - .1 Capacity.
  - .2 Throw and terminal velocity.
  - .3 Noise criteria.
  - .4 Pressure drop.
  - .5 Neck velocity.

**1.3 QUALITY ASSURANCE**

- .1 Health and Safety: do construction occupational health and safety in accordance with Sections 0010 00 – General Instructions and 00 15 45 – General Safety Section and Fire Requirements.

**1.4 DELIVERY, STORAGE, AND HANDLING**

.1 Packing, shipping, handling and unloading:

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

**1.5 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.

**1.6 MAINTENANCE**

.1 Extra Materials:

- .1 Include:
  - .1 Keys for volume control adjustment.
  - .2 Keys for air flow pattern adjustment.

**Part 2 Products**

**2.1 GENERAL**

- .1 To meet capacity, pressure drop, terminal velocity, throw, noise level, neck velocity as indicated.
- .2 Frames:
  - .1 Full perimeter gaskets.
  - .2 Plaster frames where set into plaster or gypsum board.
  - .3 Concealed fasteners.
- .3 Concealed manual volume control damper operators.
- .4 Colour: to match adjacent wall paint finish.

**2.2 MANUFACTURED UNITS**

- .1 Grilles, registers and diffusers of same generic type, products of one manufacturer.

**2.3 SUPPLY DIFFUSERS**

- .1 Type SDF-4:
  - .1 Louvered face supply register of the sizes and mounting types indicated. Registers shall be single deflection type with one set of fully adjustable deflection blades spaced 19mm on center. The blades shall run parallel to the long dimension of the register. The integral volume control damper shall be of the opposed blade type and shall be constructed of cold rolled steel. The damper shall be operable from the register face. The supply register shall be B15 Aluminum Powder Coat. Paint finish shall pass 500 hours of salt spray exposure with no measurable creep in accordance with ASTM D1654 and 1000 hours with no rusting or blistering as per ASTM D610 and ASTM D714.
  - .2 Acceptable Material: EH Price 450x100/610D/F/L/A/B15 or approved equivalent.
- .2 Type SDF-5:
  - .1 Square plaque diffuser. Precision formed back cone of one-piece seamless construction that incorporates round inlet collar of sufficient length to accommodate connection to rigid or flexible duct. Inner plaque assemble shall be incorporated and drop no more than 6mm below ceiling plane to assure proper air distribution performance. Inner plaque assembly shall be completely removable from diffuser face to allow for full access to dampers and other miscellaneous ductwork components located near the diffuser neck.
  - .2 Acceptable Material: EH Price 250/600x600/ASPD/31/B12 or approved equivalent.

## 2.4 RETURN GRILLES

- .1 Type RGR-4:
  - .1 Louvered face return grille register of the sizes and mounting types indicated. Registers shall be 45 degree deflection fixed louver type with blades spaced 13mm on center. The blades shall run parallel to the long dimension of the register. The integral volume control damper shall be of the opposed blade type and shall be constructed of cold rolled steel. The damper shall be operable from the register face. The grille shall be finished in B15 Aluminum Powder Coat. Paint finish shall pass 500 hours of salt spray exposure with no measurable creep in accordance with ASTM D1654 and 1000 hours with no rusting or blistering as per ASTM D610 and ASTM D714.
  - .2 Acceptable Material: EH Price 900x300/635D/F/L/A/B15 or approved equivalent.
- .2 Type RGR-5:
  - .1 Egg crate return grille of the sizes and mounting types indicated. Grilles shall be of aluminum construction consisting of aluminum 13 x 13 x 13 grid and an extruded aluminum border. The grille shall be finished in B12 White Powder Coat. Paint finish shall pass 500 hours of salt spray exposure with no measurable creep in accordance with ASTM D1654 and 1000 hours with no rusting or blistering as per ASTM D610 and ASTM D714.
  - .2 Acceptable Material: EH Price 600x450/80/TB///B12 or approved equivalent.

## 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 manufacturer's instructions.
- .2 Install with flat head, stainless steel screws in countersunk holes where fastenings are visible.
- .3 Bolt grilles, registers and diffusers, in place, in gymnasium and similar game rooms.
- .4 Provide concealed safety chain on each grille, register and diffuser in gymnasium and similar game rooms.

### 3.3 CLEANING

- .1 Proceed in accordance with Section 00 10 00 – General Instructions.
- .2 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            PRODUCT DATA**

- .1    Submit product data in accordance with Section 00 10 00 – General Instructions.
- .2    Product data to include:
  - .1    Replacement data for motor element, thermostat and switch.
  - .2    Mounting methods.
  - .3    kW rating, voltage, phase.
  - .4    Cabinet material thicknesses.
  - .5    Physical size.
  - .6    Finish.
  - .7    Thermostat, transformer, controls where integral.

**1.2            WASTE MANAGEMENT AND DISPOSAL**

- .1    Separate and recycle waste materials in accordance with Section 00 10 00 – General Instructions.
- .2    Remove from site and dispose of packaging materials at appropriate recycling facilities.
- .3    Collect and separate for disposal paper, plastic, polystyrene and corrugated cardboard packaging material in appropriate on-site bins for recycling.
- .4    Divert unused metal and wiring materials from landfill to metal recycling facility.

**Part 2            Products**

**2.1            FORCE FLOW UNIT HEATERS**

- .1    General:
  - .1    All equipment shall where specified and applicable, be pre-wired, and factory certified by an approved testing agency such as CETL, ETLUS, UL and CSA prior to shipment.
  - .2    Performance Data: Unit capacities are in accordance with Industry Room Fan-Coil Air Conditioner Certification Program under ARI Standard 440-97. Safety: All standard units are UL listed in the United States and Canada. Units comply with NFPA90A requirements.
- .2    Construction:
  - .1    The unit includes a chassis, coil, fan wheel(s), fan casing(s), fan board and motor(s). The fan board assembly is easily removable. The fan board assembly includes a quick-disconnect motor plug. The chassis construction is 18-gauge galvanized steel, and continuous throughout the unit. The unit is acoustically and thermally insulated with closed-cell insulation. All panels are made rigid by channel forming.

- .3 Fan:
  - .1 The aluminum fan wheels are centrifugal forward-curved and double-width. Fan wheels and housings are corrosion resistant.
  - .2 Fan housing construction is formed sheet metal.
- .4 Motors:
  - .1 All permanent split capacitor motors are run tested in assembled units.
  - .2 All motors have integral thermal overload protection with a maximum ambient operating temperature of 40 degrees C (104F) and are permanently lubricated.
  - .3 Motors are capable of starting at 78 percent of rated voltage and operating at 90 percent of rated voltage on all speed settings. Motors can operate up to 10 percent over voltage.
  - .4 Motors will soft ramp between speeds to lessen the acoustics due to sudden speed changes.
- .5 Coil:
  - .1 Hot water coils are burst tested at 3,103 kPa (450 psig) air, and leak tested at 690 kPa (100 psig) air under water.
  - .2 Maximum main coil working pressure is 2,069 kPa (300 psig).
  - .3 Maximum entering water temperature is 93 degrees C (200F).
  - .4 Tubes and u-bends are 10mm (3/8") OD copper. Fins are aluminum and are mechanically bonded to the copper tubes. Coil stub outs are 16mm (5/8") OD copper tubing.
  - .5 The hydronic coil shall include an automatic air vent that is rated to 860 kPa (125 psig).
- .6 Piping Package:
  - .1 Piping package is factory tested and installed. All piping packages are burst tested to 3,103 kPa (450 psig) air, and leak tested at 690 kPa (100 psig) air under water.
  - .2 The maximum working pressure of the interconnecting piping is 2,069 kPa (300 psig).
- .7 Modulating Control Valve:
  - .1 Two-way modulating valves are rated for a maximum 345 kPa (50 psig) pressure differential across the valve. Modulating valves are available in Cv values of 0.7, 1.5, 2.5 and 4.0. Required Cv values for valves are based on particular unit selection.
  - .2 All two-position and modulating control valves shall have a maximum working pressure of 2,069 kPa (300 psig). The maximum entering water temperature of the valve is 93 degrees C (200F).
  - .3 Control valve shall be supplied by Controls Contractor (Direct Energy Building Services) to meet requirements outlined by manufacturer.
- .8 Filters:
  - .1 Filters are concealed from sight and easily removable. Filters are located behind an integral access door on horizontal type units. Filters shall be 25mm (1") pleated media throwaway. Pleated media filters are Farr 30/30.
- .9 Disconnect Switch
  - .1 A unit mounted disconnect switch shall be provided.
- .10 Controls:

- .1 Unit shall be supplied with control interface intended to be used with a field-supplied controller provided by Controls Contractor (Direct Energy Building Services).
  - .2 The control box shall contain a relay board which includes a line voltage to 24-V transformer. All end devices are wired to low voltage terminal block and run tested, so only power connection and thermostat connection is needed to commission the unit.
- .11 Acceptable Material: TRANE Force-Flo, Model No.: FFCB0201, or approved equivalent.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install heaters in accordance with manufacturer's instructions.
- .2 Make power and control connections.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

- .1 Section Includes.
  - .1 Methods and procedures for start-up, verification and commissioning, for building Energy Monitoring and Control System (EMCS) and includes:
    - .1 Start-up testing and verification of systems.
    - .2 Check out demonstration or proper operation of components.
    - .3 On-site operational tests.

**1.2 DEFINITIONS**

- .1 For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.
- .2 AEL: ratio between total test period less any system downtime accumulated within that period and test period.
- .3 Downtime: results whenever EMCS is unable to fulfill required functions due to malfunction of equipment defined under responsibility of EMCS contractor. Downtime is measured by duration, in time, between time that Contractor is notified of failure and time system is restored to proper operating condition. Downtime not to include following:
  - .1 Outage of main power supply in excess of back-up power sources, provided that:
    - .1 Automatic initiation of back-up was accomplished.
    - .2 Automatic shut-down and re-start of components was as specified.
  - .2 Failure of communications link, provided that:
    - .1 Controller automatically and correctly operated in stand-alone mode.
    - .2 Failure was not due to failure of any specified EMCS equipment.
  - .3 Functional failure resulting from individual sensor inputs or output devices, provided that:
    - .1 System recorded said fault.
    - .2 Equipment defaulted to fail-safe mode.
    - .3 AEL of total of all input sensors and output devices is at least 99% during test period.

**1.3 DESIGN REQUIREMENTS**

- .1 Confirm with Departmental Representative that Design Criteria and Design Intents are still applicable.
- .2 Commissioning personnel to be fully aware of and qualified to interpret Design Criteria and Design Intents.

**1.4 SUBMITTALS**

- .1 Submittals in accordance with Section 00 10 00 – General Instructions.

- .2 Final Report: submit report to Departmental Representative.
  - .1 Bear signature of commissioning technician and supervisor.
  - .2 Report format to be approved by Departmental Representative before commissioning is started.
  - .3 Revise "as-built" documentation, commissioning reports to reflect changes, adjustments and modifications to EMCS as set during commissioning and submit to Departmental Representative in accordance with Section 00 10 00 – General Instructions.
  - .4 Recommend additional changes and/or modifications deemed advisable in order to improve performance, environmental conditions or energy consumption.

### **1.5 CLOSEOUT SUBMITTALS**

- .1 Provide documentation, O&M Manuals, and training of O&M personnel for review of Departmental Representative before interim acceptance in accordance with Section 00 10 00 – General Instructions.

### **1.6 COMMISSIONING**

- .1 Carry out commissioning under direction of Departmental Representative and in presence of Departmental Representative.
- .2 Inform, and obtain approval from, Departmental Representative in writing at least 14 days prior to commissioning or each test. Indicate:
  - .1 Location and part of system to be tested or commissioned.
  - .2 Testing/commissioning procedures, anticipated results.
  - .3 Names of testing/commissioning personnel.
- .3 Correct deficiencies, re-test in presence of Departmental Representative until satisfactory performance is obtained.
- .4 Acceptance of tests will not relieve Contractor from responsibility for ensuring that complete systems meet every requirement of Contract.
- .5 Perform tests as required.

### **1.7 COMPLETION OF COMMISSIONING**

- .1 Commissioning to be considered as satisfactorily completed when objectives of commissioning have been achieved and reviewed by Departmental Representative.

### **1.8 ISSUANCE OF FINAL CERTIFICATE OF COMPLETION**

- .1 Final Certificate of Completion will not be issued until receipt of written approval indicating successful completion of specified commissioning activities including receipt of commissioning documentation.

## **Part 2 Products**

### **2.1 EQUIPMENT**

- .1 Provide sufficient instrumentation to verify and commission the installed system. Provide two-way radios.

- .2 Instrumentation accuracy tolerances: higher order of magnitude than equipment or system being tested.
- .3 Independent testing laboratory to certify test equipment as accurate to within approved tolerances no more than two (2) months prior to tests.
- .4 Locations to be approved, readily accessible and readable.
- .5 Application: to conform to normal industry standards.

### **Part 3 Execution**

#### **3.1 PROCEDURES**

- .1 Test each system independently and then in unison with other related systems.
- .2 Commission each system using procedures prescribed by the Departmental Representative.
- .3 Commission integrated systems using procedures prescribed by Departmental Representative.
- .4 Debug system software.
- .5 Optimize operation and performance of systems by fine-tuning PID values and modifying CDLs as required.
- .6 Test full scale emergency evacuation and life safety procedures including operation and integrity of smoke management systems under normal and emergency power conditions as applicable.

#### **3.2 FIELD QUALITY CONTROL**

- .1 Completion Testing.
  - .1 General: test after installation of each part of system and after completion of mechanical and electrical hook-ups, to verify correct installation and functioning.
  - .2 Include following activities:
    - .1 Test and calibrate field hardware including stand-alone capability of each controller.
    - .2 Verify each A-to-D convertor.
    - .3 Test and calibrate each AI using calibrated digital instruments.
    - .4 Test each DI to ensure proper settings and switching contacts.
    - .5 Test each DO to ensure proper operation and lag time.
    - .6 Test each AO to ensure proper operation of controlled devices. Verify tight closure and signals.
    - .7 Test operating software.
    - .8 Test application software and provide samples of logs and commands.
    - .9 Verify each CDL including energy optimization programs.
    - .10 Debug software.
    - .11 Blow out flow measuring and static pressure stations with high pressure air at 700 kPa.

- .12 Provide point verification list in table format including point identifier, point identifier expansion, point type and address, low and high limits and engineering units. Include space for the commissioning technician and Departmental Representative. This document will be used in final start-up testing.
- .3 Final Start-up Testing: Upon satisfactory completion of tests, perform point-by-point test of entire system under direction of Departmental Representative and provide:
  - .1 Technical personnel capable of re-calibrating field hardware and modifying software.
  - .2 Detailed daily schedule showing items to be tested and personnel available.
  - .3 Departmental Representative's acceptance signature to be on executive and applications programs.
  - .4 Commissioning to commence during final start-up testing.
  - .5 Commissioning to be supervised by qualified supervisory personnel and Departmental Representative.
  - .6 Commission systems considered as life safety systems before affected parts of the facility are occupied.
  - .7 Operate systems as long as necessary to commission entire project.
  - .8 Monitor progress and keep detailed records of activities and results.
- .4 Final Operational Testing: to demonstrate that EMCS functions in accordance with contract requirements.
  - .1 Prior to beginning of 30 day test demonstrate that operating parameters (setpoints, alarm limits, operating control software, sequences of operation, trends, graphics and CDL's) have been implemented to ensure proper operation and operator notification in event of off-normal operation.
    - .1 Repetitive alarm conditions to be resolved to minimize reporting of nuisance conditions.
  - .2 Test to last at least 30 consecutive 24 hour days.
  - .3 Tests to include:
    - .1 Demonstration of correct operation of monitored and controlled points.
    - .2 Operation and capabilities of sequences, reports, special control algorithms, diagnostics, software.
  - .4 System will be accepted when:
    - .1 EMCS equipment operates to meet overall performance requirements. Downtime as defined in this Section must not exceed allowable time calculated for this site.
    - .2 Requirements of Contract have been met.
  - .5 In event of failure to attain specified AEL during test period, extend test period on day-to-day basis until specified AEL is attained for test period.
  - .6 Correct defects when they occur and before resuming tests.
  - .7 Testing/verification of occupancy and seasonal-sensitive systems to take place during four (4) consecutive seasons, after facility has been accepted, taken over and fully occupied.
    - .1 Test weather-sensitive systems twice: first at near winter design conditions and secondly under near summer design conditions.
- .5 Commissioning Manager to verify reported results.

**3.3 ADJUSTING**

- .1 Final adjusting: upon completion of commissioning as reviewed by Departmental Representative, set and lock devices in final position and permanently mark settings.

**3.4 DEMONSTRATION**

- .1 Demonstrate to Departmental Representative operation of systems including sequence of operations in regular and emergency modes, under normal and emergency conditions, start-up, shut-down interlocks and lock-outs.

**END OF SECTION**



**Part 1            General**

**1.1                SUMMARY**

- .1    Section Includes.
  - .1    Requirements and procedures for training program, instructors and training materials, for building Energy Monitoring and Control System (EMCS) Work.
  - .2    Training requirements, other than project specific operator's overview, are not applicable to Andover Control Systems unless requested by Departmental Representative.

**1.2                DEFINITIONS**

- .1    CDL - Control Description Logic.
- .2    For additional acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

**1.3                SUBMITTALS**

- .1    Submittals in accordance with Section 00 10 00 – General Instructions, supplemented and modified by requirements of this Section.
- .2    Submit training proposal complete with hour-by-hour schedule including brief overview of content of each segment to Departmental Representative 30 days prior to anticipated date of beginning of training.
  - .1    List name of trainer, and type of visual and audio aids to be used.
  - .2    Show co-ordinated interface with other EMCS mechanical and electrical training programs.
- .3    Submit reports within one (1) week after completion of training program that training has been satisfactorily completed.

**1.4                QUALITY ASSURANCE**

- .1    Provide competent instructors thoroughly familiar with aspects of EMCS installed in facility.
- .2    Departmental Representative reserves right to approve instructors.

**1.5                INSTRUCTIONS**

- .1    Provide instruction to designated personnel in adjustment, operation, maintenance and pertinent safety requirements of EMCS installed.
- .2    Training to be project-specific.

**1.6                TIME FOR INSTRUCTION**

- .1    Number of days of instruction to be as specified in this section (1 day = 8 hours including two 15 minute breaks and excluding lunch time).

### 1.7 TRAINING MATERIALS

- .1 Provide equipment, visual and audio aids, and materials for classroom training.
- .2 Supply manual for each trainee, describing in detail data included in each training program.
  - .1 Review contents of manual in detail to explain aspects of operation and maintenance (O&M).

### 1.8 TRAINING PROGRAM

- .1 To be in 2 phases over 6 month period.
- .2 Phase 1: 2 day program to begin before 30 day test period at time mutually agreeable to Contractor, Departmental Representative.
  - .1 Train O&M personnel in functional operations and procedures to be employed for system operation.
  - .2 Supplement with on-the-job training during 30 day test period.
  - .3 Include overview of system architecture, communications, operation of computer and peripherals, report generation.
  - .4 Include detailed training on operator interface functions for control of mechanical systems, CDL's for each system, and elementary preventive maintenance.
- .3 Phase 2: 2 day program to begin 8 weeks after acceptance for operators, equipment maintenance personnel and programmers.
  - .1 Provide multiple instructors on pre-arranged schedule. Include at least following:
    - .1 Operator training: provide operating personnel, maintenance personnel and programmers with condensed version of Phase 1 training.
    - .2 Equipment maintenance training: provide personnel with 2 days training within 5 day period in maintenance of EMCS equipment, including general equipment layout, trouble shooting and preventive maintenance of EMCS components, maintenance and calibration of sensors and controls.
    - .3 Programmers: provide personnel with 2 days training within 5 day period in following subjects in approximate percentages of total course shown:

Software and architecture:	10%	Logiciel et architecture:	10%
Application programs:	15%	Programmes d'application:	15%
Controller programming:	5%	Programmation du contrôleur:	5%
Trouble shooting and debugging:	10%	Dépannage et mise au point:	10%
Colour graphic generation:	15%	Génération de graphiques en couleur:	15%

### 1.9 ADDITIONAL TRAINING

- .1 List courses offered by name, duration and approximate cost per person per week. Note courses recommended for training supervisory personnel.

### 1.10 MONITORING OF TRAINING

- .1 Departmental Representative to monitor training program and may modify schedule and content.

**Part 2**            **Products**

**2.1**                **NOT USED**

.1                    Not Used.

**Part 3**            **Execution**

**3.1**                **NOT USED**

.1                    Not Used.

**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.

**1.2                REFERENCES**

.1            American National Standards Institute (ANSI)/The Instrumentation, Systems and Automation Society (ISA)

.1            ANSI/ISA 5.5-[1985], Graphic Symbols for Process Displays.

.2            American National Standards Institute (ANSI)/ Institute of Electrical and Electronics Engineers (IEEE)

.1            ANSI/IEEE 260.1-[1993], 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-[R2001], BACNET - Data Communication Protocol for Building Automation and Control Network.

.4            Canadian Standards Association (CSA International)

.1            CAN/CSA-Z234.1-[89(R1995)], Canadian Metric Practice Guide.

.5            Consumer Electronics Association (CEA)

.1            CEA-709.1-[B-2002], Control Network Protocol Specification.

.6            Department of Justice Canada (Jus)

.1            Canadian Environmental Assessment Act (CEAA), 1995, c. 37.

.2            Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.7            Electrical and Electronic Manufacturers Association (EEMAC)

.1            EEMAC 2Y-1-[1958], Light Gray Colour for Indoor Switch Gear.

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

.1            Material Safety Data Sheets (MSDS).

.9            Transport Canada (TC)

.1            Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

**1.3                ACRONYMS AND ABBREVIATIONS**

.1            Acronyms used in EMCS:

.1            AEL - Average Effectiveness Level.

.2            AI - Analog Input.

.3            AIT - Agreement on International Trade.

.4            AO - Analog Output.

.5            BACnet - Building Automation and Control Network.

.6            BC(s) - Building Controller(s).

- .7 BECC - Building Environmental Control Center.
- .8 CAD - Computer Aided Design.
- .9 CDL - Control Description Logic.
- .10 CDS - Control Design Schematic.
- .11 COSV - Change of State or Value.
- .12 CPU - Central Processing Unit.
- .13 DI - Digital Input.
- .14 DO - Digital Output.
- .15 DP - Differential Pressure.
- .16 ECU - Equipment Control Unit.
- .17 EMCS - Energy Monitoring and Control System.
- .18 HVAC - Heating, Ventilation, Air Conditioning.
- .19 IDE - Interface Device Equipment.
- .20 I/O - Input/Output.
- .21 ISA - Industry Standard Architecture.
- .22 LAN - Local Area Network.
- .23 LCU - Local Control Unit.
- .24 MCU - Master Control Unit.
- .25 NAFTA - North American Free Trade Agreement.
- .26 NC - Normally Closed.
- .27 NO - Normally Open.
- .28 OS - Operating System.
- .29 O&M - Operation and Maintenance.
- .30 OWS - Operator Work Station.
- .31 PC - Personal Computer.
- .32 PCI - Peripheral Control Interface.
- .33 PCMCIA - Personal Computer Micro-Card Interface Adapter.
- .34 PID - Proportional, Integral and Derivative.
- .35 RAM - Random Access Memory.
- .36 SP - Static Pressure.
- .37 ROM - Read Only Memory.
- .38 TCU - Terminal Control Unit.
- .39 USB - Universal Serial Bus.
- .40 UPS - Uninterruptible Power Supply.
- .41 VAV - Variable Air Volume.

## 1.4

### DEFINITIONS

- .1 Point: may be logical or physical.
  - .1 Logical points: values calculated by system such as setpoints, totals, counts, derived corrections and may include, but not limited to result of and statements in CDL's.
  - .2 Physical points: inputs or outputs which have hardware wired to controllers which are measuring physical properties, or providing status conditions of contacts or relays which provide interaction with related equipment (stop, start) and valve or damper actuators.

.2 Point Name: The Andover™ system utilizes an **[Area/System/Point]** naming convention. To maximize the potential of the Continuum software it is essential to maintain a standard point naming convention.

.1 Master Control Unit Names **[Area]**: Naming the **Area** is the first name to consider. This name should be simple and reflective of the area in which this MCU shall be controlling.

*Example:* M50MAST/xxx/xxx (Montreal Road Campus Building M50 Master)  
M36BCX1/xxx/xxx (Montreal Road Campus Building M36 BACnet Master/Router)

.2 LCU's, ECU's,TCU's, IOU Modules Names [System]: Naming the **System** controller is the second name to consider. This name should reflect the building in which it is located and the primary equipment this controller is controlling. As much as is possible, the NRC Equipment name is to be embedded into the code via the point naming convention.

*Example:* XXX/AHU02/xxx (Air Handling Unit 02)  
XXX/BLR01/xxx(Boiler 01)  
XXX/MISC3/xxx(Miscellaneous 3)  
XXX/Rm103/xxx (Room 103)  
XXX/IOU1/xxx (Input Output Module 1)

In the event that there are multiple pieces of equipment being controlled i.e.: 2 air handling units, the controller name shall follow the following standard.

*Example:* XXX/AHU01\_02/xxx (Air Handling Units 01 and 02)

.3 Point Inputs/Outputs Names [Point]: The **Point** name is an abbreviation of the input/output function. Each type of equipment (chilled water system controllers, terminal unit controllers, etc.) has a standard list of input and output abbreviations (see attached list). Again, as much as is possible, the NRC Equipment name is to be embedded into the code via the point naming convention.

*Example:* XXX/xxx/SFA (Supply Fan Amperage)  
XXX/xxx/CCV (Cooling Coil Valve)  
XXX/xxx/RMT (Room Temperature)  
XXX/xxx/WTM01 (Water Meter)  
XXX/xxx/CHWST (Chilled Water Supply Temperature)

In the event that there are multiple end devices on the same controller with the same function these would be first identified by the type of input/output followed by an underscore and an abbreviation of the location/description of the multiple type input.

*Example:* XXX/xxx/RMT\_102 (Room 102 Room Temperature)  
XXX/xxx/DCP01 (Domestic Circulating Pump 01)  
XXX/xxx/HCV2 (Heating Coil Valve Secondary)  
XXX/xxx/RM02\_FLOOD (Room 02 Flood Alarm)

.4 Numeric (virtual points) Names: The numeric should take on a similar naming standard as the point names. The numeric is a virtual point whose value is calculated by programs within the operator work station. The name for these

virtual points should refer first to the point it is directly effecting followed by its function.

*Example:*      XXX/xxx/DATSp      (Discharge Air Temperature Setpoint)  
                  XXX/xxx/ RFS      (Return Fan Status)  
                  XXX/xxx/SFm      (Supply Fan Mode)

Other numeric's that do not involve points directly but programs shall be named for the function they server.

*Example:*      XXX/xxx/WINTER      (Winter Flag)  
                  XXX/xxx/SiteOAT      (Site Outside Air Temperature)  
                  XXX/xxx/CTL      (Pseudo System Control Value)

.5      Control Program Names:

Program names should be names in the same convention as Point and Numeric Names. The program name should first start with a description of its function followed by the point that the program controls.

*Example:*      XXX/xxx/CtlCCV      (Cooling Coil Valve Control)  
                  XXX/xxx/CtlMode      (Mode Control)  
                  XXX/xxx/VARCALC      (Variable Calculations)

.3      Point expansion: comprised of three fields, one for each descriptor. Expanded form of short form or acronym used in "area", "system" and "point" descriptors is placed into appropriate point expansion field. Database must provide 32 character field for each point expansion.

.4      Point Object Type: points fall into following object types:

- .1      AI (analog input).
- .2      AO (analog output).
- .3      DI (digital input).
- .4      DO (digital output).
- .5      BI ( binary input).
- .6      BO ( binary output).

.5      Symbols and engineering unit abbreviations utilized in displays: to ANSI/ISA S5.5.

- .1      Printouts: to ANSI/IEEE 260.1.
- .2      Refer also to Section 25 05 54- EMCS: Identification.

**1.5      CONTRACTOR'S QUALIFICATIONS**

.1      The EMCS controls systems contractor shall:

- .1      Be an authorized distributor of the product lines listed in these specifications and on the drawings.
- .2      Have at least five (5) years experience in the installation and maintenance of DDC control systems.
- .3      Have in-house qualified technicians and tradesmen for the installation, maintenance and repair of systems.
- .4      Have an office within 20 km of the project site and shall be able to offer emergency service 24 hrs/day, 365 days/year.

## 1.6 SYSTEM DESCRIPTION

- .1 Refer to control schematics and for system architecture.
- .2 Work covered by sections referred to above consists of fully operational EMCS, including, but not limited to, following:
  - .1 Building Controllers.
  - .2 Control devices as listed in I/O point summary tables.
  - .3 OWS(s).
  - .4 Data communications equipment necessary to effect EMCS data transmission system.
  - .5 Field control devices.
  - .6 Software/Hardware complete with full documentation.
  - .7 Complete operating and maintenance manuals.
  - .8 Training of personnel.
  - .9 Acceptance tests, technical support during commissioning, full documentation.
  - .10 Electrical 120 volt power distribution and low voltage power wiring as required for controllers and devices.
  - .11 Wiring interface co-ordination of equipment supplied by others.
  - .12 Control air piping and tubing as required for controllers and devices.
  - .13 Miscellaneous work as specified in these sections and as indicated.
- .3 Design Requirements:
  - .1 Design and provide conduit and wiring linking elements of system.
  - .2 Supply sufficient programmable controllers of types to meet project requirements. Quantity and points contents as reviewed by Departmental Representative prior to installation.
  - .3 Location of controllers as reviewed by Departmental Representative prior to installation.
  - .4 Provide utility power to EMCS and emergency power to EMCS as indicated.
  - .5 Imperial references: in accordance with CAN/CSA Z234.1.
- .4 Language Operating Requirements:
  - .1 Provide English operator selectable access codes.
  - .2 Use non-linguistic symbols for displays on graphic terminals wherever possible. Other information to be in English.
  - .3 Operating system executive: provide primary hardware-to-software interface with associated documentation to be in English.
  - .4 System manager software: include in English system definition point database, additions, deletions or modifications, control loop statements, use of high level programming languages, report generator utility and other OS utilities used for maintaining optimal operating efficiency.



- .5 Include, in English:
  - .1 Input and output commands and messages from operator-initiated functions and field related changes and alarms as defined in CDL's or assigned limits (i.e. commands relating to day-to-day operating functions and not related to system modifications, additions, or logic re-definitions).
  - .2 Graphic "display" functions, point commands to turn systems on or off, manually override automatic control of specified hardware points. To be in English at specified OWS and to be able to operate one terminal in English and second in French. Point name expansions in both languages.
  - .3 Reporting function such as trend log, trend graphics, alarm report logs, energy report logs, maintenance generated logs.

## 1.7 SUBMITTALS

- .1 Make submittals in accordance with Section 00 10 00 – General Instructions and 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process.
- .2 Submit for review:
  - .1 Equipment list and systems manufacturers within 10 days after award of contract.
  - .2 List existing field control devices to be re-used.
- .3 Quality Control:
  - .1 Provide equipment and material from manufacturer's regular production, CSA certified, manufactured to standard quoted plus additional specified requirements.
  - .2 Where CSA certified equipment is not available submit such equipment to inspection authorities for special inspection and approval before delivery to site.
  - .3 Submit proof of compliance to specified standards with shop drawings and product data in accordance with Section 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process. Label or listing of specified organization is acceptable evidence.
  - .4 In lieu of such evidence, submit certificate from testing organization, approved by Departmental Representative, certifying that item was tested in accordance with their test methods and that item conforms to their standard/code.
  - .5 For materials whose compliance with organizational standards/codes/specifications is not regulated by organization using its own listing or label as proof of compliance, furnish certificate stating that material complies with applicable referenced standard or specification.
  - .6 Permits and fees: in accordance with general conditions of contract.
  - .7 Submit certificate of acceptance from authority having jurisdiction to Departmental Representative
  - .8 Existing devices intended for re-use: submit test report.

## 1.8 QUALITY ASSURANCE

- .1 Have local office within 20km of project, staffed by trained personnel capable of providing instruction, routine maintenance and emergency service on systems,
- .2 Provide record of successful previous installations submitting tender showing experience with similar installations utilizing computer-based systems.
- .3 Have access to local supplies of essential parts and provide seven (7) year guarantee of availability of spare parts after obsolescence.

- .4 Ensure qualified supervisory personnel continuously direct and monitor Work and attend site meetings.

**1.9 DELIVERY, STORAGE AND HANDLING**

- .1 Material Delivery Schedule: provide Departmental Representative with schedule within two (2) weeks after award of Contract.
- .2 Packing, shipping, handling and unloading:
  - .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

**1.10 WASTE MANAGEMENT AND DISPOSAL**

- .1 Construction/Demolition Waste Management and Disposal: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

**1.11 EXISTING CONDITIONS - CONTROL COMPONENTS**

- .1 Utilize existing control wiring and piping as indicated, and where possible.
- .2 Re-use field control devices that are usable in their original configuration provided that they conform to applicable codes, standards specifications.
  - .1 Do not modify original design of existing devices without written permission from Departmental Representative.
  - .2 Provide for new, properly designed device where re-usability of components is uncertain.
- .3 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 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 Departmental Representative.
  - .2 Failure to produce test report will constitute acceptance of existing devices by contractor.
- .4 Non-functioning items:
  - .1 Provide with report specification sheets or written functional requirements to support findings.
  - .2 Departmental Representative will repair or replace existing items judged defective yet deemed necessary for EMCS.
- .5 Submit written request for permission to disconnect controls and to obtain equipment downtime before proceeding with Work.
- .6 Assume responsibility for controls to be incorporated into EMCS after written receipt of approval from Departmental Representative.
  - .1 Be responsible for items repaired or replaced by Departmental Representative.
  - .2 Be responsible for repair costs due to negligence or abuse of equipment.
  - .3 Responsibility for existing devices terminates upon final acceptance of EMCS, applicable portions of EMCS as approved by Departmental Representative.
- .7 Remove existing controls not re-used or not required. Place in approved storage for disposition as directed.

**Part 2 Products**

**2.1 EQUIPMENT**

- .1 Control Network Protocol and Data Communication Protocol: to CEA 709.1 and ASHRAE STD 135.
- .2 Complete list of equipment and materials to be used on project and forming part of tender documents by adding manufacturer's name, model number and details of materials, and submit for approval.

**Part 3 Execution**

**3.1 MANUFACTURER'S RECOMMENDATIONS**

- .1 Installation: to manufacturer's recommendations.

**3.2 ELECTRICAL POWER AND CONTROL WIRING**

- .1 Provide 120 volt electrical power and low voltage control wiring to controllers and devices in accordance with specification sections 260521 and 260534, and coordinate work with the main electrical contractor.

**3.3 CONTROL AIR PIPING AND TUBING**

- .1 Use type "L" air copper pipe with silver brazed joints in the following locations:
  - .1 In mechanical rooms.
  - .2 Areas of ambient temperature above 80C.
  - .3 In fire rated walls and ceilings.
  - .4 Areas where piping may be subject to damage.
  - .5 In other locations polyethylene plastic tubing with barbed type fittings is acceptable.

**3.4 PAINTING**

- .1 Painting: in accordance with Section 09 91 23 - Interior Painting, supplemented as follows:
  - .1 Clean and touch up marred or scratched surfaces of factory finished equipment to match original finish.
  - .2 Restore to new condition, finished surfaces too extensively damaged to be primed and touched up to make good.
  - .3 Clean and prime exposed hangers, racks, fastenings, and other support components to match existing building standards.
  - .4 Paint unfinished equipment installed indoors to EEMAC 2Y-1.

**END OF SECTION**

**Part 1            General**

**1.1                SUMMARY**

- .1    Section Includes.
  - .1    Methods and procedures for shop drawings submittals, preliminary and detailed review process including review meetings, for building Energy Monitoring and Control System (EMCS).

**1.2                DEFINITIONS**

- .1    Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

**1.3                SUBMITTALS**

- .1    Submittals in accordance with Section 00 10 00 – General Instructions and coordinate with requirements in this Section.
- .2    Submit shop drawing documents within 15 working days after contract award, for review by Departmental Representative.
- .3    Shop Drawings to consist of one (1) soft copy of design documents, shop drawings, product data and software.
- .4    Soft copy to be in PDF format, structured using menu format for easy loading and retrieval on OWS.

**1.4                SHOP DRAWING REVIEW**

- .1    Shop drawings to include the following.
  - .1    Location of local office.
  - .2    Names of project manager and project engineer.
  - .3    Item-by-item statement of compliance.
  - .4    Proof of demonstrated ability of system to communicate utilizing Proprietary Communications Protocol (Andover Infinet), BACnet and Lontalk.
  - .5    Detailed system architecture showing all points associated with each controller identifying the following:
    - .1    Controller locations.
    - .2    Auxiliary control cabinet locations.
  - .6    Points list to include the following item:
    - .1    Input output termination location.
    - .2    Input output type.
    - .3    Point name see Section 25 05 01 for NRC point naming convention.
    - .4    Point description.
    - .5    Point revision.
    - .6    Product part number.
    - .7    Product wiring details.

- .7 System Schematic Diagrams and Sequence of Events detailing the following but not limited to:
  - .1 Display of air and water systems with point identifiers, textual description of system, electrical ladder diagrams, areas served and location of equipment as specified.
  - .2 Narrative descriptions of each automatic and manual procedure required to achieve proper operation of the mechanical equipment associated with this project, including the procedures used during the complete failure of EMCS.
    - .1 List of time of day schedules.
- .8 Equipment Schedule
  - .1 Valves: complete schedule listing including following information: designation, service, manufacturer, model, design flow rate, design pressure drop, Valve size, actual Cv, spring range, pilot range and close off pressure (actual).
  - .2 Dampers: interconnecting hardware, operator locations, operator spring range, pilot range, actual torque.
  - .3 Flow measuring stations: complete schedule listing designation, service, manufacturer, model, size, velocity at design flow rate, manufacturer.
- .9 Specification sheets to include:
  - .1 Manufacturer's descriptive literature, manufacturer's installation recommendations, specifications, drawings, diagrams, performance and characteristic curves, catalogue cuts, manufacturer's name, trade name, catalogue or model number, nameplate data, size, layout, dimensions, capacity, other data to establish compliance.
- .10 Interface wiring diagrams showing termination connections and signal levels.
- .11 Outline of proposed start-up and verification procedures. Refer to Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

## 1.5 QUALITY ASSURANCE

- .1 Shop Drawing Review Meeting: Participate in meeting within 5 working days of receipt of reviewed shop drawings. Meeting to be convened by NRC:
  - .1 Undertake functional review of shop drawing documents, resolve inconsistencies.
  - .2 Resolve conflicts between contract document requirements and actual items (e.g.: points list inconsistencies).
  - .3 Review interface requirements of materials supplied by others.
  - .4 Review "Sequence of Operations".
- .2 Departmental Representative retains right to revise sequence or subsequent CDL prior to software finalization without cost to Departmental Representative.

## Part 2 Products

### 2.1 NOT USED

- .1 Not Used.

**Part 3            Execution**

**3.1                NOT USED**

.1                Not Used.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

- .1 Section Includes.
  - .1 Requirements and procedures for final control diagrams and operation and maintenance (O&M) manual, for building Energy Monitoring and Control System (EMCS) Work.

**1.2 DEFINITIONS**

- .1 BECC - Building Environmental Control Centre.
- .2 OWS - Operator Work Station.
- .3 For additional acryonyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

**1.3 SUBMITTALS**

- .1 Submittals in accordance with Section 00 10 00 – General Instructions, supplemented and modified by requirements of this Section.
- .2 Submit Record Documents, As-built drawings and Operation and Maintenance Manual to Departmental Representative in English.
- .3 Provide soft copies and hard copies in hard-back, 50 mm 3 ring, D-ring binders.
  - .1 Binders to be 2/3 maximum full.
  - .2 Provide index to full volume in each binder.
  - .3 Identify contents of each manual on cover and spine.
  - .4 Provide Table of Contents in each manual.
  - .5 Assemble each manual to conform to Table of Contents with tab sheets placed before instructions covering subject.

**1.4 AS-BUILTS**

- .1 Provide 1 copy of detailed shop drawings generated in Section 25 05 02 - EMCS: Submittals and Review Process and include:
  - .1 Changes to contract documents as well as addenda.
  - .2 Changes to controller network wiring.
  - .3 Locations of obscure devices to be indicated on drawings.
  - .4 Panel/circuit breaker number for sources of normal/emergency power.
  - .5 Test procedures and reports: provide records of start-up procedures, test procedures, checkout tests and final commissioning reports as specified in Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.
  - .6 Basic system design and full documentation on system configuration.

- .2 Submit for final review by Departmental Representative1 soft copy of updated building as-builts and include:
  - .1 Updated project list.
  - .2 Project title page.
  - .3 Project summary.
  - .4 Updated building system architecture.
  - .5 Building system points list.
  - .6 Updated building system schematics.
  - .7 Updated building system sequence of operation
    - .1 EMCS point naming to be identified in sequence where applicable.
  - .8 Updated system equipment schedule (controller, instrumentation, valves, etc.).
- .3 A soft copy of approved as-builts and updated building as-builts to be installed on NRC ASPM BAS/EMCS server by the controls contractor.

## 1.5 O&M MANUALS

- .1 An O&M manual is required for this project.
- .2 Custom design O&M Manuals (both hard and soft copy), as outlined below, to contain material pertinent to this project only and provide full and complete coverage of subjects referred to in this Section for all new equipment.
- .3 Provide two (2) complete sets of hard and soft copies prior to system or equipment tests.
- .4 Include complete coverage in concise language, readily understood by operating personnel using common terminology of functional and operational requirements of system. Do not presume knowledge of computers, electronics or in-depth control theory.
- .5 Functional description to include:
  - .1 Functional description of theory of operation.
  - .2 Full details of data communications, including data types and formats, data processing and disposition data link components, interfaces and operator tests or self-test of data link integrity.
  - .3 Explicit description of hardware and software functions, interfaces and requirements for components in functions and operating modes.
  - .4 Description of person-machine interactions required to supplement system description, known or established constraints on system operation, operating procedures currently implemented, or planned for implementation in automatic mode.
- .6 System operation to include:
  - .1 Complete step-by-step procedures for operation of system including required actions at each OWS.
  - .2 Operation of computer peripherals, input and output formats.
  - .3 Emergency, alarm and failure recovery.
  - .4 Step-by-step instructions for start-up, back-up equipment operation, execution of systems functions and operating modes, including key strokes for each command so that operator need only refer to these pages for keystroke entries required to call up display or to input command.



- .7 Software to include:
  - .1 Documentation of theory, design, interface requirements, functions, including test and verification procedures.
  - .2 Detailed descriptions of program requirements and capabilities.
  - .3 Data necessary to permit modification, relocation, reprogramming and to permit new and existing software modules to respond to changing system functional requirements without disrupting normal operation.
  - .4 Software modules, fully annotated source code listings, error free object code files ready for loading via peripheral device
  - .5 Complete program cross reference plus linking requirements, data exchange requirements, necessary subroutine lists, data file requirements, other information necessary for proper loading, integration, interfacing, program execution.
  - .6 Software for each Controller and single section referencing Controller common parameters and functions.
- .8 Maintenance: document maintenance procedures including inspection, periodic preventive maintenance, fault diagnosis, repair or replacement of defective components, including calibration, maintenance, repair of sensors, transmitters, transducers, controller and interface firmware's, plus diagnostics and repair/replacement of system hardware.
- .9 System configuration document:
  - .1 Provisions and procedures for planning, implementing and recording hardware and software modifications required during operating lifetime of system.
  - .2 Information to ensure co-ordination of hardware and software changes, data link or message format/content changes, sensor or control changes in event that system modifications are required.
- .10 Programmer control panel documentation: provide where panels are independently interfaced with BECC, including interfacing schematics, signal identification, timing diagrams, fully commented source listing of applicable driver/handler.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                SUMMARY**

- .1            Section Includes.
  - .1            Requirements and procedures for identification of devices, sensors, wiring tubing, conduit and equipment, for building Energy Monitoring and Control System (EMCS) Work and nameplates materials, colours and lettering sizes.

**1.2                REFERENCES**

- .1            Canadian Standards Association (CSA International).
  - .1            CSA C22.1-[09], The Canadian Electrical Code, Part I (21th Edition), Safety Standard for Electrical Installations.

**1.3                DEFINITIONS**

- .1            For acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

**1.4                SYSTEM DESCRIPTION**

- .1            Language Operating Requirements: provide identification for control items in English.

**1.5                SUBMITTALS**

- .1            Submittals in accordance with Section 00 10 00 – General Instructions, supplemented and modified by requirements of this Section.
- .2            Submit to Departmental Representative for approval samples of nameplates, identification tags and list of proposed wording.

**Part 2            Products**

**2.1                NAMEPLATES FOR PANELS/CABINETS**

- .1            Identify by 1/10 inch thick Melamine, matt white finish, black core, square corners, lettering accurately aligned and engraved into core.
- .2            Sizes: 1 inch x 2-3/4 inches minimum.
- .3            Lettering: minimum ¼ inch high, black.
- .4            Inscriptions: machine engraved to identify function.

**2.2                NAMEPLATES FOR CONTROLLERS**

- .1            Identify by stick-on label the controller identifier.
- .2            Location: outside cover of controller.
- .3            Letter size: to suit, clearly legible.

### **2.3 NAMEPLATES FOR FIELD DEVICES**

- .1 Identify by plastic encased cards attached by plastic tie.
- .2 Sizes: 2 x 4 inches minimum.
- .3 Lettering: minimum 1/5 inch high produced from laser printer in black.
- .4 Data to include: point name and point address.
- .5 Companion cabinet: identify interior components using plastic enclosed cards with point name and point address.

### **2.4 NAMEPLATES FOR ROOM SENSORS**

- .1 Identify by stick-on labels using point identifier.
- .2 Location: as directed by Departmental Representative.
- .3 Letter size: to suit, clearly legible.

### **2.5 WARNING SIGNS**

- .1 Equipment including motors, starters under remote automatic control: supply and install coloured signs warning of automatic starting under control of EMCS.
- .2 Sign to read: "Caution: This equipment is under automatic remote control of EMCS" as reviewed by Departmental Representative.

### **2.6 WIRING**

- .1 Tape markings on wiring inside panels to clearly identify EMCS point name.
- .2 Colour coding: to CSA C22.1. Use colour coded wiring in communications cables, matched throughout system.
- .3 Power wiring: identify circuit breaker panel/circuit breaker number inside each EMCS panel.

### **2.7 PNEUMATIC TUBING**

- .1 Tape markings on pneumatic tubing inside panels to clearly identify EMCS point name.

### **2.8 CONDUIT**

- .1 Pre-paint box covers and conduit fittings.
- .2 Coding: use fluorescent orange paint and confirm colour with Departmental Representative during "Preliminary Design Review".

**Part 3 Execution**

**3.1 NAMEPLATES AND LABELS**

- .1 Ensure that manufacturer's nameplates, CSA labels and identification nameplates are visible and legible at all times.

**3.2 EXISTING PANELS**

- .1 Correct existing nameplates and legends to reflect changes made during Work.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

- .1 Section Includes.
  - .1 Requirements and procedures for warranty and activities during warranty period and service contracts, for building Energy Monitoring and Control System (EMCS).

**1.2 REFERENCES**

- .1 Canada Labour Code (R.S. 1985, c. L-2)/Part I - Industrial Relations.
- .2 Canadian Standards Association (CSA International).
  - .1 CSA Z204-[94(R1999)], Guidelines for Managing Indoor Air Quality in Office Buildings.

**1.3 DEFINITIONS**

- .1 For acronyms and definitions refer to Section 25 05 01 - EMCS: General Requirements.

**1.4 MAINTENANCE SERVICE DURING WARRANTY PERIOD**

- .1 Provide services, materials, and equipment to maintain EMCS for specified warranty period. Provide detailed preventative maintenance schedule for system components as described in Submittal article.
- .2 Emergency Service Calls:
  - .1 Initiate service calls when EMCS is not functioning correctly.
  - .2 Qualified control personnel to be available during warranty period to provide service to "CRITICAL" components whenever required at no extra cost.
  - .3 Furnish Departmental Representative with telephone number where service personnel may be reached at any time.
  - .4 Service personnel to be on site ready to service EMCS within two (2) hours after receiving request for service.
  - .5 Perform Work continuously until EMCS restored to reliable operating condition.
- .3 Work requests: record each service call request, when received separately on approved form and include:
  - .1 Serial number identifying component involved.
  - .2 Location, date and time call received.
  - .3 Nature of trouble.
  - .4 Names of personnel assigned.
  - .5 Instructions of work to be done.
  - .6 Amount and nature of materials used.
  - .7 Time and date work started.
  - .8 Time and date of completion.

**1.5 SERVICE CONTRACTS**

- .1 Provide in-depth technical expertise and assistance to Departmental Representative in preparation and implementation of service contracts and in-house preventive maintenance procedures.

**Part 2            Products**

**2.1                NOT USED**

.1                  Not Used.

**Part 3            Execution**

**3.1                NOT USED**

.1                  Not Used.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

.1 Section Includes:

- .1 System requirements for Local Area Network (LAN) for Building Energy Monitoring and Control System (EMCS).

**1.2 REFERENCES**

.1 Canadian Standards Association (CSA International).

- .1 CSA T529-[95(R2000)], Telecommunications Cabling Systems in Commercial Buildings (Adopted ANSI/TIA/EIA-568-A with modifications).
- .2 CSA T530-[99(R2004)], Commercial Building Standard for Telecommunications Pathways and Spaces (Adopted ANSI/TIA/EIA-569-A with modifications).

.2 Institute of Electrical and Electronics Engineers (IEEE)/Standard for Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks - Specific requirements.

- .1 IEEE Std 802.3<sup>TM</sup>-[2002], Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications.

.3 Telecommunications Industries Association (TIA)/Electronic Industries Alliance (EIA)

- .1 TIA/EIA-568-[March 2004], Commercial Building Telecommunications Cabling Standards Set, Part 1 General Requirements Part 2 Balanced Twisted-Pair Cabling Components Part 3 Optical Fiber Cabling Components Standard.
- .2 TIA/EIA-569-A-[December 2001], Commercial Building Standard for Telecommunications Pathways and Spaces.

.4 Treasury Board Information Technology Standard (TBITS).

- .1 TBITS 6.9-[2000], Profile for the Telecommunications Wiring System in Government Owned and Leased Buildings - Technical Specifications.

**1.3 DEFINITIONS**

.1 Acronyms and definitions: refer to Section 25 05 01 - EMCS - General Requirements.

**1.4 SYSTEM DESCRIPTION**

.1 Data communication network to link Operator Workstations and Master Control Units (MCU) in accordance with CSA T529, TIA/EIA-568 and CSA T530, TIA/EIA-569-A, and TBITS 6.9.

- .1 Provide reliable and secure connectivity of adequate performance between different sections (segments) of network.
- .2 Allow for future expansion of network, with selection of networking technology and communication protocols.

.2 Data communication network to include, but not limited to:

- .1 EMCS-LAN.
- .2 Network interface cards.
- .3 Network management hardware and software.

- .4 Network components necessary for complete network.

**1.5 DESIGN REQUIREMENTS**

- .1 EMCS Local Area Network (EMCS-LAN).
  - .1 High speed, high performance, local area network over which MCUs and OWSs communicate with each other directly on peer to peer basis in accordance with IEEE 802.3/Ethernet Standard.
  - .2 Each EMCS-LAN to be capable of supporting at least 254 devices.
  - .3 Support of combination of MCUs and OWSs directly connected to EMCS-LAN.
  - .4 High speed data transfer rates for alarm reporting, quick report generation from multiple controllers, upload/download information between network devices. Bit rate to be 10 Megabits per second minimum.
  - .5 Detection and accommodation of single or multiple failures of either OWSs, MCUs or network media. Operational equipment to continue to perform designated functions effectively in event of single or multiple failures.
  - .6 Commonly available, multiple sourced, networking components and protocols to allow system to co-exist with other networking applications including office automation.
- .2 Dynamic Data Access.
  - .1 LAN to provide capabilities for OWSs, either network resident or connected remotely, to access point status and application report data or execute control functions for other devices via LAN.
  - .2 Access to data to be based upon logical identification of building equipment.
- .3 Network Medium.
  - .1 Network medium: CAT5 Cable or fibre optic cable compatible with network protocol to be used within buildings. Fibre optic cable to be used between buildings.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**



**Part 1            General**

**1.1                SUMMARY**

.1            Section Includes:

.1            Hardware and software requirements for an Operator Work Station (OWS) in a Building Energy Monitoring and Control System (EMCS), including primary, secondary, portable and remote OWS's.

**1.2                DEFINITIONS**

.1            Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

.2            Secondary OWS: serves as backup to primary OWS, is storage and retrieval facility of soft copy of as-built contractor supplied data as described in Section 25 05 03 - EMCS: Project Record Documents.

.3            Portable OWS: used as remote dial-up OWS with same capabilities as primary OWS including graphic display.

.4            Remote Auxiliary OWS: performs identical user interface functions as primary OWS.

**1.3                OWS SYSTEM DESCRIPTION**

.1            Consists of commercially available personal computer in current production, with sufficient memory and processor capacity to perform functions specified.

**1.4                SUBMITTALS**

.1            Make submittals in accordance with Section 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process.

**1.5                ENVIRONMENTAL CONDITIONS**

.1            OWS to operate in conditions of 10 degrees C to 32 degrees C and 20% to 90% non-condensing RH.

**1.6                MAINTENANCE**

.1            Provide maintenance in accordance with Section 25 05 03 - EMCS: Project Record Documents.

**Part 2            Products**

**2.1                OWS HARDWARE**

.1            PC system to include:

.1            Processor: Pentium IV micro-processor, operating at minimum clock speed of 2 Gigahertz, capable of supporting software necessary to perform functions specified in this section. System backplane bus (100 Megahertz) to support PCI and ISA boards.

.2            Internal clock.

- .1 Uninterruptible clock: accuracy of plus or minus 5 seconds/month, capable of deriving year / month / day / hour / minute / second.
- .2 Rechargeable batteries: to provide minimum 48h clock operation in event of power failure.
- .3 Asynchronous interfaces for connection to listed peripheral devices including LAN and remote devices.
- .2 Power supply unit to accept 120V 60Hz source and include line surge and low voltage protection for processor and its peripherals.

## 2.2 OWS PC COMPONENTS

- .1 Primary OWS: DELL PC compatible with following as minimum:
  - .1 IDE Disk drive controller to support 4 drives.
    - .1 80 GB hard disk drive, 12 ms access time.
    - .2 48X/24X/48X CD-RW drive.
  - .2 1 GB RAM minimum.
  - .3 Enhanced 101 key keyboard.
  - .4 PS2 mouse.
  - .5 Colour monitor: 19". Flat panel display TFT, resolution 1280 X 1040, dot pitch 0.26 mm, colour support 24 bit,
  - .6 Video card with 32 MB video RAM.
  - .7 Two (2) Parallel Ports to support printer(s).
  - .8 Four (4) USB ports.
  - .9 Internal Modem - 56 k.
  - .10 PCI Ethernet LAN Adapter to connect to local Ethernet LAN network.
  - .11 200W minimum power supply.
- .2 Secondary OWS: PC compatible workstation as defined for primary OWS.
- .3 Portable OWS: IBM compatible personal laptop computer, with following as minimum:
  - .1 Pentium IV processor 2 GHz.
  - .2 80 GB hard disk drive, 9 ms access time.
  - .3 Internal 52X CD ROM.
  - .4 1 GB RAM.
  - .5 Enhanced 101-key keyboard.
  - .6 PS/2 mouse device.
  - .7 Two (2) USB ports.
  - .8 17" Colour LCD (active matrix) display.
  - .9 Ethernet LAN adapter to connect to local Ethernet Network.
  - .10 Protective case with serviceable carrying straps.
  - .11 CPU and peripherals: IBM compatible.
  - .12 Operating system: same as primary OWS.
- .4 Remote Auxiliary OWS: locate in mechanical rooms where concentrations of equipment are located.
  - .1 Locations as indicated on system architecture diagram.
  - .2 OWS to perform identical user interface functions as primary OWS: compatible PC equivalent to primary OWS with following changes:

- .1 RAM: 1GB inimum.
- .2 Colour monitor: 17" high resolution, non-interlaced, Super VGA, 1024 x 768 .28 dot pitch.

### **2.3 OPERATING SYSTEM (OS) OR EXECUTIVE**

- .1 OS to support complement of hardware terminals and software programs specified.
- .2 OS to be true multitasking operating environment.
  - .1 MS DOS or PC DOS based software platforms not permitted.
- .3 OWS software to operate in "Windows" based operating environment: Windows 2000 or Windows XP.

### **2.4 OWS CONTROL SOFTWARE**

- .1 OWS is not to form part of real-time control functions either directly or indirectly or as part of communication link. Real-time control functions to reside in MCUs, LCUs, and TCUs with peer to peer communication occurring at MCU to MCU device level.
- .2 Time Synchronization Module.
  - .1 System to provide Time Synchronization of real-time clocks in controllers.
  - .2 System to perform this feature on regular scheduled basis and on operator request.
- .3 User Display Interface Module.
  - .1 OWS software to support "Point Names" as defined in Section 25 05 01 - EMCS: General Requirements.
  - .2 Upon operator's request in either text, graphic or table mode, system to present condition of single point, system, area, or connected points on system to OWS. Display analog values digitally to one (1) place of decimal with negative sign as required. Update displayed analog values and status when new values received. Flag points in alarm by blinking. For systems supporting COV, refresh rate of screen data not to exceed five (5) seconds from time of field change and system is to execute supervisory background scan every 20 seconds to verify point data value. For other systems refresh rate not to exceed five (5) seconds for points displayed. Initial display of new system graphic display (with up to 30 active points), including presentation of associated dynamic data not to exceed eight (8) seconds.
- .4 General Event Log Module: to record system activities occurring at OWS or elsewhere in system including:
  - .1 Operator Log-in from user interface device.
  - .2 Communication messages: errors, failures and recovery.
  - .3 Event notifications and alarms by category and OWS location.
  - .4 Record of operator initiated commands.

- .5 General Event Log:
  - .1 Hold minimum of one (1) month's information and be readily accessible to operator.
  - .2 Able to be archived as necessary to prevent loss of information.
- .6 Operator Control Software Module: to support entry of information into system from keyboard and mouse, disk, or from another network device. Display of information to user; dynamic displays, textual displays, and graphic displays to display logging and trending of system information and following tasks:
  - .1 Automatic logging of digital alarms and change of status messages.
  - .2 Automatic logging of analog alarms.
  - .3 System changes: alarm limits, set-points, alarm lockouts.
  - .4 Display specific point values, states as selected.
  - .5 Provide reports as requested and on scheduled basis when required.
  - .6 Display graphics as requested, and on alarm receptions (user's option).
  - .7 Display list of points within system.
  - .8 Display list of systems within building.
  - .9 Direct output of information to selected peripheral device.
  - .10 On-line changes:
    - .1 Alarm limits.
    - .2 Setpoints.
    - .3 Deadbands.
    - .4 Control and change of state changes.
    - .5 Time, day, month, year.
    - .6 Control loop configuration changes for controller-based CDLs.
    - .7 Control loop tuning changes.
    - .8 Schedule changes.
    - .9 Changes, additions, or deletions, of points, graphics, for installed and future systems.
  - .11 According to assigned user privileges (password definition) following functions are to be supported:
    - .1 Permit operator to terminate automatic (logic based) control and set value of field point to operator selected value. These values or settings to remain in effect until returned to automatic (logic based) control by operator.
    - .2 Requests for status, analog values, graphic displays, logs and controls to be through user interface screens.
  - .12 Software and tools utilized to generate, modify and configure building controllers to be installed and operational on the OWS.
- .7 Message Handling Module - and Error Messages: to provide message handling for following conditions:
  - .1 Message and alarm buffering to prevent loss of information.
  - .2 Error detection correction and retransmission to guarantee data integrity.
  - .3 Informative messages to operator for data error occurrences, errors in keyboard entry, failure of equipment to respond to requests or commands and failure of communications between EMCS devices.
  - .4 Default device definition to be implemented to ensure alarms are reported as quickly as possible in event of faulty designated OWS.

- .8 Access Control Module.
  - .1 Minimum five (5) levels of password access protection to limit control, display, or data base manipulation capabilities. Following is preferred format of progression of password levels:
    - .1 Guest: no password data access and display only.
    - .2 Operator Level: full operational commands including automatic override.
    - .3 Technician: data base modifications.
    - .4 Programmer: data base generation.
    - .5 Highest Level : system administration - password assignment addition, modification.
  - .2 User-definable, automatic log-off timers from 1 to 120 min. to prevent operators leaving devices on-line inadvertently. Default setting = 60 minutes.
- .9 Trend Data Module: includes historical data collection utility, trend data utility, control loop plot utility. Each utility to permit operator to add trend point, delete trend point, set scan rate.
  - .1 Historical data collection utility: collect concurrently operator selected real or calculated point values at operator selectable rate 0-480 minutes. Samples to include for each time interval (time-stamped), minimum present value, maximum present value, and average present value for point selected. Rate to be individually selectable for each point. Data collection to be continuous operation, stored in temporary storage until removed from historical data list by operator.
  - .2 Trend data utility: continuously collect point object data variables for variables from building controllers as selected by operator, including at minimum; present value of following point object types - DI, DO, AI, AO , BI, BO, set points value, calculated values. Trend data utility to have capacity to trend concurrently points at operator-selectable rate of 5 seconds to 3600 seconds, individually selectable for selected value, or use of COV detection. Collected trend data to be stored on minimum 96h basis in temporary storage until removed from trend data list by operator. Option to archive data before overwriting to be available.
  - .3 Trend data Module to include display of historical or trend data to OWS screen in X Y plot presentation. Plot utility to display minimum of 6 historical points or 6 trend points concurrently. For display output of real time trend data, display to automatically index to left when window becomes full. Provide plotting capabilities to display collected data based on range of selected value for (Y) component against time/date stamp of collected data for (X) component.
  - .4 Provide separate reports for each trend utility. Provide operator feature to specify report type, by point name and for output device. Reports to include time, day, month, year, report title, and operator's initials. Implement reports using report module. Ensure trend data is exportable to third party spreadsheet or database applications for PCs.
- .10 Report Module: reports for energy management programs, function totalization, analog/pulse totalization and event totalization features available at MCU level. Refer also to Section 25 30 01 - EMCS: Building Controllers.
  - .1 Reports to include time, day, month, year, report title, operator's initials.
  - .2 Software to provide capability to:
    - .1 Generate and format reports for graphical and numerical display from real time and stored data.
    - .2 Print and store reports as selected by operator.
    - .3 Select and assign points used in such reports.
    - .4 Sort output by area, system, as minimum.

- .3 Periodic/automatic report:
  - .1 Generate specified report(s) automatically including options of start time and date, interval between reports (hourly, daily, weekly, monthly), output device. Software to permit modifying periodic/automatic reporting profile at any time.
  - .2 Reports to include:
    - .1 Power demand and duty cycle summary: see application program for same.
    - .2 Disabled "Locked-out" point summary: include point name, whether disabled by system or by operator.
    - .3 Run time summary: summary of accumulated running time of selected equipment. Include point name, run time to date, alarm limit setting. Run time to accumulate until reset individually by operator.
    - .4 Summary of run time alarms: include point name, run time to date, alarm limit.
    - .5 Summary of start/stop schedules: include start/stop times and days, point name.
    - .6 Motor status summary.
- .4 Report types:
  - .1 Dynamic reports: system to printout or display of point object data value requested by operator. System to indicate status at time of request, when displayed, updated at operator selected time interval. Provide option for operator selection of report type, by point name, and/or output device. Ensure reports are available for following point value combinations:
    - .2 Points in accessible from this OWS (total connected for this location), multiple "areas".
    - .3 Area (points and systems in Area).
    - .4 Area, system (points in system).
    - .5 System (points by system type).
    - .6 System point (points by system and point object type).
    - .7 Area point (points by system and point object type).
    - .8 Point (points by point object type).
  - .5 Summary report: printout or display of point objet data value selected by operator. Report header to indicate status at time of request. Ensure reports are available on same basis as dynamic reports. Provide option as to report type, point name, output device.
  - .6 Include preformatted reports as listed in Event/Alarm Module.
- .11 Graphics Display Module: graphics software utility to permit user to create, modify, delete, file, and recall graphics required by Section 25 90 01 - EMCS: Site Requirements, Applications and Systems Sequences of Operation.
  - .1 Provide capacity for 100% expansion of system graphics. Graphic interface to provide user with multiple layered diagrams for site, building in plan view, floor furniture plan view and building systems, overlaid with dynamic data appropriately placed and permitting direct operator interaction. Graphic interface to permit operator to start and stop equipment, change set points, modify alarm limits, override system functions and points from graphic system displays by use of mouse or similar pointing device.
  - .2 Display specific system graphics: provide for manual and/or automatic activation (on occurrence of an alarm). Include capability to call up and cancel display of graphic picture.

- .3 Library of pre-engineered screens and symbols depicting standard air handling components (fans, coils, filters, dampers, VAV), complete mechanical system components (chillers, boilers, pumps), electrical symbols.
- .4 Graphic development, creation, modification package to use mouse and drawing utility to permit user to:
  - .1 Modify portion of graphic picture/schematic background.
  - .2 Delete graphic picture.
  - .3 Call up and cancel display of graphic picture.
  - .4 Define symbols.
  - .5 Position and size symbols.
  - .6 Define background screens.
  - .7 Define connecting lines, curves.
  - .8 Locate, orient, size descriptive text.
  - .9 Define, display colours of elements.
  - .10 Establish co-relation between symbols or text and associated system points or other graphic displays.
- .5 User to be able to build graphic displays showing on-line point data from multiple MCU panels. Graphic displays to represent logical grouping of system points or calculated data based upon building function, mechanical system, building layout, other logical grouping of points which aids operator in analysis of facility operation. Data to be refreshed on screen as "changed data" without redrawing of entire screen or row on screen.
- .6 Dynamic data (temperature, humidity, flow, status) to be shown in actual schematic locations, to be automatically updated to show current values without operator intervention.
- .7 Windowing environment to allow user to view several graphics simultaneously to permit analysis of building operation, system performance, display of graphic associated with alarm to be viewed without interrupting work in progress. If interface is unable to display several different types of display at same time, provide at minimum two (2) OWS's.
- .8 Utilize graphics package to generate system schematic diagrams as required in Section 25 90 01 - EMCS: Site Requirements, Applications and System Sequences of Operation, and as directed by Departmental Representative. In addition provide graphics for schematic depicted on mechanical plan flow diagrams, point lists and system graphics. Provide graphic for floor depicting room sensors and control devices located in their actual location. Diagram to be single line schematic of ductwork as well as associated heating coil or radiation valve. Departmental Representative to provide CAD floor layouts. Provide display of TCU -VAV's in table form, include following values as minimum; space temp, setpoint, mode, actual flow, min flow setpoint, max flow setpoint, cooling signal value, and heating signal value. Organize table by rooms and floor groupings.
- .9 Provide complete directory of system graphics, including other pertinent system information. Utilize mouse or pointing device to "point and click" to activate selected graphic.
- .10 Provide for all of the following graphical items on each system graphic:
  - .1 Building name, system name and system description to be identified on each i.e. M24 - 24AHU01 – Environmental Lab.
  - .2 Location of system to be identified on each graphic (directly under the system name). (i.e. Basement Mechanical Room 02)
  - .3 NRC equipment names used to identify mechanical equipment. Format to be **black on white** consistent with NRCs equipment tags.

- .4 Provide unique sequence of operation graphic in plain English for each graphic that is depicted on OWS. Provide access to plain English sequence of operation graphic by link button on each system graphic. The plain English sequence of operation to be an accurate translation of the control descriptive logic. Sequences operation to be stored on the ASPM EMCS server.
- .5 Written sequences to use the same naming convention as on the graphics.
- .6 Each system to have a link to the appropriate floor plan.
  - .1 Floor plan graphics:
    - .1 Floor plan graphics (complete with roof plans) are required showing the following:
      - .1 Equipment locations.
      - .2 Controllers and their wiring runs. (location specifics must be included on graphics such as ceiling, closet, etc.)
      - .3 Sensor locations.
      - .4 Separate floor plans for temperature locations, controller locations and equipment locations to be the template to accommodate larger buildings.
      - .5 Floor plan graphics to be colour coded to identify the areas served by each air handling unit.
  - .7 Each building to have a heating cooling summary table.
  - .8 Items grouped under miscellaneous alarms must also have equipment locations identified.
- .12 Event/Alarm Module : displays in window alarms as received and stored in General Event Log.
  - .1 Classify alarms as priority 1, 2 or 3. Alarms and alarm classifications to be designated by personnel requiring password level.
  - .2 Presentation of alarms to include features identified under applicable report definitions of Report Module paragraph.
  - .3 Alarm reports.
    - .1 Summary of points in priority levels 1, 2 or 3. Include at least point name, alarm type, current value, limit exceeded.
    - .2 Analog alarm limit summary: include point name, alarm limits, deviation limits.
    - .3 Summary of alarm messages: include associated point name, alarm description.
  - .4 Software to notify operator of each occurrence of alarm conditions.
  - .5 EMCS to notify operator of occurrence of alarms originating at field device within following time periods of detection:
    - .1 Priority 1 - 5 seconds.
    - .2 Priority 2 - 10 seconds.
    - .3 Priority 3 - 10 seconds.
  - .6 Display alarm messages in English.
  - .7 Primary alarm message to include as minimum: point identifier, alarm classification, time of occurrence, type of alarm. Provide for initial message to be automatically presented to operator whenever associated alarm is reported.
  - .8 System reaction to alarms: provide alarm annunciation by dedicated window (activated to foreground on receipt of new alarm or event) of OWS with visual and



audible hardware indication. Acknowledgement of alarm to change visual indicator from flashing to steady state and to silence audible device. Acknowledgment of alarm to be time, date and operator stamped and stored in General Event Log. Steady state visual indicator to remain until alarm condition is corrected but must not impede reporting of new alarm conditions. Notification of alarm not to impede notification of subsequent alarms or function of Controller's/CDL. Do not allow random occurrence of alarms to cause loss of alarm or over-burden system. Do not allow acknowledgment of one alarm as acknowledgement of other alarms.

- .9 Controller network alarms: system supervision of controllers and communications lines to provide following alarms as minimum:
  - .1 Controller communication failure.
  - .2 Controller communications online - return to normal.
- .10 Digital alarm status to be interrogated every two (2) seconds as minimum or be direct interrupting non-polling type (COV). Annunciate each non-expected status with alarm message.
- .13 Archiving and Restoration Module.
  - .1 The workstation software shall have an application to save and restore field controller memory files. This application shall not be limited to saving and reloading an entire controller – it must also be able to save/reload individual objects in the controller. This allows off-line debugging of control programs, for example, and then reloading of just the modified information.
  - .2 Ensure data base back-up and downloading occurs over LAN without specialized operator technical knowledge. Provide operator with ability to manually download entire controller data base, or parts thereof as required.
- .14 Programming Environment Module.
  - .1 The programmer's environment will include access to a superset of the same programming language supported in the controllers. Here the programmer will be able to configure application software off-line (if desired) for custom program development, write global control programs, system reports, wide area networking data collection routines, and custom alarm management software. On the same screen as the program editor, the programming environment shall include dockable debug and watch bars for program debugging and viewing updated values and point attributes during programming. In addition a wizard tool shall be available for loading programs from a library file in the program editor.

**Part 3            Execution**

**3.1                NOT USED**

.1                Not used.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

.1 Section Includes:

- .1 Materials and installation for building automation controllers including:
  - .1 Master Control Unit (MCU).
  - .2 Local Control Unit (LCU).
  - .3 Equipment Control Unit (ECU).
  - .4 Terminal Control Unit (TCU).
  - .5 Input Output Units (IOU)

**1.2 REFERENCES**

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers, Inc. (ASHRAE).
  - .1 ASHRAE 2007, Applications Handbook, I-P Edition.
- .2 Canadian Standards Association (CSA International).
  - .1 C22.2 No.205-M1983(R1999), Signal Equipment.
- .3 Institute of Electrical and Electronics Engineers (IEEE).
  - .1 IEEE C37.90.1-02, Surge Withstand Capabilities (SWC) Tests for Relays and Relay Systems Associated with Electric Power Apparatus.

**1.3 DEFINITIONS**

- .1 Acronyms and definitions: refer to Section 25 05 01 - EMCS: General Requirements.

**1.4 SYSTEM DESCRIPTION**

- .1 General: Network of controllers comprising of MCU('s), LCU('s), ECU('s) or TCU('s) to be provided as indicated in System Architecture Diagram to support building systems and associated sequence(s) of operations as detailed in these specifications.
  - .1 Provide sufficient controllers to meet intents and requirements of this section.
  - .2 Controller quantity, and point contents to be approved by Departmental Representative at time of preliminary design review.
- .2 Controllers: stand-alone intelligent Control Units.
  - .1 Incorporate programmable microprocessor, non-volatile program memory, RAM, power supplies, as required to perform specified functions.
  - .2 Incorporate communication interface ports for communication to LANs to exchange information with other Controllers.
  - .3 Capable of interfacing with operator interface device.

.4 Execute its logic and control using primary inputs and outputs connected directly to its onboard input/output field terminations or slave devices, and without need to interact with other controller. Secondary input used for reset such as outdoor air temperature may be located in other Controller(s).

.1 Secondary input used for reset such as outdoor air temperature may be located in other Controller(s).

## 1.5 DESIGN REQUIREMENTS

.1 To include:

.1 Scanning of AI and DI connected inputs for detection of change of value and processing detection of alarm conditions.

.2 Perform On-Off digital control of connected points, including resulting required states generated through programmable logic output.

.3 Perform Analog control using programmable logic, (including PID) with adjustable dead bands and deviation alarms.

.4 Control of systems as described in sequence of operations.

.5 Execution of optimization routines as listed in this section.

.2 Total spare capacity for MCUs and LCUs: at least 20 % of each point type distributed throughout the MCUs and LCUs.

.3 Field Termination and Interface Devices:

.1 To: CSA C22.2 No.205.

.2 Electronically interface sensors and control devices to processor unit.

.3 Include, but not be limited to, following:

.1 Programmed firmware or logic circuits to meet functional and technical requirements.

.2 Power supplies for operation of logics devices and associated field equipment.

.3 Required communications equipment and wiring (if remote units).

.4 Leave controlled system in "fail-safe" mode in event of loss of communication with, or failure of, processor unit.

.5 Input Output interface to accept as minimum AI, AO, DI, DO, BI, BO functions as specified.

.6 Wiring terminations: use conveniently located screw type.

.4 AI interface equipment to:

.1 Convert analog signals to digital format with 10 bit analog-to-digital resolution.

.2 Provide for following input signal types and ranges. Installation of additional resistors for conversion purposes is acceptable:

.1 4 - 20mA;

.2 0 - 10V DC;

.3 100/1000 ohm RTD input;

.3 Meet IEEE C37.90.1 surge withstand capability.

.4 Have common mode signal rejection greater than 60dB to 60Hz.

.5 Where required, dropping resistors to be certified precision devices which complement accuracy of sensor and transmitter range specified.

- .5 AO interface equipment:
  - .1 Convert digital data from controller processor to acceptable analog output signals using 8 bit digital-to-analog resolution.
  - .2 Provide for following output signal types and ranges:
    - .1 4 - 20 mA.
    - .2 0 - 10V DC.
  - .3 Meet IEEE C37.90.1 surge withstand capability.
- .6 DI interface equipment:
  - .1 Able to reliably detect contact change of sensed field contact and transmit condition to controller.
  - .2 Meet IEEE C37.90.1 surge withstand capability.
  - .3 Accept pulsed inputs up to 2kHz.
- .7 DO interface equipment:
  - .1 Respond to controller processor output, switch respective outputs. Each DO hardware to be capable of switching up to 0.5amps at 24 V AC.
  - .2 Switch up to 5amps at 220V AC using optional interface relay.
- .4 Controllers and associated hardware and software: operate in conditions of 0 degrees C to 44 degrees C and 20 % to 90 % non-condensing RH.
- .5 Controllers (MCU, LCU): mount in wall mounted cabinet with hinged, keyed-alike locked door to match existing NRC standard.
  - .1 Provide for conduit entrance from top, bottom or sides of panel.
  - .2 ECUs to be mounted in equipment enclosures or separate enclosures.
  - .3 TCUs to be mounted in equipment or separate enclosures.
  - .4 Mounting details as approved by Departmental Representative for ceiling mounting.
- .6 Cabinets to provide protection from water dripping from above, while allowing sufficient airflow to prevent internal overheating.
- .7 When existing cabinets are re-used, the front panel is to be painted fluorescent orange to match existing EMCS NRC campus colour code. Any openings are to be closed with matching orange blank-plates.
- .8 Provide surge and low voltage protection for interconnecting wiring connections.

## 1.6 SUBMITTALS

- .1 Make submittals in accordance with Section 00 10 00 – General Instructions and Section 25 05 02 - EMCS: Shop Drawings, Product Data and Review Process.

## Part 2 Products

- .1 MASTER CONTROL UNIT (MCU)
  - .1 General:
    - .1 Master Control Units shall be microprocessor based, multi-tasking, multi-user, and employ a real time operating system. Each NCU control panel shall consist of modular hardware including power supply, CPU board, and

input/output modules. A sufficient number of MCUs shall be supplied to fully meet the requirements of this specification and the attached point list.

- .2 Hardware Specifications
  - .1 Memory:
    - .1 A minimum of 4MB of RAM shall be provided for MCUs with expansion up to 8MB. The 8MB versions shall include a floating-point math co-processor.
  - .2 Communication Ports:
    - .1 Each NCU shall provide communication to both the Workstation(s) and the field buses. In addition, each NCU must have at least 3 other communications ports that support a telephone modem, portable service tool, serial printer and connection to third party controllers such as a chiller control panel. On a LAN/WAN system the NCU shall be provided with a 10Mbps plug-in Ethernet TCP/IP network interface card (NIC).
  - .3 Input/Output (I/O):
    - .1 Each MCU shall support the addition of the following types of inputs and outputs:
      - .1 Digital Inputs for status/alarm contacts.
      - .2 Counter Inputs for summing pulses from meters.
      - .3 Thermistor inputs for measuring temperatures in space, ducts and thermowells.
      - .4 Analog inputs for pressure, humidity, flow and position measurements.
      - .5 Digital Outputs for on/off equipment control.
      - .6 Outs for valve and damper position control, and capacity control of primary equipment.
  - .4 Modular Expandability:
    - .1 The system shall employ a modular I/O design to allow easy expansion. Input and output capacity is to be provided through plug-in modules of various types or DIN-mountable IOU modules. It shall be possible to combine I/O modules as desired to meet the I/O requirements for individual control applications.
  - .5 Hardware Override Switches:
    - .1 All digital output units shall include three position manual override switches to allow selection of the ON, OFF, or AUTO output state. These switches shall be built into the unit and shall provide feedback to the controller so that the position of the override switch can be obtained through software. In addition each analog output shall be equipped with an override potentiometer to allow manual adjustment of the analog output signal over its full range, when the 3 position manual override switch is placed in the ON position.
  - .6 Local Status Indicator Lamps:
    - .1 Provide as a minimum LED indication of CPU status, Ethernet LAN status, and field bus status. For each output, provide LED indication of the value of the output (On/Off). For each output module provide an LED which gives a visual indication of whether any outputs on the module are manually overridden.

- .7 Real Time Clock (RTC):
  - .1 Each MCU shall include a battery-backed, real time clock, accurate to 10 seconds per day. The RTC shall provide the following: time of day, day, month, year, and day of week. In normal operation the system clock will be based on the frequency of the AC power. The system shall automatically correct for daylight savings time and leap years and be Year 2000 compliant.
- .8 Power Supply:
  - .1 The power supply for the NCUs shall be auto sensing, 120-220VAC, 60/50 Hz power, with a tolerance of +/- 20%. Line voltage below the operating range of the system shall be considered outages. The controller shall contain over voltage surge protection, and require no additional AC power signal conditioning. Optionally, if indicated on the drawings, the power supply shall accept an input voltage of (-48 VDC).
- .9 Automatic Restart After Power Failure:
  - .1 Upon restoration of power after an outage, the ECU shall automatically and without human intervention: update all monitored functions; resume operation based on current, synchronized time and status, and implement special start-up strategies as required.
- .10 Battery backup:
  - .1 Each NCU with the standard 120-220VAC power supply shall include a programmable DC power backup system rated for a minimum of 72 hours of battery backup to maintain all volatile memory or, a minimum of 2 hours of full UPS including modem power. This power backup system shall be configurable such that at the end of a settable timeframe (such as 1 hour) of running on full UPS, the unit will shut off full UPS and switch to memory retention-only mode for the remainder of the battery power. The system shall allow the simple addition of more batteries to extend the above minimum battery backup times.
- .3 Software Specifications
  - .1 General.
    - .1 The MCU shall contain flash ROM as the resident operating system. Application software will be RAM resident. Application software will only be limited by the amount of RAM memory. There will be no restrictions placed on the type of application programs in the system. Each NCU shall be capable of parallel processing, executing all control programs simultaneously. Any program may affect the operation of any other program. Each program shall have the full access of all I/O facilities of the processor. This execution of control function shall not be interrupted due to normal user communications including interrogation, program entry, printout of the program for storage, etc.
  - .2 User Programming Language:
    - .1 The application software shall be user programmable. This includes all strategies, sequences of operation, control algorithms, parameters, and setpoints. The source program shall be English language-based and programmable by the user. The language shall be structured to allow for the easy configuration of control programs, schedules, alarms, reports, telecommunications, local displays, mathematical calculations, passwords, and histories. The

language shall be self-documenting. Users shall be able to place comments anywhere in the body of a program. Program listings shall be configurable by the user in logical groupings.

- .4 Control Software:
  - .1 The NCU shall have the ability to perform the following pre-tested control algorithms:
    - .1 Proportional, Integral plus Derivative Control (PID)
    - .2 Self Tuning PID
    - .3 Two Position Control
    - .4 Digital Filter
    - .5 Ratio Calculator
    - .6 Equipment Cycling Protection
  - .2 Mathematical Functions:
    - .1 Each controller shall be capable of performing basic mathematical functions (+, -, \*, /), squares, square roots, exponential, logarithms, Boolean logic statements, or combinations of both. The controllers shall be capable of performing complex logical statements including operators such as >, <, =, and, or, exclusive or, etc. These must be able to be used in the same equations with the mathematical operators and nested up to five parentheses deep.
- .5 Energy Management Applications:
  - .1 MCUs shall have the ability to perform any or all of the following energy management routines:
    - .1 Time of Day Scheduling
    - .2 Calendar Based Scheduling
    - .3 Holiday Scheduling
    - .4 Temporary Schedule Overrides
    - .5 Optimal Start
    - .6 Optimal Stop
    - .7 Night Setback Control
    - .8 Enthalpy Switchover (Economizer)
    - .9 Peak Demand Limiting
    - .10 Temperature Compensated Duty Cycling
    - .11 CFM Tracking
    - .12 Heating/Cooling Interlock
    - .13 Hot/Cold Deck Reset
    - .14 Free Cooling
    - .15 Hot Water Reset
    - .16 Chilled Water Reset
    - .17 Condenser Water Reset
    - .18 Chiller Sequencing
- .6 History Logging:
  - .1 Each controller shall be capable of logging any system variable over user defined time intervals ranging from 1 second to 1440 minutes. Any system variables (inputs, outputs, math calculations, flags, etc.) can be logged in history. A maximum of 32767 values can be stored in each log. Each log can record either the instantaneous, average, minimum or maximum value



of the point. Logs can be automatic or manual. Logged data shall be downloadable to the Operator Workstation for long term archiving based upon user-defined time intervals, or manual command.

- .7 Alarm Management:
  - .1 For each system point, alarms can be created based on high/low limits or conditional expressions. All alarms will be tested each scan of the MCU and can result in the display of one or more alarm messages or reports.
  - .2 Up to 8 alarms can be configured for each point in the controller.
  - .3 Messages and reports can be sent to a local terminal, to the front-end workstation(s), or via modem to a remote-computing device.
  - .4 Alarms will be generated based on their priority. A minimum of 255 priority levels shall be provided.
  - .5 If communication with the Operator Workstation is temporarily interrupted, the alarm will be buffered in the MCU. When communications return, the alarm will be transmitted to the Operator Workstation if the point is still in the alarm condition.
- .8 Reporting.
  - .1 The MCU shall be able to generate user-definable reports to a locally connected printer or terminal. The reports shall contain any combination of text and system variables. Report templates shall be able to be created by users in a word processing environment. Reports can be displayed based on any logical condition or through a user command.
- .9 Use uninterruptible Power Supply (UPS) and emergency power when equipment must operate in emergency and co-ordinating mode.

## 2.2 Standalone Digital Control Units (SDCU's): (LCU's), (TCU's), (ECU's)

- .1 General:
  - .1 Standalone Digital Control Units shall provide control of HVAC and lighting. Each controller shall have its own control programs and will continue to operate in the event of a failure or communication loss to its associated MCU.
- .2 Memory:
  - .1 Control programs shall be stored in battery backed-up RAM and EPROM. Each controller shall have a minimum of 32K bytes of user RAM memory and 128K bytes of EPROM.
- .3 Communication Ports:
  - .1 SDCUs shall provide a communication port to the field bus. In addition, a port shall be provided for connection of a portable service tool to support local commissioning and parameter changes with or without the MCU online. It shall be possible from a service port on any SDCU to view, enable/disable, and modify values of any point or program on any controller on the local field bus, any MCU or any SDCU on a different field bus.
- .4 Input/Output:
  - .1 Each SDCU shall support the addition of the following types of inputs and outputs:
    - .1 Digital Inputs for status/alarm contacts.
    - .2 Counter Inputs for summing pulses from meters.
    - .3 Thermistor Inputs for measuring temperatures in space, ducts and thermowells.

- .4 Analog inputs for pressure, humidity, flow and position measurements.
- .5 Digital Outputs for on/off equipment control.
- .6 Analog Outputs for valve and damper position control, and capacity control of primary equipment.
- .5 Expandability:
  - .1 Input and output capacity shall be expandable through the use of plug-in modules. A minimum of two modules shall be added to the base SDCU before additional power is required.
- .6 Networking:
  - .1 Each SDCU will be able to exchange information on a peer to peer basis with other Standalone Digital Control Units during each field bus scan. Each SDCU shall be capable of storing and referencing global variables (on the LAN) with or without any workstations online. Each SDCU shall be able to have its program viewed and/or enabled/disabled either locally through a portable service tool or through a workstation connected to an MCU.
- .7 Indicator Lamps:
  - .1 SDCUs will have as a minimum, LED indication of CPU status, and field bus status.
- .8 Real Time Clock (RTC):
  - .1 An SDCU shall have a real time clock in either hardware or software. The accuracy shall be within 10 seconds per day. The RTC shall provide the following information: time of day, day, month, year, and day of week. Each SDCU shall receive a signal, every hour, over the network from the NCU which synchronizes all SDCU real time clocks.
- .9 Automatic Restart After Power Failure:
  - .1 Upon restoration of power, the SDCU shall automatically and without human intervention, update all monitored functions, resume operation based on current, synchronized time and status, and implement special start-up strategies as required.
- .10 Battery Back Up:
  - .1 Each SDCU shall have at least 3 years of battery back up to maintain all volatile memory.
- .11 Alarm Management:
  - .1 For each system point, alarms can be created based on high/low limits or conditional expressions. All alarms will be tested each scan of the SDCU and can result in the display of one or more alarm messages or reports.
  - .2 Up to 8 alarms can be configured for each point in the controller enabling the escalation of the alarm priority (urgency) based upon which alarm(s) is/are triggered.
  - .3 Alarm messages can be sent to a local display or to the Operator's Workstation(s).
  - .4 Alarms will be generated based on their priority. A minimum of 255 priority levels shall be provided.
  - .5 If communication with the MCU is temporarily interrupted, the alarm will be buffered in the SDCU. When communications return, the alarm will be transmitted to the NCU if the point is still in the alarm condition.

**.12 Local Control Units (LCU's):**

- .1 LCU's shall be capable of meeting the requirements of the sequence of operation found in the Execution portion of this specification and for future expansion.
- .2 LCU's shall support all the necessary point inputs and outputs as required by the sequence and operate in a standalone fashion.
- .3 LCU's shall be fully user programmable to allow for modification of the application software.
- .4 An LCD display shall be optionally available for readout of point values and to allow operators to change setpoints and system parameters.
- .5 A manual override switch shall be provided for all digital and analog outputs on the LCU. The position of the switch shall be monitored in software and available for operator displays and alarm notification.

**.13 Lighting Controller:**

- .1 Lighting controllers shall provide direct control of 20 Amp, 277 VAC lighting circuits using mechanically held, latching relays. Controllers will contain from 8 to 48 circuits per enclosure. Each controller shall also contain inputs for direct connection to light switches and motion detectors.
- .2 Each controller shall have the capability for time of day scheduling, occupancy mode control, after hour operation, alarming, and trending.

**.14 Provide multiple control functions for typical built-up and package HVAC systems, hydronic systems and electrical systems.**

**.15 Minimum of 16 I/O points of which minimum be 4 AOs, 4 AIs, 4 DIs, 4 DOs.**

**.16 Points integral to one Building System to be resident on only one controller.**

**.17 Microprocessor capable of supporting necessary software and hardware to meet specified requirements as listed in previous MCU article with following additions:**

- .1 Include minimum 2 interface ports for connection of local computer terminal.
- .2 Design so that shorts, opens or grounds on input or output will not interfere with other input or output signals.
- .3 Physically separate line voltage (70V and over) circuits from DC logic circuits to permit maintenance on either circuit with minimum hazards to technician and equipment.
- .4 Include power supplies for operation of LCU and associated field equipment.
- .5 In event of loss of communications with, or failure of, MCU, LCU to continue to perform control. Controllers that use defaults or fail to open or close positions not acceptable.
- .6 Provide conveniently located screw type or spade lug terminals for field wiring.

**.18 TERMINAL/EQUIPMENT CONTROL UNIT (TCU/ECU)**

- .1 Microprocessor capable of supporting necessary software and hardware to meet TCU/ECU functional specifications.T
- .2 TCU/ECU definition to be consistent with those defined in ASHRAE HVAC Applications Handbook section 45.

- .3 Controller to communicate directly with EMCS through EMCS LAN and provide access from EMCS OWS for setting occupied and unoccupied space temperature setpoints, flow setpoints, and associated alarm values, permit reading of sensor values, field control values (% open) and transmit alarm conditions to EMCS OWS.
- .4 TCU's shall support, but not be limited to the control of the following configurations of VAV boxes to address current requirements as described in the Execution portion of this specification, and for future expansion:
  - .1 Single Duct Cooling Only
  - .2 Single Duct Cooling with Reheat (Electric or Hot Water)
  - .3 Fan Powered (Parallel or Series)
  - .4 Dual Duct (Constant or Variable Volume)
  - .5 Supply/Exhaust
- .5 TCUs for single duct applications will come equipped with a built-in actuator for modulation of the air damper. The actuator shall have a minimum torque rating of 35 in.-lb., and contain an override mechanism for manual positioning of the damper during startup and service.
- .6 TCU's shall contain an integral velocity sensor accurate to +/- 5% of the full range of the box's CFM rating.
- .7 Each controller shall perform the sequence of operation described in Part 3 of this specification, and have the capability for time of day scheduling, occupancy mode control, after hours operation, lighting control, alarming, and trending.
- .8 TCU's shall be able to communicate with any other Standalone Digital Control Unit on the same field bus with or without communication to the MCU managing the field bus. Systems that fail to provide this (true peer-to-peer) capability will be limited to a maximum of 32 TCU's per field bus.
- .9 ECU's shall support, but not be limited to, the control of the following systems as described in the Execution portion of this specification, and for future expansion:
  - .1 Unit Ventilators
  - .2 Heat Pumps (Air to Air, Water to Water)
  - .3 Packaged Rooftops
  - .4 Fan Coils (2 or 4 Pipe)
- .10 The I/O of each ECU shall contain the sufficient quantity and types as required to meet the sequence of operation found in the Execution portion of this specification. In addition, each controller shall have the capability for time of day scheduling, occupancy mode control, after hour operation, lighting control, alarming, and trending.

## 2.3

### SOFTWARE

- .1 General Description
  - .1 The software architecture must be object-oriented in design, a true 32-bit application suite utilizing Microsoft's OLE, COM, DCOM and ODBC technologies. These technologies make it easy to fully utilize the power of the operating system to share, among applications (and therefore to the users of those applications), the wealth of data available from the EMCS.
  - .2 The workstation functions shall include monitoring and programming of all DDC controllers. Monitoring consists of alarming, reporting, graphic displays, long term data storage, automatic data collection, and operator-initiated control actions such as schedule and setpoint adjustments.
  - .3 Programming of controllers shall be capable of being done either off-line or on-line from any operator workstation. All information will be available in

graphic or text displays. Graphic displays will feature animation effects to enhance the presentation of the data, to alert operators of problems, and to facilitate location of information throughout the DDC system. All operator functions shall be selectable through a mouse.

.2 System Database

.1 The files server database engine must be Microsoft SQL Server, or another ODBC-compliant, relational database program. This ODBC (**O**pen **D**atabase **C**onnectivity)-compliant database engine allows for an owner to utilize “their” choice of database and due to it’s “open” architecture, allows an owner to write custom applications and/or reports which communicate directly with the database avoiding data transfer routines to update other applications. The system database shall contain all point configurations and programs in each of the controllers that have been assigned to the network. In addition, the database will contain all workstation files including color graphic, alarm reports, text reports, historical data logs, schedules, and polling records.

.3 User Interface

.1 The EMCS workstation software shall allow the creation of a custom, browser-style interface linked to the user that has logged into the workstation software. This interface shall support the creation of “hot-spots” that the user may link to view/edit any object in the system or run any object editor or configuration tool contained in the software. Furthermore, this interface must be able to be configured to become a user’s “PC Desktop” – with all the links that a user needs to run other applications. This, along with the Windows operating system user security capabilities, will enable a system administrator to setup workstation accounts that not only limit the capabilities of the user within the EMCS software but may also limit what a user can do on the PC and/or LAN/WAN. This might be used to ensure, for example, that the user of an alarm monitoring workstation is unable to shutdown the active alarm viewer and/or unable to load software onto the PC.

.4 User Security

.1 The software shall be designed so that each user of the software can have a unique username and password. This username/password combination shall be linked to a set of capabilities within the software, set by and editable only by, a system administrator. The sets of capabilities shall range from View only, Acknowledge alarms, Enable/disable and change values, Program, and Administer. The system shall allow the above capabilities to be applied independently to each and every class of object in the system. The system must allow a minimum of 256 users to be configured per workstation. There shall be an inactivity timer adjustable in software that automatically logs off the current operator after the timer has expired.

.5 Configuration Interface

.1 The workstation software shall use a familiar Windows Explorer™-style interface for an operator or programmer to view and/or edit any object (controller, point, alarm, report, schedule, etc.) in the entire system. In addition, this interface shall present a “network map” of all controllers and their associated points, programs, graphics, alarms, and reports in an easy to understand structure. All object names shall be alphanumeric and use Windows long filename conventions. Object names shall not be required to be unique throughout the system. This allows consistency in point naming. For example, each VAV controller can have an input called Space Temperature and a setpoint called CFM Setpoint. The VAV controller name

- shall be unique such as VAV for LAB101. Systems requiring unique object names throughout the system will not be acceptable.
- .2 The configuration interface shall also include support for template objects. These template objects shall be used as building blocks for the creation of the EMCS database. The types of template objects supported shall include all data point types (input, output, string variables, setpoints, etc.), alarm algorithms, alarm notification objects, reports, graphics displays, schedules, and programs. Groups of template object types shall be able to be set up as template subsystems and systems. The template system shall prompt for data entry if necessary. The template system shall maintain a link to all "child" objects created by each template. If a user wishes to make a change to a template object, the software shall ask the user if he/she wants to update all of child objects with the change. This template system shall facilitate configuration and programming consistency and afford the user a fast and simple method to make global changes to the EMCS.
- .6 Color Graphic Displays
    - .1 The system shall allow for the creation of user defined, color graphic displays for the viewing of mechanical and electrical systems, or building schematics. These graphics shall contain point information from the database including any attributes associated with the point (engineering units, etc.). In addition operators shall be able to command equipment or change setpoints from a graphic through the use of the mouse.
    - .2 Requirements of the color graphic subsystem include:
      - .1 SVGA, bit-mapped displays. The user shall have the ability to import AutoCAD generated picture files as background displays.
      - .2 A built-in library of animated objects such as dampers, fans, pumps, buttons, knobs, gauges, and graphs which can be "dropped" on a graphic through the use of a software configuration "wizard". These objects shall enable operators to interact with the graphic displays in a manner that mimics their mechanical equivalents found on field installed control panels. Using the mouse, operators shall be able to adjust setpoints, start or stop equipment, modify PID loop parameters, or change schedules.
      - .3 Status changes or alarm conditions must be able to be highlighted by objects changing screen location, size, color, text, blinking or changing from one display to another.
      - .4 Graphic panel objects shall be able to be configured with multiple "tabbed" pages allowing an operator to quickly view individual graphics of equipment, which make up a subsystem or system.
      - .5 Ability to link graphic displays through user defined objects, alarm testing, or the result of a mathematical expression. Operators must be able to change from one graphic to another by selecting an object with a mouse - no menus will be required.
  - .7 Automatic monitoring
    - .1 The software shall allow for the automatic collection of data and reports from any controller through either a hardwire or modem communication link. The frequency of data collection shall be completely user-configurable.
  - .8 Alarm Management
    - .1 The software shall be capable of accepting alarms directly from controllers, or generating alarms based on evaluation of data in controllers and comparing to limits or conditional equations configured through the software. Any alarm (regardless of its origination) will be integrated into the overall

- alarm management system and will appear in all standard alarm reports, be available for operator acknowledgment, and have the option for displaying graphics, or reports.
- .2 Alarm management features shall include the ability to have:
    - .1 A minimum of 255 alarm notification levels. Each notification level will establish a unique set of parameters for controlling alarm display, acknowledgment, keyboard annunciation, alarm printout and record keeping.
    - .2 Automatic logging in the database of the alarm message, point name, point value, connected controller, timestamp, username and time of acknowledgement, username and time of alarm silence (soft acknowledgement).
    - .3 Automatic printing of the alarm information or alarm report to an alarm printer or report printer.
    - .4 Playing an audible beep or audio (wav) file on alarm initiation or return to normal.
    - .5 Sending an email or alphanumeric page to anyone listed in a workstation's email account address list on either the initial occurrence of an alarm and/or if the alarm is repeated because an operator has not acknowledged the alarm within a user-configurable timeframe. The ability to utilize email and alphanumeric paging of alarms shall be a standard feature of the software integrated with the operating system's mail application interface (MAPI). No special software interfaces shall be required.
    - .6 Individual alarms shall be able to be re-routed to a workstation or workstations at user-specified times and dates. For example, a critical high temp alarm can be configured to be routed to a Facilities Dept. workstation during normal working hours (7am-6pm, Mon-Fri) and to a Central Alarming workstation at all other times.
    - .7 An active alarm viewer shall be included which can be customized for each user or user type to hide or display any alarm attributes.
    - .8 The font type and color, and background color for each alarm notification level as seen in the active alarm viewer shall be customizable to allow easy identification of certain alarm types or alarm states.
    - .9 The active alarm viewer can be configured such that an operator must type in text in an alarm entry and/or pick from a drop-down list of user actions for certain alarms. This ensures accountability (audit trail) for the response to critical alarms.
  - .9 Custom Report Generation
    - .1 The software will contain a built-in custom report generator, featuring word processing tools for the creation of custom reports. These custom reports shall be able to be set up to automatically run or be generated on demand. Each workstation shall be able to associate reports with any word processing or spreadsheet program loaded on the machine. When the report is displayed, it will automatically spawn the associated report editor such as MS Word™.
      - .1 Reports can be of any length and contain any point attributes from any controller on the network.
      - .2 The report generator will have access to the user programming language in order to perform mathematical calculations inside the

- body of the report, control the display output of the report, or prompt the user for additional information needed by the report.
- .3 It shall be possible to run other executable programs whenever a report is initiated.
  - .4 Report Generator activity can be tied to the alarm management system, so that any of the configured reports can be displayed in response to an alarm condition.
  - .5 Standard reports shall include:
    - .1 Points in each controller.
    - .2 Points in alarm.
    - .3 Disabled points.
    - .4 Overridden points.
    - .5 Operator activity report.
    - .6 Alarm history log.
    - .7 Program listing by controller with status.
    - .8 Network status of each controller
  - .2 Spreadsheet-style reports
    - .1 The software shall allow the simple configuration of row/column (spreadsheet-style) reports on any class of object in the system. These reports shall be user-configurable and shall be able to extract live (controller) data and/or data from the database. The user shall be able to set up each report to display in any text font, color and background color. In addition the report shall be able to be configured to filter data, sort data and highlight data which meets user-defined criteria.
    - .2 HTML Reporting
      - .1 The above spreadsheet-style reports shall be able to be run to an HTML template file. This feature will create an HTML "results" file in the directory of the HTML template. This directory can be shared with other computer users, which will allow those users with access to the directory to "point" their web browser at the file and view the report.
  - .10 Scheduling
    - .1 It shall be possible to configure and download from the workstation schedules for any of the controllers on the network:
      - .1 Time of day schedules shall be in a calendar style and shall be programmable for a minimum of one year in advance. Each standard day of the week and user-defined day types shall be able to be associated with a color so that when the schedule is viewed it is very easy, at-a-glance, to determine the schedule for a particular day even from the yearly view. To change the schedule for a particular day, a user shall simply click on the day and then click on the day type.
      - .2 Each schedule will appear on the screen viewable as the entire year, monthly, week and day. A simple mouse click shall allow switching between views. It shall also be possible to scroll from one month to the next and view or alter any of the schedule times.
      - .3 Schedules will be assigned to specific controllers and stored in their local RAM memory. Any changes made at the workstation will be



automatically updated to the corresponding schedule in the controller.

- .11 Programmer's Environment
  - .1 The programmer's environment will include access to a superset of the same programming language supported in the controllers. Here the programmer will be able to configure application software off-line (if desired) for custom program development, write global control programs, system reports, wide area networking data collection routines, and custom alarm management software. On the same screen as the program editor, the programming environment shall include dockable debug and watch bars for program debugging and viewing updated values and point attributes during programming. In addition a wizard tool shall be available for loading programs from a library file in the program editor.
  - .2 Saving/Reloading
    - .1 The workstation software shall have an application to save and restore field controller memory files. This application shall not be limited to saving and reloading an entire controller – it must also be able to save/reload individual objects in the controller. This allows off-line debugging of control programs, for example, and then reloading of just the modified information.
  - .3 Data Logging
    - .1 The workstation software shall have the capability to easily configure groups of data points with trend logs and display the trend log data. A group of data points shall be created by drag-and-drop method of the points into a folder. The trend log data shall be displayed through a simply menu selection. This data shall be able to be saved to file and/or printed.
  - .4 Audit Trail
    - .1 The workstation software shall automatically log and timestamp every operation that a user performs at a workstation, from logging on and off a workstation to changing a point value, modifying a program, enabling/disabling an object, viewing a graphic display, running a report, modifying a schedule, etc.

## 2.4 LEVELS OF ADDRESS

- .1 Upon operator's request, EMCS to present status of any single 'point', 'system' or point group, entire 'area', or entire network on printer or OWS as selected by operator.
  - .1 Display analog values digitally to 1 place of decimals with negative sign as required.
  - .2 Update displayed analog values and status when new values received.
  - .3 Flag points in alarm by blinking, reverse video, different colour, bracketed or other means to differentiate from points not in alarm.
  - .4 Updates to be change-of-value (COV)-driven or if polled not exceeding 2 second intervals.

## 2.5 POINT NAME SUPPORT

- .1 Controllers (MCU, LCU) to support NRC point naming convention as defined in Section 25 05 01 - EMCS: General Requirements.

## 2.6 ACCEPTABLE MANUFACTURER

- .1 Andover Continuum series of controllers.

**Part 3            Execution**

**3.1                LOCATION**

- .1            Location of Controllers to be approved by Departmental Representative.

**3.2                INSTALLATION**

- .1            Install Controllers in secure locking enclosures as indicated or as directed by Departmental Representative.
- .2            Provide necessary power from local 120V branch circuit panel for equipment.
- .3            Install tamper locks on breakers of circuit breaker panel.

**END OF SECTION**

**Part 1            General**

**1.1                SUMMARY**

.1            Section Includes:

.1            Control devices integral to the Building Energy Monitoring and Control System (EMCS): transmitters, sensors, controls, meters, switches, transducers, dampers, damper operators, valves, valve actuators, and low voltage current transformers.

**1.2                REFERENCES**

.1            American National Standards Institute (ANSI).

.1            ANSI C12.7-[1993(R1999)], Requirements for Watthour Meter Sockets.

.2            ANSI/IEEE C57.13-[1993], Standard Requirements for Instrument Transformers.

.2            American Society for Testing and Materials International, (ASTM).

.1            ASTM B148-[97(03)], Standard Specification for Aluminum-Bronze Sand Castings.

.3            National Electrical Manufacturer's Association (NEMA).

.1            NEMA 250-[03], Enclosures for Electrical Equipment (1000 Volts Maximum).

.4            Air Movement and Control Association, Inc. (AMCA).

.1            AMCA Standard 500-D-[98], Laboratory Method of Testing Dampers For Rating.

.5            Canadian Standards Association (CSA International).

.1            CSA-C22.1-[02], Canadian Electrical Code, Part 1 (19th Edition), Safety Standard for Electrical Installations.

**1.3                DEFINITIONS**

.1            Acronyms and Definitions: refer to Section 25 05 01 - EMCS: General Requirements.

**1.4                SUBMITTALS**

.1            Submit shop drawings and manufacturer's installation instructions in accordance with Section 25 05 02 - EMCS: Submittals and Review Process.

.2            Pre-Installation Tests.

.1            Submit samples at random from equipment shipped, as requested by Departmental Representative, for testing before installation. Replace devices not meeting specified performance and accuracy.

.3            Manufacturer's Instructions:

.1            Submit manufacturer's installation instructions for specified equipment and devices.

**1.5                EXISTING CONDITIONS**

.1            Cutting and Patching: as specified herein.

.2            Repair surfaces damaged during execution of Work.

- .3 Turn over to Departmental Representative existing materials removed from Work not identified for re-use.

## **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 degrees C with 10 - 90% RH (non-condensing) unless otherwise specified.
- .4 Terminations: use standard conduit box with slot screwdriver, twist on connections or connector blocks unless otherwise specified.
- .5 Transmitters and sensors to be unaffected by external transmitters including walkie talkies.
- .6 Account for hysteresis, relaxation time, maximum and minimum limits in applications of sensors and controls.
- .7 Outdoor installations: use weatherproof construction in NEMA 4 enclosures.
- .8 Devices installed in user occupied space not exceed Noise Criteria (NC) of 35. Noise generated by any device must not be detectable above space ambient conditions.

### **2.2 TEMPERATURE SENSORS**

- .1 General: except for room sensors to be resistance or thermocouple type to following requirements:
  - .1 Thermocouples: limit to temperature range of 200 degrees C and over.
  - .2 RTD's: 100 or 1000ohm at 0 degrees C (plus or minus 0.2 ohms) platinum element with strain minimizing construction, 3 integral anchored leadwires. Coefficient of resistivity: 0.00385ohms/ohm degrees C.
  - .3 Sensing element: hermetically sealed.
  - .4 Stem and tip construction: copper or type 304 stainless steel.
  - .5 Time constant response: less than three (3) seconds to temperature change of 10 degrees C.
  - .6 Immersion wells: NPS 3/4, stainless steel spring loaded construction, with heat transfer compound compatible with sensor. Insertion length 100mm as indicated.
- .2 Room temperature sensors and display wall modules.
  - .1 Temperature sensing and display wall module.
    - .1 LCD display to show space temperature and temperature setpoint.
    - .2 Buttons for occupant selection of temperature setpoint and occupied/unoccupied mode.
    - .3 Jack connection for plugging in laptop personal computer for access to zone bus.
    - .4 Integral thermistor sensing element 10,000ohm at 24 degrees C.

- .5 Accuracy 0.2 degrees C over range of 0 to 70 degrees C.
- .6 Stability 0.02 degrees C drift per year.
- .7 Separate mounting base for ease of installation.
- .2 Room temperature sensors.
  - .1 Wall mounting, in slotted type covers having brushed stainless steel finish or with plastic cover and guard as indicated.
  - .2 Element 10-50mm long RTD with ceramic tube or equivalent protection or thermistor, 10,000ohm, accuracy of plus or minus 0.2 degrees C.
- .3 Duct temperature sensors:
  - .1 General purpose duct type: suitable for insertion into ducts at various orientations, insertion length to suit duct dimensions.
  - .2 Averaging duct type: incorporates numerous sensors inside assembly which are averaged to provide one reading. Minimum insertion length 6000mm. Bend probe at field installation time to 100mm radius at point along probe without degradation of performance.
- .4 Outdoor air temperature sensors:
  - .1 Outside air type: non-corroding shield to minimize solar and wind effects, threaded fitting for mating to 13mm conduit, weatherproof construction in NEMA 4 enclosure.

## 2.3 TEMPERATURE TRANSMITTERS

- .1 Requirements:
  - .1 Input circuit: to accept 3-lead, 100 or 1000 ohm at 0 degrees C, platinum resistance detector type sensors.
  - .2 Power supply: 24V DC into load of 575ohms. Power supply effect less than 0.01 degrees C per volt change.
  - .3 Output signal: 4 - 20mA into 500ohm 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 or 1000 ohm RTD sensor: not to exceed 25mA.
  - .8 Integral zero and span adjustments.
  - .9 Temperature effects: not to exceed plus or minus 1.0% of full scale/ 50 degrees 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 degrees C to plus 50 degrees C, plus or minus 0.5 degrees C.
    - .2 0 to 100 degrees C, plus or minus 0.5 degrees C.
    - .3 0 to 50 degrees C, plus or minus 0.25 degrees C.
    - .4 0 to 25 degrees C, plus or minus 0.1 degrees C.
    - .5 10 to 35 degrees C, plus or minus 0.25 degrees C.

## 2.4 DIFFERENTIAL PRESSURE TRANSMITTERS

### .1 Requirements:

- .1 Internal materials: suitable for continuous contact with industrial standard instrument air, compressed air, water, steam, as applicable.
- .2 Output signal: 4 - 20mA into 500ohm maximum load.
- .3 Output variations: less than 0.2% full scale for supply voltage variations of plus or minus 10%.
- .4 Combined non-linearity, repeatability, and hysteresis effects: not to exceed plus or minus 0.5% of full scale output over entire range.
- .5 Integral zero and span adjustment.
- .6 Temperature effects: not to exceed plus or minus 1.5% full scale/ 50 degrees C.
- .7 Over-pressure input protection to at least twice rated input pressure.
- .8 Output short circuit and open circuit protection.
- .9 Unit to have 12.5 mm N.P.T. conduit connection. Enclosure to be integral part of unit.

## 2.5 STATIC PRESSURE SENSORS

### .1 Requirements:

- .1 Multipoint element with self-averaging manifold.
  - .1 Maximum pressure loss: 160Pa at 10 m/s. (Air stream manifold).
- .2 Accuracy: plus or minus 1% of actual duct static pressure.

## 2.6 STATIC PRESSURE TRANSMITTERS

### .1 Requirements:

- .1 Output signal: 4 - 20mA linear into 500ohm maximum load.
- .2 Calibrated span: not to exceed 150% of duct static pressure at maximum flow.
- .3 Accuracy: 0.4% of span.
- .4 Repeatability: within 0.5% of output.
- .5 Linearity: within 1.5% of span.
- .6 Deadband or hysteresis: 0.1% of span.
- .7 External exposed zero and span adjustment.
- .8 Unit to have 12.5 mm N.P.T. conduit connection. Enclosure to be integral part of unit

## 2.7 CURRENT SENSING RELAYS

### .1 Requirements:

- .1 Suitable to detect belt loss or motor failure.
- .2 Trip point adjustment, output status LED.
- .3 Split core for easy mounting.
- .4 Induced sensor power.
- .5 Relay contacts: capable of handling 0.5amps at 30 VAC / DC. Output to be NO solid state.
- .6 Suitable for single or 3 phase monitoring. For 3-Phase applications: provide for discrimination between phases.
- .7 Adjustable latch level.

## **2.8 ELECTRONIC / ELECTRIC VALVE ACTUATORS**

- .1 Requirements:
  - .1 Construction: steel, cast iron, aluminum.
  - .2 Control signal: 0-10V DC or 4-20 mA DC.
  - .3 Positioning time: to suit application. 90sec maximum.
  - .4 Fail to normal position as indicated.
  - .5 Scale or dial indication of actual control valve position.
  - .6 Size actuator to meet requirements and performance of control valve specifications.
  - .7 For interior and perimeter terminal heating and cooling applications floating control actuators are acceptable.
  - .8 Minimum shut-off pressure: refer to control valve schedule.

## **2.9 WIRING**

- .1 In accordance with Section 26 27 10 - Modular Wiring System and 26 27 26 - Wiring Devices.
- .2 For wiring under 70 volts use FT6 rated wiring where wiring is not run in conduit. Other cases use FT4 wiring.
- .3 Wiring must be continuous without joints.
- .4 Sizes:
  - .1 Field wiring to digital device: #18AWG or 20AWG stranded twisted pair.
  - .2 Analog input and output: shielded #18 minimum solid copper or #20 minimum stranded twisted pair.

## **Part 3 Execution**

### **3.1 INSTALLATION**

- .1 Install equipment, components so that manufacturer's and CSA labels are visible and legible after commissioning is complete.
- .2 Install field control devices in accordance with manufacturers recommended methods, procedures and instructions.
- .3 Temperature transmitters, humidity transmitters, current-to-pneumatic transducers, solenoid air valves, controllers, relays: install in NEMA I enclosure or as required for specific applications. Provide for electrolytic isolation in cases when dissimilar metals make contact.
- .4 Support field-mounted panels, transmitters and sensors on pipe stands or channel brackets.
- .5 Fire stopping: provide space for fire stopping in accordance with Section 07 84 00 - Firestopping. Maintain fire rating integrity.
- .6 Electrical:
  - .1 Complete installation in accordance with Section CSA C22.1-09, Canadian Electrical Code, Part 1 (21<sup>st</sup> Edition), Safety Standard for Electrical Installations.
  - .2 Modify existing starters to provide for EMCS as indicated in I/O Summaries and as indicated.



- .3 Refer to electrical control schematics included as part of control design schematics [in Section 25 90 01 - EMCS: Site Requirements Applications and Systems Sequences of Operation. Trace existing control wiring installation and provide updated wiring schematics including additions, deletions to control circuits for review by [Departmental Representative before beginning Work.
- .4 Terminate wires with screw terminal type connectors suitable for wire size, and number of terminations.
- .5 All wiring within enclosures shall be neatly bundled and anchored to permit access and prevent restriction to devices and terminals.
- .6 All wiring and cabling, including that within factory-fabricated panels shall be labelled at each end within 5 cm (2in.) of termination with the EMCS point name.
- .7 Install Low Voltage Control Wiring in EMT in the following circumstances:
  - .1 Mechanical rooms, electrical rooms, service rooms and exposed wiring – All wiring in mechanical, electrical, service rooms and exposed wiring – or where subject to mechanical damage – shall be in EMT.
  - .2 Communication wiring – Communication wiring to be installed in EMT. Communication wiring to mean all wiring linking building controllers, field panels and Operator Work Station(s).
  - .3 Power Wiring – Wiring supplying power to all levels of controllers to be in EMT.
  - .4 Building controllers, field panels and OWS(s) – All wiring between building controllers, field panels and OWS(s) to be installed in EMT. Field panels to mean all panels not considered building controllers. Ex: panels with I/P transducers.
- .8 EMT Installation:
  - .1 EMT sizes to suit wiring requirements and to allow for future expansion capabilities specified for systems.
  - .2 Maximum EMT fill not to exceed [40] %.
  - .3 Minimum EMT size is 1.905 cm ( $\frac{3}{4}$  in.) unless its to final device where 1.27 cm ( $\frac{1}{2}$  in.) would be acceptable.
  - .4 Include one pull string in each EMT 1.905 cm ( $\frac{3}{4}$  in.) or larger.
  - .5 Wherever possible, all wiring in EMT shall be installed as continuous lengths, with no splices permitted between termination points or junction boxes.
  - .6 Conceal all EMT, except within mechanical, electrical, or service rooms. Install EMT to maintain a minimum clearance of 15 cm (6 in.) from high-temperature equipment (e.g. steam pipes or flues)
  - .7 Flexible metal conduits and liquid-tight, flexible metal conduits shall not exceed 0.3048 m (1 ft) in length and shall be supported at each end. Flexible metal conduit less than 1.27 cm ( $\frac{1}{2}$  in.) electrical trade size shall not be used. In areas exposed to moisture, including chiller and boiler rooms, liquid-tight, flexible metal conduits shall be used.
  - .8 EMT must be adequately supported, properly reamed at both ends, and left clean and free of obstructions. EMT sections shall be joined with steel set-screw connectors and couplings for EMT. Terminations must be made with fittings at boxes, and ends not terminating in boxes shall have bushings installed.
  - .9 Design drawings do not show conduit layout.
  - .10 Do not run exposed conduits in normally occupied spaces unless otherwise indicated or unless impossible to do otherwise. Departmental Representative to review before starting Work.

- .7 Communication Wiring:
  - .1 The contractor shall adhere to the items in the "Electrical" article in Part 3 of the specification Section 25 30 02 EMCS: Field Control Devices.
  - .2 Do not install communication wiring in raceway and enclosures containing Class 1 wiring.
  - .3 Maximum pulling, tension, and bend radius for cable installation, as specified by the cable manufacturer, shall not be exceeded during the installation.
  - .4 Contractor shall verify the integrity of the entire network following the cable installation. Use appropriate test measures for each particular cable.
  - .5 When a cable enters or exits a building, a lightning arrestor must be installed between the lines and ground. The lightning arrestor shall be installed according to the manufacturer's instructions.
  - .6 All runs of communication wiring shall be unspliced length when that length is commercially available.
  - .7 All communication wiring shall be labelled to indicate origination and destination data.

### 3.2 TEMPERATURE AND HUMIDITY SENSORS

- .1 Stabilize to ensure minimum field adjustments or calibrations.
- .2 Readily accessible and adaptable to each type of application to allow for quick easy replacement and servicing without special tools or skills.
- .3 Outdoor installation:
  - .1 Protect from solar radiation and wind effects by non-corroding shields.
  - .2 Install in NEMA 4 enclosures.
- .4 Duct installations:
  - .1 Do not mount in dead air space.
  - .2 Locate within sensor vibration and velocity limits.
  - .3 Securely mount extended surface sensor used to sense average temperature.
  - .4 Thermally isolate elements from brackets and supports to respond to air temperature only.
  - .5 Support sensor element separately from coils, filter racks.
- .5 Averaging duct type temperature sensors.
  - .1 Install averaging element horizontally across the ductwork starting 300 mm from top of ductwork. Each additional horizontal run to be no more than 300 mm from one above it. Continue until complete cross sectional area of ductwork is covered. Use multiple sensors where single sensor does not meet required coverage.
  - .2 Wire multiple sensors in series for low temperature protection applications.
  - .3 Wire multiple sensors separately for temperature measurement.
  - .4 Use software averaging algorithm to derive overall average for control purposes.

- .6 Thermowells: install for piping installations.
  - .1 Locate well in elbow where pipe diameter is less than well insertion length.
  - .2 Thermowell to restrict flow by less than 30%.
  - .3 Use thermal conducting paste inside wells.

### **3.3 PRESSURE AND DIFFERENTIAL PRESSURE SWITCHES AND SENSORS**

- .1 Install isolation valve and snubber on sensors between sensor and pressure source where code allows.
  - .1 Protect sensing elements on steam and high temperature hot water service with pigtail syphon between valve and sensor.

### **3.4 IDENTIFICATION**

- .1 Identify field devices in accordance with Section 25 05 54 - EMCS: Identification.

### **3.5 TESTING AND COMMISSIONING**

- .1 Calibrate and test field devices for accuracy and performance in accordance with Section 25 01 11 - EMCS: Start-up, Verification and Commissioning.

**END OF SECTION**

**Part 1 General**

**1.1 SUMMARY**

- .1 Section Includes:
  - .1 At minimum detailed narrative description of Sequence of Operation of each system including ramping periods and reset schedules.
    - .1 System Diagrams consisting of the following; EMCS System Architectural Diagram, Control Design Schematic for each system (as viewed on OWS), System flow diagram for each system with electrical ladder diagram for MCC starter interface.
    - .2 Input/Output Point Summary Tables for each system.
    - .3 Sequence of Operations.

**1.2 CONTROL DESIGN SCHEMATICS (CDS)**

- .1 Prepare control schematic drawings for incorporation into the specifications, using a drawing format approved by NRC.
- .2 Ensure that the control schematic drawings are also suitable for use as graphic displays in the Operator Work Stations.
- .3 On control schematic drawings used as graphic displays in the OWS, indicate the physical location i.e. the building room number, of each system and major piece of equipment.
- .3 Provide an overall EMCS Architecture Schematic, showing all systems, all network communication devices, all Operator Work Stations (OWS), etc.
- .4 Prepare an electrical wiring schematic for each system and for each motor linked to the EMCS installation. Preferably these schematics shall be regrouped with the Control Design Schematic CDS-xx of the system they represent. They must form part of the tender documents.
- .5 All components in the electrical wiring schematic shall match the Input/Output Point Summary Table.
- .6 When the electrical wiring schematic is completed, coordinate closely with mechanical and electrical Divisions to eliminate duplication and ensure full completeness.
- .7 Prepare a separate control design schematic for each system and sub-system in the entire facility, showing schematics of all basic components forming part of the system. For example, for a typical HVAC system the CDS must show mixing chambers (plenums), dampers, filters, coils, control valves, circulating pumps, humidifiers, air washers and pumps, fans, variable inlet vanes, variable speed drives, air flow stations, location of relays and contacts for digital output points, etc.
- .8 The CDS must also show the relative location of all sensors and controlled devices.
- .9 The unique identifier for each system, point and type of point (AO, AI, DO, DI) must appear on each CDS.
- .10 Include pertinent additional operational information points as required such as calculated, duplicate or virtual points as well as fail safe position of output points.

- .11 Control Design Schematics and Input Output Point Summary Tables should form part of Section 25 90 01.

### 1.3 INPUT / OUTPUT POINT SUMMARY TABLES

- .1 The I/O Point Summary shall supplement the specifications. They must provide all details not included in the sequences of operation. A legend describing symbols and abbreviations used throughout the I/O Point Summary must be produced for each project.
- .2 Boxes which are irrelevant to the project shall not be left blank but shall be filled in with a symbol such as an oblique or an "x" to indicate that no entry is required.
- .3 If, during the design phase, information is unavailable to accurately complete this schedule, the unfilled boxes shall be completed by the Designer with values that are estimated to most closely represent the true value. These values must, however, be identified as such in the table. Certain values that absolutely cannot be defined at design time (such as low amperage settings for adjustable current relays used to confirm motor status) may be identified as field (F) assignable at TAB/Commissioning time.
- .4 Point naming convention to follow the NRC point naming convention outlined in section 25 05 01 – EMCS Identification.

### 1.4 SEQUENCE OF OPERATIONS

- .1 Write a detailed sequence of operation based on the preliminary sequence of operations attached to this specification, and on the drawings to describe the functioning of the system including pertinent details relating to the intended control concept and, interactions with other systems. A soft copy in Word format of the sequence must be available for use by the controls contractor. The sequence must detail conditions in the following modes:
- .1 Stopped mode.
  - .2 Start-up process.
  - .3 Normal operation.
  - .4 Operation under emergency conditions (when applicable).
  - .5 Emergency power mode (when applicable).

The following is a sample sequence used to demonstrate the required format:

#### **M-36 KELVIN ROOM FORCE FLOW UNIT HEATER OPERATION 36UNH27 and 36UNH28**

##### ***General:***

The force flow unit heaters 36UNH27 and 36UNH28 consist of a concealed unit housing a hot water heating coil and 3-speed supply fan connected to distribution ductwork for perimeter heating in the Kelvin Room. The heating valve and 3-speed fan shall modulate to maintain room temperature setpoint.

##### ***Stopped Mode:***

When the system is stopped the 3-speed supply fan is stopped and the heating valve is closed.

##### ***Start-Up Mode:***

1. Force flow unit shall be started by automatic start/stop scheduled program to maintain room temperature setpoint.

2. A current sensor shall be installed on the load side of the supply fan. The DDC system uses the sensor to confirm status of the fan and generate an alarm if status deviates from DDC start-stop control.

**Normal Operation:**

1. **Winter Mode:** Heating control valve shall modulate to maintain room temperature setpoint. The fan speed will be kept in low speed. However, fan speed can be overridden by OWS or Client via smart stat. If fan speed is manual overridden to low, medium or high speed it will return to automatic mode once occupancy flag is vacant.
2. **Automatic Mode:** Heating control valve shall modulate based on room temperature. Fan speed is controlled via two setpoints, FANMEDSPD (1 DEG) and FANHIGHSPD (2 DEG). If room temperature falls below FANMEDSPD the fan will cycle to medium speed. If room setpoint falls below FANHIGHSPD fan will cycle to high speed. Fan shall cycle back to low speed once room temperature setpoint is achieved.
3. **Power Failure:** On a return to normal power following a power failure, the system will be re-started automatically, if scheduled.

<b>Part 2</b>	<b>Products</b>
<b>2.1</b>	<b>NOT USED</b>
.1	Not Used.

<b>Part 3</b>	<b>Execution</b>
<b>3.1</b>	<b>NOT USED</b>
.1	Not Used.

**END OF SECTION**

**1 REFERENCES**

- .1 Perform all work to meet or exceed the requirements of the Canadian Electrical Code, CSA Standard C22.1 - (latest edition).
- .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 Do overhead and underground systems in accordance with CSA C22.3 except where specified otherwise.
- .4 Where requirements of this specification exceed those of above mentioned standards, this specification shall govern.
- .5 Notify the NRC Departmental Representative as soon as possible when requested to connect equipment supplied by NRC which is not CSA approved.
- .6 Refer to Sections 00 10 00 & 0015 45.

**2 PERMITS AND FEES**

- .1 Submit to Electrical Inspection Department 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 START-UP**

- .1 Instruct the NRC Departmental Representative and operating personnel in the operation, care and maintenance of equipment supplied under this contract.

**4 INSPECTION AND FEES**

- .1 Furnish a Certificate of Acceptance from the Authorized Electrical Inspection Department on completion of work.
- .2 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.
- .3 Pay all fees required for inspections.

**5 FINISHES**

- .1 Shop finish metal enclosure surfaces by removal of rust and scale, cleaning, application of rust resistant primer inside and outside, and at least two coats of finish enamel.
  - .1 Outdoor electrical equipment "equipment green" finish to EEMAC Y1-1-1955.
  - .2 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.

## **6 ACOUSTICAL PERFORMANCE**

- .1 In general provide equipment producing minimal sound levels in accordance with the best and latest practices established by the electrical industry.
- .2 Do not install any device or equipment containing a magnetic flux path metallic core, such as gas discharge lamp ballasts, dimmers, solenoids, etc., which are found to produce a noise level exceeding that of comparable available equipment.

## **7 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 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 switches and light fixtures are the only exceptions for electrical equipment identification (except as noted in 7.13 below). They are not to be identified.
- .3 Identify with lamicoïd 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 lamicoïd nameplates to be approved by the NRC Departmental Representative prior to fabrication.
- .6 Provide two sets of lamicoïd nameplates for each piece of equipment; one in English and one in French.
- .7 Lamicoïd 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 Lamicoïd nameplates shall be rigid lamicoïd, 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 lamicoïd nameplates, mount nameplates using two-sided tape.
- .11 For all exterior lamicoïd 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 lamicoïd nameplates to be 3.7 mm (3/16") diameter to allow for expansion of lamicoïd 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 lamicoïd 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.

## **8 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.

## **9 CONDUIT AND CABLE IDENTIFICATION**

- .1 Apply red paint to the covers of junction boxes and condulets of fire alarm conduits.
- .2 Apply yellow paint to the covers of junction boxes and condulets of emergency power circuits.
- .3 Apply blue paint to the covers of junction boxes and condulets of voice/data cables.

**10 MANUFACTURER'S & APPROVALS 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.

**11 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.

**12 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.

**13 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.

**14 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.

**15 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.

**16 COORDINATION OF PROTECTIVE DEVICES**

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

**17 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.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED WORK SPECIFIED ELSEWHERE**

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

**1.2 MATERIALS**

- .1 Provide only new equipment and materials, without blemish or defect, bearing Canadian Standards Association or Authorized Electrical Inspection Department labels, and subject to the approval of the NRC Departmental Representative.
- .2 After a contract is awarded, utilize alternative methods and/or materials only after receiving the NRC Departmental Representative's approval.

**Part 2 Products**

**2.1 BUILDING WIRES AND GENERAL REQUIREMENTS**

- .1 Conductor material for branch circuit wiring and grounding:
  - .1 Stranded copper.
  - .2 Neutral wire: continuous throughout its length without breaks.
  - .3 Separate insulated green grounding conductors in all electrical conduits.
  - .4 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.
  - .5 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 TW 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.
  - .6 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.
  - .7 Use stranded wire no smaller than No. 12 AWG for lighting and power and no smaller than No. 16 AWG for control wiring.
  - .8 Conductors shall be soft copper properly refined and tinned having a minimum conductivity of 98%.

**Part 3 Execution**

**3.1 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.

**END OF SECTION**

**Part 1           General**

**1.1           RELATED WORK SPECIFIED ELSEWHERE**

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

**1.2           MATERIALS**

- .1       Provide only new equipment and materials, without blemish or defect, bearing Canadian Standards Association or Authorized Electrical Inspection Department labels, and subject to the approval of the NRC Departmental Representative.
- .2       After a contract is awarded, utilize alternative methods and/or materials only after receiving the NRC Departmental Representative's approval.

**Part 2           Products**

**2.1           WIRE AND BOX CONNECTORS**

- .1       Pressure type wire connectors sized to fit conductors.

**2.2           WIRING TERMINATIONS**

- .1       Provide first grade wire and cable connectors suitable for the service on which they are used and install them in accordance with the latest trade practice.
- .2       Provide high quality extruded copper-free aluminium (0.4% or less) connectors for single and multi conductor cable. Steel and then zinc plated connectors for multi conductor cables.
- .3       When used in hazardous area, connectors should be certified for such location in Class, Division and Group.
- .4       For large conductor sizes, use bolted or compression solderless type connectors.
- .5       Use high temperature connectors and insulation on all connections of high temperature conductors.
- .6       Where connector types are called for on the drawings or in the specification, do not use other types.
- .7       Lugs, terminals, screws used for termination of wiring to be suitable for copper conductors.
- .8       For fire alarm wiring refer to Section 28 31 00.

**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 C22.2No.41].

**END OF SECTION**

**Part 1            General**

**1.1                RELATED WORK SPECIFIED ELSEWHERE**

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

**1.2                MATERIALS**

- .1            Provide only new equipment and materials, without blemish or defect, bearing Canadian Standards Association or Authorized Electrical Inspection Department labels, and subject to the approval of the NRC Departmental Representative.
- .2            After a contract is awarded, utilize alternative methods and/or materials only after receiving the NRC Departmental Representative's approval.

**Part 2            Products**

**2.1                FITTINGS**

- .1            Fittings: manufactured for use with conduit specified. Coating: same as conduit.
- .2            Fittings for liquid-tight flexible conduits shall be liquid-tight connectors.
- .3            Provide expansion couplings for all conduits running in slabs through expansion joints. These shall be the type approved for use in concrete with a bonding conductor.

**2.2                OUTLET BOXES**

- .1            Size boxes in accordance with CSA-C22.
- .2            Unless otherwise specified, provide galvanized steel outlet boxes at least 40mm (1-1/2") deep, single or ganged style, of proper size to accommodate devices used and shall be equipped with covers as necessary of the type designed for the specified fittings. Pull boxes shall be steel and shall be galvanized or painted to prevent rusting. For lighting fixture outlets, use 100mm (4") octagon boxes.
- .3            Equip with plaster rings for flush mounting devices in finished walls.
- .4            Blank cover plates for boxes without wiring devices.
- .5            Equip with centre fixture studs for light fixtures.
- .6            Use cast boxes where indicated and for surface mounted wiring. In areas above hung ceilings where appearance is not significant, pressed steel surface boxes may be used.
- .7            Supply all outlet boxes and pull boxes sized according to code requirements unless specified otherwise on the drawings.

**2.3                SUPPORT HARDWARE**

- .1            Use 10mm (3/8") threaded rod for suspended unistrut and conduit.



- .2 Unless otherwise specified, use 41mm x 41mm (1-5/8" x 1-5/8") galvanized steel unistrut for conduit support systems.

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Install outlet boxes as follows:
  - .1 Support boxes independently of connecting conduits.
  - .2 Make necessary mounting adjustments to the outlet to match interior finish.
  - .3 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of construction material.
  - .4 Where more than one conduit enters a switch or receptacle box on the same side, provide a 100mm (4") minimum square box with a suitable plaster ring.
  - .5 Location and appearance to be to the NRC Departmental Representative's approval.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED WORK SPECIFIED ELSEWHERE**

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

**1.2                MATERIALS**

- .1            Provide only new equipment and materials, without blemish or defect, bearing Canadian Standards Association or Authorized Electrical Inspection Department labels, and subject to the approval of the NRC Departmental Representative.
- .2            After a contract is awarded, utilize alternative methods and/or materials only after receiving the NRC Departmental Representative's approval.

**Part 2            Products**

**2.1                RACEWAYS**

- .1            Conduit:
  - .1            Each length of conduit to be new and bear the CSA Stamp of Approval.
  - .2            Conduit, unless otherwise noted, to be EMT, no smaller than 12mm (1/2").
- .2            Bushings and Connectors:
  - .1            Insulated type, with the insulation an integral part of the fitting.
- .3            Conduit Fastening:
  - .1            One hole malleable iron straps to secure surface conduits. Two hole straps for conduits larger than 50mm (2").
  - .2            Beam clamps to secure conduits to exposed steel work.
  - .3            Channel type supports for two or more conduits.
- .4            Pull Cord:
  - .1            Polypropylene cord in empty conduit.
- .5            Unless specifically called for on the drawings, do not use flexible conduits but it is recognized that there may be applications where this material will be useful, such as equipment connections, etc. In such cases, obtain permission for its use from the NRC Departmental Representative. For tender purposes, assume that flexible conduits will not be permitted unless specifically called for on the drawings or equipment specifications. All flexible conduits for vapour-tight applications shall be liquid-tight flexible conduits (seal-tight).
- .6            Provide expansion couplings for all conduits running in slabs through expansion joints. These shall be the type approved for use in concrete with a bonding conductor.

**2.2                SUPPORT HARDWARE**

- .1            Use 10mm (3/8") threaded rod for suspended unistrut and conduit.

- .2 Unless otherwise specified, use 41mm x 41mm (1-5/8" x 1-5/8") galvanized steel unistrut for conduit support systems.

### **Part 3 Execution**

#### **3.1 RACEWAYS**

- .1 Install raceways as follows:
  - .1 Rigidly supported.
  - .2 Workmanlike manner.
  - .3 Maintain maximum headroom.
  - .4 Concealed in finished area.
  - .5 Surface-mounted in open area.
  - .6 Do not pass conduits through structural members except as indicated.
  - .7 Parallel to or at right angles to the building lines.
  - .8 Thoroughly ream all conduits at ends and terminate with appropriate locknuts and bushings.
  - .9 Cause minimum interference in spaces through which they pass.
  - .10 Plug or cap conduit during construction to protect from dust, dirt or water.
  - .11 Unless specifically indicated on drawings or with the permission of the NRC Departmental Representative, do not cast conduits in concrete.
  - .12 Dry conduits out before installing wire.
  - .13 Mechanically bend steel conduit larger than 22 mm (3/4") diameter. Bend conduit cold.
  - .14 Do not cut or modify prefabricated bends.
  - .15 PVC conduit as indicated.
  - .16 Function and appearance to be to the NRC Departmental Representative's approval.
  - .17 Seal conduit and cable openings in fire- rated walls and floors with an approved fire stop material.
  - .18 Seal conduit and cable openings in exterior walls with a weatherproof silicone sealant.
  - .19 Paint exposed conduits and boxes to match existing wall / ceiling.

**END OF SECTION**

**Part 1            General**

**1.1                SHOP DRAWINGS AND PRODUCT DATA**

- .1        Submit shop drawings and product data in accordance with Section 00 10 00.
- .2        Submit stamped engineered drawings for structures supporting transformers on walls or other structures other than the floor.

**1.2                IDENTIFICATION**

- .1        Identification as per Section 26 05 00.

**Part 2            Products**

**2.1                DISCONNECT SWITCHES, FUSED AND NON-FUSED**

- .1        Fusible and non-fusible disconnect switches in EEMAC Enclosure 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.
- .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, Cutler-Hammer, Siemens.

**2.2                GROUNDING**

- .1        Insulated grounding conductors in accordance with Section 26 05 00.
- .2        Compression connectors for grounding to equipment provided with lugs.

**2.3                MOULDED CASE CIRCUIT BREAKER**

- .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 multiple 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 the value of current reaches 10 times their setting.
- .5 Circuit breaker and panel to be of same manufacturer.
- .6 Circuit breakers minimum rating: 10K for 120/240V and 25K for 600/347V or greater if indicated.
- .7 Standard of acceptance: Square D, Cutler-Hammer, Siemens.

**Part 3 Execution**

**3.1 DISCONNECT SWITCHES**

- .1 Install disconnect switches complete with fuses as indicated.

**3.2 GROUNDING**

- .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 Soldered joints not permitted.

**3.3 MOULDED CASE CIRCUIT BREAKERS**

- .1 Install circuit breakers as indicated.

**END OF SECTION**

**Part 1           General**

**1.1            MATERIALS**

- .1    Provide only new equipment and materials, without blemish or defect, bearing Canadian Standards Association or Authorized Electrical Inspection Department labels, and subject to the approval of the NRC Departmental Representative.
- .2    After a contract is awarded, utilize alternative methods and/or materials only after receiving the NRC Departmental Representative's approval.

**1.2            SHOP DRAWINGS AND PRODUCT DATA**

- .1    Submit shop drawings and product data in accordance with Section 00 10 00.

**1.3            IDENTIFICATION**

- .1    Identification as per Section 26 05 00.

**Part 2           Products**

**2.1            WIRING DEVICES**

- .1    Switches:
  - .1    Specification grade, shallow body, designed to withstand high inductive fluorescent loads CSA C22.2 No. 55.
  - .2    Number of poles as indicated.
  - .3    Captive mounting screws, quiet safe mechanical action with rust-proofed mounting strap and silver alloy contact points.
  - .4    Toggle actuated, colour white unless otherwise indicated.
  - .5    Brass screw terminals rated 20 AMP at 125 volt.
  - .6    Standard of acceptance: Hubbell, Leviton.
- .2    Dimming Switches:
  - .1    0-10VDC, suitable for use with installed light fixture.
  - .2    Suitable for use in "3-way" configuration.
  - .3    Standard of acceptance: Philips SR3W or equivalent approved by NRC Departmental Representative.
- .3    Receptacles:
  - .1    Duplex type, CSA type 5-15R, 125 volt, 15A, U ground, specification grade with the following features:
    - .1    Flush type with parallel blade slots.
    - .2    Double-wiping contacts.
    - .3    Double-grounding terminals.
    - .4    Break-off feature for separate feeds.

- .5 One piece body, colour white unless otherwise indicated.
- .2 Special receptacles with ampacity and voltage as indicated.
- .3 Receptacles of one manufacturer throughout the project.
- .4 Cover Plates:
  - .1 Cover plates for wiring devices.
  - .2 Smooth white plastic for wiring devices mounted in flush-mounted outlet box.
  - .3 Sheet metal cover plates for wiring devices mounted in surface-mounted outlet box.
  - .4 Weatherproof covers as indicated.
  - .5 Multi-outlet covers as indicated.
- .5 Splitters, Junction Boxes & Cabinets:
  - .1 Sheet metal enclosure, welded corners and formed cover, provided as required.

### **Part 3 Execution**

#### **3.1 LOCATION OF OUTLETS**

- .1 The number and general location of outlets for lighting, power, telephones, etc., are to be as shown on the drawings. Install all outlets accurately and uniformly with respect to building details. When centering outlets, make allowance for overhead pipes, ducts, etc. and for variations in wall or ceiling finish, window trim, etc. Reinstall incorrectly installed outlets at no cost to the Owner. Make field power and control connections as indicated.
- .2 The location of all outlets as shown on the plans are approximate and are subject to change, up to 3m (10') without extra cost or credit provided the information is given prior to the installation of the outlet.
- .3 Unless otherwise specified, locate light switches on latch side of doors. Determine the direction of all door swings from the architectural drawings or on site, not from the electrical drawings.

#### **3.2 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 indicated verify before proceeding with installation.
- .3 Generally, locate outlets as follows: (except those otherwise shown on the drawings):
  - .1 Local switches 1.2m (3'-11") to centreline.
  - .2 Wall receptacles 400mm (1'-4") to centreline.
  - .3 Telephone and data communications outlet 400mm (1'-4") to centreline.

### **3.3 WIRING DEVICES**

- .1 Install wiring devices as follows:
  - .1 Where more than one local device is shown at one location, they are to be set under one cover plate.
  - .2 Install single throw switches with handle in "up" position when switch closed.
  - .3 Devices in gang type outlet box when more than one device is required in one location.
  - .4 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
  - .5 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.
  - .6 Install metal barriers where required.
  - .7 Remove insulation carefully from ends of conductors and connect wiring as required.
  - .8 Bond and ground as required.

### **3.4 SPLITTERS AND DEVICES**

- .1 Installation of splitters, junction boxes, pull boxes & cabinets as follows:
  - .1 Mount plumb, true and square to the building lines.
  - .2 Install in inconspicuous but accessible locations.
  - .3 Install pull boxes so as not to exceed 30 m (100') of conduit run between boxes or as indicated.

**END OF SECTION**



**Part 1 General**

**1.1 MATERIALS**

- .1 Provide only new equipment and materials, without blemish or defect, bearing Canadian Standards Association or Authorized Electrical Inspection Department labels, and subject to the approval of the NRC Departmental Representative.
- .2 After a contract is awarded, utilize alternative methods and/or materials only after receiving the NRC Departmental Representative's approval.

**1.2 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with Section 00 10 00.
- .2 Submit complete photometric data prepared by independent testing laboratory for luminaires where specified, for review by NRC Departmental Representative.

**Part 2 Products**

**2.1 FINISHES**

- .1 Baked enamel finish.
  - .1 Metal surfaces of luminaire housing and reflectors finished with high gloss powder coated baked enamel applied after fabrication to give smooth uniform appearance, free from pinholes or defects.

**2.2 METAL SURFACES**

- .1 Metal surfaces to be minimum 20 gauge steel.

**2.3 LUMINAIRES**

- .1 LED:
  - .1 Type A:
    - .1 120V 610mm x 1219mm, LED troffer, suitable for recessed mounting in T-bar ceiling.
    - .2 5-year warranty.
    - .3 Suitable for dimming.
    - .4 Removable LED boards and driver for ease of service/replacement.
    - .5 Rated to deliver L70 performance for 50,000 hours.
    - .6 3500k colour temperature, 82 CRI, minimum 4700 lumen output.
    - .7 Standard of acceptance: Lithonia 2GTL-4-48L-LP835-NX, Philips Day-brite 2LTG47L835-4-21-UNV-CM-DIM or equivalent approved by the NRC Departmental Representative.
  - .2 Type B:

- .1 120V 610mm x 1219mm, LED troffer, suitable for recessed mounting in T-bar ceiling.
  - .2 5-year warranty.
  - .3 Removable LED boards and driver for ease of service/replacement.
  - .4 Rated to deliver L70 performance for 50,000 hours.
  - .5 3500k colour temperature, 82 CRI, minimum 4000 lumen output.
  - .6 Standard of acceptance: Lithonia 2GTL-4-40L-LP835, Philips Day-brite 2LTG40L835-4-21-UNV-CM or equivalent approved by the NRC Departmental Representative.
- .3

### **Part 3 Execution**

#### **3.1 INSTALLATION**

- .1 Supply and install all lighting fixtures complete with lamps, switches, supports, etc., to provide a complete working lighting system.
- .2 Locate and install luminaires as indicated.

#### **3.2 LUMINAIRE SUPPORTS**

- .1 For suspended ceiling installations support each luminaire, including exit lights and pot lights, independently of the ceiling support system with separate chains at each end. No. 80 steel sash chain minimum.
- .2 Unless otherwise specified support fluorescent luminaires mounted in continuous rows once every 3.6 m (12').

#### **3.3 WIRING**

- .1 Connect luminaires to lighting circuits directly for exit fixtures and exterior floodlights.

#### **3.4 LUMINAIRE ALIGNMENT**

- .1 Align luminaires mounted in continuous rows to form a straight uninterrupted line.
- .2 Align luminaires mounted individually parallel or perpendicular to building grid lines as shown on drawing.

**END OF SECTION**

**Part 1           General**

**1.1               RELATED WORK SPECIFIED ELSEWHERE**

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

**1.2               MATERIALS**

- .1           Provide only new equipment and materials, without blemish or defect, bearing Canadian Standards Association or Authorized Electrical Inspection Department labels, and subject to the approval of the NRC Departmental Representative.

**Part 2           Products**

**2.1               MATERIALS**

- .1           Raceways: Minimum 19mm (3/4") EMT larger sizes as indicated on drawing.
- .2           Tele-Power poles/Jiffy poles: type as indicated on drawings.
- .3           Floor mounted outlets: type as indicated on drawings.

**Part 3           Execution**

**3.1               CONDUIT SYSTEM**

- .1           Run conduit from wall outlets to 150mm (6") above false ceiling or to a point indicated on drawings.
- .2           Install nylon pullcords in all empty conduits.
- .3           Install additional steel pull boxes where necessary so that throughout the entire system, wires may be pulled in or withdrawn with reasonable ease. Pull boxes shall be installed in straight runs only.
- .4           Install nylon bushings at open ends of conduit.
- .5           Paint all elbows and pull box covers blue. (This identifies the conduit as conduit dedicated to voice/data wiring.)
- .6           Do not run communications cables in the same raceway as power and lighting conductors.

**3.2               MOUNTING**

- .1           Recess mount wall outlets unless otherwise indicated. Mount wall outlets to height specified in section 26 27 26 or as indicated.

- 3.3**            **WORK BY OTHERS**
- .1        Cables and terminations.

**END OF SECTION**

**Part 1 General**

**1.1 RELATED WORK SPECIFIED ELSEWHERE**

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

**1.2 MATERIALS**

- .1 Provide only new equipment and materials, without blemish or defect, bearing Canadian Standards Association or Authorized Electrical Inspection Department labels, and subject to the approval of the NRC Departmental Representative.
- .2 After a contract is awarded, utilize alternative methods and/or materials only after receiving the NRC Departmental Representative's approval.

**1.3 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with Section 00 10 00.

**1.4 SCOPE OF WORK**

- .1 Supply and install all required material, equipment and labour to provide the fire alarm changes and additions as shown on the drawings and indicated by this section of the specification.

**1.5 CONTRACTOR QULIFICATION**

- .1 The contractor must ensure the supervisor, site foreman and electrician working on site hold a valid fire alarm certificate.

**1.6 REFERENCES**

- .1 Government of Canada
  - .1 TB OSH Chapter 3-03, [latest edition], Treasury Board of Canada, Occupational Safety and Health, Chapter 3-03, Standard for Fire protection Electronic Data Processing Equipment.
  - .2 TB OSH Chapter 3-04, [latest edition], Treasury Board of Canada, Occupational Safety and Health, Chapter 3-04, Standard for Fire Alarm Systems.
- .2 Treasury Board: Fire Protection Standard effective April 1, 2010
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .4 Underwriter's Laboratories of Canada (ULC)
  - .1 CAN/ULC-S524-[ latest edition], Standard for the Installation of Fire Alarm Systems.
  - .2 CAN/ULC-S525-[ latest edition], Audible Signal Device for Fire Alarm Systems.
  - .3 CAN/ULC-S526-[ latest edition], Visual Signal Devices for Fire Alarm Systems.

- .4 CAN/ULC-S527-[ latest edition], Control Units.
  - .5 CAN/ULC-S528-[ latest edition], Manual Pull Stations for Fire Alarm Systems.
  - .6 CAN/ULC-S529-[ latest edition], Smoke Detectors for Fire Alarm Systems.
  - .7 CAN/ULC-S530-[ latest edition], Heat Actuated Fire Detectors for Fire Alarm Systems.
  - .8 CAN/ULC-S531-[ latest edition], Standard for Smoke Alarms.
  - .9 CAN/ULC-S536-S537-[ latest edition], Burglar and Fire Alarm Systems and Components.
- .5 National Fire Protection Agency
- .1 NFPA 72-[ latest edition], National Fire Alarm Code.
  - .2 NFPA 90A-[ latest edition], Installation of Air Conditioning and Ventilating Systems.

## **Part 2 Products**

### **2.1 AUTOMATIC ALARM INITIATING DEVICES**

- .1 Reuse existing devices as shown on drawing. Notify NRC Departmental Representative is any device appears damaged.

### **2.2 CONDUIT AND WIRING**

- .1 Raceway to be 16mm EMT unless indicated otherwise on the drawings. Wiring between junction box on underside of slab and heat detector junction box in T-bar ceiling to be 21mm flexible conduit.
- .2 All wiring is to be colour coded to match existing system and is to be of stranded copper.
- .3 Zone wiring is to be #16 TEW colour coded stranded copper.
- .4 Signal wiring to be sized to take into account voltage drop and is not to be smaller than #12 TW colour coded stranded copper.

## **Part 3 Execution**

### **3.1 CONDUIT AND WIRING**

- .1 All fire alarm trouble and alarm zone wiring to be class "A" using #16 TEW colour coded stranded copper wire, and in accordance with manufacturer's requirements. Connect two red and two zone colour wires to each device. If the colour coding is not given on drawings, coding will be provided after contract is awarded.
- .2 Run all four zone or signal circuit wires in the same conduit (i.e. Do not install only two of the four zone wires in a conduit - all four zone wires must be in each conduit.)
- .3 All conduit to include a #16 TW stranded copper green ground wire.
- .4 Use only uninsulated ring-type STA-KON lugs on screw connections.

- .5 Run conduit tight along underside of ceiling slab or roof deck, unless noted otherwise on drawings.
- .6 In rooms having false ceilings, each fire detection device is to have one junction box secured to the underside of the ceiling slab or roof deck and another firmly supported to the false ceiling tile. The junction box connected to the fire alarm device is not to be used as a raceway for connection to other devices. All splices and routing to other fire alarm devices is to be from the junction box mounted on the underside of the ceiling slab or roof deck.
- .7 Use Tee bar electrical box hangers (Caddy #51224 for 610mm T-bar spacing) to mount heat detectors on T-bar ceiling tiles.
- .8 Install a maximum of 1.5 m (5'-0") 3/4" (21mm) flexible conduit where a heat detector is installed on T-bar ceiling tiles. This is to allow the ceiling tile, having the device, to be shifted two feet either direction for access above the ceiling.
- .9 Leave 6 inch loops of wire in all junction boxes.
- .10 For new installations, no splicing of wires is to be made.
- .11 For renovations, splices may be made in junction boxes other than those at heat detectors after receiving approval of the NRC Departmental Representative. All splices must be soldered and taped.
- .12 Upon awarding of the contract, the NRC Departmental Representative shall provide the contractor with the standard wiring diagram for detection devices, A-7481.
- .13 Prior to installing raceways, submit to the NRC Departmental Representative a proposed method and layout of conduit for approval.

### **3.2 SCHEDULING OF SHUTDOWNS**

- .1 Make written shutdown request to the NRC Departmental Representative at least 48 hours in advance. Acceptance of shutdown request will be determined by the NRC Departmental Representative based on building user needs. Fire alarm systems are to be shut down by NRC staff only. **Contractor is not to shutdown system on their own.**

### **3.3 ACCEPTANCE TEST**

- .1 Perform tests in accordance with the latest regulations and in the presence of the NRC Departmental Representative and the representative of the regulating authority.
- .2 Test each device and alarm circuit to ensure manual alarm stations, thermal and smoke detectors transmit alarms to control panel and actuate alarm.
- .3 Check annunciator panels to ensure that the correct zones are activated.
- .4 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of trouble signals.
- .5 Give the NRC Departmental Representative one set of marked in red prints labelled "As Built".

- .6 Provide the NRC Departmental Representative with a letter of verification from the manufacturer of the equipment stating that the equipment supplied under this contract has been installed as per the latest CAN/ULC S537 and CAN/ULC-S524 standards and as per the latest edition of the Ontario Building Code.

**END OF SECTION**





**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 than 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 or 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 a cost 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.



APPENDIX 'D'

**Fair Wages and Hours of Labour**

**Labour Conditions**

ANNEXE 'D'

**Justes Salaires et Heures de Travail**

**Conditions de Travail**

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**01 Interpretation**

**In these Conditions**

- (a) "Act" means the Fair Wages and Hours of Labour Act;
- (b) "Regulations" means the Fair Wages and Hours of Labour Regulations made pursuant to the Act;
- (c) "contract" means the contract of which these Labour Conditions are part;
- (d) "contracting authority" means the department of Government or a crown corporation with whom the contract is made;
- (e) "contractor" means the person who has entered into the contract with the contracting authority;
- (f) "regional director" means the director of a regional office of the Department of Human Resources Development or the director's designated representative;
- (g) "inspector" has the meaning assigned to the term by Part III of the Canada Labour Code.
- (h) "Minister" means the Minister of Labour of Canada;
- (i) "persons" means those workers employed by the contractor, subcontractor or any other person doing or contracting to do the whole or any part of the work contemplated by the contract;

**01 Interprétation**

**Dans ces conditions**

- a) «Loi» désigne la Loi sur les justes salaires et les heures de travail;
- b) «Règlement» désigne le Règlement sur les justes salaires et les heures de travail établi en application de la Loi;
- c) «contrat» désigne le contrat auquel sont annexées les présentes Conditions de travail;
- d) «adjudicateur» désigne le ministère du gouvernement ou la société d'État avec lequel le contrat a été passé;
- e) «entrepreneur» désigne la personne qui a passé le contrat avec l'adjudicateur;
- f) «directeur régional» le responsable d'un bureau régional du ministère du Développement des ressources humaines ou son représentant désigné;
- g) «inspecteur» s'entend au sens de la partie III du Code canadien du travail;
- h) «Ministre» désigne le ministre du Travail du Canada;
- i) «personnes» désigne les travailleurs employés par l'entrepreneur, le sous-traitant ou toute autre personne exécutant ou s'engageant par contrat à exécuter la totalité ou une partie quelconque des travaux prévus dans le contrat;

## 02 General Fair Wage Clause

(a) All persons in the employ of the contractor, subcontractor, or any other person doing or contracting to do the whole or any part of the work contemplated by the contract, shall during the continuance of the work:

i) be paid fair wages that is, such wages as are generally accepted as current for competent workers in the district in which the work is being performed for the character or class of work in which such workers are respectively engaged; and

ii) in all cases, be paid no less than the minimum hourly rate of pay established by the Labour Program of the Department of Human Resources Development in the Fair Wage Schedules which form a part of this contract as Appendix A to these Labour Conditions; and

iii) for contracts covering work performed in the province of Quebec, be paid at least the wage rates established by that province for the purposes of the Quebec "Construction Decree".

(b) Where there is no wage rate in the schedules referred to in (a) for a particular character or class of work, the contractor shall pay wages for that character or class of work at a rate not less than the rate for an equivalent character or class of work.

(c) Where during the term of the contract, the contractor receives notice from the contracting authority of any change in wage rates, the contractor shall pay not less than the changed wage rate beginning on the first day after receipt, by the contractor, of the notice of the change in wage rates.

## 03 Hours of Work

(a) The hours of work in a day and in a week of persons employed in the execution of the contract, including the hours of work in excess of which a person shall be paid overtime at a rate at least equal to one and one half times the fair wage, are the hours of work for the province in which the work is being performed as set out from time to time in an Act of that province.

(b) The daily or weekly hours of work referred to in paragraph (a) may be exceeded in accordance with the applicable provincial law.

## 02 Clause générale de justes salaires

(a) Toutes les personnes employées par l'entrepreneur, le sous-traitant ou toute autre personne exécutant ou s'engageant par contrat à exécuter la totalité ou une partie quelconque des travaux prévus dans le contrat seront payées :

i) des justes salaires tant que dureront les travaux, c'est-à-dire les salaires généralement reconnus comme salaires courants pour les travailleurs qualifiés dans la région où les travaux sont exécutés, selon la nature ou la catégorie du travail auquel ces travailleurs sont respectivement affectés; et

ii) dans tous les cas, pas moins que les taux horaires minima fixés par le Programme du travail du ministère du Développement des ressources humaines dans les échelles de justes salaires qui deviennent partie de ce contrat en tant qu'Annexe A de ces Conditions de travail; et

iii) pour les contrats concernant les travaux effectués dans la province de Québec, pas moins que les taux de salaires qui sont établis par cette province pour les fins du "Décret de la construction" du Québec.

(b) Lorsqu'il n'y a aucun taux prévu dans l'échelle des taux de salaires à l'égard d'un travail d'une nature ou d'une catégorie données, l'entrepreneur verse à l'employé un taux de salaire qui n'est pas inférieur à celui établi pour un travail de nature ou de catégorie équivalente.

(c) Lorsque pendant la durée du contrat, l'entrepreneur reçoit de l'adjudicateur un avis de modification à l'échelle de salaires, l'entrepreneur rémunère les employés touchés par cette modification à des taux qui ne sont pas inférieurs aux taux modifiés à compter de la journée qui suit la réception par lui, de l'avis.

## 03 Durée du travail

(a) Les heures de travail quotidiennes et hebdomadaires des personnes employées à l'exécution du contrat, notamment les heures au-delà desquelles une personne doit être rétribuée selon le tarif pour heures supplémentaires, soit au moins le juste salaire majoré de 50 pour cent, sont celles fixées et éventuellement modifiées par la législation de la province dans laquelle le travail est effectué.

(b) Les heures de travail quotidiennes ou hebdomadaires mentionnées à l'alinéa (a) peuvent être dépassées conformément à la législation provinciale applicable.

<p><b>04 Labour Conditions to be Posted</b></p> <p>For the information and the protection of all persons, the contractor agrees to post and keep posted, in a conspicuous place on the premises where work contemplated by the contract is being carried out or on premises occupied or used by persons engaged in carrying out such work, a copy of these Labour Conditions, and a copy of the applicable Fair Wage Schedules along with any subsequent changes.</p>	<p><b>04 Affichage des conditions de travail</b></p> <p>Pour l'information et la protection de toutes les personnes, l'entrepreneur convient d'afficher et de tenir affichés, bien à la vue, à l'endroit où les travaux prévus dans le contrat sont exécutés, ou dans les locaux occupés ou fréquentés par les personnes employées à l'exécution desdits travaux, un exemplaire des présentes Conditions de travail, un exemplaire de l'échelle de justes salaires applicable et toutes modifications subséquentes.</p>
<p><b>05 The Contractor to Keep Records which are to be Kept Open for Inspection</b></p> <p>(a) The contractor agrees to keep books and records showing the names, addresses, classifications of employment and work of all workers employed under the contract, the rate of wages to be paid, the wages paid and the daily hours worked by the workers.</p> <p>(b) The contractor also agrees that the contractor's books, records and premises will be open at all reasonable times for inspection by an inspector.</p> <p>(c) The contractor also agrees to furnish the inspector and the contracting authority, on request, with such further information as is required to ascertain that the requirements of the Act, the Regulations and the contract with respect to wages, hours of work and other labour conditions have been complied with.</p>	<p><b>05 L'entrepreneur tient des dossiers pour fins d'inspection</b></p> <p>(a) L'entrepreneur convient de tenir les registres et dossiers où sont consignés le nom, l'adresse et la catégorie d'emploi et de travail de tous les travailleurs employés à des travaux exécutés en vertu du contrat, de même que le taux de salaire, le salaire payé et la durée journalière du travail pour chacun de ces travailleurs.</p> <p>(b) L'entrepreneur convient également à faire en sorte que ses registres, ses dossiers et ses locaux soient accessibles en tout temps opportun, pour fins d'inspection par un inspecteur.</p> <p>(c) L'entrepreneur convient en outre de fournir, sur demande, à l'inspecteur et à l'adjudicateur tous les autres renseignements requis pour permettre de constater qu'on a satisfait aux exigences de la Loi, des règlements et du contrat en ce qui concerne les salaires, la durée du travail et les autres conditions de travail.</p>
<p><b>06 Departmental Requirements before Payment made to Contractor</b></p> <p>(a) The contractor agrees that the contractor will not be entitled to payment of any money otherwise payable under the contract until the contractor has filed with the contracting authority in support of a claim for payment a sworn statement:</p> <p>(i) that the contractor has kept the books and records required by these Regulations,</p> <p>(ii) that there are no wages in arrears in respect of work performed under the contract, and</p> <p>(iii) that to the contractor's knowledge, all the conditions in the contract required by the Act and the Regulations have been complied with.</p> <p>(b) The contractor also agrees that, where fair wages have not been paid by the contractor to persons employed under the contract, the contracting authority shall withhold from any money otherwise payable under the contract to the contractor the amount necessary to ensure that fair wages are paid to all employees until fair wages are paid.</p>	<p><b>06 Exigences du ministère avant le versement des sommes dues à l'entrepreneur</b></p> <p>(a) L'entrepreneur convient qu'il n'aura droit au paiement d'aucune somme qui autrement devrait lui être versée en vertu du contrat tant qu'il n'aura pas déposé auprès de l'adjudicateur, à l'appui de sa réclamation de paiement, une déclaration sous serment indiquant:</p> <p>(i) qu'il a tenu les registres et dossiers requis par les présents règlements,</p> <p>(ii) qu'il n'y a pas d'arrérages de salaires à l'égard des travaux exécutés en vertu du contrat, et</p> <p>(iii) qu'à sa connaissance, toutes les conditions du contrat exigées par la Loi et les règlements ont été observées.</p> <p>(b) L'entrepreneur convient en outre que lorsqu'il n'a pas versé un juste salaire à une personne employée en vertu du contrat, l'adjudicateur sera autorisé à retenir de toute somme autrement payable à l'entrepreneur en vertu du contrat la somme requise pour assurer le paiement de justes salaires à tous les employés jusqu'à ce qu'ils aient touché leur juste salaire.</p>

<p><b>07 Authority to pay Wages in the Event of Default by the Contractor</b></p> <p>(a) The contractor agrees that where the contractor is in default of payment of fair wages to an employee, the contractor will pay the Minister the amount the contractor is in default.</p> <p>(b) The contractor agrees that where the contractor fails to comply with paragraph (a), the contracting authority will pay to the Receiver General, out of any money otherwise payable to the contractor, the amount for which the contractor is in default.</p>	<p><b>07 Paiement des salaires par l'adjudicateur si l'entrepreneur omet de le faire</b></p> <p>(a) L'entrepreneur convient qu'à défaut du paiement par ce dernier d'un juste salaire à un travailleur, l'entrepreneur devra verser au ministre le montant qu'il a omis de payer.</p> <p>(b) L'entrepreneur convient que s'il omet de se conformer au paragraphe (a), l'adjudicateur paiera au Receveur général, à même les sommes autrement payables à l'entrepreneur, le montant qu'il a omis de payer.</p>
<p><b>08 Conditions of Subcontracting</b></p> <p>The contractor and the subcontractor agree that in subcontracting any part of the work contemplated by the contract, they will place in the subcontract the conditions respecting fair wages, hours of work and other labour conditions set out in the contract and the requirements set out in Section 4. The contractor further agrees that the contractor will be responsible for carrying out these conditions in the event the subcontractor fails to carry them out.</p>	<p><b>08 Conditions imposées à un sous-traitant</b></p> <p>L'entrepreneur et le sous-traitant conviennent, dans l'adjudication à un sous-traitant de toute partie des travaux prévus par le contrat, d'insérer dans le sous-contrat les conditions relatives aux justes salaires, à la durée du travail et autres conditions de travail indiquées dans le contrat ainsi que les obligations énoncées à l'article 4. L'entrepreneur convient en outre qu'il sera responsable du respect de ces conditions si elles ne sont pas respectées par le sous-traitant.</p>
<p><b>09 Non-discrimination in Hiring and Employment of Labour</b></p> <p>The contractor agrees that in the hiring and employment of workers to perform any work under the contract, the contractor will not refuse to employ and will not discriminate in any manner against any person because</p> <p>(a) of that person's race, national or ethnic origin, colour, religion, age, sex, sexual orientation, marital status, disability, conviction for which a pardon has been granted, or family status;</p> <p>(b) of the race, national or ethnic origin, colour, religion, age, sex, sexual orientation, marital status, disability, conviction for which a pardon has been granted, or family status of any person having a relationship or association with that person, or</p> <p>(c) a complaint has been made or information has been given in respect of that person relating to an alleged failure by the contractor to comply with subparagraph (a) or (b).</p>	<p><b>09 Non-discrimination dans l'embauchage et l'emploi de main-d'oeuvre</b></p> <p>L'entrepreneur convient que dans l'embauchage et l'emploi des travailleurs aux fins de l'exécution de tout travail en vertu du contrat, l'entrepreneur ne refusera pas d'employer une personne ou d'exercer de quelque façon que ce soit des distinctions injustes à l'endroit d'une personne en raison</p> <p>(a) de la race, de l'origine nationale ou ethnique, de la couleur, de la religion, de l'âge, du sexe, de l'orientation sexuelle, de l'état matrimonial, de la situation de famille, de l'état de personne graciée ou d'une déficience de la personne;</p> <p>(b) de la race, de l'origine nationale ou ethnique, de la couleur, de la religion, de l'âge, du sexe, de l'orientation sexuelle, de l'état matrimonial, de la situation de famille, de l'état de personne graciée ou d'une déficience de toute personne ayant un lien avec elle;</p> <p>(c) du fait que cette personne a porté plainte ou a fourni des renseignements ou parce qu'une plainte a été portée ou des renseignements ont été fournis en son nom relativement à toute prétendue omission de la part de l'entrepreneur de se conformer aux sous-alinéas (a) ou (b).</p>



**FAIR WAGE SCHEDULE**  
FOR FEDERAL CONSTRUCTION CONTRACTS

**ÉCHELLE DE JUSTES SALAIRES**  
POUR LES CONTRATS FÉDÉRAUX DE CONSTRUCTION

**Ontario – Ottawa Zone / Ontario – Zone d'Ottawa**  
**Effective August 15, 2011 / En vigueur le 15 août 2011**

<p>Construction trades workers on the federal government construction contract listed in this appendix must be paid a regular hourly wage rate no less than the rate on this schedule for the type of work they are doing under the contract.</p> <p>The apprentice wage rates are included into this schedule by reference to the Ontario <i>Trades Qualification and Apprenticeship Act</i> and its Regulations. Thus, where the Regulations refer to a percentage of a corresponding journey person's wage for a specific occupation, that percentage shall be applied against the wages listed below.</p>	<p>Les travailleurs de métiers de la construction, sur un contrat fédéral de construction, doivent être payés à un taux de salaires non moindre que le taux de cette échelle pour le type de travail effectué en vertu du contrat en question.</p> <p>Le salaire des apprentis est inclus dans cette échelle en faisant référence à la Loi sur la qualification professionnelle et l'apprentissage des gens de métier de l'Ontario et ses Règlements. Ainsi, là où les Règlements prescrivent que le salaire d'un apprenti doit correspondre au pourcentage du salaire d'un ouvrier qualifié de la même occupation, le calcul sera effectué en utilisant les taux ci-dessous.</p>
<p>*Denotes a compulsory trade: a trade license or apprenticeship registration valid in Ontario is required to work in the occupation.</p>	<p>*Dénote un métier obligatoire : un métier qui exige une licence ou un enregistrement d'apprentissage valide en Ontario.</p>
<p><b>CLASSIFICATION OF LABOUR</b> <b>CATÉGORIES DE MAIN-D'OEUVRE</b></p>	<p><b>FAIR WAGE RATE PER HOUR NOT LESS THAN</b> <b>TAUX DE JUSTE SALAIRE NON INFÉRIEUR À</b></p>
<p>*Electricians *Electriciens</p>	<p><b>33.19</b></p>
<p>*Plumbers *Plombiers</p>	<p><b>30.99</b></p>
<p>Sprinkler System Installers Poseurs de gicleurs</p>	<p><b>36.14</b></p>
<p>*Pipefitters, Steamfitters *Tuyauteurs, monteurs d'appareils de chauffage</p>	<p><b>34.57</b></p>
<p>*Sheet Metal Workers *Toliers (ouvriers de feuilles de métal)</p>	<p><b>31.06</b></p>
<p>Boilermakers Chaudronnier</p>	<p><b>33.26</b></p>
<p>Ironworkers (except Reinforcing Ironworkers (Rebar/Rodman)) Monteurs de charpentes métalliques (sauf ferrailleurs et placeurs de tiges métalliques dans le béton)</p>	<p><b>30.17</b></p>
<p>Reinforcing Ironworkers (Rebar/Rodman) Placeurs de tiges métalliques dans le béton</p>	<p><b>29.50</b></p>
<p>Carpenters Charpentiers-menuisiers</p>	<p><b>24.43</b></p>
<p>Bricklayers Briqueurs-maçons</p>	<p><b>32.15</b></p>
<p>Cement Finishers Finiisseurs de béton ou ciment</p>	<p><b>26.98</b></p>

Tilesetters (including terrazo, marble setters) Poseurs de carrelage (de céramique, de marbre, etc.)	31.65
Plasterers and Drywall Tapers Pâtriers et jointoyeurs de cloisons sèches	29.19
Drywall Installers, Finishers and Lathers Lateurs et poseurs de cloisons sèches, finisseurs	31.67
Interior System Mechanics (including steel stud) Mécaniciens de systèmes intérieurs (incluant structure d'acier)	32.38
Roofers Couvreurs de revêtement de toiture	21.50
Glaziers Vitriers	29.20
Insulators Calorifugeurs	32.35
Painters Peintres	18.44
Flooring Installers Poseurs de revêtements d'intérieur	30.22
Construction Millwrights Mécaniciens de chantier	34.60
*Heavy-Duty Equipment Mechanics *Mécaniciens d'équipement lourd	23.29
*Refrigeration and Air Conditioning Mechanics *Mécaniciens en réfrigération et climatisation	36.65
Elevator Constructors Constructeurs d'ascenseurs	43.53
*Mobile Crane Operators *Conducteurs/opérateurs de grue mobile	33.82
*Tower Crane Operators *Conducteurs/opérateurs de grue à tour	34.78
Straight Truck Drivers Conducteurs de camions unitaires	19.45
Road Tractor Drivers for Semi-Trailers and Trailers Conducteurs de tracteurs routiers pour semi-remorques ou remorques	19.57
Operators-Heavy Equipment (ex. Cranes, Graders) Conducteurs de machinerie lourdes (sauf grues, niveleuses)	22.10
Grader Operators Conducteurs de niveleuse (grader)	27.47
Asphalt Plant Operators Opérateurs de machinerie de pavage	22.01
Scraper Operators Conducteurs de scraper	29.16
Packer (road roller) Operators Conducteurs de rouleau compresseur (Packer)	18.06
Pressure Vessel Welder	33.61

Soudeur de réservoirs pour fluides sous-pression	
Traffic Accommodation/Control Persons Ouvriers chargé de diriger la circulation	<b>15.54</b>
Labourers (Except Traffic Accommodation/Control Persons) Manoeuvres (sauf ouvriers chargé de diriger la circulation)	<b>19.29</b>
<p>Fair wage schedule prepared by:                  Labour Standards and Workplace Equity Division                  Labour Program, Human Resources and Skills Development Canada</p> <p>Based on The National Construction Industry Wage Rate Survey (2009) conducted by the Small Business and Special Surveys Division, Statistics Canada.</p>	
<p>L'échelle des justes salaires est préparée par :                  Division des normes du travail et équité en milieu de travail                  Programme du travail, Ressources humaines et Développement des compétences Canada</p> <p>Basée sur l'Enquête nationale sur les taux salariaux dans le secteur de la construction (2009) faite par la Division des petites entreprises et enquêtes spéciales, Statistique Canada.</p>	

<b>CONTRACTORS SHOULD NOTE:</b>	<b>L'ENTREPRENEUR DOIT NOTER :</b>
<p>a) that during the term of this contract, the rates listed herein may be revised in accordance with the labour conditions; and</p> <p>b) that in carrying out any of the work contemplated by this contract, the contractor is also subject to any applicable provincial laws and regulations; and</p> <p>c) overtime must be paid according to provincial legislation concerning hours of work at a rate equal to at least one and one-half times the fair wage rate; and</p> <p>d) schedule rates are 'straight' wages and do not include compensation in the form of benefits (for example, medical, dental or pension plans); and</p> <p>e) in the event of a complaint under the Fair Wages and Hours of Labour Act, if the occupation of the complainant is not on the posted schedule, the Labour Program inspector will assign the most similar occupation from the schedule by comparing the national occupational classification (NOC) code and the job description that best defines the work actually done by the complainant.</p>	<p>a) que pendant la durée de ce contrat, les taux de salaires énumérés dans l'annexe peuvent être révisés en conformité avec les conditions de travail, et</p> <p>b) que dans l'exécution de tout travail prévu par le contrat, l'entrepreneur est aussi assujéti aux lois et règlements provinciaux, et</p> <p>c) le temps supplémentaire doit être rémunéré conformément aux lois provinciales relatives aux heures de travail à un taux équivalent au moins une fois et demi le taux des justes salaires, et</p> <p>d) les taux de l'échelle fait référence à la rémunération en salaire et ne comprennent pas la rémunération sous forme d'avantages sociaux (par exemple, les plans d'assurance médicale ou dentaire, ou les régimes de pension), et</p> <p>e) dans le cas d'une plainte sous la Loi sur les justes salaires et les heures de travail, si le métier du plaignant ne figure pas dans l'échelle affichée, l'inspecteur du Programme du travail déterminera le métier le plus semblable dans l'échelle en comparant le code et la description de tâches de la Classification nationale des professions (CNP) qui décrivent le mieux le travail effectué par le plaignant.</p>

<p><b>FOR INFORMATION CONCERNING THESE SCHEDULES AND THE <i>FAIR WAGES AND HOURS OF LABOUR ACT</i> UNDER WHICH THEY ARE DEVELOPED, OR TO LODGE A COMPLAINT, CONTACT YOUR NEAREST LABOUR PROGRAM DISTRICT OFFICE LISTED IN THE BLUE PAGES OF YOUR TELEPHONE DIRECTORY UNDER <b>GOVERNMENT OF CANADA, HUMAN RESOURCES AND SKILLS DEVELOPMENT CANADA OR CALL 1-800-OCANADA.</b></b></p>	<p><b>POUR OBTENIR DE L'INFORMATION SUR LES ÉCHELLES ET LA <i>LOI SUR LES JUSTES SALAIRES ET LES HEURES DE TRAVAIL</i> SOUS LAQUELLE ELLES ONT ÉTÉ DÉVELOPPÉES, OU POUR DÉPOSER UNE PLAINTE, CONTACTEZ LE BUREAU LOCAL DU PROGRAMME DU TRAVAIL LE PLUS PRÈS DE CHEZ VOUS EN CHERCHANT DANS LES PAGES BLEUES DE VOTRE ANNUAIRE SOUS <b>GOVERNEMENT DU CANADA, RESSOURCES HUMAINES ET DÉVELOPPEMENT DES COMPÉTENCES CANADA.</b> VOUS POUVEZ ÉGALEMENT TÉLÉPHONER AU <b>1-800-OCANADA.</b></b></p>
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## **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
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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
Security Classification / Classification de sécurité

**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	ASPM/SAGI
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3. a) Subcontract Number / Numéro du contrat de sous-traitance	3. b) Name and Address of Subcontractor / Nom et adresse du sous-traitant
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4. Brief Description of Work / Brève description du travail  
Renovate Kelvin Room (1100A) in building M-36

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"/>
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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: Specify country(ies): / Préciser le(s) pays: <input type="checkbox"/>	Restricted to: / Limité à: Specify country(ies): / Préciser le(s) pays: <input type="checkbox"/>	Restricted to: / Limité à: Specify country(ies): / Préciser le(s) pays: <input type="checkbox"/>

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 <input type="checkbox"/>	COSMIC TOP SECRET / COSMIC TRÈS SECRET <input type="checkbox"/>	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"/>



Contract Number / Numéro du contrat
Security Classification / Classification de sécurité

**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<br>COTE DE FIABILITÉ | <input type="checkbox"/> CONFIDENTIAL<br>CONFIDENTIEL           | <input type="checkbox"/> SECRET<br>SECRET           | <input type="checkbox"/> TOP SECRET<br>TRÈS SECRET               |
| <input type="checkbox"/> TOP SECRET - SIGINT<br>TRÈS SECRET - SIGINT        | <input type="checkbox"/> NATO CONFIDENTIAL<br>NATO CONFIDENTIEL | <input type="checkbox"/> NATO SECRET<br>NATO SECRET | <input type="checkbox"/> COSMIC TOP SECRET<br>COSMIC TRÈS SECRET |
| <input type="checkbox"/> SITE ACCESS<br>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



Contract Number / Numéro du contrat
Security Classification / Classification de sécurité

**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	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
IT Media / Support IT / IT Link / Lien électronique	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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).



Contract Number / Numéro du contrat
Security Classification / Classification de sécurité

**PART D - AUTHORIZATION / PARTIE D - AUTORISATION**

**13. Organization Project Authority / Chargé de projet de l'organisme**

Name (print) - Nom (en lettres moulées) <b>Bruno Valliere</b>	Title - Titre Manager Facilities Engineering Unit	Signature 
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Telephone No. - N° de téléphone 613-991-5586	Facsimile No. - N° de télécopieur 613-957-9828	E-mail address - Adresse courriel Bruno.Vallieres@nrc-cnrc.gc.ca	Date November 20, 2013
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**14. Organization Security Authority / Responsable de la sécurité de l'organisme**

Name (print) - Nom (en lettres moulées) Charlotte Carrier	Title - Titre Controlled Goods and Contracts Security Coordinator	Signature 
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Telephone No. - N° de téléphone (613) 993-8956	Facsimile No. - N° de télécopieur (613) 990-0946	E-mail address - Adresse courriel Charlotte.Carrier@nrc-cnrc.gc.ca	Date 20 Nov 2013
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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) MARC BEDARD	Title - Titre Senior Contracting Officer	Signature 
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Telephone No. - N° de téléphone 613-993-2274	Facsimile No. - N° de télécopieur	E-mail address - Adresse courriel	Date 26/11/13
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**17. Contracting Security Authority / Autorité contractante en matière de sécurité**

Name (print) - Nom (en lettres moulées)	Title - Titre	Signature
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Telephone No. - N° de téléphone	Facsimile No. - N° de télécopieur	E-mail address - Adresse courriel	Date
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