



# SPECIFICATIONS

**SOLICITATION #:** 18-22095

**BUILDING:** M-38  
1200 Montreal Road  
Ottawa, Ontario

**PROJECT:** M38- Phase 3 Renovation

**PROJECT #:** M38-5310

**Date:** December 2018



# **SPECIFICATION**

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## Directions to the Ottawa Research Facilities – Montreal Road

1200 Montréal Road  
Ottawa, Ontario, Canada K1A 0R6

Tel: 613-993-9101

<b>NRC Institutes/Branch/Program</b>	<b>Buildings</b>
Information/Security	M-1
NRC Administrative Services and Property Management (NRC-ASPM)	M-5, M-6, M-15, M-16, M-18A, M-19, M-22, M-26, M-39, M-40A, M-53
NRC Canada Institute for Scientific and Technical Information (NRC-CISTI)	M-50, M-55
NRC Canadian Hydraulics Centre (NRC-CHC)	M-32
NRC Communications and Corporate Relations Branch (NRC-CCRB)	M-58
NRC Design and Fabrication Services (DFS)	M-2, M-4, M-10, M-36
NRC Financial Branch (NRC-FB)	M-58
NRC Human Resources Branch (NRC-HRB)	M-55, M-58
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NRC Institute For Information Technology (NRC-IIT)	M-2, M-50
NRC Institute For Microstructural Sciences (NRC-IMS)	M-36, M-37, M-50
NRC Institute For National Measurements Standards (NRC-INMS)	M-35, M-36, M-51
NRC Institute For Research In Construction (NRC-IRC)	M-20, M-24, M-25, M-27, M-42, M-48, M-59
NRC Strategy and Development Branch (NRC-SDB)	M-58

**By Road, from the OTTAWA International Airport**

1. From the airport take the AIRPORT PARKWAY to RIVERSIDE DR EAST
2. Follow RIVERSIDE DR EAST to HIGHWAY 417 EAST
3. Take HIGHWAY 417 EAST, past the ST-LAURENT BLVD exit, where HIGHWAY 417 splits, continue LEFT on HIGHWAY 174 (ROCKLAND)
4. Exit HIGHWAY 174 on BLAIR RD NORTH
5. Proceed on BLAIR RD NORTH, cross OGILVIE RD, and continue on to the traffic lights at the intersection of BLAIR and MONTREAL RD
6. Turn left onto MONTREAL RD and take the first immediate right onto the ramp leading down to the traffic circle. Stop at Building M-1 on the north side of the traffic circle. Ask the commissionaires in M-1 for directions to the NRC building, institute or staff member you seek.

**By Road, from MONTRÉAL**

1. Take MÉTROPOLITAIN 40 WEST and follow signs for OTTAWA and HIGHWAY 417 WEST
2. Follow 417 WEST to reach OTTAWA
3. Exit at HIGHWAY 174 EAST (ROCKLAND) when entering OTTAWA
4. Follow 174 EAST and exit at BLAIR RD NORTH (first exit after entering 174 EAST)
5. Follow BLAIR RD NORTH, cross OGILVIE RD, and continue on to the traffic lights at the intersection of BLAIR and MONTREAL RD
6. Turn left onto MONTREAL RD and take the first immediate right onto the ramp leading down to the traffic circle. Stop at Building M-1 on the north side of the traffic circle. Ask the commissionaires in M-1 for directions to the NRC building, institute or staff member you seek.





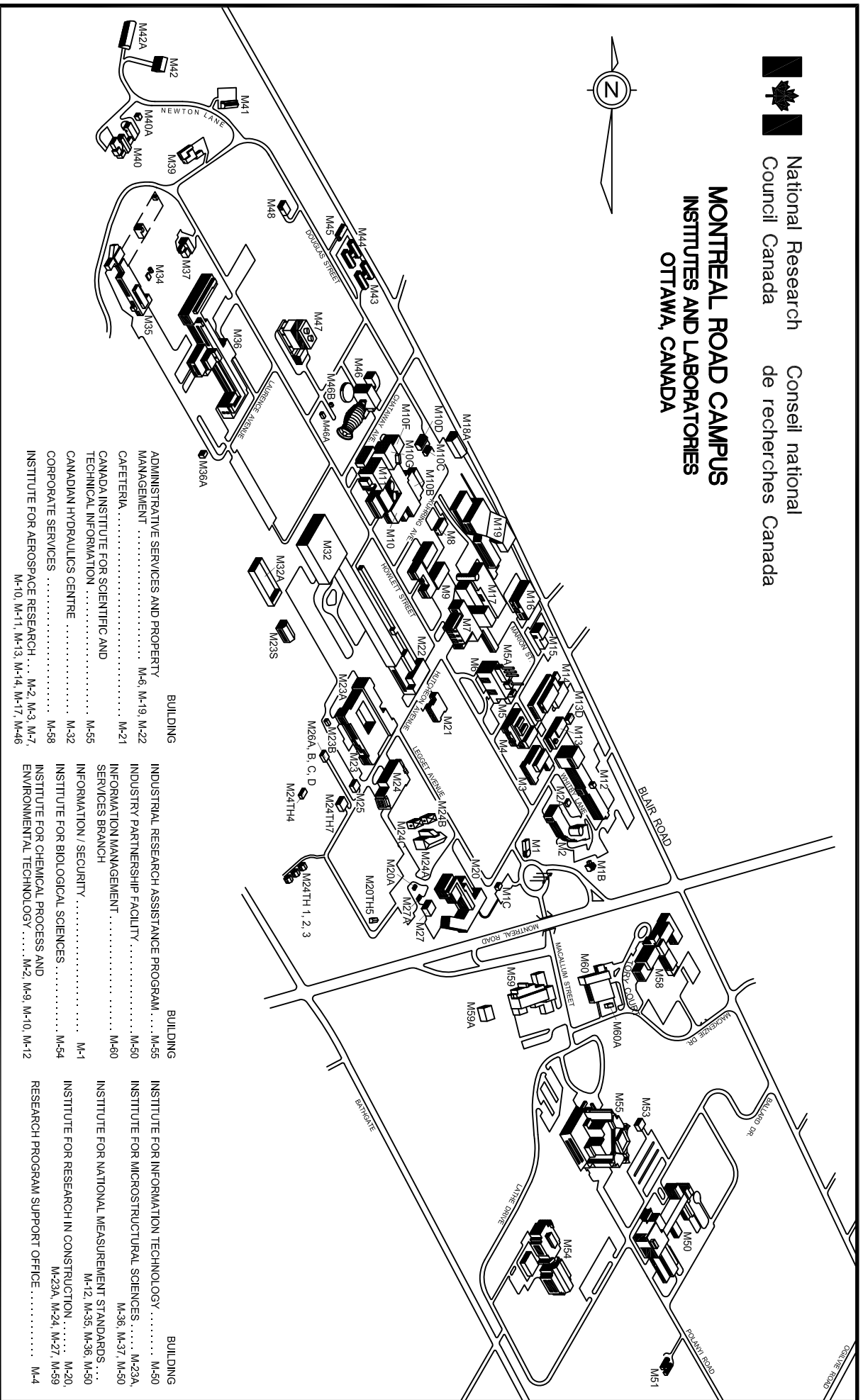


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|--|---|---|---|---|
|  NRC Institute    |  Major HWY     |  Airport       |  Ferry       |  Metro |
|  Trans Canada HWY |  Secondary HWY |  Train Station |  Bus Station |   |



National Research Council Canada  
Conseil national de recherches Canada

# MONTREAL ROAD CAMPUS INSTITUTES AND LABORATORIES OTTAWA, CANADA



- |  |          |  |          |  |
|--|----------|--|----------|--|
| ADMINISTRATIVE SERVICES AND PROPERTY MANAGEMENT . . . . . M-6, M-19, M-22                    | BUILDING | INDUSTRIAL RESEARCH ASSISTANCE PROGRAM . . . . . M-55                                      | BUILDING | INSTITUTE FOR INFORMATION TECHNOLOGY . . . . . M-50                            |
| CAFETERIA . . . . . M-21   |          | INDUSTRY PARTNERSHIP FACILITY . . . . . M-50   |          | INSTITUTE FOR MICROSTRUCTURAL SCIENCES . . . . . M-23A, M-36, M-37, M-50       |
| CANADA INSTITUTE FOR SCIENTIFIC AND TECHNICAL INFORMATION . . . . . M-55                     |          | SERVICES BRANCH  |          | INSTITUTE FOR NATIONAL MEASUREMENT STANDARDS . . . . . M-12, M-35, M-36, M-50  |
| CANADIAN HYDRAULICS CENTRE . . . . . M-32  |          | INFORMATION / SECURITY . . . . . M-1   |          | INSTITUTE FOR RESEARCH IN CONSTRUCTION . . . . . M-20, M-23A, M-24, M-27, M-59 |
| CORPORATE SERVICES . . . . . M-58  |          | INSTITUTE FOR BIOLOGICAL SCIENCES . . . . . M-54   |          | RESEARCH PROGRAM SUPPORT OFFICE . . . . . M-4                                  |
| INSTITUTE FOR AEROSPACE RESEARCH . . . . . M-2, M-3, M-7, M-10, M-11, M-13, M-14, M-17, M-46 |          | INSTITUTE FOR CHEMICAL PROCESS AND ENVIRONMENTAL TECHNOLOGY . . . . . M-2, M-9, M-10, M-12 |          |  |

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National Research Council    Conseil national de recherches  
Canada                            Canada

Administrative Services        Direction des services  
& Property management       administratif et gestion  
Branch (ASPM)                    de l'immobilier (SAGI)

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## Construction Tender Form

**Project Identification**        **M38- Phase 3 Renovation**

**Tender No.:**        **18-22095**

**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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Administrative Services & Property management Branch (ASPM)	Direction des services administratif et gestion de l'immobilier (SAGI)

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

## BUY AND SELL NOTICE

### M38- Phase 3 Renovation

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

Phase 3 renovation. New lighting, power systems and mechanical systems.

#### 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 January 8<sup>th</sup> and January 11<sup>th</sup>, 2019 at **9:00**. Meet Allan Smith at Building M38, Main Entrance, 1200 Montreal Road 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. CLOSING DATE

Closing date is February 4<sup>th</sup>, 2019 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/ssi-iss-services/eso-oss-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: **Allan Smith**  
Telephone: **613 852-1357**.

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

## INSTRUCTIONS TO BIDDERS

### Article 1 – Receipt of Tender

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

All such amendments are to be addressed to:  
National Research Council of Canada  
Alain Leroux, Senior Contracting Officer  
Building M-58  
Montreal Road, Ottawa, Ontario  
K1A 0R6

Fax: (613) 991-3297

### Article 2 – Tender Form & Qualifications

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

### Article 3 - Contract

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

### Article 4 – Tender Destination

- 1a) Tenders are to be submitted in sealed envelopes to:  
National Research Council Canada  
Administrative Services and Property Management Branch  
1200 Montreal Road  
Building M-58  
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-58, 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-58, 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

ISBN: 1-4249-2007-8 (Print), **1-4249-2009-4 (PDF)**, **1-4249-2008-6 (HTML)**

## 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:

net book value at date of import × 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)

## M a n u f a c t u r i n g   f o r   O w n   U s e

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)

## C o n t r a c t s   w i t h   t h e   F e d e r a l   G o v e r n m e n t

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.

## E x e m p t i o n s

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

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

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

---

## Articles of Agreement

These Articles of Agreement made in duplicate this      day of      .

Between

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

and

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

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

A1      Contract Documents

**(23/01/2002)**

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

1.1.1    these Articles of Agreement,

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

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

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

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

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

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

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

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

1.1.10

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## Articles of Agreement

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

### 1.2 In the contract

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

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

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

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

### A2 Date of Completion of Work and Description of Work

**(23/01/2002)**

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

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

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## Articles of Agreement

### A3 Contract Amount

**(23/01/2002)**

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

### A4 Contractor's Address

**(23/01/2002)**

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



**Articles of Agreement**

A5 Unit Price Table

(23/01/2002)

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

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

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

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

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**Articles of Agreement**

Signed on behalf of Her Majesty by

\_\_\_\_\_

as Senior Contracting Officer

and \_\_\_\_\_

as \_\_\_\_\_

of the **National Research Council Canada**

on the \_\_\_\_\_

day of \_\_\_\_\_

Signed, sealed and delivered by

\_\_\_\_\_

as \_\_\_\_\_ and  
Position

by \_\_\_\_\_

as \_\_\_\_\_  
Position

of

on the \_\_\_\_\_

day of \_\_\_\_\_

**Seal**

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**1. SCOPE OF WORK**

- .1 Work under this contract covers the Renovation in the Council's Building M-38 of the National Research Council.

**2. DRAWINGS**

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

- .1 ASK01
- .2 ASK02
- .3 ASK03
- .4 5310-M001
- .5 5310-M201
- .6 5310-M202
- .7 5310-M301
- .8 5310-M302
- .9 5310-M401
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- .15 5310-E07
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- .17 5310-E09
- .18 5310-E10
- .19 5310-E11

**3. COMPLETION**

- .1 Complete all work within 16 weeks after receipt of notification of acceptance of tender.

**4. GENERAL**

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

**5. 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 ten (10) 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 ten (10) working days before tender closing date or after the tender period, will not be considered.

## **6. 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.

## **7. WORKPLACE HAZARDOUS MATERIAL INFORMATION SYSTEM (WHMIS)**

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



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

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

- .1 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.

**9. COST BREAKDOWN**

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

**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. PERSONNEL SECURITY AND IDENTIFICATION**

- .1 All persons employed by the contractor, or by any subcontractor and present on the site must be security cleared in accordance with the requirements of the Section entitled Special Instructions to Tenderers.
- .2 All such persons must wear and keep visible identification badges as issued by the Security Office of NRC.

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

**13. SCHEDULE**

- .1 The contractor shall prepare a detailed schedule, fixing the date for commencement and completion of the various parts of the work and update the said schedule. Such schedule

shall be made available to the Departmental Representative not later than two weeks after the award of the contract and prior to commencement of any work on site.

- .2 Notify Departmental Representative in writing of any changes in the schedule.
- .3 14 days before the scheduled completion date, arrange to do an interim inspection with the Departmental Representative.

**14. 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.

**15. SHOP DRAWINGS**

- .1 Submit to Departmental Representative for review, shop drawings, product data and samples specified within 2 weeks 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 bi-week basis and any changes to the list shall be immediately notified in writing to the Departmental Representative.
- .3 Review shop drawings, data sheets and samples prior to submission.
- .4 Submit electronic copy of all shop drawings and product data and samples for review, unless otherwise specified.
- .5 Review of shop drawings and product data by the Departmental Representative does not relieve the contractor of the responsibility for errors and omissions and for the conformity with contract documents.

**16. SAMPLES AND MOCK-UPS**

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

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**17. 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.

**18. WORK & MATERIALS SUPPLIED BY OWNER**

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

**19. 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 Provide snow clearing and removal as required during the contract period.
- .7 Make good any damage and clean up dirt, debris, etc., resulting from contractor's use of existing roads.

**20. USE OF SITE**

- .1 Restrict operations on the site to the areas approved by the Departmental Representative

- .2 Locate all temporary structures, equipment, storage, etc., to the designated areas.
- .3 Restrict parking to the designated areas.

**21. 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.

**22. SITE OFFICE & TELEPHONE**

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

**23. SANITARY FACILITIES**

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

**24. 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.

**25. DOCUMENTS REQUIRED AT WORK SITE**

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

**26. 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.

**27. PROTECTION AND WARNING NOTICES**

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

**28. BILINGUALISM**

- .1 Ensure that all signs, notices, etc. are posted in both official languages.

- .2 Ensure that all identification of services called for by under this contract are bilingual.

**29. LAYOUT OF WORK**

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

**30. DISCREPANCIES & INTERFERENCES**

- .1 Prior to the start of the work, examine drawings and specifications. Report at once to the Departmental Representative, any defects, discrepancies, omissions or interferences affecting the work.
- .2 Contractor to immediately inform the Departmental Representative in writing, of any discrepancies between the plans and the physical conditions so the Departmental Representative may promptly verify same.
- .3 Any work done after such a discovery, until authorized, is at the contractor's risk.
- .4 Where minor interferences as determined by the Departmental Representative are encountered on the job and they have not been pointed out on the original tender or on the plans and specifications, provide offsets, bends or reroute the services to suit job conditions at no extra cost.
- .5 Arrange all work so as not to interfere in any way with other work being carried out.

**31. 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.

**32. TEMPORARY HEATING AND VENTILATING**

- .1 Bear the costs of temporary heat and ventilation during construction including costs of installation, fuel, operation, maintenance, and removal of equipment.
- .2 Use of direct-fired heaters discharging waste products into the work areas will not be permitted unless prior approval is given by the Departmental Representative.
- .3 Furnish and install temporary heat and ventilation in enclosed areas as required to:

- .1 Facilitate progress of work.
- .2 Protect work and products against dampness and cold.
- .3 Reduce moisture condensation on surfaces to an acceptable level.
- .4 Provide ambient temperature and humidity levels for storage, installation and curing of materials.
- .5 Provide adequate ventilation to meet health regulations for a safe working environment.
- .4 Maintain minimum temperature of 10 °C (50 °F) or higher where specified as soon as finishing work is commenced and maintain until acceptance by the Departmental Representative. Maintain ambient temperature and humidity levels as required for comfort of NRC personnel.
- .5 Prevent hazardous or unhealthy accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction including also, storage areas and sanitary facilities.
  - .1 Dispose of exhaust materials in a manner that will not result in a harmful or unhealthy exposure to persons.
- .6 Maintain strict supervision of operation of temporary heating and ventilating equipment.
  - .1 Enforce conformance with applicable codes and standards.
  - .2 Comply with instructions of the Departmental Representative including provision of full-time watchman services when directed.
  - .3 Enforce safe practices.
  - .4 Vent direct-fired combustion units to outside.
- .7 Submit tenders assuming existing or new equipment and systems will not be used for temporary heating and ventilating.
- .8 After award of contract, Departmental Representative may permit use of the permanent system providing agreement can be reached on:
  - .1 Conditions of use, special equipment, protection, maintenance, and replacement of filters.
  - .2 Methods of ensuring that heating medium will not be wasted and in the case of steam, agreement on what is to be done with the condensate.
  - .3 Saving on contract price.
  - .4 Provisions relating to guarantees on equipment.

**33. CONNECTIONS TO AND INTERRUPTIONS TO EXISTING SERVICES**

- .1 Where work involves breaking into or connecting to existing services, carry out work at times and in the manner agreed to by the Departmental Representative and by authorities having jurisdiction, with minimum disruption to NRC Personnel and vehicular traffic and minimum service interruption. Do not operate any NRC equipment or plant.
- .2 Before commencing work, establish location and extent of service lines in area of work and notify Departmental Representative of findings.

- .3 Submit a schedule to and obtain approval from the Departmental Representative for any shut-down or closure of active service or facility; allow minimum 72 hours notice. Adhere to approved schedule and provide notice to the Departmental Representative.
- .4 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .5 Provide detours, bridges, alternate feeds, etc., as required to minimize disruptions.
- .6 Protect existing services as required and immediately make repairs if damage occurs.
- .7 Remove any abandoned service lines as indicated on the contract documents and as approved by the Departmental Representative; cap or otherwise seal lines at cut-off points. Record and provide a copy to the Departmental Representative of locations of maintained, re-routed and abandoned service lines.

**34. CUTTING AND PATCHING**

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

**35. FASTENING DEVICES**

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



**36. 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.

**37. DRAINAGE**

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

**38. ENCLOSURE OF STRUCTURES**

- .1 Construct and maintain all temporary enclosures as required to protect foundations, sub-soil, concrete, masonry, etc., from frost penetration or damage.
- .2 Maintain in place until all chances of damage are over and proper curing has taken place.
- .3 Provide temporary weather tight enclosures for exterior openings until permanent sash and glazing and exterior doors are installed.
- .4 Provide lockable enclosures as required to maintain the security of NRC facilities and be responsible for the same.
- .5 Provide keys to NRC security personnel when required.
- .6 Lay out the work carefully and accurately and verify all dimensions and be responsible for them. Locate and preserve general reference points.
- .7 Throughout the course of construction, keep continuously acquainted with field conditions, and the work being developed by all trades involved in the project. Maintain an awareness of responsibility to avoid space conflict with other trades.
- .8 Conceal all services, piping, wiring, ductwork, etc., in floors, walls or ceilings except where indicated otherwise.

**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 Departmental Representative.

**40. GENERAL REVIEW**

- .1 Periodic review of the contractor's work by the Departmental Representative does not relieve the contractor of the responsibility of making the work in accordance with contract documents. Contractor shall carry out his own quality control to ensure that the construction work is in accordance with contract documents.

- .2 Inform the Departmental Representative of any impediments to the installation and obtain his / her approval for actual location.

**41. 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.

**42. 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.

**43. PARTIAL OCCUPANCY**

- .1 NRC may request partial occupancy of the facility if the contract extends beyond the expected completion date.
- .2 Do not restrict access to the building, routes, and services.
- .3 Do not encumber the site with materials or equipment.

**44. DISPOSAL OF WASTES**

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

**45. 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.

**46. 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

**47. WARRANTY AND RECTIFICATION OF DEFECTS IN WORK**

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

**48. MAINTENANCE MANUALS**

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

**END OF SECTION**

## 1. GENERAL CONSTRUCTION SAFETY REQUIREMENTS

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

- .10 The Departmental Representative will monitor to ensure that safety requirements are met and that safety records are properly kept and maintained. Continued disregard for safety standards can cause the contract to be cancelled and the Contractor or sub-contractors removed from the site.
- .11 The Contractor will report to the Departmental Representative and jurisdictional authorities, any accident or incident involving Contractor or NRC personnel or the public and/or property arising from the Contractor's execution of the work.
- .12 If entry to a laboratory is required as part of the work of the Contractor, a safety orientation shall be provided to all his employees as well as those of any subcontractors regarding lab safety requirements and procedures, as provided by the Researcher or the Departmental Representative.

## **2. FIRE SAFETY REQUIREMENTS**

### **.1 Authorities**

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

### **.2 Smoking**

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

### **.3 Hot Work**

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

### **.4 Reporting Fires**

- .1 Know the exact location of the nearest Fire Alarm Pull Station and telephone, including the emergency phone number.
- .2 REPORT immediately, all fire incidents as follows:
  - .1 Activate nearest fire alarm pull station and;

.2 Telephone the following emergency phone number as appropriate:

<b>FROM AN NRC PHONE</b>	<b>333</b>
<b>FROM ANY OTHER PHONE</b>	<b>(613) 993-2411</b>

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

**.5 Interior and Exterior Fire protection & Alarm Systems**

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

**.6 Fire Extinguishers**

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

- .4 Carbon Dioxide (CO<sub>2</sub>) extinguishers will not be considered as substitutes for the above.

## **.7 Roofing Operations**

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

## **.8 Welding / Grinding Operations**

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

## **.9 Fire Watch**

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

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

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

**.11 Rubbish and Waste Materials**

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

**.12 Flammable Liquids**

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



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

**3. Questions and/or clarifications**

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

**END OF SECTION**

## PART 1 - GENERAL

### 1.1 RELATED SECTIONS

- .1 Section 01 33 00 - Submittal Procedures.
- .2 Section 01 35 30 - Health and Safety Requirements.
- .3 Section 04 05 19 – Masonry Anchorage and Reinforcing
- .4 Section 04 22 00 – Concrete Unit Masonry
- .5 Section 07 21 16 – Blanket Insulation
- .6 Section 08 11 00 – Metal Doors, Frames and Screens
- .7 Section 09 21 16 – Gypsum Board

### 1.2 REFERENCES

- .1 National Building Code 2015, Part 4.
- .2 Ontario Building Code 2012, Part 4.
- .3 ASTM A 653/A653M-04a, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
- .4 American Society for Testing and Materials International (ASTM).
- .5 Canadian Standards Association (CSA International)
  - .1 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .2 CSA W47.1-03, Certification of Companies for Fusion Welding of Steel.
  - .3 CSA W55.3-08 (R2013), Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
  - .4 CSA W59-03 (R2008), Welded Steel Construction (Metal Arc Welding) (Metric Version).
  - .5 CAN/CSA S136-01 (R2007), North American Specification for the Design of Cold-Formed Steel Structural Members.
  - .6 Canadian Sheet Steel Building Institute (CSSBI)
    - .1 CSSBI 50M-87, Lightweight Steel Framing Manual.
    - .2 CSSBI 52M-91, Lightweight Steel Framing Binder.
    - .3 CSSBI S5-04, Guide Specification for Wind Bearing Steel Studs.

### 1.3 SUBMITTALS

- .1 Make submittals in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Submit 3 copies of engineering calculations or data verifying the

capacity of the members and the ability of the assemblies to meet the design requirements.

- .3 Submit shop drawings in accordance with Section 01 33 00.
  - .1 Each shop drawing submitted shall bear the stamp and signature of a qualified Professional Engineer who is registered and licensed to practice in the Province of Ontario. The metal stud systems contractor shall retain the services of a Professional Structural Engineer for the Project and pay for engineering services in connection with shop drawings and review during construction of the metal stud systems.
  - .2 Include all necessary shop details and erection diagrams. Indicate member sizes, locations, thicknesses exclusive of coating, coatings and materials. Include connection details for attaching framing to itself and for attachment to the structure. Show splice details where permitted. Indicate dimension, openings, requirement of related work and critical installation procedures. Show temporary bracing required for erection purposes.
  - .3 Indicate design loads.
- .4 Do not fabricate until all submittals are reviewed by the Architect.
- .5 Submit 3 copies of field review reports from the Systems Contractors Structural Engineer.
- .6 Contractor shall retain and pay for a qualified Professional Engineer who is licensed to practice in the Province of Ontario, to verify and provide a written statement that installed steel stud systems will withstand factored loads identified in items listed above. The written statement shall bear the stamp and signature of the Professional Engineer.

#### 1.4 DESIGN CRITERIA

- .1 Provide and pay for structural engineering and design for the following:
  - .1 Control Room 123 and B.F. WC 123A, wall and ceiling assembly.
  - .2 East wall stud wall along gridline 13 between gridlines B.6 and C.5.
- .2 The design for the entire wall system, framing, suspension system, and anchoring to the building structure shall be based on principles using factored loads and resistances.
- .3 Loads, load factors and seismic restraints shall be in accordance with the 2012 Ontario Building Code the User's Guide NBC 2015 Structural Commentaries, Commentary.
- .4 Resistances and resistance factors shall be determined in accordance with the 2012 Ontario Building Code and CAN/CSA-S136.

- .6 Design bridging to prevent member rotation and member translation perpendicular to the minor axis. Provide for secondary stress effects due to torsion between lines of bridging. Sheathing shall **not** be used to help restrain member rotation and translation perpendicular to the minor axis for: wind bearing studs.
- .7 Maximum deflections under specified loads shall be  $L/600$ .
- .8 Design components or assemblies to accommodate specified erection tolerances of the structure.
- .9 Wall stud framing spacing shall not exceed 400 mm o/c (16")
- .10 Allow for movement of the building structure. Design wind bearing stud end connections to accommodate deflections of the building structure such that the studs are not loaded axially.
- .11 Connections between stud framing members shall be by bolts, welding or sheet metal screws.
- .12 Resistances for sheet metal screw shall be based on the manufacturer's lower bound test values multiplied by the appropriate resistance factor, given in CAN3-S136.
- .13 Allow for appropriate end eccentricities in the design of axial load bearing members.
- .14 Design framing of openings to support glazed pressed metal screens, doors and windows.

**1.5 DELIVERY,  
STORAGE AND  
HANDLING**

- .1 Protect steel studs during transportation, site storage and installation in accordance with CSSBI Sheet Steel Facts #3.
- .2 Handle and protect galvanized materials from damage to zinc coating.

**PART 2 – PRODUCTS**

**2.1 MATERIALS**

- .1 Steel: to CSA S136, fabricated from ASTM A 653/A653M, grade as required for structural performance.
- .2 Zinc coated steel sheet: quality to ASTM A 653/A653M.
- .3 Welding materials: to CSA W59 and certified by Canadian Welding Bureau.
- .4 Screws: self-drilling, self-tapping sheet metal screws, corrosion protected with minimum zinc coating thickness of 0.008 mm.

- .5 Anchors: concrete expansion anchors or other suitable drilled type fasteners.
- .6 Bolts, nuts, washers: hot dipped galvanized to CAN/CSA-0164.
- .7 Touch up primer: zinc rich, to CAN/CGSB 1-GP-181.

## 2.2 STEEL STUD DESIGNATIONS

- .1 Colour code: to CSSBI Technical Bulletin Vol. 7, No. 2.

## 2.3 EXTERIOR WALL METAL FRAMING

- .1 EXTERIOR WALL CHANNEL STUD FRAMING: to ASTM C1007-latest edition; stud side 203 mm deep; 152 mm, and 92 mm as indicated on drawings; roll formed from minimum 18 gauge thickness (0.0428 inch – 1.09 mm) hot dip galvanized sheet steel; for screw attachment of cementitious and gypsum based sheathing boards and steel girth. Knock out service holes at 460 mm centres.
- .2 EXTERIOR STUD WALL FLOOR TRACKS: to ASTM C955-latest edition, in widths to suit stud sizes. 50 mm + flange height, to suit individual conditions; roll formed from minimum 18 gauge thickness (0.0428 inch – 1.09 mm), hot dip galvanized sheet steel. Increase gauge as required to meet design criteria.
- .3 EXTERIOR STUD WALL TOP TRACKS: to ASTM C955-latest edition, in width to suit stud sizes complete with long legged and slotted inner and outer top track to accommodate deflection of the building structure. Screwed top track deflection as per Bailey Construction Detail No. A3. Finish to match wall stud framing. Roll formed from minimum 18 gauge thickness (0.0428 inch – 1.09 mm). Increase gauge as required to meet design criteria.
- .4 Bridging: fabricated from same material and finish as studs, 38 x 12 x 1.09 mm minimum thickness.
- .5 Angle clips: fabricated from same material and finish as studs, 38 x 38 mm x depth of steel stud, 1.37 mm minimum thickness, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web and capable of resisting forces imposed by the wall system.
- .6 Tension straps and accessories: as recommended by manufacturer and as required for structural performance.
- .7 Insulating strip: rubberized, moisture resistant 3 mm thick neoprene strip, 12 mm wide, with self-sticking adhesive on one (1) face, lengths as required.

**PART 3 - EXECUTION**

**3.1 GENERAL**

- .1 Do welding in accordance with CSA W59.
- .2 Certification of companies: CSA W47.1 for fusion welding and CSA W55.3 for resistance welding.
- .3 Do work to CSSBI S5.

**3.2 ERECTION**

- .1 Erect components to requirements of reviewed shop drawings.
- .2 Anchor tracks securely to structure at spacing required for structural performance.
- .3 Erect studs plumb, aligned and securely attached as required for structural performance.
- .4 Install studs at not more than 50.0 mm from abutting walls, openings, and each side of corners and terminations with dissimilar materials.
- .5 Brace steel studs with horizontal internal bridging at 1500 mm maximum and as required for structural performance.
  - .1 Fasten bridging to steel clips fastened to steel studs with screws or by welding.
- .6 Frame openings in stud walls to adequately carry loads by use of additional framing members and bracing as detailed on shop drawings.
- .7 Touch up welds with coat of zinc rich primer.

**3.3 ERECTION  
TOLERANCES**

- .1 Plumb: not to exceed 1/500th of member length.
- .2 Camber: not to exceed 1/1000th of member length.
- .3 Spacing: not more than +/- 3.0 from design spacing.
- .4 Gap between end of stud and track web: not more than 4.0 m.

**3.4 CUTOUTS**

- .1 Maximum size of cutouts for services as follows:

Member Depth	Across Member Depth	Along Member Length	Centre to Centre Spacing (mm)
92	40 max.	105 max.	600 min.
102	40 max.	105 max.	600 min.
152	65 max.	115 max.	600 min.

- .2 Limit distance from centreline of last unreinforced cutout to end of member to less than 300 mm.

**3.5 STRUCTURAL  
CERTIFICATION**

- .1 Upon completion of work, identified in Item 1.3 and 1.4, provide a certificate that shall state that the work has been performed in accordance with requirements of the Ontario Building Code and Regulations of Authorities in Jurisdiction. The certificate shall bear the seal of a qualified Structural Engineer who is licensed in the Province of Ontario.

**END OF SECTION**

## PART 1 - GENERAL

### 1.1 RELATED SECTIONS

- .1 Section 05 41 00 – Structural Metal Stud Framing
- .2 Section 07 27 00.02 – Air Barriers
- .3 Section 09 22 16 - Non-Structural Metal Framing
- .4 Insulation for Mechanical Work – Refer to Mechanical Drawings

### 1.2 REFERENCES

- .1 ASTM International (ASTM):
  - .1 ASTM C165 – 2012, Standard Test Method for Measuring Compressive Properties of Thermal Insulations.
  - .2 ASTM C303 – 2010, Standard Test Method for Dimensions and Density of Preformed Block and Board-Type Thermal Insulation.
  - .3 ASTM C518 – 2010, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
  - .4 ASTM C612 – 2010, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
  - .5 ASTM C665 – 2011, Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
  - .6 ASTM C1104/C1104M – 2013, Standard Test Method for Determining the Water Vapour Sorption of Unfaced Mineral Fiber Insulation.
  - .7 ASTM C1338 – 2008, Standard Test Method for Determining Fungi Resistance of Insulation Materials and Facings.
  - .8 ASTM E96/E96M – 2010, Standard Test Methods for Water Vapour Transmission of Materials.
- .2 Underwriters' Laboratories of Canada (ULC).
  - .1 CAN/ULC S102-2010, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.
  - .2 CAN/ULC S114-2005, Standard Method of Test for Determination of Non-Combustibility in Building Materials.
  - .3 CAN/ULC S702-2014, Standard for Thermal Insulation Mineral Fiber for Buildings.
- .3 Canadian Gas Association (CGA)
  - .1 CAN/CGA-B149.1-R2015, Natural Gas and Propane Installation Code Handbook.
  - .2 CAN/CGA-B149.2-R2015, Propane Storage and Handling Code.
- .4 CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe coverings.



- 1.3 SUBMITTALS**
- .1 Product Data:
    - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 00 10 00.
  - .2 Manufacturer's Instructions:
    - .1 Submit manufacturer's installation instructions.
- 1.4 QUALITY ASSURANCE**
- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

## **PART 2 - PRODUCTS**

- 2.1 INSULATION**
- .1 Semi-rigid insulation, Mineral fibre board: to CAN/ULC-S702, ASTM C 612.
    - .1 Density: 70 kg/m<sup>3</sup>.
    - .2 Surfaces: unsurfaced.
    - .3 Thickness: as indicated.
    - .4 Acceptable Material:  
Rockwool Cavity Rock Insulation as manufactured by Rockwool Inc.
- 2.2 ACCESSORIES**
- .1 For concrete block or poured concrete - Insulation clips: impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self locking type.

OR

Purpose-made plastic ribbed mechanical fasteners with head size of 40 mm dia., length to suit for fastening to concrete or concrete block.
  - .2 Adhesive as recommended by manufacturer, to CGSB 71-GP-24M, Type 1, compatible with insulation types, air/vapour barrier system and bituminous dampproofing

## **PART 3 - EXECUTION**

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

- 3.2 WORKMANSHIP**
- .1 Install insulation after building substrate materials are dry.
  - .2 Install insulation to maintain continuity of thermal protection to building elements and spaces.
  - .3 Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.
  - .4 Offset both vertical and horizontal joints in multiple layer applications.
  - .5 Do not enclose insulation until it has been inspected and approved by Departmental Representative.
- 3.3 CAVITY WALL INSTALLATION**
- .1 Install mineral fibre insulation boards as detailed and as recommended by Insulation Manufacturer.
- 3.4 PERIMETER FOUNDATION INSULATION**
- .1 Extend boards on exterior and interior face of foundation wall and underslab as indicated.
- 3.5 CLEANING**
- .1 Upon completion of installation, remove surplus materials, rubbish, tools and equipment barriers.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 RELATED SECTIONS**

- .1 Gypsum Board Section 09 21 16
- .2 Insulation for Mechanical Work Refer to Mechanical Drawings

**1.2 REFERENCES**

- .1 American Society for Testing and Materials specified in project specification.
  - .1 ASTM C 553-13, Specification for Mineral Fibre Blanket Thermal Insulation for Commercial and Industrial Applications.
  - .2 ASTM C 665-12, Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
  - .3 ASTM C 1320-10(R2016), Standard Practice for Installation of Mineral Fiber Batt and Blanket Thermal Insulation for Light Frame Construction.
- .2 Canadian Gas Association (CGA)
  - .1 CAN/CGA-B149.1-2015, Natural Gas and Propane Installation Code Handbook.
  - .2 CAN/CGA-B149.2-05, Propane Storage and Handling Code.
- .3 Canadian Standards Association (CSA International)
  - .1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.
- .4 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC-S604-M1991, Type A Chimneys.
  - .2 CAN/ULC-S702-09, Standard for Mineral Fibre Insulation.

**1.3 SUBMITTALS**

- .1 Product Data:
  - .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 01 33 00.
- .2 Manufacturer's Instructions:
  - .1 Submit manufacturer's installation instructions.

**1.4 QUALITY ASSURANCE**

- .1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .2 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

## **PART 2 PRODUCTS**

### **2.1 INSULATION**

- .1 Sound attenuation batt insulation: to CAN/ULC S702-latest edition, Type 1 (without membrane). Thickness to match depth of wall cavity.

.1 Acceptable Materials:

- .1 "Safe 'N' Sound" batt insulation and/or "Acoustical Fire Batts - AFB" as manufactured by Roxul Inc.
- .2 "Quiet Zone" noise stop blanket - 700 Series as manufactured by Owens Corning Canada Inc.
- .3 Eco Touch Pink Quite Zone Pink Fiberglas Acoustic Insulation.
- .4 "Noise Reducer" Sound Attenuation Batt by Certain Teed Insulation.

### **2.2 ACCESSORIES**

.1 Insulation clips:

- .1 For concrete block and concrete back-up walls and gypsum sheathing boards - Impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self locking type.
- .2 For Steel Stud back-up walls - Insulations screws complete with 50mm diameter white polypropylene washer. Screws to be of length to suit installation, corrosion resistance to DIN 50018.2.01 and ASTM B117, self-tapping, Phillips head screws. Retaining washer to be made of polypropylene and is to be a minimum of 50 mm diameter.

.1 Standard of Acceptance: Grid-Mate by, ITW Buildex

- .3 Nails: galvanized steel, length to suit insulation plus 25 mm, to CSA B111.
- .4 Staples: 12 mm minimum leg.
- .5 Tape: as recommended by manufacturer.

## **PART 3 EXECUTION**

### **3.1 MANUFACTURER'S INSTRUCTIONS**

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

### **3.2 INSULATION INSTALLATION**

- .1 Install insulation to maintain continuity of thermal protection to building elements and spaces and to ASTM C 1320.
- .2 Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.

- .3 Do not compress insulation to fit into spaces.
- .4 Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures.
- .5 Install insulation where indicated. Lap ends and side flanges of membrane over framing members. Retain in position with nails, staples, insulation clips or wire ties installed as recommended by manufacturer. Tape seal butt ends and lapped side flanges. Do not tear or cut vapour barrier.
- .6 Fit insulation between window frame, door frame, and surrounding masonry opening, or other surfaces.
- .7 Do not enclose insulation until it has been inspected and approved by Architect.

### **3.3 CLEANING**

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

**END OF SECTION**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- .1 Materials and installation methods providing air vapour barrier materials and assemblies.

**1.2 RELATED SECTIONS**

- .1 Masonry Accessories Section 04 05 23  
.2 Sealants Section 07 92 00  
.3 Aluminum Doors and Door Frames Section 08 11 16

**1.3 REFERENCES**

- .1 Canadian Construction Documents Committee  
.1 CCDC 2 - Stipulated Price Contract.
- .2 Canadian General Standards Board (CGSB)  
.1 CAN/CGSB-19.13M-[M87], Sealing Compound, One Component, Elastomeric Chemical Curing.  
.2 CAN/CGSB-19.18M-[M87], Sealing Compound, One Component, Silicone Base Solvent Curing.  
.3 CAN/CGSB-19.24M-[M90], Multi-Component, Chemical Curing Sealing Compound.  
.4 CGSB 19-GP-14M-[76], Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.  
.5 CGSB 37-GP-56M: Membrane, Modified, Bituminous, Prefabricated, and Reinforced.
- .3 American Society for Testing and Materials International (ASTM).  
1. ASTM E2357: Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.  
2. ASTM E2178: Standard Test Method for Air Permeance of Building Materials.  
3. ASTM E283: Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.  
4. ASTM E330: Standard Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.  
5. ASTM E331: Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference  
6. ASTM E96: Water Vapor Transmission of Materials.
- .4 NBC 2010; Part 5 - Environmental Separation
- .5 Sealant and Waterproofer's Institute - Sealant and Caulking Guide Specification.

**1.4 SUBMITTALS**

- .1 Submit shop drawings in accordance with Section 01 33 00.

- .2 Submit manufacturer's product data sheets in accordance with Section 01 33 00.
- .3 Submit manufacturer's installation instructions in accordance with Section 01 33 00.

**1.5 QUALITY ASSURANCE**

- .1 Perform Work in accordance with Sealant and Waterproofer's Institute – Sealant and Caulking Guide Specification requirements for materials and installation.
- .2 Perform Work in accordance with National Air Barrier Association – Professional Contractor Quality Assurance Program and manufacturer's requirements for materials and installation.
- .3 At the beginning of the work and at all times during the execution of the work, allow access to work site by the air/vapour barrier membrane manufacturer's representative.
- .4 Components used in this section shall be sourced from one manufacturer, including sheet membrane, air/vapour barrier sealants, primers, mastics and adhesives.

**1.6 MOCK-UP**

- .1 Construct mock-up in accordance with Section 01 33 00.
- .2 Construct typical exterior wall panel, incorporating window and frame and sill, insulation, junction with roof system and illustrating materials interface and seals.
- .3 Locate where directed.
- .4 Allow 24 h for inspection of mock-up by Architect before proceeding with air/vapour barrier work.

**1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 Common Product Requirements.
- .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .3 Avoid spillage. If spillage occurs and start clean up procedures.
- .4 Clean spills and leave area as it was prior to spill.
- .5 Deliver materials to the job site in undamaged and original packaging indicating the name of the manufacturer and product.
- .6 Store roll materials on end in original packaging.
- .7 Store adhesives and primers at temperatures of 5°C and above to facilitate handling.
- .8 Keep solvent away from open flame or excessive heat.
- .9 Protect rolls from direct sunlight until ready for use.

**1.8 PROJECT ENVIRONMENTAL REQUIREMENTS**

- .1 Do not install solvent curing sealants or vapour release adhesive materials in enclosed spaces without ventilation.
- .2 Maintain temperature and humidity recommended by materials manufacturers before, during and after installation.

**1.9 SEQUENCING**

- .1 Sequence work to permit installation of materials in conjunction with related materials and seals.

**1.10 WARRANTY**

- .1 Provide a three year warranty.
- .2 Warranty: Include coverage of installed sealant and sheet materials which fail to achieve air tight and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

**PART 2 PRODUCTS**

**2.1 SHEET MATERIALS**

- .1 Sheet air/vapour barrier membrane, an SBS modified bitumen, self-adhering sheet membrane complete with engineered thermoplastic film. Membrane shall have the following physical properties:
  - .1 ASTM E2357: Standard Test Method for Determining Air Leakage of Air Barrier Assemblies,
  - .2 Air leakage: <0.0001 CFM/ft<sup>2</sup> @1.6 lbs/ft<sup>2</sup> to ASTM E2178 and ASTM E283 and have no increased air leakage when subjected to a sustained wind load of 10.5 lbs/ft<sup>2</sup> for 1 hour and gust wind load pressure of 62.8 lbs/ft<sup>2</sup> for 10 seconds when tested at 1.6 lbs/ft<sup>2</sup> to ASTM E331,
  - .3 Vapour permeance: 0.03 perms to ASTM E96 (Desiccant Method),
  - .4 Membrane Thickness: 0.0394 inches (40 mils),
  - .5 Low temperature flexibility: -22 degrees F to CGSB 37-GP-56M,
  - .6 Elongation: 200% to ASTM D412-modified,
  - .7 Meets CAN/CGSB-51-33 Type I Water Vapor Permeance requirements
  - .8 Acceptable Material: Blueskin<sup>®</sup> SA manufactured by Henry; For application temperatures down to 10 degrees F use Blueskin<sup>®</sup> SA LT.

**2.2 SEALANTS**

- .1 Termination Sealant; a moisture cure, medium modulus polymer modified sealing compound having the following physical properties:
  - .1 Compatible with sheet air barrier, roofing and waterproofing membranes and substrate,
  - .2 Complies with Fed. Spec. TT-S-00230C, Type II, Class A,
  - .3 Complies with ASTM C 920, Type S, Grade NS, Class 25,
  - .4 Elongation: 450 – 550%,
  - .5 Remains flexible with aging,
  - .6 Seals construction joints up to 1 inch wide
  - .7 Acceptable Material: HE925 BES Sealant manufactured by Henry



## 2.3 INSULATION ADHESIVES

- .1 Insulation adhesive; a synthetic, trowel applied, rubber based adhesive, having the following physical properties:
  - .1 Compatibility: With air barrier membrane, substrate and insulation,
  - .2 Air leakage: 0.0026 CFM/ft<sup>2</sup> @ 2.1 lbs/ft<sup>2</sup> to ASTM E283,
  - .3 Water vapour permeance: 0.03 perms to ASTM E96,
  - .4 Long term flexibility: CGSB 71-GP-24M
  - .5 Acceptable Material: Air-Bloc 21 Insulation Adhesive manufactured by Henry

## 2.4 PRIMERS

- .1 Primer for self-adhering membranes at temperatures above 25 degrees F; a polymer emulsion based adhesive, quick setting. Primer shall have the following physical properties:
  - .1 Colour: Aqua,
  - .2 Weight: 8.7 lbs/gal,
  - .3 Solids by weight: 53%,
  - .4 Water based, no solvent odours,
  - .5 Drying time (initial set): 30 minutes at 50% RH and 70 degrees F
  - .6 Acceptable Material: Aquatac™ Primer manufactured by Henry

## PART 3 EXECUTION

### 3.1 EXAMINATION

- .1 Verify that surfaces and conditions are ready to accept the Work of this section. Notify architect in writing of any discrepancies. Commencement of the work or any parts thereof shall mean acceptance of the prepared substrates.
- .2 All surfaces must be sound, dry, clean and free of oil, grease, dirt, excess mortar or other contaminants. Fill spalled areas in substrate to provide an even plane. Strike masonry joints flush.
- .3 Where curing compounds are used they must be clear resin based without oil, wax or pigments.
- .4 Do not proceed with application of air barrier membrane when rain is expected within 24 hours.
- .5 Condition materials to room temperature prior to application to facilitate handling.

### 3.2 PREPARATION

- .1 Surfaces must be sound, clean and free of oil, grease, dirt, excess mortar or other contaminants. Fill spalled areas in substrate to provide an even plane.
- .2 New concrete should be cured for a minimum of 14 days and must be dry before air/vapour barrier membranes are applied.
- .3 Ensure all preparatory Work is complete prior to applying primary air/vapour barrier membrane.

- .4 Mechanical fasteners used to secure sheathing boards or penetrate sheathing boards shall be set flush with sheathing and fastened into solid backing.
- .5 Apply primer at rate recommended by manufacturer to all areas to receive self-adhering sheet air/vapour barrier membrane and or through-wall flashing membrane as indicated on drawings by roller or spray and allow minimum 30 minute open time. Primed surfaces not covered by self-adhering membrane or self-adhering through-wall flashing membrane during the same working day must be re-primed.

### 3.3 INSTALLATION

- .1 Install materials in accordance with manufacturer's instructions.

#### .2 INSIDE AND OUTSIDE CORNERS

- .1 Seal inside and outside corners of sheathing boards with a strip of self-adhering air/vapor barrier membrane extending a minimum of 3 inches on either side of the corner detail.
  - .1 Prime surfaces as per manufacturers' instructions and allow to dry.
  - .2 Align and position self-adhering transition membrane, remove protective film and press firmly into place. Ensure minimum 2 inches overlap at all end and side laps of membrane.
  - .3 Roll all laps and membrane with a counter top roller to ensure seal.

#### .3 TRANSITION AREAS

- .1 Tie-in to structural beams, columns, floor slabs and intermittent floors, parapet curbs, foundation walls, roofing systems and at the interface of dissimilar materials as indicated in drawings with self-adhering air/vapor barrier membrane.
  - .1 Prime surfaces as per manufacturers' instructions and allow to dry.
  - .2 Align and position self-adhering transition membrane, remove protective film and press firmly into place. Provide minimum 3 inch lap to all substrates.
  - .3 Ensure minimum 2 inch overlap at all end and side laps of membrane.
  - .4 Roll all laps and membrane with a counter top roller to ensure seal.

#### .4 WINDOWS AND ROUGH OPENINGS

- .1 Wrap rough openings with self-adhered air/vapour barrier membrane as detailed.
  - .1 Prime surfaces as per manufacturer's instructions and allow to dry.
  - .2 Align and position self-adhering transition membrane, remove protective film and press firmly into place. Ensure minimum 2 inch overlap at all end and side laps of membrane.
  - .3 Roll all laps and membrane with a counter top roller to ensure seal.

**.5 THROUGH-WALL FLASHING MEMBRANE**

- .1 Apply through-wall flashing membrane along the base of masonry veneer walls and over shelf angles as detailed.
  - .1 Prime surfaces and allow to dry, press membrane firmly into place, overlap minimum 2 inches at all end and side laps. Promptly roll all laps and membrane to ensure the seal.
  - .2 Applications shall form a continuous flashing membrane and shall extend up a minimum of 8 inches up the back-up wall.
  - .3 Seal the top edge of the membrane where it meets the substrate using termination sealant. Trowel-apply a feathered edge to seal termination to shed water.
  - .4 Install through-wall flashing membrane and extend 1/2 inch from outside edge of veneer. Provide end dam flashing as detailed.

**.6 PRIMARY AIR/VAPOUR BARRIER**

- .1 Apply self-adhering air/vapour barrier membrane complete and continuous to prepared and primed substrate in an overlapping shingle fashion and in accordance with manufacturer's recommendations and written instructions. Stagger all vertical joints.
  - .1 Prime surfaces as per manufacturers' instructions and allow to dry.
  - .2 Align and position self-adhering air/vapour barrier membrane, remove protective film and press firmly into place. Ensure minimum 2 inch overlap at all end and side laps of membrane.
  - .3 Roll all laps and membrane with a counter top roller to ensure seal.
  - .4 At the end of each days work seal the top edge of the membrane where it meets the substrate with termination sealant. Trowel apply a feathered edge to seal termination and shed water.

**3.4 INSTALLATION OF INSULATION**

- .1 Coordinate with Wall Insulation for insulating materials.
- .2 Apply insulation adhesive in a serpentine pattern over the air barrier membrane.
  - .1 Dab Method: Apply walnut-sized dabs of insulation adhesive spaced 6 inches on centre to substrate. Apply insulation using sufficient hand pressure to compress dabs up to 2 inches.
  - .2 Bead Method: Apply ¼ inch beads 6 inches on centre in a serpentine pattern.
- .3 Immediately embed insulation into the adhesive and press firmly into place to ensure full contact. Apply additional adhesive if allowed to skin over.

**3.5 PROTECTION OF WORK**

- .1 Damp substrates must not be inhibited from drying out. Do not expose the backside of the substrate to moisture or rain.
- .2 Cap and protect exposed back-up walls against wet weather conditions during and after application of membrane.
- .3 Air/Vapour barrier membrane is not designed for permanent exposure. Good practice calls for covering as soon as possible.

- .4 Ensure finished work is protected from climatic conditions.

**3.6 AIR/VAPOUR BARRIER MEMBRANE**

- .1 Pre-apply membrane sealing compound to changes in-plane and out-of-plane variations.
- .2 Apply membrane complete and continuous to primed substrate in an overlapping shingle fashion and in accordance with manufacturer's recommendations and written instructions. Stagger all vertical joints.
- .3 Align, position and dry-fit sheet membrane, remove protective film and press firmly into place. Ensure minimum 50 mm overlap at all end and side laps. To ensure full adhesion, promptly apply pressure by rolling all membrane surfaces using acceptable roller. Re-roll laps.
- .4 At the end of each day's work, seal the top edge of the membrane where it meets the substrate using membrane sealing compound. Trowel apply a feathered edge to seal termination and shed water.
- .5 Ensure all projections, including anchors are properly sealed with a caulk application of membrane sealing compound.
- .6 Membrane applied to the underside of substrate shall receive special attention on application to ensure maximum surface area adhesion is obtained.
- .7 Use sheets of largest practical size to minimize joints.
- .8 Before work is concealed, inspect sheets for continuity. Repair punctures and tears with membrane patches, at least 50 mm wider than the defect, on all sides. Seal edges of repair patches with membrane sealing compound.

**END OF SECTION**

**PART 1 - GENERAL**

- 1.1 SECTION INCLUDES** .1 Materials, preparation and application for caulking and sealants.
- 1.2 RELATED WORK** .1 Masonry Procedures Section 04 05 00  
.2 Acoustical caulking Section 09 21 16
- 1.3 REFERENCES** .1 American Society for Testing and Materials International, (ASTM)
- .1 ASTM C 919-Latest Edition, Standard Practice for use of Sealants in Acoustical Applications.
  - .2 ASTM C 661 - Standard Test Method for Indentation Hardness of Elastomeric Type Sealants by means of a Durometer.
  - .3 ASTM C 794 - Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants.
  - .4 ASTM C834 - Specification for Latex Sealants.
  - .5 ASTM C 920 - Specification for Elastomeric Joint Sealants.
  - .6 ASTM C 1087 - Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems.
  - .7 ASTM C 1193 - Guide for Use of Joint Sealants.
  - .8 ASTM C 1248 - Test Method for Staining of Porous Substrate by Joint Sealants.
  - .9 ASTM C 1311 - Specification for Solvent Release Sealants.
  - .10 ASTM C 1330 - Cylindrical Sealant Backing for Use with Cold Liquid Applied Sealants.
  - .11 ASTM D 412 - Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension.
  - .12 ASTM D 624 - Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
  - .13 ASTM D 2240 - Test Method for Rubber Property - Durometer Hardness.
  - .14 ASTM E 283 - Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
  - .15 ASTM E 331 - Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.

- .16 ASATM C679 – Standard Test Method for Tack-Free Time of Elastomeric Sealants.
  - .17 ASTM C719 – Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement (Hockman Cycle).
  - .18 ASTM C1135 – Standard Test Method for Determining Tensile Adhesion Properties of Structural Sealants.
  - .19 ASTM D412 - Standard Test Method for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers – Tension.
  - .20 ASTM D2202 – Standard Test Method for Slump of Sealants.
- .2 Canadian General Standards Board (CGSB)
    - .1 CAN/CGSB-19.13-M87, Sealing Compound, One-Component, Elastomeric, Chemical Curing.
    - .2 CAN/CGSB-19.24-M90, Multi-component, Chemical Curing Sealing Compound.
  - .3 Department of Justice Canada (Jus)
    - .1 Canadian Environmental Protection Act, 1999 (CEPA).
  - .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
    - .1 Material Safety Data Sheets (MSDS).
  - .5 Transport Canada (TC)
    - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
  - .6 Underwriter's Laboratories of Canada (ULC)
    - .1 CAN/ULC S102-07 Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

#### 1.4 SUBMITTALS

- .1 Submit product data in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Manufacturer's product to describe.
  - .1 Caulking compound.
  - .2 Primers.
  - .3 Sealing compound, each type, including compatibility when different sealants are in contact with each other.
- .3 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

- .4 Submit duplicate samples of each type of material and colour.
- .5 Cured samples of exposed sealants for each colour where required to match adjacent material.
- .6 Submit manufacturer's instructions in accordance with Section 01 33 00 – Submittal Procedures.
  - .1 instructions to include installation instructions for each product used.

**1.5 QUALITY  
ASSURANCE / MOCK-UP**

- .1 Construct mock-up in accordance with Section 01 33 00.
- .2 Construct mock-up to show location, size, shape and depth of joints complete with back-up material, primer, caulking and sealant.
- .3 Mock-up will be used:
  - .1 To judge workmanship, substrate preparation, operation of equipment and material application.
- .4 Locate where directed.
- .5 Allow 48 hours for inspection of mock-up by Consultant before proceeding with sealant work.
- .6 When accepted, mock-up will demonstrate minimum standard of quality required for this Work. Approved mock-up may remain as part of finished Work.
- .7 Adhesion test: Apply silicone sealant to small area and perform adhesion test in accordance with ASTM C1193, Method A, to determine if primer is required to achieve adequate adhesion. If necessary, apply primer at rate and in accordance with manufacturer's instructions.

**1.6 WARRANTY**

- .1 Provide a written warranty in the name of the Owner: Original statement on Installer's letterhead in which Installer agrees to repair or replace joint sealants that demonstrate deterioration or failure within warranty period specified.
  - .1 Warranty Period: Five years from date of Certificate of Substantial Performance.
- .2 Special Manufacturer's Warranty: Manufacturer's Standard form in which joint sealant manufacturer agrees to furnish joint sealants to repair or replace those that demonstrate deterioration or failure under normal use within warranty period specified.

.1 Warranty Period for Silicone Sealants: 20 years date of Certificate of Substantial Performance.

.3 Warranty Conditions: Special warranties exclude deterioration or failure of joint sealants in normal use due to structural movement resulting in stresses on joint sealants exceeding sealant manufacturer's written specifications, joint substrate deterioration, mechanical damage, or normal accumulation of dirt or other contaminants.

**1.7 DELIVERY,  
STORAGE AND HANDLING**

.1 Deliver, handle, store and protect materials in accordance with Section 01 61 00.

.2 Deliver and store materials in original wrappings and containers with manufacturer's seals and labels, intact. Protect from freezing, moisture, water and contact with ground or floor.

**1.8 WASTE MANAGEMENT  
AND DISPOSAL**

.1 Separate waste materials for recycling.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Place materials defined as hazardous or toxic in designated containers.

.5 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.6 Unused sealant material must not be disposed of into sewer system, into streams, lakes, onto ground or in other location where it will pose health or environmental hazard.

.7 Divert unused joint sealing material from landfill to official hazardous material collections.

.8 Empty plastic joint sealer containers are not recyclable. Do not dispose of empty containers with plastic materials destined for recycling.

.9 Fold up metal banding, flatten, and place in designated area for recycling.

**1.9 PROJECT  
CONDITIONS**

.1 Environmental Limitations:



- .1 Do not proceed with installation of joint sealants under following conditions:
  - .1 When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 4.4 degrees C.
  - .2 When joint substrates are wet.
- .2 Joint-Width Conditions:
  - .1 Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.
- .3 Joint-Substrate Conditions:
  - .1 Do not proceed with installation of joint sealants until contaminants capable of interfering with adhesion are removed from joint substrates.

**1.10 ENVIRONMENTAL REQUIREMENTS**

- .1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to Labour Canada.
- .2 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.
- .3 Ventilate area of work by use of approved portable supply and exhaust fans.

**PART 2 - PRODUCTS**

**2.1 SEALNT MATERIALS**

- .1 Products and manufacturers specified establish performance and quality required and are not intended to restrict submission by other manufacturers.
- .2 Acceptance of Products from other manufacturers will be subject to review by the Consultant, for conformity with the Specifications and meeting the physical characteristics of the specified Products. Include compliance with referenced standards. Submittals which do not include adequate data for the product evaluation will not be considered.
- .3 If unapproved, substitute products are included in the bid, the specified Products shall be provided without additional compensation.
- .4 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

- .5 When low toxicity caulks are not possible, confine usage to areas which off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.
- .6 Where sealants are qualified with primers use only these primers.
- .7 Compatibility: Provide joint sealants and accessory materials that are compatible with one another, and with materials in close proximity under use conditions, as demonstrated by sealant manufacturer using ASTM C1087 testing and related experience.
- .8 Joint Sealant Standard: Comply with ASTM C 920 and other specified requirements for each liquid-applied joint sealant.
- .9 Stain Test Characteristics: Where sealants are required to be non-staining, provide sealants tested per ASTM C 1248 as non-staining on porous joint substrates indicated for Project.

**2.2 SEALANT  
MATERIAL DESIGNATIONS**

- .1 Type 1: Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 100/50, for Use T, NT; SWRI validation.
  - .1 Basis of Design Product: **DOW CORNING® 790 Silicone Building Sealant.**
  - .2 Hardness, ASTM C 661: 15 durometer Shore A.
  - .3 Volatile Organic Compound (VOC) Content: 26 g/L maximum.
  - .4 Staining, ASTM C 1248: None on concrete, granite, limestone, and brick.
  - .5 Colour: As selected by Architect from manufacturer's full line.
- .2 Type 2: Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT; SWRI validation.
  - .1 Basis of Design Product: **DOW CORNING® 756 SMS Building Sealant.**
  - .2 Hardness, ASTM C 661: 35 durometer Shore A.
  - .3 Volatile Organic Compound (VOC) Content: 60 g/L maximum
  - .4 Staining, ASTM C 1248: None on white marble.
  - .5 Colour: As selected by Architect from manufacturers full line.
- .3 Type 4: Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT, G, A, and O; SWRI validation.

- .1 Basis of Design Product: **DOW CORNING® 795 Silicone Building Sealant.**
  - .2 Hardness, ASTM C 661: 35 - 45 durometer Shore A.
  - .3 Volatile Organic Compound (VOC) Content: 32 g/L maximum
  - .4 Staining, ASTM C 1248: None on concrete, granite, limestone, and brick.
  - 5 Colour: As selected by Architect from manufacturers full line.
- .4 Type 6: Single-Component, Nonsag, Neutral-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT; SWRI validation.
- .1 Basis of Design Product: **DOW CORNING® 758 Silicone Weather Barrier Sealant.**
  - .2 Hardness, ASTM D 2240: 45 durometer Shore A.
  - .3 Volatile Organic Compound (VOC) Content: 61 g/L maximum
  - .4 Colour: White.
- .5 Type 7: Single-Component, Nonsag, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
- .1 Basis of Design Product: **DOW CORNING® 999-A Silicone Building & Glazing Sealant.**
  - .2 Hardness, ASTM D 2240: 25 durometer Shore A minimum.
  - .3 Volatile Organic Compound (VOC) Content: 36 g/L maximum
  - .4 Ultimate Tensile, ASTM D 412: 325 psi (1.2 MPA) at 21 day cure (Dumbbell)
  - .5 Colour: As selected by Architect from manufacturers full line.
- .6 Type 8: Mildew-Resistant, Single-Component, Nonsag, Acid-Curing Silicone Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use NT.
- .1 Basis of Design Product: **DOW CORNING® 786 Silicone Sealant.**
  - .2 Hardness, ASTM D 2240: 25 durometer Shore A
  - .3 Volatile Organic Compound (VOC) Content: 36 g/L maximum.
  - .4 NSF Standard 51 and FDA Regulation No. 21 CFR 177.2600 compliant.
  - .5 Colour: As selected by Architect from manufacturer's standard colours.

- .7 Type 9: Latex Joint Sealant: Siliconized acrylic latex, ASTM C 834, Type OP, Grade NF.
- .8 Type 10: Butyl-Rubber-Based Joint Sealant: ASTM C 1311.
- .9 PRE-FORMED JOINT SEALANTS
  - .1 Type 11: Preformed Silicone Elastomer Extrusion: Highly flexible low-modulus flashing and transition material for bonding to substrates with silicone sealant. SWRI validation.
    - .1 Basis of Design Product: **DOW CORNING® 123 Silicone Seal.**
    - .2 Surface: Textured.
    - .3 Bonding Sealant: Manufacturer's recommended neutral-curing silicone.
    - .4 Hardness, ASTM D 2240: 25 durometer Shore A, minimum.
    - .5 Colour: As selected by Architect from manufacturer's full line.
  - .2 Type 12: Preformed Silicone Elastomer Custom Two- and Three- Dimension Extrusion: Highly flexible flashing and transition material for bonding to substrates with silicone sealant.
    - .1 Basis of Design Product: **DOW CORNING® 123 Silicone Seal Custom Designs H.C.**
    - .2 Formulation: General Purpose.
    - .3 Shape: Multi-dimensional as indicated on drawings and approved shop drawings and as required to fit and functionally seal specific application and prevent air and water penetration
    - .4 Bonding Sealant: Manufacturer's recommended neutral-curing silicone.
    - .5 Colour: As selected by Architect from manufacturer's full line.
- .10 WEATHER BARRIER TRANSITIONS
  - .1 Type 13: Silicone Elastomer Weather Barrier Transition: Highly flexible clear flashing and transition strip and pre-molded corners for bonding with silicone sealant to weather barrier substrates and to adjacent curtain wall, storefront, and window frames and other transition substrates.
    - .1 Basis of Design Product: **DOW CORNING® Silicone Transition Strip (STS).**

- .2 Hardness, ASTM D 2240: 50 - 60 durometer Shore A.
  - .3 Colour: Translucent
  - .4 Air Infiltration, ASTM E 283: Maximum 0.025 cfm/sq. ft. (0.127 L/s per sq. m) at 6.24 lbf/sq. ft. (300 Pa).
  - .5 Water Penetration under Static Pressure, ASTM E 331: None at 15 lbf/sq. ft. (720 Pa).
  - .6 Movement Capability: Not less than plus 200, minus 75 percent.
  - .7 Tensile Strength, ASTM D 412: Not less than 800 psi (5.5 MPa).
  - .8 Tear Strength, ASTM D 624: Not less than 200 psi (16 kN/m).
  - .9 Elongation, ASTM D 412: Not less than 400 percent.
  - .10 Bonding Sealant: Manufacturer's recommended neutral-curing silicone.
- .11 ACOUSTICAL SEALANT
- .1 Type 14 – Acoustical Sealant
    - .1 Foam sealant.
    - .2 Flames Spread Rating: < 25, in accordance With CAN/ULC-S102.
    - .3 Smoke Development Classification: < 50, in accordance with CAN/ULC-S102.
    - .4 Sealants must have a VOC limit of less than 250 g/L, as per SCAQMD Rule 1168, October 2003.
  - .2 Type 15 – Acoustical Sealant, Paintable.
    - .1 To ASTM C834.
    - .2 Sealants must have a VOC limit of less than 250 g/L, as per SCAQMD Rule 1168, October 2003.
    - .3 Colour: white.
- .12 EXPANSION JOINT SEAL
- .1 Type 16 – Seismic Expansion Joint
    - .1 Waterproof seal with thermal insulation with 100% movement capability, UV stability, and with colour coordination with adjacent surfaces.
    - .2 Preformed sealant shall be silicone pre-coated, preformed, pre-compressed, self-expanding, sealant system. Expanding foam to be cellular foam impregnated with a water-based, non-drying, 100% acrylic dispersion. Seal shall combine factory-applied, low-modulus silicone and a backing of

acrylic-impregnated expanding foam into a unified hybrid sealant system.

- .3 Material shall be capable of movements of +50%, -50% (100% total) of nominal material size
- .4 Silicone external color facing to be factory-applied to the foam while it is partially pre-compressed to a width greater than maximum joint extension and cured before final compression. When compressed to final supplied dimension, a bellow(s) to handle movement must be created in the silicone coating. Silicone coating shall be available in a range of not less than 26 standard colors for coordination with adjacent building materials.
- .5 Acceptable manufacturer: SEISMIC COLORSEAL as manufactured by EMSEAL JOINT SYSTEMS LTD

### 2.3 SEALANT SELECTION

- .1 Perimeters of exterior openings where aluminum and FRP frames meet exterior facade of building (insulated metal wall panels): Sealant Type 2 or Type 4.
- .2 Expansion and control joints in exterior surfaces of poured-in-place concrete walls: Sealant Type 1.
- .3 Expansion and control joints in exterior surfaces of precast, architectural wall panels: Sealant Type 1.
- .4 Control and expansion joints in exterior surfaces of unit masonry walls: Sealant Type 1 or Type 4.
- .5 Coping joints and coping-to facade joints: Sealant Type 2.
- .6 Cornice and wash or horizontal surface joints: Sealant Type 2.
- .7 Exterior joints in horizontal wearing surfaces (as itemized): Sealant Type 1.
- .8 Seal interior perimeters of exterior openings as detailed on drawings: Sealant Type 1 or Type 4.
- .9 Control and expansion joints on the interior of exterior poured-in place concrete walls: Sealant Type 1.
- .10 Control and expansion joints on the interior of exterior surfaces of unit masonry walls: Sealant Type 1.
- .11 Interior control and expansion joints in floor surfaces: Sealant Type 1.
- .12 Perimeters of interior frames, as detailed and itemized: Sealant Type 4.
- .13 Interior masonry vertical control joints (block-to-block, block-to-concrete, and intersecting masonry walls): Sealant Type 1.

- .14 Joints at tops of non-load bearing masonry walls at the underside of poured concrete: Sealant Type 1.
- .15 Perimeter of bath fixtures (e.g. sinks, tubs, urinals, waterclosets, basins, vanities): Sealant Type 8.
- .16 Exposed interior control joints in drywall: Sealant Type 9.
- .17 Acoustical Partitions as detailed and in accordance with Section 09 21 16 – Gypsum Board: Sealant Type 3: Acoustical for concealed applications, except in return air plenums where fire stopping sealants specified in Section 07 84 00 shall be used.
- .18 Acoustical Partitions as detailed and in accordance with Section 09 21 16 – Gypsum Board: Sealant Type 4: Acoustical for exposed applications.
- .19 Top of ceramic tile bases, top and sides of countertops and backsplash: Sealant Type 8.
- .20 Exterior door thresholds bead of sealant over entire length of threshold: Sealant Type 2.
- .21 Glazing butt sealant: Type 7 for clear interior or Type 4 for exterior.
- .22 Air Barrier membranes to facades or window frames: Sealant Type 6.
- .23 Expansion joint between new and existing building: Sealant Type 16.
- .24 Penetrations through non-fire rated floor slabs and walls: Sealant Type 1 on both sides of penetration, and semi-rigid insulation and sealant backing to fill cavity.

#### **2.4 ACCESSORIES**

- .1 Joint Substrate Primers: Substrate primer recommended by sealant manufacturer for application.
- .2 Cylindrical Sealant Backing: ASTM C 1330, Type B non-absorbent, bi-cellular material with surface skin, or Type O open-cell polyurethane, as recommended by sealant manufacturer for application.
- .3 Bond Breaker Tape: Polymer tape compatible with joint sealant materials and recommended by sealant manufacturer.

#### **2.5 JOINT CLEANER**

- .1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant recommended by sealant manufacturer.
- .2 Primer: as recommended by manufacturer.

**PART 3 - EXECUTION**

- 3.1 PROTECTION** .1 Protect installed Work of other trades from staining or contamination.
- 3.2 SURFACE PREPARATION** .1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.
- .2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter which may impair Work.
- .3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.
- .4 Ensure joint surfaces are dry and frost free.
- .5 Prepare surfaces in accordance with manufacturer's directions.
- 3.3 PRIMING** .1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.
- .2 Prime sides of joints in accordance with sealant manufacturer's instructions immediately prior to caulking.
- 3.4 BACKUP MATERIAL** .1 Apply bond breaker tape where required to manufacturer's instructions.
- .2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.
- 3.5 MIXING** .1 Mix materials in strict accordance with sealant manufacturer's instructions.
- 3.6 APPLICATION** .1 Sealant:
- .1 Apply sealant in accordance with manufacturer's written instructions.
- .2 Mask edges of joint where irregular surface or sensitive joint border exists to provide neat joint.
- .3 Apply sealant in continuous beads.
- .4 Apply sealant using gun with proper size nozzle.



- .5 Use sufficient pressure to fill voids and joints solid.
  - .6 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.
  - .7 Tool exposed surfaces before skinning begins to give slightly concave shape.
  - .8 Remove excess compound promptly as work progresses and upon completion.
- .2 Curing:
- .1 Cure sealants in accordance with sealant manufacturer's instructions.
  - .2 Do not cover up sealants until proper curing has taken place.
- .3 Cleanup:
- .1 Clean adjacent surfaces immediately and leave Work neat and clean.
  - .2 Remove excess and droppings, using recommended cleaners as work progresses.
  - .3 Remove masking tape after initial set of sealant.

**END OF SECTION**

## PART 1 - GENERAL

- 1.1 SECTION INCLUDES**
- .1 Non-fire rated acoustic pressed steel frames.
  - .2 Non-fire rated acoustic hollow metal doors.
  - .3 Perimeter and bottom acoustic seals, threshold and astragal.
- 1.2 RELATED SECTIONS**
- .1 Section 04 05 12: Masonry grout fill of metal frames.
  - .2 Section 07 92 00 – Joint Sealing: Caulking between door assemblies and adjacent construction.
  - .3 Section 09 91 23 – Painting: Field Painting of doors and frames.
- 1.3 REFERENCES**
- .1 ASTM A653/A653M-15e1 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .2 ASTM E90-09(2016) - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
  - .3 ASTM E413-16 - Classification for Rating Sound Insulation.
  - .4 AWS D1.1/D1.1M:2015, Structural Welding Code - Steel.
  - .5 CSA G40.20-13/G40.21-13 - General requirements for rolled or welded structural quality steel / Structural quality steel.
  - .6 CSDMA, Selection and Usage Guide for Steel Doors and Frames, 2009.
  - .7 HMMA 802-07 - Manufacturing of Hollow Metal Doors and Frames.
  - .8 HMMA 840-07 - Installation and Storage of Hollow Metal Doors and Frames.
  - .9 HMMA 865-13 - Guide Specifications For Swinging Sound Control Hollow Metal Doors and Frames.
  - .10 National Building Code 2015.

#### 1.4 SUBMITTALS

- .1 Section 00 10 00: Submission procedures.
- .2 Product Data: Provide product data on door construction.
- .3 Shop Drawings: Indicate door and frame elevations, anchor types and spacing, closure methods, finishes, location of cut-outs for hardware.
- .4 Samples: Submit manufacturer's door finish samples.
- .5 Test Data:
  - .1 Submit test data indicating compliance with the performance requirements specified in Section 2.2.
  - .2 Include laboratory name, test report number, and date of test.
  - .3 Submit certification from internationally recognized testing laboratory.
- .6 Installation Instructions: Submit manufacturer's installation instructions.

#### 1.5 QUALITY ASSURANCE

- .1 Perform Work to requirements of CSDMA (Canadian Steel Door Manufacturers Association), HMMA (Hollow Metal Manufacturers Association) standards.
- .2 Provide Products of this section from a single manufacturer, unless components are referenced specifically in other sections.
- .3 Manufacturer: Minimum 5 years documented experience manufacturing sound control door assemblies.
- .4 Pre-installation Meeting: Convene a pre-installation meeting 1 week before installation of acoustic door and frame assemblies. Require attendance from relevant subcontractors, consultants, and manufacturer's representative. Review installation and coordination with other work.

#### 1.6 DELIVERY, STORAGE AND PROTECTION

- .1 Comply with HMMA 840, and manufacturer's written instructions.
- .2 Weld minimum two temporary jamb spreaders per frame prior to shipment on frames shipped in one piece.
- .3 Remove doors and frames from wrappings or coverings upon receipt on site and inspect for damage.
- .4 Store in vertical position, spaced with blocking to permit air circulation between components. Stand doors on top end, to avoid damage to bottom end.

- .5 Store materials out of water and covered to protect from damage.
- .6 Clean and touch up scratches or disfigurement caused by shipping or handling with zinc-rich primer.

**1.7 WARRANTY**

- .1 Manufacturer's Limited Warranty: Five (5) years from date of supply, covering material and workmanship.

**PART 2 – PRODUCTS**

**2.1 MANUFACTURERS**

Basis of design: Alternative manufacturers may be accepted if acoustic performance requirements can be met or exceeded. Refer to Section 00 21 13 Instructions to Bidders for substitution requirements.

- .1 **AMBICO Limited**  
 1120 Cummings Avenue  
 Ottawa, Ontario, Canada K1J 7R8  
 Toll Free Phone 888-423-2224  
 Phone 613-746-4663
- .2 **Dortek Inc**  
 One Boston Place, Suite 2600  
 Boston, MA, United States 02108  
 Tel No: 617-401-8226
- .3 **CURRIES Company**  
 1502 12<sup>th</sup> St. NW,  
 Mason City, IA, United States 50401  
 Tel No. 641-423-1334

**2.2 PERFORMANCE REQUIREMENTS**

- .1 Acoustic Performance: Minimum Transmission Loss as indicated in the below tables, tested to ASTM E90. Deviation from the minimum performance requirements must be approved by the NRC.

4-ROOM	Minimum TL		
1/3 Octave Band Center Frequency (Hz)	Double Doors into the Inner Chamber	(Not in Phase 3 Scope of Work) Large Door into Workspace 124A	Man Door into Workspace 124B
50	40	34	34

63	49	23	20
80	44	22	20
100	42	25	20
125	43	29	29
160	44	32	32
200	43	35	35
250	50	38	38
315	50	41	41
400	55	44	44
500	57	45	45
630	59	46	46
800	61	47	47
1000	63	48	48
1250	66	49	49
1600	69	49	49
2000	71	49	49
2500	72	49	49
3150	75	49	49
4000	77	51	49
5000	79	53	45
6300	79	53	45
8000	79	53	45
10000	79	53	45

- .2 Metal Doors, frames and anchoring system shall be designed to withstand factored loads in accordance with National Building Code 2015, and applicable standards.

**2.3 MATERIALS**

- .1 Sheet Steel:
  - .1 Galvanized steel to ASTM A653/A653M, ZF75 (A25), minimum 1.5 mm (16 ga).
- .2 Reinforcement: Same material as sheet steel.

**2.4 FABRICATION**

- .1 Manufacture doors and frames to meet the specified performance ratings with minimum door surface density indicated below.

- .2 Steel Sound Control Doors:
  - .1 Sheet steel faces, thickness, design, and core suitable to achieve specified acoustic performance.
  - .2 Acoustic core construction, longitudinal edges tacked and filled seamless.
  - .3 Reinforce doors where surface-mounted hardware is required.
  - .4 Drill and tap for mortised, templated hardware.
  - .5 Top Channel: Minimum 14ga welded steel channel tacked and filled seamless.
  - .6 Bottom Channel: Minimum 14ga welded steel channel to fit bottom seal.
  - .7 Structural steel core to prevent racking and allow site assembly of oversized doors if required due to size.
  - .8 Doors shipped in 1 section up to 5' wide x 12' tall. Doors over 5' wide or 12' tall may be shipped in multiple sections for site assembly by door installer.
  - .9 Hollow door shall be stiffened with steel ribs and all voids filled with semi-rigid insulation minimum density 24 kg/m<sup>3</sup>.
  - .10 Astragals: Metal acoustic astragals with integral acoustic seals for double doors. Standard overlapping active/inactive.
- .3 Steel Sound Control Frames:
  - .1 Sheet steel, metal thickness as required to maintain specified performance ratings, mitred corners, fully welded seams.
  - .2 Structural steel reinforced frame to support the weight of the doors.
  - .3 Frame shipped in 1 piece when smallest overall dimension is no more than 109". Frames with overall width and height over 109" to be shipped in multiple pieces for site assembly by frame installer.
  - .4 Provide anchors for the installation in masonry walls, existing masonry walls and concrete walls. Anchors type, spacing, installation method shall meet structural requirements specific for door type, size, wall type, and weight.
- .4 Install and adjust perimeter and bottom acoustic seals around frames and mullions.
- .5 Affix permanent nameplates to door and frame, indicating manufacturer's name, and STC rating of the provided TL test data for the corresponding door design.

**2.5 FINISHES** .1 Factory Door Finish: Factory applied zinc phosphate primer; apply touch up primer where Product has been welded and ground smooth.

**2.6 ACCESSORIES**

.1 Hinges: By door manufacturer.

.2 Latching Hardware: Commercial Grade Door latches, hinges, and surface bolts supplied by door manufacturer.

.3 Primer: Rust inhibitive zinc phosphate.

.4 Threshold: Smooth top to provide a seal for door in closed position.

.5 Steel Astragal: Supplied loose for field installation by door installer. Overlapping astragal to be a minimum 2 mm (14 ga) thick.

.6 Acoustic seals: Provide perimeter and bottom seals to meet the specified acoustic rating.

### **PART 3 – EXECUTION**

**3.1 INSTALLATION**

.1 Install components to manufacturer's written instructions.

.2 Fully grout or concrete fill frames installed using masonry or existing wall anchors.

.3 Door and seals to be installed by door manufacturer or certified installers, supervised by door manufacturer's representative.

.4 Install steel doors and frames to CSDMA HMMA 840 standards.

.5 Utilize welders certified by Canadian Welding Bureau (CWB) for field welding.

.6 Coordinate with masonry, gypsum board, and concrete wall construction for anchor placement.

.7 Set frames plumb, square, level at correct elevation.

.8 Allow for deflection to ensure that structural loads are not transmitted to frame.

.9 Adjust operable parts for correct clearances and function.

.10 Install and adjust perimeter and bottom acoustic seals.

.11 Finish paint in accordance with Section 09 91 23.

.12 Touch up painted finishes where damaged.

**3.2 ERECTION  
TOLERANCES**

- .1 Maximum deviation from square, alignment, twist and plumb:  
± 0.75 mm (1/32") over a 7' span.

**3.3 FIELD QUALITY  
CONTROL**

- .1 Provide qualified manufacturer's representative to instruct installers on the proper installation and adjustment of door assemblies.
- .2 Provide manufacturer's representative to inspect door installation, and test minimum five (5) cycles of operation. Correct any deficient doors.

**END OF SECTION**



**PART 1 - GENERAL**

- 1.1 RELATED SECTIONS** .1 Section 08 11 00 – Metal Doors and Frames.
- 1.2 REFERENCES** .1 Canadian Steel Door and Frame Manufacturers' Association (CSDFMA).  
.1 CSDFMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction): standard hardware location dimensions.
- .2 Canadian General Standards Board (CGSB).  
.1 CAN/CGSB-69.17-M86(R1993), Bored and Preassembled Locks and Latches.  
.2 CAN/CGSB-69.18-M90/ANSI/BHMA A156.1-1981, Butts and Hinges.  
.3 CAN/CGSB-69.19-93/ANSI/BHMA A156.3-1984, Exit Devices.  
.4 CAN/CGSB-69.20-M90/ANSI/BHMA A156.4-1986, Door Controls (Closers).  
.5 CAN/CGSB-69.21-[90/ANSI/BHMA A156.5-1984, Auxiliary Locks and Associated Products.  
.6 CAN/CGSB-69.22-M90/ANSI/BHMA A156.6-1986, Architectural Door Trim.  
.7 CAN/CGSB-69.24-M90/ANSI/BHMA A156.8-2005, Door Controls - Overhead Holders.  
.8 CAN/CGSB-69.26-96/ANSI/BHMA A156.10-1999, Power-operated Pedestrian Doors.  
.9 CAN/CGSB-69.29-93/ANSI/BHMA A156.13-2012, Mortise Locks and Latches.  
.10 CAN/CGSB-69.30-93/ANSI/BHMA.  
.11 CAN/CGSB-69.31-M89/ANSI/BHMA A156.15-2011, Closer/Holder Release Device.  
.12 CAN/CGSB-69.32-M90/ANSI/BHMA A156.16-2013, Auxiliary Hardware.  
.13 CAN/CGSB-69.34-93/ANSI/BHMA A156.18-2012, Materials and Finishes.  
.14 CAN/CGSB-69.35-M89/ANSI/BHMA A156.19-2013, Power Assist and Low Energy Power Operated Doors.  
.15 CAN/CSA-B651-04.  
.16 All hardware for fire rated openings shall meet ULC or Warnock-Hersey testing as required.  
.17 All fire and life safety codes shall be met as required by the authority having jurisdiction.
- 1.3 SUBMITTALS** .1 Product Data:  
.1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 00 10 00 - Submittal Procedures.

- .2 Hardware List:
  - .1 Submit contract hardware list in accordance with Section 00 10 00 - Submittal Procedures.
  - .2 Indicate specified hardware, including make, model, material, function, size, finish and other pertinent information.
- .3 Manufacturer's Instructions:
  - .1 Submit manufacturer's installation instructions.
- .4 Closeout Submittals
  - .1 Provide operation and maintenance data for door closers, locksets, door holders, electrified hardware for incorporation into manual specified in Section 00 10 00 - Closeout Submittals.
- .5 Submit template information to the contractor for distribution to related trades.
- .6 Provide with templates and hardware schedule, catalogue cuts of all products proposed.

**1.4 QUALITY ASSURANCE**

- .1 Regulatory Requirements:
  - .1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.
- .2 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.
- .3 Certificates: product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
- .4 The supplier of finishing hardware shall be regularly involved in the sale and distribution of Builders Hardware for Commercial Projects of this nature
- .5 The Company shall employ a qualified hardware consultant to oversee the scheduling, detailing, ordering and coordination of this project.

**1.5 DELIVERY, STORAGE, AND HANDLING**

- .1 Packing, Shipping, Handling and Unloading:
  - .1 Deliver, store, handle and protect materials in accordance with Section 00 10 00.
  - .2 Package each item of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.
- .2 Storage and Protection:
  - .1 Store finishing hardware in locked, clean and dry area.

- 1.6 MAINTENANCE**
- .1 Extra Materials:
    - .1 Provide maintenance materials in accordance with Section 00 10 00 - Closeout Submittals.
    - .2 Supply two sets of wrenches for door closers, locksets.
  - .2 Provide maintenance data, parts lists, and manufacturer's instruction for each type door closers, locksets, door holders and fire exit hardware for incorporation into maintenance manual.

- 1.7 HARDWARE REQUIREMENTS**
- .1 NRC has a bonded locksmith for our keying system on standing contract. See contract coordinator for information.
  - .2 Contractor will be responsible to have all cylinders keyed by NRC bonded locksmith on standing offer contract.
  - .3 Contractor will be responsible to carry all associated costs for cylinders and keying of same with NRC bonded standing offer locksmith.

- 1.8 WARRANTY**
- .1 All hardware shall be warranted for a period of one (1) year from date of substantial completion.
  - .2 Door closers shall be warranted for a period of ten (10) years, and electric HDCP operators for a period of two (2) years from date of substantial completion.
  - .3 Material will be covered against manufacturing defects of breakage, willful damage excluded.

## **PART 2 - PRODUCTS**

- 2.1 HARDWARE ITEMS**
- .1 Use one manufacturer's products only for similar items.

- 2.2 MATERIALS**
- .1 All hardware shall be supplied complete with the necessary screws, bolts and other fasteners so as to anchor the hardware in position to the consultants' approval.
  - .2 Exposed fastening devices to match finish of hardware.
  - .3 Where a pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.
  - .4 Push plates and kickplates are to be supplied complete with

self-tapping countersunk flat head, flush mounting screws to suit door material.

### 2.3 DOOR HARDWARE

- .1 Hinges (3 per Door):
  - .1 Interior doors: Dorex 114.3mm x 101.6mm x 179 454 NRP X C15.
  - .2 Exterior doors "Dorex" BB1079-454-26D-NRP.
  - .3 Security enabled doors: Von Duprin EPT2 Transfer Hinge.
  - .4 Hager Hinge (Roton) – Continuous Hinge
- .2 Latching devices: Apply to all buildings other than buildings M-50 and M-55.
  - .1 Lockset "Yale" AU-5307LN x 626.
  - .2 Latchset "Yale" AU-5301LN x 626.
  - .3 Storeroom "Yale" AU-5305LN x 626, keyed on approach side for use with HES 4500 electric strike.
- .3 Latching devices: Apply to building M-50 only.
  - .1 Lockset: "Corbin" CL-3651 X626 x NZD.
  - .2 Latchset: "Corbin" CL-3610 x 626 x NZD.
- .4 Latching devices: Apply to building M-55 only.
  - .1 Lockset: "Sargent" 10G05LL x 26B.
  - .2 Latchset: "Sargent" 10U65LL x 26B.
- .5 Cylinders:
  - .1 Medeco, keyed to NRC key plan M19CA5 by Lister Lock.
  - .2 Contractor to carry all costs associated with keying of doors.
- .6 Electric Strikes:
  - .1 Pre-wired by door supplier.
  - .2 Model: HES 4500.
- .7 Closers: Standard duty on:
  - .1 Interior doors "Norton" 1600BC-Reg x AL. Parallel arm.
  - .2 Exterior doors "LCN" 4040XP Rw/Pa-AL (regular arm/parallel arm bracket)
    - .1 Include integral overhead stop.
- .8 Astragal: Provide 5mm thick clear anodized aluminum astragal c/w nylon brush sweep on active leaf.
  - .1 K.N.Crowder W24S clear anodized aluminum brush sweep.

- .9 Single Door Exit devices: modern-narrow stile with exit trim.
  - .1 Sargent ASSA ABLOY 8500 Series  
8515xET-704-RHR-15-26D-36
- .10 Paired Door Exit devices: modern-narrow stile with exit trim.
  - .1 Sargent ASSA ABLOY 8300 Series  
8315-F-xET-704-RHR-15-26D-36
    - .1 Auxiliary items: open back strike 815 with tamper proof plate.
- .11 Door bottom seal: heavy duty, door seal of extruded aluminum frame and closed cell neoprene weather seal, closed ends, adjustable with automatic retract mechanism when door is open.
  - .1 K.N. Crowder CT-52 (surface mounted OR semi-mortised)
- .12 Flush Bolt: lever action, with flat plate shoe on inactive leaf.
  - .1 Ives FB458 12" Manual 626.
- .13 Threshold: Full length and width of opening, extruded aluminum, with thermal break of rigid PVC.
  - .1 K.N. Crowder CT45
- .14 Door Holder: Provide "Hager" Kick down Door Holder 270C. S1-sprayed aluminum finish.
- .15 Door Stops: Floor Mounted Door Stops
  - .1 Acceptable Manufacturer:
    - .1 "Hagar" 243F, Light duty dome stop – High, or approved equal.
- .16 Weatherstripping:
  - .1 Head and jamb seal:
    - .1 Extruded aluminum frame and hollow closed cell neoprene insert, clear anodized finish.
    - .2 Adhesive backed neoprene material.

## 2.4 FASTENINGS

- .1 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.
- .2 Exposed fastening devices to match finish of hardware.
- .3 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.

- .4 Use fasteners compatible with material through which they pass.

## 2.5 KEYING

- .1 Doors, locks to be keyed as directed by Departmental Representative.
- .2 Provide keys in duplicate for every lock in this Contract.
- .3 Provide three master keys for each MK or GMK group.
- .4 Stamp keying code numbers on keys and cylinders.
- .5 Provide construction cores.
- .6 Provide all permanent cores and keys to Departmental Representative.

## PART 3 - EXECUTION

### 3.1 MANUFACTURER'S INSTRUCTIONS

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

### 3.2 INSTALLATION

- .1 Install hardware to standard hardware location dimensions in accordance with Canadian Metric Guide for Steel Doors and Frames (Modular Construction) prepared by Canadian Steel Door and Frame Manufacturers' Association.
- .2 Where door stop contacts door pulls, mount stop to strike bottom of pull.
- .3 Install key control cabinet.
- .4 Use only manufacturer's supplied fasteners. Failure to comply may void manufacturer's warranties and applicable licensed labels. Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.
- .5 Remove construction cores when directed by Departmental Representative; install permanent cores and check operation of locks.

- .6 Weatherstripping and surface smoke seals shall not be installed until final coat of paint has been applied to door and frame and is completely dry.

### 3.3 INSTALLATION

- .1 Standard mounting heights are as follows:
- |                           |   |
|---------------------------|---|
| Locks/Latches:            | 40-5/16" centre strike to finished floor                                |
| Deadlock/Nightlatch:      | 47" centre of strike to finished floor                                  |
| Exit Device:              | 40-5/16" centre of push bar to finished floor                           |
| Push Plates:              | 1143 mm (45") from centre of plate to finished floor                    |
| Door Pulls:               | 1067 mm (42") from centre of pull to finished floor                     |
| Automatic Door Operators: | Minimum 900 mm – maximum 1100 mm bottom of push plate to finished floor |
- .2 The above mounting heights are to be considered a general guide unless conditions such as intermediate rails, line of glass lights, etc., dictate otherwise. Installer must carefully check manufacturer's installation instructions packed with hardware products. In particular, the installation heights when using mullions and/or vertical rod devices may be predetermined by certain manufacturers.
- .3 All mineral core fire doors shall have pilot holes of 1/8" dia. predrilled for installation of hinges, and screws shall be turned into pilot holes by use of manual or "Yankee" screw driver. If installer does not follow this method, it may void door manufacturer's warranty.
- .4 Kickplates are to be installed 1/4" (6.35mm) maximum up from the bottom edge of door push side, with the exception of doors where a lip threshold is being used. Then install kickplates to clear threshold not greater than a 1/4" (6.35mm). On single doors, install in the centre of the door equally spaced to clear between the frame jamb stops and/or weatherstripping. On pairs of doors, install 1/4" (6.35mm) maximum from meeting edge of doors and the correct distance away from hinge edge of door to clear frame jamb stop and/or weatherstrip.
- .5 Thresholds are to be extended in full width of door rough opening and are to be coped around the frames. Installer to caulk threshold base to ensure proper seal.
- .6 Width of threshold shall be coordinated and adjusted to specific door opening and shall fully cover top of foundation wall.
- .7 Weatherstripping and surface smoke seals are not to be installed until final coat of paint has been applied to the door and frame and is completely dry (except for W20P type, which must be installed prior to installation of door closers and panic sets)>
- .8 Install key cabinet as directed by the Owner on site.

**3.4 ADJUSTING**

- .1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.
- .2 Lubricate hardware, operating equipment and other moving parts.
- .3 Adjust door hardware to provide tight fit at contact points with frames.

**3.5 CLEANING**

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

**END OF SECTION**



## PART 1 - GENERAL

### 1.1 RELATED SECTIONS

#### 1.2 REFERENCES

- .1 ASTM F1233 – 08 (2013) Test Method for Security Glazing Materials and Systems.
- .2 CAN/CGSB-12.1 – M90 Tempered or Laminated Safety Glass.
- .3 Laminators Safety Glass Association Standards Manual.

#### 1.3 PERFORMANCE REQUIREMENTS

- .1 Provide continuity of building enclosure vapour and air barrier using glass and glazing materials as follows:
  - .1 Utilize interior lite of multiple lite sealed units for continuity of air and vapour seal.
- .2 Size glass to withstand wind loads, dead loads and positive and negative live loads acting normal to plane of glass to a design pressure in accordance with the National Building Code as measured in accordance with ASTM E330-02.
- .3 Limit glass deflection to 1/200 flexural limit of glass with full recovery of glazing materials.

#### 1.4 SAMPLES

- .1 Submit two 300 x 300 mm (1'-0" X 1'-0") samples of glass for approval by Engineer in accordance with Section 00 10 00.

#### 1.5 SHOP DRAWINGS

- .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 00 10 00 – General Instructions.

Specifications and product data shall include:

- Type of glass and thickness
- U-Value
  - .1 Winter night
  - .2 Summer day
- Transmittance:
  - .1 Visible
  - .2 Solar
- Reflectance:
  - .1 Visible %out
  - .2 Visible %in
- Solar % out

- Shading Co-efficient (sc)
- Solar Heat Gain Co-efficient (SHGC)

- 1.6 WARRANTY** .1 For work of this section, the 120 months warranty period.
- 1.7 MAINTENANCE DATA** .1 Provide maintenance data including cleaning instructions for incorporation into maintenance manual specified in Section 00 10 00.

## **PART 2 - PRODUCTS**

- 2.1 GLASS MATERIALS** .1 Safety glass: tempered to CAN/CGSB-12.1-M90, glazing quality of thickness indicated
- 2.2 GLAZING & SEALING COMPOUND MATERIALS**
- .1 Only compounds listed on the CGSB Qualified Products List are acceptable for use on this project.
- .2 Sealing compound: two component, polysulphide, CANCGSB-19.24-M90, type 2, Class A, colour selected by Departmental Representative.
- .3 Setting blocks: Neoprene, 80 Shore "A" durometer hardness to ASTM D2240-02b, minimum 100 mm x width of glazing rabbet space minus 1.5 mm x height.
- .4 Spacer shims: Neoprene, 50-60 Shore "A" durometer hardness to ASTM D2240-02b, 75 mm long x one-half height of glazing stop x thickness to suit application. Self adhesive on one face.
- .5 Glazing tape: Preformed butyl compound, 10-15 Shore "A" durometer hardness to ASTM D2240-02b; coiled on release paper: thickness and width as recommended by manufacturer: black colour.
- .6 Glazing splines: manufacturer's standard dry glazing splines to suit aluminum extrusion.
- .7 Glazing clips: manufacturer's standard type.
- .8 Lock-strip gaskets: to ASTM C542-94 (1999).
- .9 Primer-sealers and cleaners: to glass manufacturer's standard.

### **PART 3 - EXECUTION**

- 3.1 EXAMINATION**
- .1 Verify that openings for glazing are correctly sized and within tolerance.
  - .2 Verify that surfaces of glazing channels or recesses are clean, free of obstructions, and ready to receive glazing.
- 3.2 PREPARATION**
- .1 Remove protective coating and clean contact surfaces with solvent and wipe dry.
  - .2 Seal porous glazing channels or recesses with substrate compatible primer or sealer.
  - .3 Prime surfaces scheduled to receive sealant.
- 3.3 WORKMANSHIP**
- .1 Place setting blocks in accordance with manufacturer's instructions.
  - .2 Install glass, rest on setting blocks, ensure full contact and adhesion at perimeter.
  - .3 Install removable stops, without displacing tape or sealant.
  - .4 Provide edge clearance of 3 mm (1/8") minimum.
  - .5 Apply cap bead of sealant at exterior void.
  - .6 Apply sealant to uniform and level line, flush with sightline and tooled or wiped with solvent to smooth appearance.
  - .7 Do not cut or abrade tempered, heat treated, or coated glass.
- 3.4 CLEANING**
- .1 Immediately remove sealant, compound droppings and glazing materials from finish surfaces.
  - .2 Remove labels after work is complete.
  - .3 Clean all glass.

**END OF SECTION**

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**ABBREVIATIONS**

CB	CONCRETE BLOCK
CT-1	CERAMIC TILES - 300x600mm - EPOXY GROUT
CTB	CERAMIC TILE BASE - 600 X 160 MM HIGH - EPOXY GROUT
E	EXISTING
EC	EXISTING CONCRETE
ECB	EXISTING CONCRETE BLOCK
ECS	EXISTING CONCRETE AND CLEAR SEALER
EGBA	EXISTING GYPSUM BOARD - ABUSE RESISTANT TYPE
EIMWP	EXISTING INSULATED METAL WALL PANEL
ESTSTR	EXISTING STEEL STRUCTURE AND METAL DECK
GB	GYPSUM BOARD
GBA	GYPSUM BOARD - ABUSE RESISTANT TYPE
GBM	GYPSUM BOARD - MOISTURE RESISTANT TYPE
GT-1	GLAZED CERAMIC WALL TILE
P	PAINT FINISH
R	RUBBER BASE
TC	SPECIAL ACRYLIC PAINT COATING FOR HUMID AREAS

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**IN ADDITION TO WORK INDICATED IN THE FINISH SCHEDULE, NOTE THE FOLLOWING:**

- 1 EXCEPT WHERE NOTED OTHERWISE ALL BASES SHALL BE 100 mm HIGH.
- 2 PAINT ALL PRESSED METAL DOOR FRAMES AND FRAMES FOR GLAZED SCREENS.
- 3 THE FINISH SCHEDULE SHALL BE READ IN CONJUNCTION WITH INFORMATION INDICATED ELSEWHERE ON DRAWINGS AND IN SPECIFICATIONS. IN THE EVENT OF DISCREPANCIES THE MOST STRINGENT REQUIREMENT SHALL GOVERN.
- 4 PAINT ACCESS DOORS AND PANELS SAME COLOUR AS WALL, CEILING OR BULKHEAD IT IS INSTALLED IN.
- 5 IN THE EVENT A ROOM IS NOT IDENTIFIED IN THE FINISH SCHEDULE, SUCH ROOMS SHALL BE FINISHED TO A MINIMUM STANDARD AS FOLLOWS: FLOOR: CS; BASE: R; WALLS: P; CEILING:AT.
- 6 COORDINATE CEILING HEIGHTS INDICATED IN FINISH SCHEDULE WITH HEIGHTS INDICATED ON REFLECTED CEILING PLANS AND SECTION DETAILS.
- 7 PAINT ALL GYPSUM BOARD BULKHEADS AND SOFFITS.
- 8 PAINT ALL STEEL ITEMS, EXCEPT FACTORY FINISH OR STAINLESS STEEL.
- 9 IN JUNCTION BETWEEN ALL CT FLOORING, & CONCRETE, PROVIDE EXTRUDED ALUMINUM TRANSITION TRIM.
- 10 AT THE JUCTION OF DISSIMILAR FLOOR FINISHES, PROVIDE FLOOR LEVELING AS REQUIRED TO ACHIEVE SMOOTH AND LEVEL FINISH BETWEEN THE TWO MATERIALS.
- 11 DO NOT PAINT FACTORY PRE-FINISHED SURFACES UNLESS NOTED OTHERWISE.

**TYPICAL NOTES**

ROOM FINISH SCHEDULE

NO.	NAME	FLOOR			WALL			CEILING			REMARKS
		MAT.	FIN.	BASE	MATERIAL	FIN.	MAT.	FIN.	HEIGHT		
117	Electrical Room	ECS		R	N:	ECB	P	ESTSTR	-	-	
					E:	ECB	P				
					S:	ECB	P				
					W:	ECB	P				
118	Comm & Stor	ECS		R	N:	ECB	P	ESTSTR	-	-	
					E:	ECB	P				
					S:	ECB	P				
					W:	ECB	P				
121	KIJ Floor Space	ECS			N:	ECB/EGBA	P/-	ESTSTR	-	-	
					E:	ECB	P				
					S:	EIMWP	-				
					W:	EIMWP	P/-				
123	Control Room	ECS		R	N:	GBA	P	GB	P	2310	
					E:	GBA	P				
					S:	GBA	P				
					W:	GBA	P				
123A	B.F. WC	CT-1		CTB	N:	GBM	TC/-	GBM	TC	2310	
					E:	GBM	TC/-				
					S:	GBM	TC/-				
					W:	GBM	TC/-				
126	Work Space	ECS			N:	EIMWP	-	ESTSTR	-	-	
					E:	EIMWP	-				
					S:	ECB	-				
					W:	EGBA	-				

**PART 1 - GENERAL**

<b>1.1 RELATED WORK</b>	.1	Structural Metal Stud Framing	Section 05 41 00	
	.2	Blanket Insulation	Section 07 21 16	
	.3	Air Barriers	Section 07 27 00	
	.4	Joint Sealants	Section 07 92 00	
	.5	Metal Doors, Frames and Screens	Section 08 11 00	
	.6	Room Finish Schedule	Refer to Drawings	
	.7	Non-Structural Framing	Section 09 22 16	
	.8	Painting	Section 09 91 23	
<b>1.2 REFERENCE STANDARDS</b>	.1	Do work in accordance with ASTM C840-04 and the "C.G.C. Gypsum Construction Handbook" 2004 Edition, except where specified otherwise.		
	.2	Aluminum Association		
		.1	Designation for Aluminum Finishes	
	.3	American Society for Testing and Materials International (ASTM).		
		.1	ASTM C 36/C36M-01, Specification for Gypsum Wallboard.	
		.2	ASTM C 79/C79M-01, Standard Specification for Treated Core and Non-treated Core Gypsum Sheathing Board.	
		.3	ASTM C 442/C442M-01, Specification for Gypsum Backing Board, Gypsum Coreboard, and Gypsum Shaftliner Board.	
		.4	ASTM C 475-01, Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.	
		.5	ASTM C 514-01, Specification for Nails for the Application of Gypsum Board.	
		.6	ASTM C 557-99, Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing.	
	.7	ASTM C 630/C630M-01, Specification for Water-Resistant Gypsum Backing Board.		
	.8	ASTM C 840-01, Specification for Application and Finishing of Gypsum Board.		
	.9	ASTM C 931/C931M-01, Specification for Exterior Gypsum Soffit Board.		
	.10	ASTM C 954-00, Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in.		

- (2.84 mm) in Thickness.
- .11 ASTM C 1002-01, Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- .12 ASTM C 1047-99, Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
- .13 ASTM C 1280-99, Specification for Application of Gypsum Sheathing Board.
- .14 ASTM C 1177-01, Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
- .15 ASTM C 1178/C1178M-01, Specification for Glass Mat Water-Resistant Gypsum Backing Board.

.4 Association of the Wall and Ceilings Industries International (AWEI)

.5 Canadian General Standards Board (CGSB)

- .1 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .2 CAN/CGSB-71.25-M88, Adhesive, for Bonding Drywall to Wood Framing and Metal Studs.

.6 Underwriters' Laboratories of Canada (ULC)

- .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.

### 1.3 DELIVERY, STORAGE AND HANDLING

- .1 Deliver materials in original packages, containers or bundles bearing manufacturers brand name and identification.
- .2 Store materials inside, level, under cover. Keep dry. Protect from weather, other elements and damage from construction operations and other causes.
- .3 Handle gypsum boards to prevent damage to edges, ends or surfaces. Protect metal accessories and trim from being bent or damaged.

### 1.4 SITE ENVIRONMENTAL REQUIREMENTS

- .1 Maintain temperature minimum 10 degrees C, maximum 21 degrees C for 48 hours prior to and during application of gypsum boards and joint treatment, and for at least 48 hours after completion of joint treatment.
- .2 Apply board and joint treatment to dry, frost free surfaces.
- .3 Ventilation: Ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.



- 1.5 SAMPLES** .1 Submit duplicate 300 mm x 300 mm samples of the specified water resistant gypsum board in accordance with Section 01 34 00.
- 1.6 FIRE RATED CONSTRUCTION** .1 Provide fire rated wall, columns and structural braces for fire protection assemblies as indicated on drawings to ULC and WHI Test Designs and National Building Code Fire Performance Requirements. Refer to assemblies identified on drawings.
- 1.7 SHOP DRAWINGS AND SUBMITTALS** .1 Provide engineering submittal and shop drawings in accordance with Section 09 22 16.

## PART 2 - PRODUCTS

- 2.1 GYPSUM BOARD PANELS**
- .1 Type 'X' interior, plain paper faced gypsum core panel to ASTM C1396M, 13 mm (where shown for horizontal shaft wall construction only), 16 mm thick, as indicated on drawings 1200 mm wide by maximum practical lengths, ends square cut, edges tapered with round edges.
- .2 Abuse resistant gypsum board: 16 mm thick Type X, and 13 mm thick Type C (for Two and Four Room facilities – outer room wall IM4), 1200 mm wide as indicated on drawings by maximum practical length.
- .1 Acceptable Material:
- .1 MoldTough VHI as manufactured by CGC;
- .2 Extreme Impact as manufactured by CertainTeed Gypsum.
- .3 Paperless Interior Glass Mat Gypsum Panels to ASTM C 473, ASTM C 630 and ASTM D 3273, 16mm thick, 1200mm wide by maximum practical lengths, ends square cut, edges tapered with round edges, Type X.
- .1 Acceptable Product:
- .1 DensArmour Plus Paperless Interior Drywall as manufactured by Georgia-Pacific Corporation
- 2.2 METAL FURRING AND SUSPENSION SYSTEMS** .1 Metal Furring Runners 0.87 mm (20 gauge), Hangers, Tie Wires, Inserts, Anchors: to ASTM C1002-04, hot dipped, galvanized.

- .2 Drywall Furring Channels: 0.87 mm (20 gauge) core thickness galvanized steel channels for screw attachment of all kinds of gypsum boards specified herein.

### 2.3 FASTENINGS AND ADHESIVES

- .1 Nails and Screws: to ASTM C954-04, bugle head, fine thread, rust-resistant, sharp point drywall screw for light gauge metal framing or furring. Type S-12, bugle head, fine thread, rust-resistant, drill point drywall screw for heavy gauge (12-22 gauge) steel framing. Screws for exterior application shall be zinc coated or stainless steel.
- .2 Stud adhesive: to CAN/CGSB-71.25-M88.
- .3 Laminating compound as recommended by manufacturer.
- .4 Drywall Construction Adhesive: latex based construction adhesive PL 200.

### 2.4 JOINT TREATMENT MATERIAL

- .1 For Interior Use:
  - .1 Joint tape: 50 mm wide, high strength cross fibre paper tape for reinforcing joints, as manufactured by C.G.C. Inc.
  - .2 Joint compound: ready-mixed all-purpose drywall compound as manufactured by C.G.C. Inc.
- .2 For Paperless Glass Mat Interior Drywall
  - .1 Joint tape for interior paperless drywall, 50 mm wide, 10 x 10 woven glass mesh joint tape
  - .2 Joint compound for Dens-Glass Gold: horizontal surfaces, G.P. gypsum "Speed Set 90" as manufactured by Georgia Pacific
- .3 For Abuse Resistant Gypsum Board
  - .1 Joint tape: 50 mm wide, high strength cross fibre paper tape for reinforcing joints, as manufactured by CGC Inc.
  - .2 Pre-filling and Filling Joint Compound: High Density 90 by Certain Teed or Durabond 90 by CGC Inc.
  - .3 Finishing Joint Compound: Ready mixed all-purpose drywall compound as manufactured by CGC Inc.

### 2.5 ACCESSORIES

- .1 Drywall casing and corner beads, trims, reveals, control joints and furring/framing accessories: 26 gauge, galvanized steel as manufactured by C.G.C. Inc., Bailey Metal Products Ltd., and Fryreglet.
  - .1 Casing Beads: 200-B metal trim by C.G.C.  
D-200 drywall metal trim by Bailey
  - .2 Corner Beads: Dur-A-Bead No. 114 (90° and 130°)  
by C.G.C.  
D-100-90° by Bailey  
D-100-130° by Bailey

- .3 Control Joints: Control Joint No. 093 by C.G.C.
  - .4 Extruded Aluminum Reveal Molding: DRM-50-50, DRM-50-100, DRMF-50-100  
Fryreglet , refer to drawings for location
  - .5 Channel Trim: 4411 channel trim by Bailey
  - .6 Angle Framing Trim: D-300 reveal trim by Bailey  
D-500 angle trim by Bailey  
D-700 angle trim by Bailey  
130° angle trim by Bailey
  - .7 Edge Mouldings and Trims: Custom shapes and profiles in galvanized steel or extruded aluminium to arrangements and types as indicated on drawings by Bailey.
- .2 Acoustic Sealant: to CAN/CGSB-19.24-M90.
- .1 Sealants acceptable for use on this project must be listed on CGSB Qualified Product List issued by CGSB Qualification Panel for Joint Sealants. Refer also to Section 07270.
- .3 Polyethylene: to CAN/CGSB-51GP-51M, Type 2.
- .4 Insulating Strip: rubberized, moisture resistant, 3 mm thick closed cell neoprene strip, 25 mm wide, with self sticking permanent adhesive on one (1) face; lengths as required.
- .5 Sound Attenuation Batts: Friction fit, thickness to suit and to fill entire width of stud wall. Acceptable material as specified in Section 07 21 16.
- .6 Fire Stopping Material: Refer to Specification Section 07 84 00.
- .7 Adhesive for Trim Accessories: "premium grade" contact cement.

### PART 3 - EXECUTION

#### 3.1 ERECTION

- .1 Do application and finishing of gypsum board in accordance with ASTM C 840 except where specified otherwise.
- .2 Do application of gypsum sheathing in accordance with ASTM C 1280.

- .3 Erect hangers and runner channels for suspended gypsum board ceilings in accordance with ASTM C 8440 except where specified otherwise.
- .4 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
- .5 Install work level to tolerance of 1:1200.
- .6 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles.
- .7 Install furring channels parallel to, and at exact locations of steel stud partition header track.
- .8 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.
- .9 Furr above suspended ceilings for gypsum board fire and sound stops and to form plenum areas as indicated.
- .10 Install wall furring for gypsum board wall finishes in accordance with ASTM C 840, except where specified otherwise.
- .11 Furr openings and around built-in equipment, cabinets, access panels, on four sides. Extend furring into reveals. Check clearances with equipment suppliers.
- .12 Furr duct shafts, beams, columns, pipes and exposed services where indicated.
- .13 Erect drywall resilient furring transversely across studs, joists, spaced maximum 600 mm on centre and not more than 150 mm from ceiling/wall juncture.

**3.2 INTERIOR SUSPENDED  
AND FURRED CEILINGS  
AND BULKHEADS SUSPENSION  
SYSTEM**

- .1 Erect hangers and runner channels for suspended gypsum board ceilings in accordance with C.G.C. "Gypsum Construction Handbook" except where specified otherwise.
- .2 Install work level to tolerance of 1:1200.
- .3 4 mm (9 gauge) hangers shall be spaced not over 1200 mm for interior applications, in the direction of the 33 mm main runner channels and not over 1200 mm for interior applications, and not over 900 mm for exterior applications in the direction at right angles to the main runners, and within 150 mm of the ends of main runner runs and of boundary walls or similar interruptions of ceiling continuity.
- .4 Main runners shall be placed not over 1200 mm oc for internal applications, and maximum 900 mm oc for exterior applications, properly positioned, levelled, and hangers shall be

saddle tied along runner.

- .5 Main runners shall not be let into nor come in contact with abutting walls. Runner channels shall be located within 150 mm, 6" of the walls to support the ends of the furring channels.
- .6 Except where shown otherwise, metal furring channels shall be spaced 450 mm o.c. for internal application and 300 mm oc for exterior application. Metal furring channels shall be securely clipped with furring channel clips or saddle tied with two (2) strands of 16 gauge tie wire to main runners or main support members and shall not be let into or come in contact with abutting masonry walls.
- .7 End splices shall be provided by nesting channels or studs no less than 200 mm and securely attached with wire.
- .8 Metal furring channel clips shall be installed on alternate sides of the main runner channel. Wire tie metal furring channel to 38 mm channel and to main support members when clips cannot be alternated.
- .9 At light fixtures or any openings that interrupt the main runner or channels, reinforce grillage with 19 mm cold rolled channels, wire tied atop and parallel to the main runner channels. Provide gypsum board boxing over fixtures or other devices to maintain fire resistance rating of one (1) hour where rating is required. Size boxing of recessed light fixtures to meet fixture manufacturer's requirements for dissipation of heat.
- .10 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.
- .11 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles.
- .12 Install 22 x 68 mm C.G.C. furring channels parallel to, and at exact locations of steel stud partition header track.
- .13 Furr for gypsum board faced vertical bulkheads within or at termination of ceilings. Vertical furring shall be braced type wherever possible. Where bracing is impractical, furring shall be sized to suit the condition prevailing.
- .14 Furr above suspended ceilings for gypsum board sound barriers and to form plenum areas as indicated.

### 3.3 INSTALLATION OF SOUND ATTENUATION BATTS

- .1 Provide sound attenuation batts in all interior steel stud wall cavities and/or as indicated.
- .2 At junction between top of a fire-rated or non-rated walls and steel deck. Install at top of wall fire-rated firestopping assembly. Refer also to Specification Section 07 84 00.

- .3 Install blanket insulation using approved by manufacturer adhesive and mechanically fasteners at 200 mm o.c. along edges and at 300 mm o.c. on field. Use impaling pins with plastic or metal black retaining plates.

### 3.4 WALL FURRING

- .1 Install wall furring for gypsum board wall finishes in accordance with C.G.C. "Gypsum Construction Handbook, except where specified otherwise. Use metal studs for furring where indicated.
- .2 Frame openings and also around built-in equipment, cabinets, access panels, on four (4) sides. Extend furring into reveals. Check clearances with equipment suppliers.
- .3 Furr duct shafts, beams, columns, pipes and exposed services.

### 3.5 RESILIENT FLOORING

- .1 Erect drywall resilient furring transversely spaced maximum 400 mm o.c. and not more than 150 mm from ceiling/wall juncture. Secure to each support.

### 3.6 GYPSUM BOARD APPLICATION (INTERIOR)

- .1 Do not apply gypsum board until bucks, anchors, blocking, electrical and mechanical work are reviewed by the Architect.
- .2 Apply 12 mm diameter bead of acoustic and fire stopping sealant continuously around perimeter of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, etc., in partitions where perimeter is sealed with acoustical sealant.
- .3 Install acoustic fibrous material in all metal stud partitions both above and below the ceiling to achieve minimum STC 45 rating for partition.
- .4 Install specified layers of the specified wallboard to steel studs as indicated.
- .5 Apply the specified number of layers of gypsum wallboard over steel studs:  
  
One (1) layer: vertically;  
Two (2) layers: first layer vertically, second layer horizontally.
- .6 Gypsum wallboard shall be screwed at 300 mm on centres at a maximum in the field of the board and 200 mm, 8" on centres along the vertical abutting edges.
- .7 Use 31.7 mm (1-1/4") screws for one (1) layer of wallboard; 63.4 mm (2-1/2") screws for two (2) layers of wallboard:

First layer: apply with screws as specified in para .7 above.

Second layer: laminate over first layer using the specified compound.

- .8 Install sound attenuation batts as specified herein at all interior partitions, and elsewhere specified herein or shown on the drawings. Press in tightly and staple to the back side of one (1) face of the partition.
- .9 Joints on opposite sides of the partition shall occur on different studs. Cut wallboard neatly to fit around all interruptions.
- .10 Install sealant at the perimeter and on both sides of all walls and at all interruptions.
- .11 All visible internal and external angles formed by the intersection of either wallboard surfaces or other surfaces shall be treated with galvanized steel trims, as specified herein and as indicated.
- .12 Carry all partitions to underside of concrete structure. Pack all gaps between deck and top of partitions with the specified sound attenuation batts. Use ULC approved fire stopping material for walls which are required to provide a smoke barrier or fire rating.
- .13 All abutting end or edge joints shall occur over the web surface of the furring channel and shall be fitted neatly and accurately with end joints staggered.
- .14 Gypsum wallboard shall be properly supported around all cut-outs and openings in the ceiling.
- .15 Install casing beads around perimeter of suspended soffits, bulkheads, and in addition, elsewhere where indicated on drawings.
- .16 For diffusers and access panels see also mechanical specifications and mechanical drawings for details to be complied with.
- .17 Within ceiling spaces; install smoke seal as specified in Section 07 84 00.

### **3.7 INSTALLATION – GENERAL**

- .1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges. Secure at 150 mm on centre.
- .2 Install casing beads around perimeter of suspended ceilings.
- .3 Install casing beads where gypsum board butts against surfaces having no trim concealing junction and where indicated.
- .4 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.

- .5 Install shadow mould at gypsum board/ceiling juncture as indicated. Minimize joints; use corner pieces and splicers.
- .6 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.
- .7 Locate control joints where indicated at changes in substrate construction..
- .8 Install control joints straight and true.
- .9 Construct expansion joints as detailed, at building expansion and construction joints.
- .10 Install expansion joint straight and true.
- .11 Install access doors to electrical and mechanical fixtures specified in respective sections.
  - .1 Rigidly secure frames to furring or framing systems.
- .12 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.
- .13 Gypsum Board Finish: finish gypsum board walls and ceilings to following levels in accordance with Association of the Wall and Ceiling Industries (AWCI) International Recommended Specification on Levels of Gypsum Board Finish:
  - .1 In plenum areas above suspended ceilings, Level 1: Embed tape for joints and interior angles in joint compound. Surfaces to be free of excess joint compound; tool marks and ridges are acceptable.
  - .2 Where water resistant gypsum backing board is used, Level 2: Embed tape for joints and interior angles in joint compound and apply one separate coat of joint compound over joints, angles, fastener heads and accessories; surface free of excess joint compound; tool marks and ridges are acceptable.
  - .3 At all exposed surfaces – Level 5: Embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; apply a thin skim coat of joint compound to entire surface; surfaces smooth and free of tool marks and ridges.
- .14 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.
- .15 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.



- .16 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.
  - .17 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.
  - .18 Apply one coat of white primer sealer over surface to be textured. When dry apply textured finish in accordance with manufacturer's instructions.
- 3.8 ACCESS DOORS**
- .1 Install access doors to electrical or mechanical fixtures specified in respective Sections.
  - .2 Rigidly secure frames to furring or framing system.
- 3.9 TRIM**
- .1 Minimize joints; use corner pieces as specified herein.
- 3.10 INSTALLATION OF GYPSUM WALLBOARD TREATMENT JOINT TREATMENT**
- .1 All junctions of wallboard panels shall be taped and filled in accordance with the following.
    - .1 Joint compounds shall be mixed in accordance with manufacturer's instructions and C.G.C. "Gypsum Construction Handbook".
    - .2 Prefill abutting rounded edges of eased edge gypsum wallboard with pre-fill compound. Leave a depression for tape.
    - .3 Apply the specified reinforced tape; embed it in joint compound and fold it and embed it in all angles to provide a true angle.
    - .4 A filling coat shall be applied over the embedding coat to fill board tapers flush with the wallboard surface. On joints with no taper the fill coat shall cover the tape and feather out at least 100 mm on either side of the tape.
    - .5 A finishing coat shall be applied to the fill coat and feathered to a smooth uniform finish.
    - .6 To provide a smooth surface, sanding shall occur between coats and following the final application of compound.
- .11 INSTALLATION OF PAPERLESS GLASS MAT GYPSUM PANELS**
- .1 Proceed as per paragraph 3.6 except as noted below.
  - .2 At interior ceilings and walls where indicated:

- .1 Install 16mm DensArmour Plus gypsum panels perpendicular to metal framing. Stagger end joints over framing. Butt joints together, Apply water resistant sealant to edges, ends, cut-outs with exposed core, and to fastener heads.
- .2 Install control joints to manufacturer's recommendations and as indicated on drawings.
- .3 Apply the specified reinforced tape; embed it in joint compound as specified and fold it and embed it in all angles to provide a true angle.
- .4 A filling coat shall be applied over the embedding coat to fill board tapers flush with the wallboard surface. On joints with no taper the fill coat shall cover the tape and feather out at least 100 mm on either side of the tape.
- .5 A finishing coat shall be applied to the fill coat and will be feathered to a smooth uniform finish.
- .6 To provide a smooth surface, sanding shall occur between coats and following the final application of compound.

### 3.13 CONTROL JOINTS

- .1 Construct control joints of preformed units set in gypsum board facing and supported independently on both sides of joint.
- .2 Provide continuous polyethylene dust barrier behind and across control joints.
- .3 For interior work, locate control joints at changes in substrate construction at approximate 5 m spacing on walls, at approximate 10 m spacing on ceilings and as indicated on drawings. Provide additional control joints as required to accommodate deflection of the building structure.
- .4 For exterior work, locate control joints as per manufacturer's recommendations and as indicated on drawings.
- .5 Install control joints straight and true.

### 3.14 PATCHING AND MAKING GOOD

- .1 Patch and make good new surfaces cut, damaged or disturbed, to Architect's approval.
- .2 Making good shall extend beyond the immediate limits of the disturbed surfaces to ensure the imperceptible continuity of existing decor.

**END OF SECTION**

**PART 1 - GENERAL**

- |                                    |    |   |                  |
|------------------------------------|----|---|------------------|
| <b>1.1 RELATED WORK</b>            | .1 | Masonry Anchorage and Reinforcing   | Section 04 05 19 |
|                                    | .2 | Concrete Unit Masonry   | Section 04 22 00 |
|                                    | .3 | Blanket Insulation  | Section 07 21 16 |
|                                    | .4 | Metal Doors, Frames and Screens   | Section 08 11 00 |
|                                    | .5 | Gypsum Board  | Section 09 21 16 |
|                                    | .  |   |                  |
| <b>1.2 FIRE RATED CONSTRUCTION</b> | .1 | Provide wall assemblies for fire rated partitions to ULC test designs.  |                  |
|                                    | .  |   |                  |
| <b>1.3 REFERENCE STANDARDS</b>     | .1 | Referenced standard shall be the latest edition except where specified otherwise:   |                  |
|                                    | .1 | User's Guide NBC 2015 Structural Commentaries ( Part 4 of Division B)   |                  |
|                                    | .2 | Ontario Building Code 2012  |                  |
|                                    | .3 | CAN/CSA-S136, current edition - Cold Formed Steel Structural Members  |                  |
|                                    | .4 | CSA-W47.1, current edition - Certification of Companies for Fusion Welding of Steel Structures  |                  |
|                                    | .5 | CSA-W59, current edition - Welded Steel Construction (Metal Arc Welding)  |                  |
|                                    | .6 | ASTM-A653/A653M Standard Specification for Steel Sheet Zinc-Coated (Galvanized) or Zinc Iron Alloy Coated   |                  |
|                                    | .7 | ASTM-C954 Standard Specification for Steel Drill Screws for Application of Gypsum Panel Products or Metal   |                  |
|                                    | .  |   |                  |
| <b>1.4 DESIGN CRITERIA</b>         | .1 | Provide and pay for structural engineering and design for the following:  |                  |
|                                    | .1 | For interior walls with masonry veneer facing.  |                  |
|                                    | .2 | For interior walls that support millwork and equipment.   |                  |
|                                    | .3 | For suspended drywall soffits and bulkheads.  |                  |
|                                    | .4 | For interior walls with top installed "Z"-shaped clips, refer to Drawings and System No. HW-D-0571 assembly.  |                  |
|                                    | .  |   |                  |
|                                    | .2 | The design for the entire wall system, framing, suspension system, and anchoring to the building structure shall be based on principles using factored loads and resistances. |                  |

- .3 Loads, load factors and seismic restraints shall be in accordance with the 2012 Ontario Building Code the User's Guide NBC 2015 Structural Commentaries, Commentary.
- .4 Resistances and resistance factors shall be determined in accordance with the 2012 Ontario Building Code and CAN/CSA-S136.
- .5 Conform to the requirements of specified fire rated assemblies.
- .6 Design bridging to prevent member rotation and member translation perpendicular to the minor axis. Provide for secondary stress effects due to torsion between lines of bridging. Sheathing shall **not** be used to help restrain member rotation and translation perpendicular to the minor axis for: wind bearing studs.
- .7 Maximum deflections under specified loads shall be  $L/600$ .
- .8 Design components or assemblies to accommodate specified erection tolerances of the structure.
- .9 Wall stud framing spacing shall not exceed 400mm o/c (16")
- .10 Allow for movement of the building structure. Design wind bearing stud end connections to accommodate deflections of the building structure such that the studs are not loaded axially.
- .11 Connections between stud framing members shall be by bolts, welding or sheet metal screws.
- .12 Resistances for sheet metal screw shall be based on the manufacturer's lower bound test values multiplied by the appropriate resistance factor, given in CAN3-S136.
- .13 Allow for appropriate end eccentricities in the design of axial load bearing members.
- .14 Design framing of openings to support glazed pressed metal screens, doors and windows.

#### 1.5 SUBMITTALS

- .1 Submit representative pieces of all framing component parts including mechanical fasteners if used. The length of pieces submitted need not exceed 300 mm. Tag pieces with the name of the part, the metal thickness exclusive of coating and the manufacturer.
- .2 Submit 3 copies of engineering calculations or data verifying the capacity of the members and the ability of the assemblies to meet the design requirements.
- .3 Submit shop drawings in accordance with Section 01 33 00.
  - .1 Each shop drawing submitted shall bear the stamp and signature of a qualified Professional Engineer who is registered and licensed to practice in the Province of Ontario.

The metal stud systems contractor shall retain the services of a Professional Structural Engineer for the Project and pay for engineering services in connection with shop drawings and review during construction of the metal stud systems.

- .2 Include all necessary shop details and erection diagrams. Indicate member sizes, locations, thicknesses exclusive of coating, coatings and materials. Include connection details for attaching framing to itself and for attachment to the structure. Show splice details where permitted. Indicate dimension, openings, requirement of related work and critical installation procedures. Show temporary bracing required for erection purposes.
- .3 Indicate design loads.
- .4 Do not fabricate until all submittals are reviewed by the Architect.
- .5 Submit 3 copies of field review reports from the Systems Contractors Structural Engineer.
- .6 Contractor shall retain and pay for a qualified Professional Engineer who is licensed to practice in the Province of Ontario, to verify and provide a written statement that installed steel stud systems will withstand factored loads identified in items listed above. The written statement shall bear the stamp and signature of the Professional Engineer.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- .1 **NON-LOADBEARING CHANNEL STUD FRAMING FOR INTERIOR USE:** to ASTM C645-latest edition; 41 mm, 64 mm, 92 mm, 152 mm and 203 mm deep x 0.53 mm (25 gauge) minimum thickness; roll formed from electrogalvanized steel sheet, for screw attachment of gypsum board. Knock out service holes at 460 mm centres. Increase stud thickness (gauge) as required to meet design criteria for interior walls steel channel stud framing.
- .2 **FLOOR AND TOP TRACKS FOR INTERIOR STUD WALLS:** to ASTM C645-latest edition; in widths to suit stud sizes, minimum 40 mm flange height, long legged and slotted, inner and outer top track to accommodate deflection of the building structure. Top tracks for partitions located below steel roof or floor structures shall be deflection tracks which allow maximum 25 mm deflection of building structure. Tracks roll formed from minimum 25 gauge. Increase gauge as required to meet design criteria.
- .3 **METAL CHANNEL STIFFENER FOR STUD WALLS:** 2 mm thick by minimum 38 mm wide cold rolled steel, coated with rust inhibitive coating.

- .4 SHAFT WALL CONSTRUCTION: C-H metal studs, and E metal studs, 64 mm, 102 mm, 152 mm, and Type S drywall screws.
- .5 RESILIENT CHANNELS: to ASTM C645-latest edition; 25 gauge, electrogalvanized steel sheet; channel 13 mm deep.
- .6 FURRING CHANNELS: to ASTM C645-latest edition; 20 gauge electrogalvanized steel sheet; channels hat-shaped 22 mm deep.
- .7 ACOUSTICAL SEALANT: to ASTM-C919, latest edition.
- .8 INSULATING STRIP: rubberized, moisture resistant 3 mm thick neoprene strip, 12 mm wide, with self-sticking adhesive on one (1) face, lengths as required.
- .9 SCREWS, "Z"-clips for ULC System No. HW-D-0571, AND FASTENINGS FOR STUD WALL SYSTEM: purpose-made to suit application, to ASTM 954-04, Type S, shall be zinc coated, use stainless steel for exterior stud wall system.

### **PART 3 - EXECUTION**

#### **3.1 ERECTION OF NON LOAD BEARING CHANNEL STUD FRAMING FOR INTERIOR USE**

- .1 Design wind pressures shall conform to section 59, Commentary I of User's Guide NBC 2015 Structural Commentaries.
- .2 Align partition tracks at floor and underside of metal deck and concrete structure and secure at 400 mm o.c. maximum.
- .3 Place studs vertically at 400 mm o.c. and not more than 50 mm 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.
- .4 Erect metal studding to tolerance of 1:1000.
- .5 Attach studs to bottom and top track or as detailed on drawings, using screws or crimp pop rivets.
- .6 Coordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.
- .7 Coordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.
- .8 Provide two (2) or more studs extending from floor to ceiling at each side of openings wider than stud centres specified or as shown on drawings. Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.

- .9 .1 Provide one row of continuous horizontal of stiffener for all interior stud walls.
- .9 .2 At partitions over 3500 mm (12'-0") high provide two (2) rows. There upon provide one additional row of horizontal stiffener for every 1500 mm (5'0") height of partition.
- .10 Erect track at head of door/window openings and sills of sidelight/window openings to accommodate intermediate studs. Secure track to studs at each end, in accordance with manufacturer's printed instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.
- .11 Provide 40 mm stud or furring channel and wood blocking as required secured between studs for attachment of millwork, fixtures, etc., and other items including wall stops for doors, towel rails, etc., attached to steel stud partitions.
- .12 Install steel studs or furring channel between studs for attaching electrical and other boxes.
- .13 Extend partitions to underside metal deck and/or concrete except where noted otherwise.
- .14 Maintain clearance under steel structure to avoid transmission of structural loads to studs. Use 50 mm leg top tracks with stud connections at these locations to allow for movement. Refer to drawings for additional details.
- .15 Install continuous insulating strips to isolate studs from uninsulated surfaces.
- .16 Install two (2) continuous beads of sealant behind studs and tracks around perimeter of all partitions.
- .17 Extend studs vertically and tie to structure to provide lateral stability.
- .18 Provide diagonal bracing above ceilings as required to meet design criteria.
- .19 To maintain continuity of fire separation or sound separation of interior intersecting walls, extend entire wall assembly into exterior steel studs wall cavity and up to interior face of exterior sheathing board.
- .20 Frame all openings in fire rated partitions, inclusive of mechanical and electrical Channel openings, to ULC-G21, Figures 4, 5, 6, 7, 8 for and 15, ULC CR 1255, Figures 1 and 2, and ULC Certification Bulletin #80-5 (bound in at the end of this section of specifications).

**3.2 STRUCTURAL  
CERTIFICATION**

- .1 Upon completion of work, identified in Item 1.4 and 1.5, provide a certificate that shall state that the work has been performed in



accordance with requirements of the Ontario Building Code and Regulations of Authorities in Jurisdiction. The certificate shall bear the seal of a qualified Structural Engineer who is licensed in the Province of Ontario.

**END OF SECTION**

## PART 1 - GENERAL

- 1.1 RELATED SECTIONS** .1 Section 07 92 10 - Joint Sealing.
- 1.2 REFERENCES**
- .1 American National Standards Institute (ANSI)/Ceramic Tile Institute (CTI)
    - .1 ANSI A108.1-2013, Specification for the Installation of Ceramic Tile (Includes ANSI A108.1A-C, 108.4-.13, A118.1-.10, ANSI A136.1).
    - .2 CTI A118.3-2013, Specification for Chemical Resistant, Water Cleanable Tile Setting and Grouting Epoxy and Water Cleanable Tile Setting Epoxy Adhesive (included in ANSI A108.1).
    - .3 CTI A118.4-2012, Specification for Latex Portland Cement Mortar (included in ANSI A108.1).
    - .4 CTI A118.6-2010, Specification for Ceramic Tile Grouts (included in ANSI A108.1).
  - .2 American Society for Testing and Materials (ASTM International) International
    - .1 ASTM C 144-2004, Specification for Aggregate for Masonry Mortar.
  - .3 Canadian General Standards Board (CGSB)
    - .1 CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
  - .4 Canadian Standards Association (CSA International)
    - .1 CAN/CSA-A3000-13, Cementitious Materials Compendium (Consists of A5-98, A8-98, A23.5-98, A362-98, A363-98, A456.1-98, A456.2-98, A456.3-98).
  - .5 Terrazzo Tile and Marble Association of Canada (TTMAC)
    - .1 Tile Specification Guide 093000, Tile Installation Manual.
    - .2 Tile Maintenance Guide.
- 1.3 PRODUCT DATA**
- .1 Submit product data in accordance with Section 00 10 00
  - .2 Include manufacturer's information on:
    - .1 Ceramic tile, marked to show each type, size, and shape required.
    - .2 Chemical resistant mortar and epoxy grout.
    - .3 Transition strip.
    - .4 Flexible membrane.
    - .5 Leveling compound.
    - .6 Adhesives.

**1.4 SAMPLES**

- .1 Submit samples in accordance with Section 00 10 00
- .2 Wall tile: submit duplicate sample panels of each colour, size.
- .3 Floor tile: submit duplicate sample panels of each colour.
- .4 Transition and reducer strips: each type and profile.

**1.5 DELIVERY,  
STORAGE AND  
HANDLING**

- .1 Deliver materials in containers with labels legible and intact and grade-seals unbroken.
- .2 Store material so as to prevent damage or contamination.
- .3 Store materials in a dry area, protected from freezing, staining and damage.
- .4 Store cementitious materials on a dry surface.

**1.6 ENVIRONMENTAL  
CONDITIONS**

- .1 Maintain air temperature and structural base temperature at ceramic tile installation area above 12 ° C for 48 h before, during, and 48 h after, installation.
- .2 Do not install tiles at temperatures less than 12 ° C or above 38 ° C.
- .3 Do not apply epoxy mortar and grouts at temperatures below 15 ° C or above 25 ° C.

**1.7 EXTRA MATERIAL**

- .1 Provide maintenance materials in accordance with Section 00 10 00.
- .2 Provide minimum 5% of each type and colour of tile required for project for maintenance use. Store where directed.
- .3 Maintenance material to be of same production run as installed material.

**PART 2 - PRODUCTS**

**2.1 FLOOR TILE**

- .1 CT-1 Floor Tiles
  - .1 Ceramic Tiles: to CAN/CGSB-75.1, Type S, Class M21, slip resistant surface.
  - .2 Acceptable Material:
    - .1 CT-1: By Olympic Yuza New Series – Lead Grey, Size: 300 x 600 mm.

<b>2.2 WALL TILE</b>		NOT USED
<b>2.3 THIN SET MORTAR AND ADDITIVES</b>	.1	Acceptable Material: .1 Thin-Set Mortar: .1 Flextile 51 as manufactured by Flextile Ltd. .2 Additive: .1 Flextile 44 as manufactured by Flextile Ltd.
	.2	Water: potable and free of minerals and chemicals which are detrimental to mortar and grout mixes.
<b>2.4 BOND COAT</b>	.1	Latex Portland Cement mortar: to ANSI A108.1, two-component universal dry-set mortar.
<b>2.5 WATERPROOFING SYSTEM</b>	.1	Flexible, load-bearing waterproofing system which consists of an elastomeric latex compound with a reinforcing fabric.
	.2	Acceptable Material: .1 Flextile WP-980 as manufactured by Flextile Ltd.
<b>2.6 GROUT</b>	.1	Chemical-Resistant Grout: .1 Epoxy grout: to ANSI A108.1, having quality, colour and characteristics to match epoxy bond coat. Adhesive and grout by same manufacturer. .2 Colour: Silver Grey. .3 Acceptable Material: .1 Two component flex-epoxy 100 as manufactured by Flextile Ltd.
<b>2.7 ACCESSORIES</b>	.1	Transition and Reducer Strips: purpose made metal anodized aluminum type. .1 At wall or floor tile termination or transition between dissimilar finishes use anodized aluminum profiles manufactured by Schluter Systems Inc. .1 Floor transition between dissimilar materials: Schluter – Schiene or approved equal .2 Wall outside corner: Schluter – Quadec. .3 Wall termination: Schluter – Jolly. .4 Floor transition between dissimilar materials – Schluter – Reno-TK. .5 Floor expansion/control joint: Schluter – Dilex – BWS.

- .2 Sealant: in accordance with Section 07 92 10 - Joint Sealing.

## 2.8 MIXES

- .1 Portland Cement:
  - .1 Scratch coat: 1 part portland cement, 1/5 to 1/2 parts hydrated lime to suit job conditions, 4 parts sand, 1 part water, [and latex additive where required]. Adjust water volume depending on water content of sand.
  - .2 Slurry bond coat: portland cement and water mixed to creamy paste. Latex additive may be included.
  - .3 Mortar bed for floors: 1 part portland cement, 4 parts sand, 1 part water. Adjust water volume depending on water content of sand. Include Latex additive.
  - .4 Mortar bed for walls: 1 part portland cement, 1/5 to 1/2 parts hydrated lime to suit job conditions, 4 parts sand and 1 part water. Adjust water volume depending on water content of sand. Include Latex additive.
  - .5 Levelling coat: 1 part portland cement, 4 parts sand, minimum 1/10 part latex additive, 1 part water including latex additive.
  - .6 Bond or setting coat: 1 part portland cement, 1/3 part hydrated lime, 1 part water.
  - .7 Measure mortar ingredients by volume.
- .2 Dry set mortar: mix to manufacturer's instructions.
- .3 Organic adhesive: pre-mixed.
- .4 Mix bond and levelling coats, and grout to manufacturer's instructions.
- .5 Adjust water volumes to suit water content of sand.

## 2.9 PATCHING AND LEVELING COMPOUND

- .1 Polymer modified, cementitious self-levelling underlayment, manufactured specifically for resurfacing and leveling concrete floors. Products containing gypsum are not acceptable.
- .2 Have not less than the following physical properties:
  - .1 Compressive strength – 33.1 MPa (@ 28 days).
  - .2 Density - 1.9 (Wet).
- .3 Capable of being applied in layers up to 50 mm thick, being brought to feather edge, and being trowelled to smooth finish.
- .4 Ready for use in 4 hours after application.
- .5 Acceptable Material:
  - .1 59 Flex-Flo self-levelling underlayment as manufactured by Flextile Ltd.
  - .2 Primer: Flextile 4040 as manufactured by Flextile Ltd.

**2.10 CLEANING  
COMPOUNDS**

- .1 Specifically designed for cleaning masonry and concrete and which will not prevent bond of subsequent tile setting materials including patching and leveling compounds and elastomeric waterproofing membrane and coat.
- .2 Materials containing acid or caustic material are not acceptable.

**PART 3 - EXECUTION**

**3.1 WORKMANSHIP**

- .1 Do tile work in accordance with TTMAC Tile Installation Manual, "Ceramic Tile", except where specified otherwise.
- .2 Apply tile to clean and sound surfaces.
- .3 Fit tile around corners, fittings, fixtures, drains and other built-in objects. Maintain uniform joint appearance. Cut edges smooth and even. Do not split tiles.
- .4 Maximum surface tolerance 1:800.
- .5 Make joints between tile uniform and approximately 1.5 mm wide, plumb, straight, true, even and flush with adjacent tile. Ensure sheet layout not visible after installation. Align patterns.
- .6 Lay out tiles so perimeter tiles are minimum 1/2 size.
- .7 Sound tiles after setting and replace hollow-sounding units to obtain full bond.
- .8 Make internal angles square.
- .9 Use transition strip at termination of wall tile panels.
- .10 Install transition or reducer strips at junction of tile flooring and dissimilar materials.
- .11 Allow minimum 24 h after installation of tiles, before grouting.
- .12 Clean installed tile surfaces after installation and grouting cured.
- .13 Install waterproofing system under floor tiles and on walls up to 300 mm above top of floor.
- .14 Install self-levelling underlayment under floor tiles.

**END OF SECTION**

## PART 1 - GENERAL

- 1.1 RELATED WORK**
- .1 Room Finish Schedule Refer to Drawings
  - .2 Colour Code Marking Banks for Identification of Piping and Ductwork Mechanical
- 1.2 DESCRIPTION**
- .1 Section includes: All labour, material, tools, and other equipment, services and supervision required to complete all exterior and interior painting of new surfaces and repainting of existing surfaces as indicated on the Finish Schedules and the full extent of the drawings and specifications.
  - .2 Work under this section shall also include but not necessarily be limited to:
    - .1 Moisture testing of substrates.
    - .2 Surface preparation of substrates as required for acceptance of paint, including cleaning, small crack repair, patching and making good surfaces and areas to the limits defined under MPI preparation requirements, and under MPI Repainting Manual Preparation requirements.
    - .3 Specific pre-treatment noted herein or as specified in the MPI Architectural Painting Specification Manual and the MPI Repainting Manual requirements.
    - .4 Sealing and priming surfaces for painting and repainting in accordance with in the MPI Architectural Painting Specification Manual and the MPI Repainting Manual requirements.
    - .5 Provision of safe and adequate ventilation as required, and over and above ventilation supplied by others, where toxic and/or volatile flammable materials are being used.
- 1.3 EXAMINATION**
- .1 Examine all drawings and Finish and Door Schedules to determine extent of interior and exterior work.
  - .2 Report in writing to the Architect any defects in work affecting the work of this Section.
  - .3 Commencement of work shall be construed as evidence of acceptance of underlying surfaces as satisfactory.
  - .4 Work shall not take place or be left to dry in any area where the temperature is below 10 degrees C.
- 1.4 REFERENCE STANDARDS**
- .1 Except where more stringent requirements are specified, the following reference standard shall govern the work of this Section:

- .1 Canadian General Standards Board  
(CGSB)CAN/CGSB-85,100-M81: Painting
- .2 Master Painters Institute (MPI) Architectural Painting Specification Manual and Maintenance Repainting Manual (MPI Manuals), including Identifiers, Evaluation, Systems, preparation and painting of exterior and interior surfaces and Approved Product List, latest editions, and referenced herein as the MPI Manual , as issued by the local MPI Accredited Quality Assurance Association having jurisdiction
- .3 Test Method for Measuring Total Volatile Compound Content of Consumer Products, Method 24 ( for Surface Coatings ) of the Environmental Protection Agency (EPA)
- .4 National Fire Code of Canada

#### 1.5 QUALITY ASSURANCE

- .1 Comply with the requirements of the MPI Manuals, except where more stringent requirements are specified.
- .2 Qualifications of Applicators:
  - .1 Applicator shall have a minimum of 5 years proven satisfactory experience and shall show proof before commencement of work that he will maintain a qualified crew of painters throughout the duration of the work. When requested, submit a list of the last three comparable jobs including, name and location, specifying authority/project manager, start and completion dates and cost amount of the painting work.
  - .2 Only qualified journeymen who have a "Tradesman Qualification Certificate of Proficiency" shall be engaged in painting and decorating work. Apprentices may be employed provided they work under the direct supervision of a qualified journeyman in accordance with trade regulations.
- .3 Pre-application Meeting
  - .1 Convene a pre-application meeting for the Products specified in this Section. Attendees must include, as a minimum, representatives of the following:
    - .1 Contractor (Site Superintendent & Project Manager)
    - .2 Application Subcontractor (Site Foreman & Project Manager)
    - .3 Product Manufacturers and/or Distributors (Technical Representatives)
    - .4 Related Subcontractors (i.e. Mechanical and/or Electrical)
    - .5 Consultant
- .4 Retain purchase orders, invoices and other documents to prove



conformance with noted MPI requirements when requested by the Architect.

## 1.6 SUBMITTALS

- .1 Submit required submittals in accordance with Section 01 33 00.
- .2 MPI Manual:
  - .1 Submit 1 copy each, of MPI Manuals – latest edition, and maintain at site office for reference.
- .3 Product Data and List of Products:
  - .1 Submit manufacturer's Product Data Sheets for Products proposed for use in the work of this section as identified in "Approved Product List" section of the MPI Painting Manual. Correlate Products to Schedule furnished by Consultant.
- .4 Samples and Colours:
  - .1 Colours: Architect will furnish paint colour numbers and colour schedule indicating colour locations.
  - .2 Samples for initial selection:
    - .1 Submit manufacturer's colour charts showing full range of colours available including light and deep dark tones, for each type of finish material indicated for colour selection by Consultant.
    - .2 Consultant shall have complete freedom in choice of colours in compiling colour schedule and will not necessarily select colours from standard colour charts of manufacturer of Products specified.
      - .1 Colour schedule: to be provided by the Consultant. Allow for a maximum of 5 field colours and 10 strong accent colours.
  - .3 Samples for verification:
    - .1 Submit 3 samples on 200 mm x 305 mm (8" x 12") material of same type as that on which coating is to be applied, for Consultant's approval, at least 30 days before materials are required.
    - .2 Identify each sample as to Project, finish, formula, colour name, number, gloss name and number, date and name of Contractor and painting Subcontractor.
- .5 Mock-ups:
  - .1 Provide full finished mock-up installation of each paint colour, for indicated surfaces and mock-up size, showing colour and finish selected by Consultant, under lighting conditions matching final area lighting, for acceptance by Consultant. Locate at Place of the Work as part of finished installation if accepted.
    - .1 Concrete block, concrete and gypsum board: 9.3 m<sup>2</sup>

- (100ft<sup>2</sup>).
- .2 Hollow metal doors and frames: 1 door and frame for each finish specified.
- .3 Painted wood base.

.6 Closeout submittals:

- .1 Submit closeout submittals in accordance with Section 01 73 10.
- .2 Maintenance Materials:
  - .1 Provide 2 sealed containers, each of 4 litres (1 gallon) capacity of each paint product in each colour used in the Work for Owner's maintenance use. Containers shall be new, clearly labelled with manufacturer's name, type of paint, colour and colour number. Store at Place of the Work where directed by Owner.

**1.7 ENVIRONMENTAL REQUIREMENTS**

- .1 Comply with environmental requirements of the MPI Manuals.
- .2 Perform no painting work when ambient air and substrate temperatures are below 10°C for both interior and exterior work, unless suitable weatherproof covering and sufficient heating and ventilation facilities are in place in accordance with MPI Manuals
- .3 Perform no painting work when relative humidity is above 85% or when dew point is less than 3°C (5°F) variance between air/surface temperature.
- .4 Check moisture content of surfaces to be painted using properly calibrated electronic moisture meter approved by paint manufacturer, and Consultant, or other approved method. Maximum moisture contents shall be in accordance with manufacturer's recommendations and as follows:
  - .1 Concrete and concrete masonry (clay and concrete brick/block): Maximum 12%
  - .2 Gypsum board and plaster: 15%
  - .3 Wood: Maximum 15%
- .5 Conduct moisture tests on concrete floors using cover patch test method.
- .6 Test concrete, masonry and plaster surfaces for alkalinity.

**1.8 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver painting materials in sealed, original labelled containers bearing manufacturer's name, brand name, type of paint or coating and colour designation, standard compliance, materials content as well as mixing and/or reducing and application requirements.
- .2 Store paint products and materials in original labelled containers in

secure (lockable), dry, heated and well ventilated single designated area meeting minimum requirements of both paint manufacturer and authorities having jurisdiction, and at a minimum ambient temperature of 7°C.

- .3 Protect floor and wall surfaces of storage area. Protect floors with sheets or clean plywood or metal pans where mixing is being carried out.

### 1.9 WARRANTY

- .1 Provide a Painting Association Warranty for work of this section for a period of 2 years.
- .2 Throughout warranty period, painting systems shall remain free from failure due to causes including: material failure; surface preparation less than that specified; and paint film thickness less than that specified, or when not specified, less than that coverage recommended by manufacturer.
- .3 Presence of any of the following during the warranty period shall constitute failure: visible corrosion, film peeling, blistering, checking, scaling, embrittling or general film disintegration; and poor adhesion as determined by tape "peel-off" test procedures.

### 1.10 COMPLETION SCHEDULE

- .1 Furnish a schedule showing expected completion of the respective coats of paint for the various areas and surfaces. Keep this schedule current as the job progresses.

### 1.11 COLOUR SCHEDULE

- .1 A colour schedule will be prepared as the job progresses by the Architect. The final selection of colours and surface textures of all finishes throughout shall rest solely with the Architect.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- .1 Materials shall be premium grade, Only products listed in MPI Manuals shall be used in the work unless specified otherwise.  
  
Acceptable Material: Sherwin Williams Product line
- .2 The products of generally only one (1) manufacturer shall be used on the project and the Architect shall be notified of the products to be used prior to delivery of the materials to the site.
- .3 Water-borne surface coatings must be manufactured and transported in a manner that steps of process, including disposal of waste products arising therefrom, will meet requirements of applicable

governmental acts, by-laws and regulations including, for the facilities located in Canada, Fisheries Act and Canadian Environmental Protection Act (CEPA).

- .4 Other paint materials, such as linseed oil, shellac, and the like, shall be highest quality products of an approved manufacturer listed in the MPI Manual and shall be compatible with other coating materials as required.
- .5 Paint materials shall have good flowing and brushing properties and shall dry or cure free of blemishes or sags.
- .6 Where required, paints and coatings shall meet flame spread and smoke developed ratings designated by building code requirements and/or authorities having jurisdiction.
- .7 Paints and coatings materials used within the weatherproofing system shall not exceed the VOC content limits of the following criteria.
  - .1 Interior paints and coatings: to following Green Seal GS-11 VOC limits:
    - .1 Flat coating type: 50 gm/L.
    - .2 Non-flat coating type: 100 gm/L.
  - .2 Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates:  
Green Seal Standard GC-03, Anti-Corrosive Paints.
  - .3 Clear wood finishes, floor coatings, stains, and shellacs applied to interior elements: South Coast Air Quality Management District (SCAQMD) Rule 1113, Architectural Coatings.
- .8 Paints and coatings materials used to the exterior of the weatherproofing system shall not exceed the VOC content limits of the following criteria.
  - .1 Exterior paints coatings: Green Seal GS-11: to following Green Seal VOC limits:
    - .1 Flat coating type: 100 gm/L.
    - .2 Non-flat coating type: 200 gm/L.

## 2.2 EQUIPMENT

- .1 Painting and coating equipment in accordance with written requirements of MPI Manual.

## 2.3 MIXING AND TINTING

- .1 Unless otherwise specified, paints shall be ready-mixed. Re-mix prior to application to ensure colour and gloss uniformity.
- .2 Paste, powder or catalysed paint mixes shall be mixed in accordance with manufacturer's written instructions.
- .3 Perform colour tinting operations prior to delivery of paint to Place of

the Work.

- .4 Where thinner is used, addition shall not exceed paint manufacturer's recommendations.

**2.4 GLOSS / SHEEN RATINGS**

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

Gloss Level	Description	Units @ 60 degrees	Units @ 85 degrees
G1	Matte or Flat finish	0 to 5	10 maximum
G2	Velvet finish	0 to 10	10 to 35
G3	Eggshell finish	10 to 25	10 to 35
G4	Satin finish	20 to 35	35 minimum
G5	Semi-Gloss finish	35 to 70	
G6	Gloss finish	70 to 85	
G7	High-Gloss finish	>85	

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

**PART 3 - EXECUTION**

**3.1 PROTECTION**

- .1 Protect surrounding or adjacent work by adequately covering with tarpaulins or similar coverings.
- .2 Any damage which results from failure to provide proper protection shall be made good.
- .3 Before commencement of work all electric plates, surface hardware and other fixtures shall be removed and shall be replaced when painting is completed.

**3.2 EXTENT OF EXTERIOR PAINTING**

- .1 All items which are not prefinished and which are installed at the exterior of the building shall be painted.
- .2 All exterior mechanical and electrical equipment, inclusive of exposed pipes, conduits, and duct work, shall be painted.
- .3 All miscellaneous metal items and bollards shall be painted.

**3.3 EXTENT OF**

- .1 As indicated in Room Finish Schedule, drawings and specifications.

**INTERIOR PAINTING OF  
NEW WORK AND REPAINTING  
OF EXISTING SURFACES**

- .2 All interior mechanical and electrical equipment, inclusive of exposed pipes and ducts, shall be painted.
- .3 All miscellaneous metal items, bollards, stairs, gratings shall be painted.

**3.4 CONDITIONS OF  
SURFACES**

- .1 Prior to commencement of work of this section, thoroughly examine surfaces scheduled to be painted.
- .2 Check moisture content and PH of surfaces to be painted in accordance with paragraph above titled Environmental Requirements.
- .3 Inspect surfaces to be coated for gouges, marks, nibs, and other defects and properly prepare patching, filling, smoothing or other surface preparation necessary to ensure satisfactory finish.
- .4 Report in writing any condition adversely affecting work of this section.
- .5 Proceed with work only when surfaces and conditions are satisfactory. Remove dust, grease, rust, scale and extraneous matter, tool and machine marks and insects from surfaces which could be detrimental to a satisfactory and acceptable finish.

**3.5 PREPARATION**

- .1 Comply with manufacturer's written instructions and recommendations in "MPI Manual" applicable to substrates indicated.
- .2 Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
  - 1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.
- .3 Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
  - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.
- .4 Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
  - 1. Concrete Floors: Remove oil, dust, grease, dirt, and other foreign materials. Comply with SSPC-SP-13/NACE 6 or ICRI 03732.
- .5 Masonry Substrates: Remove efflorescence and chalk. Do not paint

surfaces if moisture content or alkalinity of surfaces or mortar joints exceed that permitted in manufacturer's written instructions.

- .6 Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer[.] [ but not less than the following:
  1. SSPC-SP 2, "Hand Tool Cleaning."
  2. SSPC-SP 3, "Power Tool Cleaning."
  3. SSPC-SP 7/NACE No. 4, "Brush-off Blast Cleaning."
  4. SSPC-SP 11, "Power Tool Cleaning to Bare Metal."
- .7 Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
- .8 Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.
- .9 Aluminum Substrates: Remove loose surface oxidation.
- .10 Wood Substrates:
  1. Scrape and clean knots, and apply coat of knot sealer before applying primer.
  2. Sand surfaces that will be exposed to view, and dust off.
  3. Prime edges, ends, faces, undersides, and backsides of wood.
  4. After priming, fill holes and imperfections in the finish surfaces with putty or plastic wood filler. Sand smooth when dried.
- .11 Cotton or Canvas Insulation Covering Substrates: Remove dust, dirt, and other foreign material that might impair bond of paints to substrates.

### 3.6 APPLICATION

- .1 Apply paints according to manufacturer's written instructions and to recommendations in "MPI Manual."
- .2 Use applicators and techniques suited for paint and substrate indicated.
- .3 Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
- .4 Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
- .5 Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.

- .6 Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.
- .7 Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match colour of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- .8 If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, colour, and appearance.
- .9 Paint colours shall be in accordance with the colour schedule prepared by the Architect at a later date.
- .10 The different surfaces in any one (1) room will not necessarily be one (1) colour. Doors, walls, and other elements within rooms shall be painted with different strong accent colours. The total number of strong accent colours in the project shall be limited to ten (10). A total of five (5) basic wall colours shall be used. Doors shall be painted a different colour from door frame. Doors shall be a different colour from walls. Radiator covers shall be painted in strong accent colours.
- .11 In the Room Finish Schedule, where surfaces in rooms are specified to be painted, all elements fixed to those surfaces including frames of openings, doors, exposed new metal surfaces, shall be painted unless otherwise specified. Paint behind radiator covers.
- .12 Apply each coat at the proper consistency in accordance with the manufacturer's directions.
- .13 Sand lightly between coats when enamel or varnish is applied to wood or metal.
- 14 Regardless of the number of coats specified for any surface, apply sufficient number of extra coats of paint to produce a solid, uniform appearance and coverage in the opinion of the Architect.
- .15 Paint shall be applied by brush, roller, and airless spray. Reduce paint materials in strict accordance with the manufacturer's directions.
- .16 Top and bottom edges of doors shall receive the same finish as the face of the door.
- .17 Do not paint unless substrates are acceptable and/or until environmental conditions (heating, ventilation, lighting and completion of work of other sections) are acceptable for applications of Products.
- .18 Apply primer, paint or stain in accordance with MPI Manual Premium Grade finish requirements.
- .19 Apply paint and coatings within an appropriate time frame after



cleaning when environmental conditions encourage flash-rusting, rusting, contamination or manufacturer's paint specifications require earlier applications.

- .20 Painting coats specified are intended to cover surfaces satisfactorily when applied at proper consistency and in accordance with manufacturer's recommendations.
- .21 Unless otherwise approved by Architect, apply a minimum of 4 coats of paint where deep or bright colours are used to achieve satisfactory results.
- .22 Sand and dust between each coat to provide an anchor for next coat and to remove defects visible from a distance up to 1000mm (39").
- .23 Do not apply finishes on surfaces that are not sufficiently dry. Unless manufacturer's directions state otherwise, each coat shall be sufficiently dry and hard before a following coat is applied.
- .24 Prime coat of stain or varnish finishes may be reduced in accordance with manufacturer's directions.
- .25 Paint finish shall continue through behind wall-mounted items (i.e. chalk and tack boards).
- .26 Exposed means visible in complete work including interiors of cupboards and closets, tops of doors, trim, and the like, whether in sight line or not, including behind surface mounted fixtures and heating units.
- .27 Consultant shall have right to make changes in colour tone of finishes prior to final coat to obtain desired results without additional cost to Owner.
- .28 Access doors, prime coated butts and other prime painted hardware, registers, and covers, exposed piping and electrical panels shall be painted to match adjacent surfaces in terms of colour texture and sheen, unless otherwise indicated.

**3.7 FIELD QUALITY  
CONTROL/STANDARD OF  
ACCEPTANCE**

- .1 Painted exterior and interior surfaces shall be considered to lack uniformity and soundness if any of the following defects are apparent to the Consultant:
  - .1 Brush / roller marks, streaks, laps, runs, sags, drips, heavy stippling, hiding or shadowing by insufficient application methods, skipped or missed areas, and foreign materials in paint coatings.
  - .2 Evidence of poor coverage at rivet heads, plate edges, lap joints, crevices, pockets, corners and re-entrant angles.
  - .3 Damage due to touching before paint is sufficiently dry or any other contributory cause.
  - .4 Damage due to application on moist surfaces or caused by

- .5 inadequate protection from weather.  
Damage and/or contamination of paint due to blown contaminants (dust, spray paint, etc.).
- .2 Painted surfaces shall be considered unacceptable if any of the following are evident under natural lighting source for exterior surfaces and final lighting source (including daylight) for interior surfaces.
  - .1 Visible defects are evident on vertical surfaces when viewed at normal viewing angles from a distance of not less than 1000 mm (39").
  - .2 Visible defects are evident on horizontal surfaces when viewed at normal viewing angles from a distance of not less than 1000 mm (39").
  - .3 Visible defects are evident on ceiling, soffit and other overhead surfaces when viewed at normal viewing angles).
  - .4 When final coat on any surface.
- .3 Painted surfaces rejected by the Consultant shall be made good at the expense of the Subcontractor. Small affected areas may be touched up; large affected areas or areas without sufficient dry film thickness of paint shall be repainted. Runs, sags, of damaged paint shall be removed by scraper or by sanding prior to application of paint.

### 3.8 CLEANING

- .1 Promptly as work proceeds and on completion of Work, remove paint where spilled, splashed or spattered during the progress of the Work keep the premises free from unnecessary accumulation of tools, equipment, surplus materials and debris; and the conclusion of the work leave the premises clean. Do not scratch or damage adjacent finished surfaces.
- .2 At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- .3 Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- .4 At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

### 3.9 INTERIOR AND EXTERIOR PAINT SYSTEMS

- .1 System references listed are based on MPI Manual and are Premium Grade, Low VOC, unless listed otherwise
- .2 New Gypsum Board – Walls: to MPI, INT 9.2B, High Performance Interior System, Premium Grade:
  - .1 One (1) coat of primer-sealer MPI 50.

- Acceptable Material: ProMar® 200 Zero VOC Latex Primer, B28W2600 by Sherwin Williams
- .2 Two (2) coats of, high performance, pre-catalized water based epoxy. Eggshell Finish, MPI 139.  
Acceptable Material: "PRO Industrial Pre-catalyzed Waterbased Epoxy, K45 Series" by Sherwin Williams
- .3 New Gypsum Board – Ceilings and Bulkheads: to MPI, INT 9.2B, High Performance Interior System, Premium Grade:
- .1 One (1) coat of primer-sealer MPI 50.  
Acceptable Material: ProMar® 200 Zero VOC Latex Primer, B28W2600 by Sherwin Williams
- .2 Two (2) coats of, professional quality, washable, interior vinyl acrylic. Flat Finish.  
Acceptable Material: ProMar® 200 Zero VOC Interior Latex Flat, B30-2600 Series by Sherwin Williams
- .4 New Gypsum Board (in damp areas indicated in the Finish Schedule as "TC") to MPI, INT 9.2F Two Component Epoxy (Tile-Like) Waterborne, Premium Grade
- .1 One (1) coat of primer-sealer MPI 50
- .2 Two (2) coats of water based catalyzed epoxy resin Satin Finish, MPI 115  
Acceptable Material: "Pro Industrial WB Epoxy" by Sherwin Williams"
- .5 Concrete Block and Poured Concrete Walls to MPI, INT 4.2K, High Performance Acrylic, Premium Grade:
- .1 One (1) coat of Heavy Duty block filler MPI 4
- .2 Two (2) coats of water based catalyzed epoxy resin Satin Finish, MPI 151.  
Acceptable Material: "Heavy Duty Block Filler" and "Pro Industrial Pre-catalyzed Waterbased Epoxy Coating, K45 Series" by Sherwin Williams.
- .6 Concrete Floors to MPI, INT 3.2C, Two Component Epoxy, Premium Grade:
- .1 One (1) coat of two component catalyzed semi-gloss epoxy resin. Reduce in accordance with manufacturer's instructions. MPI 77.
- .2 Two (2) coats of two component catalyzed epoxy resin, Gloss finish, MPI 77.  
Acceptable Material: "Tile-Clad Epoxy" by Sherwin Williams Series 7100' with sharp grip.
- .7 Exterior Metalwork (except copper, stainless steel, aluminum and factory finish coated metalwork). Acceptable material by Sherwin Williams:
- .1 Zinc Clad 5 b69a45 primer
- .2 Intermediate coat with Macropoxy 646 b58w610

- .3 Final coat of urethane 2 component b65w611 Acrolon HS. Semi Gloss Finish
- .8 Galvanized and Zinc Coated Metal Roof Deck and Exposed Roof Structure painted to MPI, INT 5.1C, Waterborne Dry Fall:
  - .1 Two (2) coats of premium quality waterborne acrylic dry fall, Semi Gloss Finish, MPI 226.  
Acceptable Material: "Pro Industrial Dryfall" by Sherwin Williams.
- .9 Interior Woodwork designated for painting, (wood doors, trim, etc) to MPI, INT 6.3Q, High Performance Polyurethane, Premium Grade:
  - .1 One (1) coat of enamel undercoat MPI 130
  - .2 Two (2) coats of High performance Polyurethane, MPI 130  
Acceptable Material: "Wood Classic WB Polyurethane, Satin Finish" by Sherwin Williams.
- .10 On surfaces designated for stain and varnish finish to MPI, INT 6.4G, Semi-Transparent Stain/Polyurethane Varnish, Premium Grade:
  - .1 One (1) coat of paste filler. Tint filler shall match stain colour. MPI 102
  - .2 One (1) coat of semi-transparent stain to CAN/CGSB 1.145M, Type 2 colour at Architect's discretion
  - .3 One (1) coat semi-gloss polyurethane varnish (reduced as per manufacturer's instructions) to CAN/CGSB 1.176, lightly sanded MPI 102
  - .4 One (1) coat polyurethane varnish to CAN/CGSB 1.176, lightly sanded MPI 56
  - .5 One (1) polyurethane varnish, Satin finish to CAN/CGSB 1.176, MPI 56  
Acceptable Material: "Wood Classic WB Polyurethane" by Sherwin Williams.
- .11 On surfaces designated to receive clear varnish finish to MPI, INT 6.4L, Clear Polyurethane Varnish, Premium Grade:
  - .1 One (1) coat of paste filler. filler shall match wood colour. MPI 102
  - .2 One (1) coat polyurethane varnish (reduced as per manufacturer's instructions) to CAN/CGSB 1.176, lightly sanded, MPI 56
  - .3 One (1) coat polyurethane varnish to CAN/CGSB 1.176, lightly sanded MPI 56
  - .4 One (1) coat polyurethane varnish, Satin Finish, to CAN/CGSB 1.176. MPI 56  
Acceptable Material: "Wood Classic WB Polyurethane" by Sherwin Williams.
- .12 For all interior metalwork, High Performance Acrylic, Premium Grade

to MPI INT 5.3B

- .1 One (1) coat of DTM 100% acrylic primer MPI 107
- .2 Two (2) coats of high performance, gloss DTM 100% acrylic Enamel, Semi Gloss Finish, MPI 153  
Acceptable Material: "Pro Industrial Pro-Cryl Universal Primer" and "Pro Industrial Acrylic Coating" by Sherwin Williams.

- .13 Interior of Ductwork visible through grilles or diffusers:
  - .1 One (1) coat matt black conforming to CAN/CGSB 1.114. May be spray applied.
- .14 Gypsum Board "Green" Wall; Room 217 – 7&8 Drama:
  - .1 Two (2) coats of white primer Rosco Tough Prime by Rosco. Minimum film thickness: 3 mil, dry film.
  - .2 Three (3) coats of chroma key matte green paint.
  - .3 Acceptable Material: Chroma Key by Rosco.

### 3.10 MECHANICAL AND ELECTRICAL EQUIPMENT

- .1 Paint exposed conduits, pipes, hangers and other mechanical and electrical equipment occurring in finished areas as well as inside cupboards and cabinet work. Colour and texture to match adjacent surfaces except as noted otherwise. Do not paint inside mechanical cabinets.
- .2 Fire protection piping shall be red 509-102 in accordance with MPI 5.3B, High Performance Acrylic. For Acceptable Materials see Item 3.9, this Section.
- .3 Natural gas piping shall be yellow 505-101 in accordance with MPI 5.3B, High Performance Acrylic. For Acceptable Materials see Item 3.9, this Section.
- .4 Keep sprinkler heads free of paint.
- .5 Paint both sides and edges of plywood backboards for equipment before installation. Leave equipment in original finish except for touch-ups as required. Do not paint over name plates.
- .6 Finish paint primed mechanical and electrical items with minimum 2 coats of paint. Include for the following list unless otherwise indicated:
  - .1 Conduit
  - .2 Ductwork
  - .3 Pipes
  - .4 Hangers
- .7 Prime and paint exposed insulated and bare pipes. Prime and paint exposed conduits and electrical raceways, fittings, outlet boxes, junction boxes, pull boxes and similar items. Use heat resistant epoxy paint on pipes and surfaces where operating surface temperature exceeds 65°C.
- .8 Coordinate the painting of pipes, and coverings with mechanical

contractor applying colour banding, flow arrows and pipe identification after the painting of pipes and coverings.

- .9 Paint work to match adjacent walls and ceilings unless directed otherwise.
- .10 Paint and finish wall surfaces behind convectors and new architectural woodwork. Walls to be finished prior to installation of convector covers and new architectural woodwork. Touch up walls after covers are installed as necessary to make good installation damage.

**END OF SECTION**

## **PART 1 - GENERAL**

### **1.1 RELATED SECTIONS**

### **1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM A 167-2009, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
  - .2 ASTM B 456-03, Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.
  - .3 ASTM A 653/A653M-06, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
  - .4 ASTM A 924/A924M-10, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.81-M90, Air Drying and Baking Alkyd Primer for Vehicles and Equipment.
  - .2 CAN/CGSB-1.88-92, Gloss Alkyd Enamel, Air Drying and Baking.
  - .3 CAN/CGSB-12.5-M86, Mirrors, Silvered.
  - .4 CGSB 31-GP-107Ma-90, Non-inhibited Phosphoric Acid Base Metal Conditioner and Rust Remover.
- .3 Canadian Standards Association (CSA)
  - .2 CAN/CSA-G164-[M92], Hot Dip Galvanizing of Irregularly Shaped Articles.

### **1.3 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 00 10 00.
- .2 Indicate size and description of components, base material, surface finish inside and out, hardware and locks, attachment devices, description of rough-in-frame, building-in details of anchors for grab bars.

### **1.4 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for toilet and bath accessories for incorporation into manual specified in Section 00 10 00 - Closeout Submittals.

## PART 2 - PRODUCTS

- 2.1 MATERIALS**
- .1 Sheet steel: to ASTM A 653/A653M with ZF001 designation zinc coating.
  - .2 Stainless steel sheet metal: to ASTM A 167, Type 304, with No. 4 finish.
  - .3 Stainless steel tubing: Type 304 peened finish..
  - .4 Fasteners: concealed screws and bolts hot dip galvanized, exposed fasteners to match face of unit. Expansion shields fibre, lead or rubber as recommended by accessory manufacturer for component and its intended use.
- 2.2 COMPONENTS**
- .1 **Shower curtain "SC":** 0.2 mm thick translucent vinyl anti-bacterial shower curtain. Provide curtain hold-back hook and chain at each curtain.
    - .1 Acceptable material:
      - .1 Hold back hook and chain: Frost Code 1144-500.
      - .2 Shower Curtain: Frost Code 1144-502.
      - .3 Stainless steel Curtain Hooks (Pack of 12): Frost Code 1144-501L.
  - .2 **Shower rods "SR":** 25 mm dia stainless steel tubing of required length with satin chrome finished flanges. Shower rod material and anchorage to withstand downward pull of 0.9 kN.
    - .1 Acceptable material:
      - .1 Shower Rod: Bobrick B-207.
  - .4 **Coat hook "CH":** stainless steel with concealed fasteners.
    - .1 Acceptable material:
      - .1 Frost, Code 1138S.
  - .5 **Waste receptacle "WR":** Type semi-recessed, 12 gallon stainless steel.
    - .1 Acceptable material:
      - .1 American Specialties Model No. 0458.
  - .6 **Mirror "MIRR":** wall mounted unit, fixed framed mirror 6 mm to CAN/CGSB-12.5, stainless steel frame with shelf.
    - .1 Acceptable material:
      - .1 Frost Stock Series Mirror, Fixed: Frost Code 941-1836
  - .7 **Mirror Shelf "MS":** Stainless steel shelf.
    - .1 Acceptable material:
      - .1 Frost, Code 950-24 Series.
  - .8 **Grab Bars L-shaped "GBL":** 32 mm o.d., stainless steel (peened finish), L-shaped, 90° angle, 760 mm horizontal x 760 mm vertical,



- concealed fasteners
- .1 Acceptable material:
  - .1 Frost, Code 1003 – 30" x 30" Supply right or left hand grab bars as required to suit arrangement.
- .9 **Horizontal Grab Bars "HGB"**: 32 mm o.d., stainless steel (peened finish), horizontal grab bar. Concealed fasteners.
  - .1 Acceptable material:
    - .1 Frost, Code 1001 - 24" and 42"
- .10 **Vertical Grab Bars "VGB"**: 32 mm o.d., stainless steel, vertical grab bar. Concealed fasteners, peened grip surface.
  - .1 Acceptable material:
    - .1 Frost, Code 1001 – 24", 30", and 48"
- .11 **TILT MIRROR "MIRT"**: Tilt mirror 24"W x 36"H, scrim backing, tempered glass. Stainless steel frame.
  - .1 Acceptable material:
    - .1 Frost, Code 941FT-2436 Series

### 2.3 FABRICATION

- .1 Weld and grind joints of fabricated components flush and smooth. Use mechanical fasteners only where approved.
- .2 Wherever possible form exposed surfaces from one sheet of stock, free of joints.
- .3 Brake form sheet metal work with 1.5 mm radius bends.
- .4 Form surfaces flat without distortion. Maintain flat surfaces without scratches or dents.
- .5 Back paint components where contact is made with building finishes to prevent electrolysis.
- .6 Hot dip galvanize concealed ferrous metal anchors and fastening devices to CSA G164.
- .7 Shop assemble components and package complete with anchors and fittings.
- .8 Deliver inserts and rough-in frames to job site at appropriate time for building-in. Provide templates, details and instructions for building in anchors and inserts.
- .9 Provide steel anchor plates and components for installation on studding and building framing.

**PART 3 - EXECUTION**

**3.1 INSTALLATION**

- .1 Install and secure accessories rigidly in place as follows:
  - .1 Stud walls: install steel back-plate to stud prior to plaster or drywall finish. Provide plate with threaded studs or plugs.
  - .2 Hollow masonry units or existing plaster/drywall: use toggle bolts drilled into cell/wall cavity.
  - .3 Solid masonry, marble, stone or concrete: use bolt with lead expansion sleeve set into drilled hole.
  - .4 Toilet/shower compartments: use male/female through bolts.
- .2 Use tamper proof screws/bolts for fasteners.
- .3 Fill units with necessary supplies shortly before final acceptance of building.

**END OF SECTION**

## PART 1 - GENERAL

- 1.1 RELATED SECTIONS** .1 Section 00 10 00 - Submittal Procedures.
- 1.2 REFERENCES** .1 CAN/CGSB-44.40--2001, Steel Clothing Locker.
- 1.3 SHOP DRAWINGS** .1 Submit shop drawings in accordance with Section 00 10 00 - Submittal Procedures.
- .2 Indicate type and class of locker, thicknesses of metal, fabricating and assembly methods, assembled banks of lockers, hooks, shelves, bases, trim, numbering, filler panels, end/back panels, doors, handles, locking method, finishes.
- 1.4 SAMPLES** .1 Submit samples in accordance with Section 00 10 00 - Submittal Procedures.

## PART 2 - PRODUCTS

- 2.1 MANUFACTURED UNITS** .1 Lockers: to CAN/CGSB-44.40, Type 2 - Single tier locker, freestanding.
- .1 Size: steel thickness No.18 MSG and 305 mm wide x 455 mm x 1829 mm high.
- .2 Assembly: pop-riveted construction.
- .3 Top: flat.
- .4 Doors: one-piece perforated double-wall envelope construction, steel thickness No.16 MSG, welded to No. 18 MSG inner panel.
- .5 Door Frames: Both vertical members shall be not less than 16 gauge and formed into a rigid channel 6 mm wide exposed frame and 62 mm side depth. The frame shall be completed by 76 mm high top and bottom cross members of not less than 18 gauge formed as an open box channel and welded to the verticals. The bottom frames' full width lintel extends back and down to form a rigid box to support the bottom shelf. Both vertical frame members shall be formed to offer a full length 11 mm wide continuous door strike. The latch vertical member shall include a welded 11 gauge padlock hasp together with 11 mm o.d. air-cushioned rubber bumper. No fasteners shall be exposed on fronts of locker doors and frames.
- .6 Door handle: recessed handle aluminum.
- .7 Colour: #500 White.

- .8 Acceptable Manufacturer:
  - .1 Emperor (Corridor) as manufactured by Hadrian Manufacturing Inc.

## 2.2 ACCESSORIES

- .1 Latching/Locking Device – Single Point
  - .1 An 11 gauge 51 mm x 19 mm padlock hasp shall be securely welded to the continuous strike midway up on the frame and centered at the handle location. The hasp shall be formed to protrude through an extruded aluminum recessed handle which is cliplocked and bonded to the door. The handle's inner surface shall be concave and grooved for finger-tip door control. To keep the door closed when not in use, 13 mm o.d. nylon friction catch shall be installed on the door to engage the frame in four (4) locations. Provide padlock.
- .2 Hinge Continuous
  - .1 A full length heavy-duty 16 gauge continuous steel piano hinge shall be securely welded to the frame and fastened to the door with screws or rivets. Hinge shall maximize security and enhance resistance to abuse and vandalism.
- .3 Ventilation
  - .1 Airflow is achieved through 4 sets of 5 unobstructed louvers ¾" wide x ¼" high in the vertical frame members. Provide 18 each 3/16" diameter perforations at outside perimeter of each top, shelf, and bottom to offer additional ventilation throughout the inside of each locker.
- .4 Number Plate
  - .1 Doors shall have a high strength black laminated plastic number plate 64 mm wide x 25 mm high with numbers not less than 11 mm high. Plates shall accommodate up to four digits, be nestled in a recess flush with door surface and shall be fastened to the door with two rivets. Lockers will be numbered by Departmental Representative.
- .5 Interior Equipment
  - .1 In the single tier locker shall be one hat shelf and three single prong coat hooks. All hooks zinc plated steel with ball point heads and are attached with two fasteners.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- .1 Assemble and install lockers in accordance with manufacturer's written instructions.
- .2 Securely fasten lockers to grounds and nailing strips.
- .3 Install finished end panels to exposed ends of locker banks.

.4 Install locker numbers.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 REFERENCES**

- .1 American Society of Heating, Refrigerating and Air Conditioning Departmental Representatives (ASHRAE)
  - .1 ASHRAE 90.1-2016, Energy Standard for Buildings except Low-Rise Residential Buildings.
- .2 Ontario Regulation
  - .1 ONTARIO OBC-2012, 2012 Ontario Building Code Compendium.
- .3 National Research Council Canada, 2015
  - .1 NRC Canadian Building Code, National Building Code of Canada 2015.
- .4 National Fire Protection Association (NFPA)
  - .1 NFPA (Fire) 13, Installation of Sprinkler Systems, 2016 edition.

### **1.2**

### **1.3 GENERAL**

- .1 Coordinate location & installation of all equipment with all trades to ensure the equipment is serviceable and requirements at all other Divisions are not compromised...
- .2 The word "provide" shall mean "supply and install".

### **1.4 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.

### **1.5 EQUIPMENT**

- .1 General:
  - .1 Mechanical equipment that is not regulated by the Green Energy Act, shall carry a permanent label installed by the manufacturers stating the equipment complies with the requirement of ASHRAE 90.1.
  - .2 The minimum equipment efficiency, standard rating and operating conditions shall be as per ASHRAE 90.1, superseded by Ontario Building Code (OBC) Supplementary Standard SB -10, unless indicated otherwise on contract documents. The higher of the energy efficiencies of the listed equipment shall prevail.
  - .3 Provide new materials and equipment of proven design, quality and of current models with published ratings for which replacement parts are readily available.

- .4 Uniformity: Use product of one manufacturer unless otherwise specified, for equipment or material of the same type of classification.
- .2 Installation:
  - .1 Unions, flanges and/or couplings: provide for ease of maintenance and disassembly.
  - .2 Space for servicing, disassembly and removal of equipment and components: provide as recommended by manufacturer, Code or as indicated; whichever is the more stringent.
  - .3 Equipment drains: pipe to floor drains in a manner which is non-obstructing.
  - .4 Install equipment, rectangular cleanouts and similar items parallel to or perpendicular to building lines.
  - .5 Unless otherwise specified, follow manufacturer's recommendations for safety, adequate access for inspection, maintenance and repairs.
  - .6 Permit equipment maintenance and disassembly with minimum disturbance to connecting piping and duct systems without interference with building structure or other equipment.
  - .7 Lubrication: Provide accessible lubricating means for bearings, including permanent lubrication "Lifetime" bearings. Extended grease nipples to be supplied.

#### **1.5 ANCHOR BOLTS AND TEMPLATES**

- .1 Supply anchor bolts and templates for installation by other divisions.

#### **1.6 TRIAL USAGE**

- .1 Departmental Representative may use equipment and systems for test purposes or for continuity of operation prior to acceptance. Supply labour, material, and instruments required for testing & operation.

#### **1.7 PROTECTION OF OPENINGS**

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

#### **1.8 ELECTRICAL**

- .1 Electrical work to be coordinated with Division 26.
- .2 Any costs associated with deviation of mechanical equipment rating affecting electrical Division 26 shall be carried by the mechanical contractor.

#### **1.9 PAINTING**

- .1 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.
- .2 Prime and touch up marred finished paintwork to match original. Use primer or enamel to match original. Do not paint over nameplates.

- .3 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up.
- .4 Hangers, supports and equipment fabricated from ferrous metals shall be given at least one coat of corrosion resistant primer paint before shipment to job site.
- .5 Touch-up damaged surfaces of all mechanical equipment and materials, to the satisfaction of Departmental Representative. Use primer or enamel to match original. Do not paint over nameplates.

#### **1.10 WASTE MANAGEMENT AND DISPOSAL**

- .1 Waste Reduction Workplan (WRW):
  - .1 Perform work in accordance with project's WRW. If one does not exist, provide the following:
    - .1 Identify opportunities for reduction, re-use and/or recycling of materials.
    - .2 Post workplan or summary where workers on site are able to review its content.
  - .2 Materials Source Separation Program (MSSP):
    - .1 Perform all work in accordance with project's MSSP. If one does not exist, provide the following:
      - .1 Provide containers for collection of re-usable and/or recyclable materials.
      - .2 Transport off-site salvaged materials to authorized recycling facility or to users of material for re-use.
  - .3 Disposal of Waste:
    - .1 Disposal of waste, volatile materials, mineral spirits, oil, paint thinner, etc. into wastewater waterways, storm or sanitary sewers is prohibited.
  - .4 Storage, Handling and Protection:
    - .1 Store materials for re-use in a secure area as directed by project manager, where they will not be damaged. Provide protection of materials as necessary.
    - .2 Unless otherwise specified, removed materials become the Contractor's property. Contractor shall be responsible for transport & delivery of non-salvageable items to a licensed disposal facility.

#### **1.11 DEMONSTRATION AND OPERATING AND MAINTENANCE INSTRUCTIONS**

- .1 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.
- .2 Where specified elsewhere in Divisions 20, 21, 22, 23 & 25, manufacturers to provide demonstrations and instructions.
- .3 Use operation and maintenance manual, as-built drawings, audio visual aids, etc. as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections and as needed to cover instruction material related to specific system or equipment.



- .5 Where deemed necessary, Departmental Representative may record these demonstrations on video tape for future reference.
- .6 Furnish trained instructors to instruct Departmental Representative's operating staff in the operation, maintenance and adjustment of all mechanical equipment; and, instruct personnel on any changes to or modifications of any equipment made under terms of the guarantee.
- .7 The instructions shall take place during regular working hours before systems are accepted and turned over to Departmental Representative's staff.
- .8 Ensure that the Departmental Representative's operating personnel have received and been given opportunity to review the Operating and Maintenance Manuals prior to commencing instruction. Allow two full days on site for review of these manuals with Departmental Representative's personnel and for their instruction in operation and maintenance of all mechanical equipment.

#### **1.12 CLOSEOUT SUBMITTALS**

- .1 Submit operation and maintenance data for incorporation into manual.
- .2 Operation and maintenance manual (O&M) to be approved by, and final copies deposited with, Departmental Representative before final inspection.
- .3 For all equipment listed in O&M manuals provide a schedule detailing the supplied component, name, address & phone no. of equipment vendor, parts supplier and warranty agent.
- .4 Operation data to include:
  - .1 Control schematics for each system including environmental controls.
  - .2 Description of each system and its controls.
  - .3 Description of operation of each system at various loads together with reset schedules and seasonal variances.
  - .4 Operation instruction for each system and each component.
  - .5 Description of actions to be taken in event of equipment failure.
  - .6 Valves schedule and flow diagram.
- .5 Maintenance data shall 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.
- .6 Performance data to include:
  - .1 Equipment manufacturer's performance data sheets with point of operation as left after commissioning is complete.
  - .2 Equipment performance verification test results.
  - .3 Special performance data as specified elsewhere.
- .7 Approvals:
  - .1 Submit electronic format (pdf) copy of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be

accepted unless so directed by Departmental Representative. PDF file to include tabs to allow navigation to each section of the manual.

- .2 Make changes as required and re-submit as directed by Departmental Representative.
- .3 Upon acceptance by Departmental Representative submit one (1) electronic format(pdf) and three (3) hardcopies of O&M manuals to Departmental Representative.

.8 Additional data:

- .1 Prepare and insert additional data into operation and maintenance manual when the need becomes apparent during demonstrations and instructions specified above.

### **1.13 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 ten (10) 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 ten (10) working days before tender closing date or after the tender period, will not be considered.

### **1.14 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit single electronic (pdf) copy of shop drawings and product data along with transmittal, in accordance with project requirements. Hard copy shop drawings shall not be accepted.
- .2 Shop drawings and product data shall show:
  - .1 Mounting arrangements.
  - .2 Operating and maintenance clearances. e.g. access door swing spaces.
- .3 Shop drawings and product data shall be accompanied by:
  - .1 Detailed drawings of bases, supports, and anchor bolts.
  - .2 Acoustical sound power data, where applicable.
  - .3 Points of operation on full equipment performance curves.
  - .4 Manufacturer to certify as to current model production.

- .5 Certification of compliance to applicable codes.
- .4 The information to be indicated on manufacturers' shop drawings submitted for review shall include the following:
  - .1 General arrangement drawings showing component parts. Where the equipment proposed, or a component part thereof, includes modifications to a manufacturers' standard to meet the requirements of a specification, a complete assembly drawing must be submitted.
  - .2 Overall dimensions, roughing-in dimensions and clearance dimensions of all major components.
  - .3 Mounting details and dimensions.
  - .4 Complete certified performance data for the specified application with particular reference to rate of flow, operating pressure and temperatures, entering and leaving conditions of air or fluid, operating weights, operating limitation, electrical characteristics and BHP requirements.
  - .5 Gauge of fabricated material and finish specification.
  - .6 Vibration isolators and resilient hangers stating locations and weight distribution.
  - .7 Electrical wiring diagrams, control panel boards, motor test data, motor starters and controls for electrically-operated equipment furnished by mechanical trades.
- .5 Review of shop drawings or detail drawings will not relieve the obligation of ensuring that the equipment, materials, or layouts meet the functional requirements of the specifications, and that all necessary mounting space and clearance requirements are met. Thus, the Departmental Representative's review is for assistance only.
- .6 No equipment will be accepted on the job site without shop drawings having been reviewed by the Departmental Representative.

#### **1.15 AS-BUILT DRAWINGS**

- .1 Site records:
  - .1 Mechanical sub-contractor shall mark all changes as work progresses and as changes occur.
  - .2 On a weekly basis, transfer information to record set of documents, revising to show all work as actually installed.
  - .3 Use different colour waterproof ink for each service.
  - .4 Make available for reference purposes and inspection at all times.
- .2 As-built drawings:
  - .1 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows:  
- AS-BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).
  - .2 Submit hard copy to Departmental Representative for approval.
  - .3 Following approval, submit completed hard copy as-built drawings and scanned soft copy with Operating and Maintenance Manuals.
- .3 Submit copies of as-built drawings for inclusion in final O&M manual.

#### **1.16 CONFLICT/CO-ORDINATION DRAWINGS**

- .1 For congested areas, prior to installation the contractor shall prepare interference drawings indicating proposed location of all systems & equipment including ductwork, piping, fans, diffusers, VAV boxes, conduits, lighting fixtures, etc. Prior to installation the contractor shall submit the drawings to the Departmental Representative for review.
- .2 Architectural, structural and electrical outlines may be shown to assist in coordination of work; confirm final arrangements before layout of mechanical work.
- .3 Do not scale.
- .4 Except where dimensioned, drawings indicate general mechanical layouts only.
- .5 Provide field drawings to show relative positions of various services. Obtain approval before beginning work. As a minimum provide layout/coordination drawings for mechanical rooms & corridor ceilings. Drawings must show coordination between all equipment and systems within the given space. All sub-trades to coordinate their work in conjunction with others.
- .6 Within two (2) weeks of Letter of Intent, contractor to verify that proposed rooms, shafts, chases, reflected ceiling elevations, etc. provide adequate space for the installation of systems. This is to identify if there are any spatial shortcomings and to give adequate time for construction manager, consultants and trades to make any dimensional changes and to make clear to all trades where items are to be installed. Installation and layout will not be on a first come first layout basis.
- .7 If this procedure is not followed the contractor shall be responsible for all modifications required to integrate the systems & equipment.

#### **1.17 FEES AND PERMITS**

- .1 Pay all fees and obtain all permits, taxes relating to the mechanical scope of work.

#### **1.18 WARRANTY**

- .1 Unless indicated otherwise provide one (1) year warranty starting at substantial completion for all new systems including materials, equipment & labour.

#### **1.19 LOCATION OF MECHANICAL EQUIPMENT**

- .1 Allow for 1500 mm of adjustment for exact location of air handling units, pumps, ducts, piping, etc. at no extra cost or credit.

#### **1.20 ELECTRONIC DRAWINGS**

- .1 Departmental Representative will agree to supply the mechanical drawings in the form of electronic documents for the project to the User for the convenience of the User in carrying out its work. The User shall sign a License Agreement before drawings will be released.

## **1.21 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.

## **1.22 CUTTING, PATCHING & CORING**

- .1 Provide cutting, patching and coring of all walls, ceiling & concrete slabs and other surfaces as required for mechanical work. Check with Departmental Representative prior to core drilling and cutting of structure regarding building requirements and policies. Provide notification, clearance & protection.
- .2 The following procedure shall be followed for cutting & core drilling:
  - .1 Contractor to coordinate and summarize all new cores and openings in building structure. Contractor to investigate on site and locate any existing available hole which may be re-used for new systems.
  - .2 Contractor to prepare a layout sketch showing all existing openings & holes and required new openings & holes, with size and locations to the closest grid line in both directions, and submit for review and approval by the Departmental Representative.
  - .3 Structural Departmental Representative to provide written report outlining acceptance of the openings, as well as specific requirements for reinforcing at each location.
  - .4 Contractor to proceed with reinforcing tracing as per report and scanning for electrical conduit. Scanning to be completed using ground penetrating Radar (GPR) technology.
  - .5 Contractor shall identify at each location prior to coring and cutting the location, direction and layer of each reinforcing bar and conduit.
  - .6 Any core or opening where reinforcing steel was cut during the cutting & coring process must be retained on site, and the Contractor must inform the Departmental Representative with the following information: size of the reinforcing bar, reinforcing layer location (top steel or bottom slab steel) and direction of the bar (east - west or north - south).
- .3 Patch and make good surfaces cut, damaged or disturbed, to Departmental Representative's approval. Match existing material, colour, finish and texture or as indicated otherwise.
- .4 Provide dust tight screens or partitions to localize dust generating activities and for protection of finished areas of work, workers and public.

## **1.23 MECHANICAL COST BREAKDOWN**

- .1 Upon award of contract, provide cost breakdown for Departmental Representative's review and for progress billing purposes.
- .2 Costs such as site trailers, mobilization, shop drawings, engineering, etc. to be included as part of material and labour for each piece of equipment.
- .3 Controls programming and commissioning to be billed upon completion of commissioning.
- .4 Fire protection engineering costs to be included as part of material and labour costs.

- .5 Closeout documents including O&M manuals, as-built drawings, approved air & hydronic TAB reports, seismic letters, NFPA letters, etc. shall constitute 5% of the total mechanical construction cost and shall be approved as a single lump sum line item after submission to and final acceptance by Departmental Representative. Contractor to indicate cost as a separate line item in Progress Billing.
- .6 Proposed billings to be submitted a minimum of fourteen (14) calendar days prior to submission of first billing, for review and approval by Departmental Representative.
- .7 Equipment costs are to be broken down into specific equipment grouping and submitted with proposed billing submittal.

#### **1.24 FINAL INSPECTION**

- .1 Do not request final inspection until:
  - .1 Deficiencies are less than 5 items.
  - .2 All systems have been tested and are ready for operation.
  - .3 All air & water balancing has been completed as applicable.
  - .4 The Departmental Representative's operating personnel have been instructed in the operation of all systems and equipment.
  - .5 All inspection certificates have been furnished including but not limited to seismic certification, NFPA (Fire) 13 certification, City's final plumbing inspection.
  - .6 All record drawings have been completed and approved.
  - .7 All fire extinguishers have been installed.
  - .8 The cleaning up is finished in all respects.
  - .9 Upon completion of above, contractor to request in writing for final site review with a minimal 72 hour notification.
- .2 Final installation shall be subject to the approval of the Departmental Representative.

**END OF SECTION**



## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 RELATED DOCUMENTS**

- .1 Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification Section, apply to work specified in this section.

### **1.3 DEFINITIONS**

- .1 Firestopping: Material or combination of materials used to retain integrity of fire-rated construction by maintaining an effective barrier against the spread of flame, smoke, water and hot gases through penetrations in fire rated wall and floor assemblies.

### **1.4 GENERAL DESCRIPTION OF THE WORK OF THIS SECTION**

- .1 Only tested firestop systems shall be used in specific locations as follows:
  - .1 Penetrations for the passage of duct, piping, and other mechanical equipment through fire-rated vertical barriers (walls and partitions), horizontal barriers (floor/ceiling assemblies), and vertical service shaft walls and partitions
  - .2 Repetitive plumbing penetrations in fire-rated floor assemblies. Penetrations exist for the installation of tubs, showers, aerators and other plumbing fixtures.
- .2 All penetrations through walls as a result of this work shall be assumed to be 1 hour rated unless otherwise indicated.

### **1.5 RELATED WORK OF OTHER SECTIONS**

- .1 Coordinate work of this section with work of other sections as required to properly execute the work and as necessary to maintain satisfactory progress of the work of other sections, including:
  - .1 Section 04 04 99 - Masonry for minor Works
  - .2 Section 07 84 00 - Firestopping
  - .3 Section 09 21 16 - Gypsum Board Assemblies



## 1.6 REFERENCES

- .1 Test Requirements: ULC-S115-M or CAN4-S115-M, "Standard Method of Fire Tests of Through Penetration Fire Stops".
- .2 International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgments.
- .3 Inspection Requirements: ASTM E2174-18, "Standard Practice for On-site Inspection of Installed Fire Stops.
- .4 CAN/ULC-S102-M, Standard Test Method for Surface Burning Characteristics of Building Materials.
- .5 All major building codes: NBC, OBC.
- .6 NFPA (Fire) 101 - Life Safety Code, 2018 Edition
- .7 ASTM G21-15, Standard Practice for Determining Resistance of Synthetic Polymeric

## 1.7 QUALITY ASSURANCE

- .1 Proposed firestop materials and methods shall conform to applicable governing codes having local jurisdiction.
- .2 Firestop Systems do not reestablish the structural integrity of load bearing partitions/assemblies, or support live loads and traffic. Installer shall consult the structural engineer prior to penetrating any load bearing assembly.
- .3 For those firestop applications that exist for which no ULC or cUL tested system is available through a manufacturer, a manufacturer's engineering judgement derived from similar ULC or cUL system designs or other tests will be submitted to local authorities having jurisdiction for their review and approval prior to installation. Engineer judgement drawings must follow requirements set forth by the International Firestop Council.

## 1.8 SUBMITTALS

- .1 Submit Product Data: Manufacturer's specifications and technical data for each material including the composition and limitations, documentation of ULC or cUL firestop systems to be used and manufacturer's installation instructions to comply with Division 01.
- .2 Manufacturer's engineering judgement identification number and drawing details when no ULC or cUL system is available for an application. Engineer judgement must include both project name and contractor's name who will install firestop system as described in drawing.

- .3 Submit material safety data sheets provided with product delivered to job-site.
- .4 Submit a complete firestopping and smoke seal schedule. Schedule is to include complete details, cut sheets, system descriptions and location of each proposed firestopping & smoke seal application.

## **1.9 INSTALLER QUALIFICATIONS**

- .1 Engage an experienced Installer who is certified, licensed, or otherwise qualified by the firestopping manufacturer as having been provided the necessary training to install manufacturer's products per specified requirements. A manufacturer's willingness to sell its firestopping products to the Contractor or to an Installer engaged by the Contractor does not in itself confer qualification on the buyer.

## **1.10 DELIVERY, STORAGE, AND HANDLING**

- .1 Deliver materials undamaged in manufacturer's clearly labelled, unopened containers, identified with brand, type, and ULC or cUL label where applicable.
- .2 Coordinate delivery of materials with scheduled installation date to allow minimum storage time at job-site.
- .3 Store materials under cover and protect from weather and damage in compliance with manufacturer's requirements.
- .4 Comply with recommended procedures, precautions or remedies described in material safety data sheets as applicable.
- .5 Do not use damaged or expired materials.

## **1.11 PROJECT CONDITIONS**

- .1 Do not use materials that contain flammable solvents.
- .2 Scheduling:
  - .1 Schedule installation of CAST IN PLACE firestop devices after completion of floor formwork, metal form deck, or composite deck but before placement of concrete.
  - .2 Schedule installation of Drop-In firestop devices after placement of concrete but before installation of the pipe penetration. Diameter of sleeved or cored hole to match the listed system for the device.
  - .3 Schedule installation of other firestopping materials after completion of penetrating item installation but prior to covering or concealing of openings.

- .3 Verify existing conditions and substrates before starting work. Correct unsatisfactory conditions before proceeding.
- .4 Weather conditions: Do not proceed with installation of firestop materials when temperatures exceed the manufacturer's recommended limitations for installation printed on product label and product data sheet.
- .5 During installation, provide masking and drop cloths to prevent firestopping materials from contaminating any adjacent surfaces.

## **PART 2 PRODUCTS**

### **2.1 FIRESTOPPING, GENERAL**

- .1 Provide firestopping composed of components that are compatible with each other, the substrates forming openings, and the items, if any, penetrating the firestopping under conditions of service and application, as demonstrated by the firestopping manufacturer based on testing and field experience.
- .2 Provide components for each firestopping system that are needed to install fill material. Use only components specified by the firestopping manufacturer and approved by the qualified testing agency for the designated fire-resistance-rated systems.
- .3 Firestopping Materials are either "cast-in-place" (integral with concrete placement) or "post installed." Provide cast-in-place firestop devices prior to concrete placement.
- .4 Penetrations in Smoke Barriers: Provide firestopping with ratings determined in accordance with ULC S-115.
  - .1 L-Rating: Not exceeding 25.4 L/s/sq.m (5.0 cfm/sq.ft.) of penetration opening at both ambient and elevated temperatures.
- .5 Mold Resistance: Provide penetration firestopping with mold and mildew resistance rating of 0 as determined by ASTM G21.

### **2.2 ACCEPTABLE MATERIALS**

- .1 Hilti (Canada) Corporation (1-800-363-4458), 3M (1-800-328-1687), or as alternative materials approved by addendum in accordance with Instructions to Tenderers.

## 2.3 MATERIALS

- .1 Use only firestop products that have been ULC or cUL tested for specific fire-rated construction conditions conforming to construction assembly type, penetrating item type, annular space requirements, and fire-rating involved for each separate instance.
- .2 Pre-Installed firestop devices for use with non-combustible and combustible pipes (closed and open systems) penetrating concrete floors and/or gypsum walls.
- .3 Sealants or caulking materials for use with non-combustible items including steel pipe, copper pipe, rigid steel conduit and electrical metallic tubing (EMT).
- .4 Sealants or caulking materials for use with sheet metal ducts.
- .5 Intumescent sealants or caulking materials for use with combustible items (penetrates consumed by high heat and flame) including insulated metal pipe, PVC jacketed, flexible cable or cable bundles and plastic pipe.
- .6 Firestop collar or wrap devices attached to assembly around combustible plastic pipe (closed and open piping systems) tested to 50 Pa. differential.
- .7 Materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways.
- .8 Non curing, re-penetrable materials used for large size/complex penetrations made to accommodate cable trays, multiple steel and copper pipes, electrical busways in raceways.
- .9 For blank openings made in fire-rated wall or floor assemblies, where future penetration of pipes, conduits, or cables is expected.
- .10 For penetrations through a Fire Separation wall provide a firestop system with a "F" Rating as determined by ULC or cUL as indicated below:

Fire Resistance Rating Firestopping Assembly	Required ULC or cUL "F" Rating of Separation	of
30 minutes	20 minutes	
45 minutes	45 minutes	
1 hour	45 minutes	
1.5 hours	1 hour	
2 hours	1.5 hours	
3 hours	2 hours	
4 hours	3 hours	

For combustible pipe penetrations through a Fire Separation provide a firestop system with a "F" Rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.

- .11 For penetrations through a Fire Wall or horizontal Fire Separation provide a firestop system with a "FT" Rating as determined by ULC or cUL which is equal to the fire resistance rating of the construction being penetrated.

### **PART 3 EXECUTION**

#### **3.1 PREPARATION**

- .1 Verification of Conditions: Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.
  - .1 Verify penetrations are properly sized and in suitable condition for application of materials.
  - .2 Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, rust, laitance, release agents, water repellents, and any other substances that may affect proper adhesion.
  - .3 Ensure all service lines are in place, tested and acceptable to the authority having jurisdiction, prior to application of fire stopping and smoke seal.
  - .4 Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.
  - .5 Comply with manufacturer's recommendations for temperature and humidity conditions before, during and after installation of firestopping.
  - .6 Do not proceed until unsatisfactory conditions have been corrected.

#### **3.2 COORDINATION**

- .1 Coordinate construction of openings and penetrations to ensure that the fire stop systems are installed according to specified requirements.
- .2 Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate through-penetration fire stop systems.
- .3 Coordinate fire stopping with other trades so that obstructions are not placed in the way prior to the installation of the fire stop systems.

#### **3.3 INSTALLATION**

- .1 Regulatory Requirements: Install firestop materials in accordance with ULC Fire Resistance Directory or UL Products Certified for Canada (cUL) Directory or Omega Point Laboratories Directory.

- .2 Manufacturer's Instructions: Comply with manufacturer's instructions for installation of through-penetration and construction joint materials.
  - .1 Seal all holes or voids made by penetrations to ensure an air and water resistant seal.
  - .2 Consult with mechanical engineer, project manager, and damper manufacturer prior to installation of ULC or cUL firestop systems that might hamper the performance of fire dampers as it pertains to duct work.
  - .3 Protect materials from damage on surfaces subjected to traffic.

### **3.4 FIELD QUALITY CONTROL**

- .1 Examine sealed penetration areas to ensure proper installation before concealing or enclosing areas.
- .2 Keep areas of work accessible until inspection by applicable code authorities.
- .3 Inspection of through-penetration firestopping shall be performed in accordance with ASTM E2174, "Standard Practice for On-Site Inspection of Installed Fire Stops" or other recognized standard.
- .4 Perform under this section patching and repairing of firestopping caused by cutting or penetrating of existing firestop systems already installed by other trades.

### **3.5 IDENTIFICATION & DOCUMENTATION**

- .1 The firestop contractor is to supply documentation for each single application addressed. This documentation shall identify each penetration and joint location on the entire project.
- .2 The Documentation Form for through penetrations is to include:
  - .1 A Sequential Location Number
  - .2 The Project Name
  - .3 Date of Installation
  - .4 Detailed description of the penetrations location
  - .5 Tested System or Engineered Judgement Number
  - .6 Type of assembly penetrated
  - .7 A detailed description of the size and type of penetrating item
  - .8 Size of opening
  - .9 Number of sides of assemblies addressed
  - .10 Hourly rating to be achieved
  - .11 Installers Name
- .3 Submit the record document to the Engineer at the completion of the project.

- .4 Identify through-penetration firestop systems with pressure-sensitive, self-adhesive, preprinted vinyl labels. Attach labels permanently to surfaces of penetrated construction on both sides of each firestop system installation where labels will be visible to anyone seeking to remove penetrating items or firestop systems. Include the following information on labels:
  - .1 The words: "Warning -Through Penetration Firestop System-Do Not Disturb. Notify Building Management of Any Damage."
  - .2 Contractor's Name, address, and phone number.
  - .3 Through-Penetration firestop system designation of applicable testing and inspecting agency.
  - .4 Date of Installation.
  - .5 Through-Penetration firestop system manufacturer's name.
  - .6 Installer's Name.

### **3.6 ADJUSTING AND CLEANING**

- .1 Remove equipment, materials and debris, leaving area in undamaged, clean condition.
- .2 Clean all surfaces adjacent to sealed holes and joints to be free of excess firestop materials and soiling as work progresses.

### **3.7 WASTE MANAGEMENT**

- .1 Separate and recycle waste materials in accordance with Waste Management Plan as specified in Section 01 74 19, and place in designated areas for recycling.
- .2 Place materials defined as hazardous or toxic waste in designated containers. Before disposing of containers, relieve containers of any remaining foam and pressure. Allow foam to fully cure before disposing. Never dispose of foam in a liquid state.
- .3 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections in Divisions 20, 21, 22, 23 & 25.

### **1.2 REFERENCES**

- .1 National Fire Protection Association (NFPA)
  - .1 NFPA (Fire) 13, Standard for the Installation of Sprinkler Systems, 2016 Edition.
  - .2 NFPA (Fire) 14, Standard for the Installation of Standpipe and Hose Systems, 2016 Edition
  - .3 NFPA (Fire) 20, Standard for the Installation of Stationary Pumps for Fire Protection, 2016 Edition.
- .2 National Research Council Canada
  - .1 NRCC NBCC-2015, National Building Code of Canada.

### **1.3 DEFINITIONS**

- .1 SRS: acronym for Seismic Restraint System.

### **1.4 QUALIFICATIONS**

- .1 Prime mechanical contractor shall engage a Seismic Engineer who shall be responsible for all mechanical sections to ensure all mechanical sections listed in Item 1.1.1 are covered. Prime mechanical contractor shall ensure the Seismic Engineer is a Professional Engineer holding a Certificate of Authorization in the Province of Ontario with a minimum of 5 years experience in seismic design, and is covered with a minimum of \$2 million Professional Liability Insurance.
- .2 The Manufacturer shall be a member of VISCMA (Vibration Isolation and Seismic Control Manufacturers Association). They shall have a letter issued to their Supplier confirming that they have reviewed and accepted the engineering practices used by the Seismic Engineer. The letter shall also state that the manufacturer accepts the Supplier to act as their representative for the product.
- .3 Acceptable Suppliers: HTS Engineering, Master Group, Walmar, E.H. Price. Alternate to be approved by Addendum (only).



## **1.5 GENERAL DESCRIPTION**

- .1 This section covers design, supply and installation of complete SRS for all systems, equipment specified for installation on this project. This includes fire protection piping & mechanical equipment and systems, both vibration isolated and statically supported.
- .2 SRS to be fully integrated into & compatible with:
  - .1 Noise and vibration controls specified elsewhere in this project specification.
  - .2 Structural, mechanical, electrical design of project.
- .3 During a seismic event, SRS to prevent systems and equipment from causing personal injury and from moving from normal position unless noted otherwise. Specified critical systems as noted below must remain operational during and after an seismic event:
  - .1 All systems for buildings as listed in OBC Table 4.1.8.18 - non-structural components.
  - .2 Life safety systems.

## **1.6 SUBMITTALS**

- .1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Seismic Engineer shall be a Professional Engineer specializing in design of SRS and registered in Province of Ontario. The following submittals shall bear the SRS Design Engineer's seal and signature:
  - .1 A complete list of documents reviewed & list of exclusion.
  - .2 Full details of design criteria, calculations for all equipment & associated systems.
  - .3 A spreadsheet identifying all equipment requiring or not requiring seismic restraints and include all calculations.
  - .4 Copy of shop drawings and product data sent to Structural Engineer for review of connection points to building structure.

## **1.7 FINAL CERTIFICATION SUBMITTAL**

- .1 Seismic Engineer shall be a Professional Engineer specializing in design of SRS and registered in Province of Ontario. The following shall bear the SRS Design Engineer's seal and signature:
  - .1 SRS installation inspections.
  - .2 SRS final certification letter for the project.
- .2 The Fire Protection Contractors shall be responsible for their respective discipline as it relates to Seismic restraints system. The contractor shall adhere to Section 20 05 49.01 and/or more stringent code (i.e. NFPA (Fire) 13, 14 & 20). Prime mechanical contractor to compile all of the above, review and submit for the record.

- .3 The final certification letter shall be formatted to identify the following within the body of the letter:
  - .1 The date of the final inspection.
  - .2 A statement that lists ALL contract documents which were reviewed including but not limited to the mechanical drawings, project change orders, site instructions, etc.
  - .3 A statement which clearly identifies any exclusions of scope of service.
  - .4 A statement that certifies the complete mechanical seismic installation meets the latest version of OBC & applicable codes & standards.

## **1.8 MAINTENANCE DATA**

- .1 Provide maintenance data including monitoring requirements for incorporation into manuals specified in Section 20 05 01 - Mechanical General Requirements.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- .1 Definitions
  - .1 Seismic System: isolation and seismic restraint products supplied by one supplier.
  - .2 Manufacturer: manufacturer of the isolation and seismic restraint system.
  - .3 Supplier: manufacturers' and seismic engineer's representative
- .2 Each contractor shall use one Supplier to provide seismic design, isolation, and seismic restraint.
- .3 Seismic restraints are to be provided for all operational and functional components of building services in accordance with the current National Building Code, and NFPA (Fire) 13, 14 & 20.
- .4 The contractor shall utilize a Supplier familiar with the design of seismic systems to provide a comprehensive package of isolation and seismic restraint for the project. Provide detailed shop drawings showing the proposed restraint system for all required equipment, piping, and ductwork on the project. The shop drawings submittals shall include all items listed in Item 1.6.
  - .1 Acceptable Manufacturers: Kinetics / Vibron, Tecoustics, Mason, Gripple Seismic, Vibroaxoustics.
  - .2 Alternates to be approved by Addendum only.
- .5 Cable restraint systems, rod stiffener clamps and seismic isolator capacities to be verified by an independent test laboratory. Connection materials and site specific designs to be by the Seismic Engineer. The Seismic Engineer may specify material and anchors provided by the contractor where this is appropriate. It is the contractors' responsibility to ensure that the Seismic Engineers' requirements and specification have been met.
- .6 At the completion of the project, the Supplier and the Seismic Engineer shall review the installations on site, and shall prepare a written report, with a sealed letter from the Seismic

Engineer, certifying that the installations have been completed in accordance with their design and shop drawings. Refer to item 1.1.

## **2.2 SEISMIC FORCE**

- .1 The Importance Factor for this project is:
  - .1  $I = 1.0$  - All other buildings i.e.: Office & General Buildings. Note: As per NBC.
- .2 The site classification for seismic site response and shear wave velocity parameters shall be as indicated on structural documents and as recorded in the geotechnical report.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 Install Seismic Restraint Systems in accordance with Seismic Engineer's and manufacturer's recommendations.
- .2 Install SRS at least 25 mm from all other equipment, systems, services.
- .3 Co-ordinate connections with all disciplines.

### **3.2 INSPECTION AND CERTIFICATION**

- .1 SRS to be inspected and certified by Manufacturer upon completion of installation.
- .2 Seismic Design Engineer shall provide written report to Engineer certifying that SRS has been installed in accordance with the SRS drawings. The report shall bear the seal and signature of the SRS Design Engineer.

### **3.3 COMMISSIONING DOCUMENTATION**

- .1 Upon completion and acceptance of certification, hand over to Engineer complete set of construction documents, revised to show "as-built" conditions.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Submit catalogue details for each type of door illustrating profiles, dimensions and methods of assembly.

## **PART 2 PRODUCTS**

### **2.1 ACCESS DOORS**

- .1 Supply and install as necessary to gain access to all concealed mechanical equipment for operating, inspecting, adjusting, servicing.
- .2 Sizes: Except as indicated otherwise, to be minimum sizes as follows:
  - .1 For body entry: 600 x 600 mm (24" x 24").
  - .2 For hand entry: 300 x 300 mm (12" x 12").
- .3 Construction: Rounded safety corners, concealed hinges, screwdriver latch, anchor straps, able to open 180°.
- .4 Materials
  - .1 Tiled or marble surfaces and other special areas: Stainless steel with brushed satin or polished finish as directed by Consultant.
  - .2 All other areas: Prime coated steel.
- .5 Fire Rating
  - .1 Access doors fire rating to match that of wall, ceiling or floor the access door is installed in. Coordinate with architectural drawings.

### **2.2 EXCLUSIONS**

- .1 Lay-in tile ceilings. In this instance, use unobtrusive identification locators.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- .1 Installation in accordance with Manufacturer's installation instructions for particular surface.

**3.2 LOCATION**

- .1 Location: Ensure that equipment is clearly within view and accessible for operating, inspecting, adjusting, servicing without the need for special tools.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 001000 - General Instructions and Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .2 National Fire Protection Association
  - .1 NFPA (Fire) 13, Standard for the Installation of Sprinkler Systems, 2016 Edition.
- .3 National Research Council Canada
  - .1 NRCC NBCC-2015, National Building Code of Canada.

### **1.3 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with Section 001000 - General Instructions and Section 20 05 01 - Mechanical General Requirements and in accordance with NFPA (Fire) 13, working plans and design requirements.
- .2 Pipe layout shall be the Contractors responsibility and fully coordinated with other trades.

### **1.4 ENGINEERING DESIGN CRITERIA**

- .1 Design system in accordance with NFPA (Fire) 13 using following parameters:
  - .1 System shall be wet pipe systems as indicated.
  - .2 All areas shall be designed for hazard coverage indicated with design area and associated densities.
  - .3 Pipe size and layout:
    - .1 Hydraulic design.
    - .2 Sprinkler layout to NFPA (Fire) 13 and with sprinkler centred in short direction of ceiling tile and no less than 300 mm from the tile's edge unless approved otherwise. Sprinkler contractor shall be responsible to provide sprinkler and piping layout fully coordinated with other systems.
    - .3 The hydraulic design shall be sized to accommodate the highest and most remote zones and where indicated to accommodate future building addition.
    - .4 Allow for additional sprinklers and pipe distribution to suit electrical, architectural and structural coordination.
    - .5 Sprinklers shown are for architectural coordination, coverage to suit NFPA (Fire) 13 requirements. Provide additional sprinklers as required.
  - .4 Water supply:
    - .1 Base design on NFPA (Fire) 13 and obtain water supply data from nearest fire hydrant (most recent test data indicate 60 psi static and 40 psi @ 716 gpm at nearest hydrant (Hydrant #56)). Hydraulic calculations shall commence at water main connection at street. Provide as part of hydraulic calculation submission, fire hydrant flow test data (to be performed by contractor) and deduct 10% as safety factor based on available pressure value. Note: Bid price must allow for

- appropriate pipe sizing, head selection and additional hangars to accommodate the design densities indicated with respect to the low water pressure available.
- .5 Drawings and calculations shall be certified by a Professional Engineer licensed in the Province of Ontario.
  - .6 Sprinkler system to be seismically restrained to National Building Code and NFPA (Fire) 13 requirements.
  - .7 Final installations to be reviewed by Professional Engineer licensed in the Province of Ontario. NFPA (Fire) 13 compliance letter to be stamped by Hydraulic Design Engineer and submitted at end of contract.

## **1.5 DRAWING PREPARATION**

- .1 Review architectural, structural, mechanical and electrical drawings to determine interferences affecting the distribution layout prior to shop drawing submission.

## **1.6 MAINTENANCE DATA**

- .1 PROVIDE MAINTENANCE DATA FOR INCORPORATION INTO MANUAL SPECIFIED IN SECTION 001000 - GENERAL INSTRUCTIONS AND SECTION 20 05 01 - MECHANICAL GENERAL REQUIREMENTS.

## **1.7 MAINTENANCE MATERIALS**

- .1 Provide spare sprinklers and tools within cabinet as required by NFPA (Fire) 13.

## **1.8 ACCEPTABLE SPRINKLER CONTRACTORS**

- .1 Contractors shall be members of Canadian Automatic Sprinkler Association (CASA), and must submit proof of good standing at time of bidding.

## **PART 2 PRODUCTS**

### **2.1 PIPE, FITTINGS AND VALVES**

- .1 Pipe:
  - .1 Ferrous: to NFPA (Fire) 13. Painted red.
  - .2 Ferrous hot dipped galvanized: to NFPA (Fire) 13 in corrosive or damp environments.
- .2 Fittings and joints to NFPA (Fire) 13:
  - .1 Ferrous: screwed, welded, flanged or roll grooved.
  - .2 All exposed piping shall be rigid piping.
- .3 Flexible sprinkler drops:
  - .1 Braided flexible stainless steel sprinkler drops, cULus and FM listed for fire protection service for installation on suspended ceiling grids, wood or metal stud/joist or furring channels.
  - .2 25 mm (1") nominal ID braid hose and fitting made of 304 stainless steel, 1206 kPa (175 psi) maximum working pressure, 178 mm (7") minimum bending radius within length of

- 750 mm to 1800 mm as per cULus. The maximum amount of allowable bends as per cULus are as follows: 750 mm (36") (5 bends); 1200 mm (48") (8 bends); 1500 mm (60") (10 bends); 1800 mm (72") (12 bends).
- .3 Inlet nipple 25 mm (1") NPT with straight or 90° reducer for 13 mm (1/2") or 20 mm (3/4") NPT sprinkler.
  - .4 A steel bracket with square bar, adjustable centre bracket and adjustable end brackets suitable for ceiling types. End bracket shall have permanent securement to ceiling system.
  - .5 Acceptable material: Victaulic Model VicFlex AH2; Viking model VKFD28B.
- .4 Valves:
- .1 ULC listed for fire protection service.
  - .2 Up to NPS 2: bronze, screwed ends, OS&Y rising stem gate or ball valve.
  - .3 NPS 2-1/2 and over: cast iron, flanged or roll grooved ends, OS&Y rising stem gate or butterfly type.
  - .4 Check valves: swing type as above.
  - .5 Ball drip check valve.
- .5 Pipe hangers:
- .1 ULC listed for fire protection services.
- .6 Sprinkler system shall be rated at 1380 kPa (200 psi).
- .7 **Piping in exposed areas to be primed and painted red.**

## 2.2 BACKFLOW PREVENTER

- .1 ULC and FM listed, double check valve assembly, vertical upflow arrangement if required, tri-link check modules, 304 stainless steel slave housing, grooved ends, supervised gate valves. Rated working pressure 1207 kPa (175 psi) hydrostatic test pressure 2068 kPa (300 psi).
  - .1 Acceptable material: Watts Model 757N-BFG.

## 2.3 SPRINKLERS

- .1 General: to NFPA (Fire) 13 and ULC listed for fire services.
- .2 Provide wire guards in all mechanical rooms, storage areas, electrical rooms and in flexible cabin lab.
- .3 All sprinklers shall have low zinc content (less than 10%) brass alloy and metal to metal sealing mechanism in the water ways.
- .4 Acceptable materials: Viking, Grinnell, Victaulic and Tyco.



## **2.4 CONCEALED SPRINKLER**

- .1 Fully concealed pendent, quick response for hazard coverage as indicated, 5.6 K factor, enclosed escutcheon, separate two-piece design of mounting cup and coverplate, internal threaded closure, 68°C (155°F) rated, 13 mm (½") adjustment, FM approved, white enamel or chrome finish, as directed by Departmental Representative.

## **2.5 SEMI-RECESSED SPRINKLER**

- .1 Semi-recessed pendent, quick response for hazard coverage as indicated, 5.6 K factor, extended adjustable escutcheon, chrome finish, FM approved, glass bulb type; 68°C (155°F) rated, 13 mm (½") orifice.

## **2.6 UPRIGHT SPRINKLER**

- .1 Upright bronze, quick response for hazard coverage as indicated, 5.6 K factor minimum, FM approved, chrome finish (white finish within Rooms 108 and 115), glass bulb type c/w wire guard; 68°C (155°F) rated, 13 mm (½") orifice (20 mm orifice to meet coverage with available pressure).

## **2.7 PENDANT SPRINKLER**

- .1 Pendant, quick response for hazard coverage as indicated, 5.6 K factor, adjustable chrome escutcheon, FM approved, chrome finish, glass bulb type; 68°C (155°F) rated, 13 mm (½") orifice.

## **2.8 SIDEWALL SPRINKLER**

- .1 Sidewall quick response for hazard occupancy as indicated, FM approved, 5.6 K factor, chrome finish glass bulb with adjustable escutcheon plate, 68°C (155°F) rated, 13 mm (½") orifice.

## **2.9 SUPERVISORY SWITCHES**

- .1 General: to NFPA (Fire) 13 and ULC listed for fire service.
- .2 Die-cast enclosure over, die-cast base, all part corrosion resistant finish, paint finish.
- .3 Valves:
  - .1 Mechanically attached to valve body, with normally open and normally closed contacts and supervisory capability.
  - .2 Cover tamper activated by cover removal.
  - .3 Two sets of SPDT contacts, 15.0 Amps @ 125/250 VAC, 2.5 Amps @ 30 VDC resistive.
- .4 Flow switch type:
  - .1 With normally open and normally closed contacts and supervisory capability.
  - .2 0.63 l/s (10 GPM) Minimum flow rate.
  - .3 Cover taper activated by cover removal.
  - .4 Two sets of SPDT contacts, 15.0 Amps @ 125/250 VAC, 2.0 Amps @ 30 VDC resistive.
  - .5 Mechanical retard, adjustable from 10-90 seconds.

- .5 Pressure alarm switch:
  - .1 With normally open and normally closed contacts and supervisory capability.
  - .2 On-off differential 6.9 kPa (1 psi) minimum.
  - .3 Visible pressure indication: 206-1338 kPa (30-165 psi).
  - .4 Adjustable range: 172-1207 kPa (25-175 psi).
  - .5 Maximum operating pressure: 1207 kPa (175 psi).
  - .6 SPDT for use with normally open or normally closed circuits, 250 VAC 15 A ¼HP, 125 VAC 15 A 1/8 HP, 250 VDC 0.2 A, 125 VAC 0.4 A, 30 VDC 2.0 A.
  - .7 Die-cast aluminum cover with enamel red paint finish, zinc plated steel base.

## **2.10 FIRE DEPARTMENT CONNECTION**

- .1 Fully recessed type, 100 mm x 65 mm x 65 mm with "SPRINKLER" identification, polished chrome finish c/w caps and chains.

## **2.11 PRESSURE GAUGES**

- .1 ULC listed.
- .2 Shall have maximum limit of not less than twice normal working pressure at point where installed.

## **2.12 INSPECTOR TEST STATION**

- .1 One piece design test and drain assembly, FM/ULC listed, 1034 kPa rated.
- .2 Approved materials: Victaulic, A.G.F. Manufacturing Inc., National Fire Equipment Ltd. test and drain assembly.

## **2.13 SIGNS**

- .1 Signs for control drain and test valves: to NFPA (Fire) 13.

## **2.14 SPARE PARTS CABINET**

- .1 For storage of maintenance materials, spare sprinklers and special tools.
- .2 Construct to sprinkler manufacturers standard.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 Install, inspect and test to acceptance in accordance with NFPA (Fire) 13.
- .2 Testing to be witnessed by Authority having jurisdiction.
- .3 Test station to be piped to test drain riser.

- .4 Install and test equipment to manufacturers' standards.
- .5 Provide adequate pipe supports and bracing as per NFPA (Fire) 13 requirements and as follows:
  - .1 Fire protection contractor shall carry a structural engineer to design and certify the support system for any piping distribution system exceeding 100 mm (4") or where piping is grouped such that the distributed weight exceeds the building structure limits. (Note: In steel building structure the piping supports shall never be supported by a single joist or off the bottom chord of the joist or truss.
  - .2 Fire protection tree to be supported off pipes to ends from floor.

### **3.2 TESTING**

- .1 Pressure test all piping systems as required by NFPA and provide pressure test verification documents.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .1 National Fire Protection Association NFPA
  - .1 NFPA (Fire) 10, Portable Fire Extinguishers, 2018 Edition.
- .2 Ontario Fire Code.
- .3 Underwriters Laboratories of Canada
  - .1 CAN/ULC S508-02 (R2013), Standard for the Rating and Fire Testing of Fire Extinguishers.

### **1.3 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements.

### **1.4 MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

## **PART 2 PRODUCTS**

### **2.1 MULTI-PURPOSE DRY CHEMICAL EXTINGUISHER**

- .1 (FE1) Stored pressure dry chemical type with heavy duty steel cylinder, positive on/off operation, waterproof stainless steel gauge, shut-off nozzle, ULC labelled for A, B and C class protection c/w wall mounting bracket and signage. Size 2.25 kg, 3A-40BC rating.
- .2 (FE2) Stored pressure carbon dioxide type with heavy duty steel cylinder, positive ON/OFF operation, waterproof stainless steel gauge. ULC labelled for B and C class protection. Size: 5 kg, 10-BC rating c/w wall mounting bracket.

## **2.2 SEMI-RECESSED CABINET**

- .1 Semi-recessed type cabinet with 22 gauge primed & painted tub, white baked enamel finish, semi-recessed piano hinged door and turned back to suit wall depth. Flush stainless steel door hatch.
- .2 Acceptable material: National Fire CE-950-3-2 series, Canadian Fire Equipment.

## **2.3 RECESSED CABINET**

- .1 Recessed type cabinet with 22 gauge primed & painted tub, 16 gauge front white baked enamel finish, semi-recessed piano hinged door and clear glass front. Flush stainless steel door hatch.
- .2 Acceptable material: National Fire CE-950-3 series, Canadian Fire Equipment.

## **2.4 IDENTIFICATION**

- .1 Identify extinguishers in accordance with recommendations of NFPA (Fire) 10, CAN/ULC S508 and Ontario Fire Code.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 Install extinguishers where indicated and at a height in accordance with NFPA (Fire) 10 and Ontario Fire Code.

**END OF SECTION**

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**PART 1 GENERAL**

**1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

**1.2 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Indicate:
  - .1 Equipment, including connections, fittings, control assemblies and ancillaries. Identify whether factory or field assembled.
  - .2 Wiring and schematic diagrams.
  - .3 Dimensions and recommended installation.
  - .4 Pump performance and efficiency curves.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.
- .2 Data to include:
  - .1 Manufacturers name, type, model year, capacity and serial number.
  - .2 Details of operation, servicing and maintenance.
  - .3 Recommended spare parts list with names and addresses.

**PART 2 PRODUCTS**

**2.1 STORM AND SANITARY PUMPS**

- .1 NRC supplied pumps. Refer to Appendix A for details.
- .2 Provide piping and accessories to install pumps and accessories within existing storm and sanitary pits on site.

**PART 3 EXECUTION**

**3.1 INSTALLATION**

- .1 Make piping and electrical connections to pump and motor assembly and controls as indicated.
- .2 Ensure pump and motor assembly do not support piping.

**3.2 FIELD QUALITY CONTROL**

- .1 Check power supply.
- .2 Check starter protective devices.
- .3 Start-up, check for proper and safe operation.
- .4 Check settings and operation of all hand-off-auto selector switch, operating, safety and limit controls, audible and visual alarms, over-temperature and other protective devices.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME B16.15-2013, Cast Bronze Threaded Fittings, Classes 125 and 250.
  - .2 ASME B16.18-2018, Cast Copper Alloy Solder Joint Pressure Fittings.
  - .3 ASME B16.22-2013, Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings.
  - .4 ASME B16.24-2016, Cast Copper Alloy Pipe Flanges and Flanged Fittings and Valves: Class 150, 300, 600, 900, 1500 and 2500.
- .2 American Society for Testing and Materials (ASTM)
  - .1 ASTM A307-14e1, Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
  - .2 ASTM B88M-18, Specification for Seamless Copper Water Tube (Metric).
- .3 American Water Works Association (AWWA)
  - .1 AWWA C111/A21.11-17, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

### **1.3 PRODUCT DATA**

- .1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.

## **PART 2 PRODUCTS**

### **2.1 PIPING**

- .1 Domestic hot, cold and recirculation systems, within building.
  - .1 Above ground: copper tube, hard drawn, type L: to ASTM B88M.
  - .2 Buried or embedded: copper tube, soft annealed, type K: to ASTM B88M, in long lengths and with no buried joints.
- .2 Piping to be of all North American manufacturer.



## **2.2 FITTINGS**

- .1 Bronze pipe flanges and flanged fittings, Class 150 and 300: to ASME B16.24.
- .2 Cast bronze threaded fittings, Class 125 and 250: to ASME B16.15.
- .3 Cast copper, solder type: to ASME B16.18.
- .4 Wrought copper and copper alloy, solder type: to ASME B16.22.
- .5 Fittings to be of all North American manufacturer.

## **2.3 JOINTS**

- .1 Rubber gaskets, 1.6 mm thick: to AWWA C111/A21.11.
- .2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
- .3 Solder: 95/5 lead free solder. No lead content in excess of 0.2%.
- .4 Teflon tape: for threaded joints.
- .5 Dielectric connections between dissimilar metals: dielectric fitting to ASTM F492, complete with thermoplastic liner. Bronze or brass ball valves are an acceptable dielectric fitting where applicable.

## **2.4 VALVES**

- .1 Refer to Section 23 05 23 - Valves.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 Install in accordance with Canadian Plumbing Code, Provincial Plumbing Code and local authority having jurisdiction.
- .2 Cut square, ream and clean tubing and tube ends, clean recesses of fittings and assemble without binding.
- .3 Install pipe work in accordance with Section 23 05 05 - Installation of Pipe Work, supplemented as specified herein.

- .4 Assemble piping using fittings manufactured to ANSI standards.
- .5 Install DCW piping below and away from DHW and DHWR and other hot piping so as to maintain temperature of cold water as low as possible.
- .6 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.
- .7 Buried tubing:
  - .1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.
  - .2 Bend tubing without crimping or constriction. No fittings permitted below grade.
- .8 Install isolation valves at all branch take-offs and to isolate each piece of equipment, and as indicated.

### **3.2 PRESSURE TESTS**

- .1 Refer to Section 23 05 05 - Installation of Pipework.
- .2 Test pressure: greater of 1½ times maximum system operating pressure or 860 kPa.

### **3.3 FLUSHING AND CLEANING**

- .1 Flush entire system for 8 h. Ensure outlets flushed for 2 h. Let stand for 24 h, then draw one sample off longest run. Submit to testing laboratory to verify that system is clean. Let system flush for additional 2 h, then draw off another sample for testing. Submit test results to Engineer.

### **3.4 PRE-START-UP INSPECTIONS**

- .1 Systems to be complete, prior to flushing, testing and start-up.
- .2 Verify that system can be completely drained.
- .3 Ensure that pressure booster systems are operating properly.
- .4 Ensure that air chambers, expansion compensators are installed properly.

### **3.5 DISINFECTION**

- .1 Flush out, disinfect and rinse system to requirements of authority having jurisdiction and to the approval of Engineer.
- .2 Upon completion, provide laboratory test reports on water quality for Engineer approval.

### **3.6 START-UP**

- .1 Timing: Start up after:
  - .1 Pressure tests have been completed.
  - .2 Disinfection procedures have been completed.
  - .3 Certificate of static completion has been issued.
- .2 Provide continuous supervision during start-up.
- .3 Start-up procedures:
  - .1 Establish circulation and ensure that air is eliminated.
  - .2 Check pressurization to ensure proper operation and to prevent water hammer, flashing and/or cavitation.
- .4 Rectify start-up deficiencies.

### **3.7 PERFORMANCE VERIFICATION**

- .1 Timing:
  - .1 After pressure and leakage tests and disinfection completed, and certificate of completion has been issued by authority having jurisdiction.
- .2 Procedures:
  - .1 Verify that flow rate and pressure meet Design Criteria.
  - .2 TAB DHWR in accordance with Section 23 05 93 - Testing Adjusting and Balancing (TAB) of Mechanical Systems.
  - .3 Adjust pressure regulating valves while withdrawal is maximum and inlet pressure is minimum.
  - .4 Verify performance of temperature controls.
  - .5 Verify compliance with safety and health requirements.
  - .6 Check for proper operation of water hammer arrestors. Run 10% of outlets for 10 seconds, then shut off water immediately. If water hammer occurs, replace water hammer arrestor or re-charge air chambers. Repeat for outlets and flush valves.
  - .7 Confirm water quality consistent with supply standards, verifying that no residuals remain as a result of flushing and/or cleaning.
- .3 Reports:
  - .1 In accordance with Section 20 05 01 - Mechanical General Requirements: Reports, using report forms as specified in Section 20 05 01 - Mechanical General Requirements: Report Forms and Schematics.
  - .2 Include certificate of water flow and pressure tests conducted on incoming water service, demonstrating adequacy of flow and pressure.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM B32-08 (R2014), Specification for Solder Metal.
  - .2 ASTM B306-13, Specification for Copper Drainage Tube (DWV).
  - .3 ASTM C564-14, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
  - .4 ASTM C1540-18, Standard Specification for Heavy Duty Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.
- .2 Canadian Standards Association (CSA)
  - .1 CSA B70-12 (R2016), Cast Iron Soil Pipe, Fittings and Means of Joining.
  - .2 CSA B125-01, Plumbing Fittings.
- .3 Cast Iron Soil Pipe Institute (CISPI)
  - .1 CISPI 310-04, Specification for coupling for use in connection with hubless cast iron soil pipe and fittings for sanitary and storm drain, waste, and vent piping applications.

## **PART 2 PRODUCTS**

### **2.1 COPPER TUBE AND FITTINGS**

- .1 Above ground sanitary, storm and vent Type DWV to: ASTM B306.
  - .1 Fittings.
    - .1 Cast brass: to CSA B125.
    - .2 Wrought copper: to CSA B125.
  - .2 Solder: 95/5, lead free, to ASTM B32, type 50A.

### **2.2 CAST IRON PIPING AND FITTINGS**

- .1 Above ground sanitary, storm and vent: to CSA B70.
  - .1 Mechanical joints.
    - .1 Provide hubless soil pipe couplings designated as Heavyweight, constructed of extra wide 4 to 6 band corrugated type 304 stainless steel bands, with heavy duty worm drive clamps.
    - .2 Flanged gasket to be made of neoprene rubber, meeting ASTM C564 and unit to meet CISPI 310 and ASTM C1540 standards.
    - .3 Tightened to 80 in. lbs. torque.

- .4 Acceptable materials: Mission Rubber Company.

### **PART 3 EXECUTION**

#### **3.1 INSTALLATION**

- .1 Install in accordance with Canadian Plumbing Code, Provincial Plumbing Code and local authority having jurisdiction.
- .2 Allow for locating of existing buried sanitary piping prior to excavating for connection of new services.
- .3 Bedding and backfilling should be in accordance with City of Ottawa standards and specifications. Install buried pipe on 150 mm (6") bed of compacted clean Granular A bedding compacted to 95% (min.) dry proctor density, shaped to accommodate hubs and fittings, to line and grade as indicated. The material should be placed in maximum 300 mm thick lifts. (If trench bottom is unstable, bring to Engineers attention before bedding is laid). Limit vertical deflection and increase pipe support by compacting soil in both directions away from the pipe toward trench walls. Initial backfill to begin at springline of pipe to 300 mm (12") above pipe using compacted clean Granular A bedding compacted to 95% (min.) dry proctor density. Final backfill shall be in accordance with Geotechnical Report and as minimum utilize clean Granular A compacted to 95% dry proctor density in 300 mm thick lifts. Bedding and backfill shall be provided by this division and in accordance with Div. 02  
- Site Work.
- .4 Install above ground piping parallel and close to walls and ceilings to conserve headroom and space, and to grade as indicated.
- .5 Urinal waste pipe & fittings shall be DWV PVC equivalent to IPEX System 15 in accordance with specification Section 22 13 18 - Drainage Waste and Vent - Plastic. Extend plastic piping up to combined waste from adjacent lavatory or other plumbing fixtures allowing dilution of waste.
- .6 On pumped discharge, cast iron with mechanical joint shall not be allowed. (Use Type L copper with DWV fittings.)

#### **3.2 TESTING**

- .1 Test in accordance with OBC Part 7 requirements.
- .2 Hydraulically test to verify grades and freedom from obstructions.

### **3.3 PERFORMANCE VERIFICATION**

- .1 Cleanouts:
  - .1 Ensure accessible and that access doors are correctly located.
  - .2 Open, cover with linseed oil and re-seal.
  - .3 Verify that cleanout rods can probe as far as the next cleanout, at least.
- .2 Test to ensure traps are fully and permanently primed.
- .3 Storm water drainage:
  - .1 Verify domes are secure.
  - .2 Ensure weirs are correctly sized and installed correctly.
  - .3 Verify provisions for movement of roof system.
- .4 Ensure that fixtures are properly anchored, connected to system and effectively vented.
- .5 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

**END OF SECTION**



## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM D2564-12(2018), Specification for Solvent Cements for Poly(Vinyl-Chloride) (PVC) Plastic Piping Systems.
- .2 Canadian Standards Association (CSA)
  - .1 CSA B1800-18, Thermoplastic Nonpressure Piping Compendium.
- .3 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC S102.2-10, Method of Test for Surface Burning Characteristics of Flooring, Floor Coverings, and Miscellaneous Materials and Assemblies.
  - .2 CAN/ULC S115-11, Standard Method of Fire Tests of Firestop Systems.

## **PART 2 PRODUCTS**

### **2.1 PIPING AND FITTINGS**

- .1 DWV PVC (Polyvinyl Chloride):
  - .1 Application: below grade sanitary, storm & vent piping & fittings and above grade where combustible piping is permitted **excluding** OBC 3.2.6 (High-rise) applications and ceiling plenums.
  - .2 Pipe and Fittings: Drain, waste and vent pipe and fittings shall be certified to CSA B181.2. When combustible pipe and fittings are used in buildings required to be of noncombustible construction, they shall be listed by ULC to the Standard CAN/ULC S102.2 and clearly marked with the certification logo indicating a flame-spread rating not exceeding 25.
  - .3 Acceptable material: IPEX System 15 DWV.
- .2 Fire & smoke resistant coated DWV PVC (Polyvinyl Chloride) piping & fittings:
  - .1 Application: Above grade sanitary, storm & vent piping & fittings where combustible piping is permitted including OBC 3.2.6 High-rise applications and within ceiling plenums.
  - .2 Pipe and Fittings: Drain, waste and vent pipe and fittings shall be certified to CSA B181.2 and when used in noncombustible construction, high-rise buildings and air plenums, they shall be tested and listed in accordance with CAN/ULC S102.2 and clearly marked with the



- certification logo indicating a flame-spread rating not exceeding 25 and a smoke-developed classification not exceeding 50.
- .3 Acceptable material: IPEX System XFR 15/50 PVC-DWV.
  - .3 Firestopping Devices:
    - .1 All combustible pipe penetrations shall comply with the requirements described in the O.B.C. 3.1.9.4.(1) through (8) and provide a firestop system that has been Tested and Listed to the test Standard CAN/ULC S115 with a pressure differential of 50 Pa. In addition, the manufacturer shall provide a documentation confirming compliance with the Listed system.
  - .4 Solvent Welding:
    - .1 Solvent cements shall be CSA certified and meet the requirements of ASTM D2564. One-step cement may be used for sizes from NPS 40 to 150. Two-step cement must be used in conjunction with primer on larger pipe sizes. Proper solvent cementing procedures must be followed at all times.
    - .2 The manufacturer, shall be consulted prior to installation for proper solvent welding procedures and proper solvent cement requirements.
  - .5 Expansion/Contraction:
    - .1 Compensation shall be made to accommodate expansion/contraction on the drainage system. It is recommended that there be compensation on every second floor for the vertical piping system. Consult pipe system manufacturer for specific details regarding approved compensation methods.
  - .6 Compatibility:
    - .1 To ensure compatibility, performance and material quality, all pipe and fitting drainage system shall be produced by the same manufacturer.
  - .7 Quality Control:
    - .1 The manufacturer of the pipe and fitting system shall be contacted prior to the installation to obtain precise installation instructions. Site meetings shall be arranged and include, the Contractor, Manufacturer and Building Inspector.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 Install in accordance with Canadian Plumbing Code, Provincial Plumbing Code and local authority having jurisdiction.
- .2 Allow for locating of existing buried sanitary piping prior to excavating for connection of new services.

- .3 Bedding and backfilling should be in accordance with City of Ottawa standards and specifications. Install buried pipe on 150 mm (6") bed of compacted clean Granular A bedding compacted to 95% (min.) dry proctor density, shaped to accommodate hubs and fittings, to line and grade as indicated. The material should be placed in maximum 300 mm thick lifts. (If trench bottom is unstable, bring to Engineers attention before bedding is laid). Limit vertical deflection and increase pipe support by compacting soil in both directions away from the pipe toward trench walls. Initial backfill to begin at springline of pipe to 300 mm (12") above pipe using compacted clean Granular A bedding compacted to 95% (min.) dry proctor density. Final backfill shall be in accordance with Geotechnical Report (if available) and as minimum utilize clean Granular A compacted to 95% dry proctor density in 300 mm thick lifts. Bedding and backfill shall be provided by this division.
- .4 Plastic pipe shall not be used on pumped sanitary & storm discharge. Copper only.

### **3.2 TESTING**

- .1 Test in accordance with OBC Part 7 requirements.
- .2 Pressure test buried systems before backfilling.
- .3 Hydraulically test to verify grades and freedom from obstructions.
- .4 Video Testing:
  - .1 Provide video scanning of underground sanitary and storm piping for contractor's review and approval prior to pouring of concrete. Repair deficiencies and re-scan as required. Submit final video to Engineer for record.
  - .2 Flush & video scan sanitary and storm piping for contractor's review and approval prior to building turnover. Repair deficiencies and re-scan as required. Submit final video to Engineer for record.

### **3.3 PERFORMANCE VERIFICATION**

- .1 Cleanouts:
  - .1 Ensure accessible and that access doors are correctly located.
  - .2 Open, cover with linseed oil and re-seal.
  - .3 Verify cleanout rods can probe as far as the next cleanout, at least.
- .2 Test to ensure traps are fully and permanently primed.
- .3 Storm water drainage:
  - .1 Verify domes are secure.
  - .2 Ensure weirs are correctly sized and installed correctly.
  - .3 Verify provisions for movement of roof system.
- .4 Ensure that fixtures are properly anchored, connected to system and effectively vented.

- .5 Affix applicable label (storm, sanitary, vent, pump discharge etc.) c/w directional arrows every floor or 4.5 m (whichever is less).

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .1 American Society of Sanitary Engineering (ASSE)
  - .1 ASSE (Plumbing) 1018-2001, Performance Requirements for Trap Seal Primer Valves-Potable Water Supplied.
  - .2 ASSE (Plumbing) 1070-2015, Performance Requirements for Water Limiting Devices.
- .2 Canadian Standards Association (CSA)
  - .1 CSA B64 Series-11 (2016), Backflow Preventers And Vacuum Breakers.
  - .2 CSA B64.10-17/B64.10.1-17, Selection and Installation of Backflow Preventers/Maintenance and Field Testing of Backflow Preventers.
  - .3 CSA B356-10 (R2015), Water Pressure Reducing Valves for Domestic Water Supply Systems.
- .4 National Research Council Canada
  - .1 NRCC NBCC-2015, National Building Code of Canada.
- .5 Plumbing and Drainage Institute (PDI)
  - .1 PDI WH201-2010, Water Hammer Arresters Standard.

### **1.3 SUBMITTALS**

- .1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 For shop drawings, indicate dimensions, construction details and materials.
- .3 For product data, indicate dimensions, construction details and materials for items specified herein.

### **1.4 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

- .2 Data to include:
  - .1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.
  - .2 Details of operation, servicing and maintenance.
  - .3 Recommended spare parts list.

## **PART 2 PRODUCTS**

### **2.1 FLOOR DRAINS**

Existing to remain.

### **2.2 CLEANOUTS**

- .1 Cleanout plugs: heavy cast iron male ferrule with brass screws and threaded brass or bronze plug. Sealing-caulked lead seat or neoprene gasket.
  - .1 Acceptable material: Watts, J.R. Smith & Zurn Z-1449.
- .2 Access covers:
  - .1 Wall access: face or wall type, stainless steel square or round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs. Acceptable material: Watts, Zurn ZANB-1463 (wall) ZANB-1460 (floor).

### **2.3 NON FREEZE WALL HYDRANTS**

- .1 Recessed with integral vacuum breaker, 20 mm (NPS 3/4) hose outlet, locking cover with removable operating key. Polished bronze finish.
- .2 Acceptable material: Watts, J.R. Smith & Zurn Z-1320 (recessed).

### **2.4 TRAP SEAL PRIMERS**

- .1 Type 2: for use on lavatory cold water line.
  - .1 Brass trap seal primer with removable poppet, integral vacuum breaker, access gasketed cover 13 NPT (1/2") threaded inlet and outlet connections, complete with 13 NPT (1/2") sweat connection adapters and 13 NPT (1/2") drip line connection.
  - .2 Trap seal primers are listed with I.A.P.M.O. and CSA and are tested and certified to the ASSE 1018.
  - .3 Trap seal primers shall be installed minimum 305 mm (12") above the grid of a floor drain or flood level rim of equipment served.
  - .4 Operating range for trap seal primers is 138 kPA (20 psi) to 861 kPA (125 psi). Operates on pressure drop of Minimum 14 kPA (2 psi).

- .5 Acceptable material: PPP Prime-pro, Mifab MI-TSP-3, Watts, Zurn.
- .3 Type 3: Electronic Trap Primer - Timer Type
  - .1 Electronic activated type, all brass construction with "O" ring seals, 12 mm (NPT ½) female inlet & 12 mm (NPT ½) female outlet drip line connection with air female inlet & 12 mm (NPT ½) female outlet drip line connection with air gap, viewing holes, and removable filter screen. Trap primer shall have no flow adjustment. Operating range shall be 138 kPa (20 psi) to 861 kPa (125 psi).  
Operates on pre-set 24 h clock with manual override switch/test button. Unit shall have 120 V solenoid valve and calibrated manifold for equal water distribution.  
One (1) to ten (10) drain taps per unit.
  - .2 Identify on as-built drawings the location of each trap seal primer.
  - .3 Ensure all trap seal primers are accessible for maintenance purposes and are connected to cold water line. Trap line shall be from top of cold water line and include a service valve. All to be installed in steel cabinet and serviceable from access door.
  - .4 Acceptable material: Zurn Z-1020 (1 to 5) for 10 - 2 distribution units will be required.

## **2.5 WATER HAMMER ARRESTORS**

- .1 Copper construction, bellows or piston type: to PDI-WH201.
- .2 Acceptable material: Watts, J.R. Smith & Zurn Z-1700.

## **2.6 BACK FLOW PREVENTORS**

- .1 To CSA B64.10.1.
- .2 Application: as indicated to meet NBC requirements.
- .3 Reduced pressure principle type c/w quarter turn ball valves.
  - .1 Acceptable material: Watts Model 009QT or approved equal.
- .4 Double check valve assembly.
  - .1 Acceptable material: Watts Series LF009 or approved equal.
- .5 Back flow preventer with intermediate atmospheric vent or vacuum breaker.

## **2.7 VACUUM BREAKERS**

- .1 To CSA B64.
- .2 Atmospheric vacuum breaker:
  - .1 Acceptable material: Zurn Model 35VCH (chrome finish), Watts.

- .3 Hose connection vacuum breaker:
  - .1 Acceptable material: Zurn Model BFP-9, Watts.
- .4 Laboratory faucet intermediate vacuum breaker:
  - .1 Acceptable material: Zurn Model 730 to be installed at end of spout, Watts.

## **2.8 PRESSURE REGULATORS**

- .1 Performance:
  - .1 Inlet pressure: 1034 kPa (150 psi).
  - .2 Outlet pressure: 413 kPa (60 psi).
  - .3 Capacity: as indicated.
- .2 NPS 1/2 to NPS 2 bronze body Z3 sealed spring cage, stainless steel adjusting and cage screws, integral stainless steel strainer, Teflon diaphragm, EPDM & Buna-n material not be accepted, replaceable seat, bypass feature, threaded or soldered: certified to CSA B356.
  - .1 Acceptable material: Watts LFU5B-Z3, Wilkins NR3.

## **2.9 BACKWATER VALVES**

- .1 Coated extra heavy cast iron body with bronze seat, revolving bronze flapper and threaded cover.
  - .1 Acceptable material: Watts.
- .2 Access:
  - .1 Surface access.
  - .2 Access pipe with cover: maximum 300 mm (12") depth.
  - .3 Steel housing with gasketed steel cover.
  - .4 Concrete access pit with cover, as indicated.

## **2.10 HOSE BIBBS AND SEDIMENT FAUCET**

- .1 Bronze construction complete with integral back flow preventer, hose thread spout, cap chain, replaceable composition disc, and chrome plated in finished areas.
- .2 Acceptable material: Watts.

## **2.11 MAKE-UP WATER ASSEMBLY**

- .1 20 mm dia. assembly complete with backflow preventer (38BFD03), pressure gauge on inlet and outlet, pressure reducing valve to CSA B356 set to 20 psi (adjustable) (38PRV01), pressure relief valve on low pressure side and ball valves on inlet and outlet.

- .2 Acceptable material: Watts.

## **2.12 STRAINERS**

- .1 860 kPa (125 psi), Y type with 20 mesh, monel, bronze or stainless steel removable screen.
- .2 NPS 2 and under, bronze body, screwed ends, with brass cap.  
.1 Acceptable material: Watts, Wilkins S-XL.
- .3 NPS 2½ and over, cast iron body, flanged ends, with bolted cap.  
.1 Acceptable material: Watts, Wilkins FS.

## **2.13 UNDER SINK THERMOSTATIC MIXING VALVE**

- .1 Thermostatic Mixing Valve:
- The valve shall be ASSE 1070 and IAPMO CUPC listed and control the temperature of the hot water. It shall have a lead free brass 4-port, "H" pattern body. Lead free\* under counter thermostatic valves shall comply with codes and standards, where applicable, requiring reduced lead content. The valve shall include integral check valves, integral screens and an adjustment nut with locking feature. The valve shall be provided with 10 mm (3/8"), male compression or quick-connect fittings.
  - Acceptable material: Watts series LFUSG-B.

## **2.14 EXPANSION TANKS**

- .1 Horizontal or vertical steel pressurized removable bladder and/or diaphragm type expansion tank as per schedule.
- .2 ASME construction, steel shell construction.
- .3 Diaphragm sealed in heavy duty butyl material.
- .4 Polypropylene liner material.
- .5 Working pressure: 862 kPa (150 psi) with ASME stamp and certification including Canadian Registration Number (CRN).
- .6 Working temperature: 93°C (200°F).
- .7 Stainless steel system connections.
- .8 Air precharged to initial fill pressure of system as per schedule.



- .9 Saddles for horizontal installation; base mount for vertical installation.
- .10 Supports: Provide supports with hold down bolts and installation templates incorporating seismic restraint systems.
- .11 Basis of Design: 38EXT01 - Thermextrol ST-5 or approved equal.

### **PART 3 EXECUTION**

#### **3.1 INSTALLATION**

- .1 Install in accordance with Canadian Plumbing Code, and local authority having jurisdiction.
- .2 Install in accordance with manufacturer's instructions and as specified.

#### **3.2 FLOOR DRAINS**

- .1 Floor drains to be installed at lowest point in floor and placed to ensure floor finishing is flush/slightly higher than strainer. Contractor to chip concrete around drains, lower assembly, patch concrete and provide floor finish should the installed elevation be unacceptable to Engineer.
- .2 Contractor to provide suitable means of protecting floor drains and cleanouts from damage during construction. Contractor to be responsible for turning over facility to Owner with floor drains and strainers in new condition. Damaged material shall be replaced with new at contractor's expense.

#### **3.3 CLEANOUTS**

- .2 In addition to those required by code, and as indicated, install at base of soil and waste stacks, and rainwater leaders.
- .3 Bring cleanouts to wall or finished floor unless serviceable from below floor.
- .4 Building drain cleanout and stack base cleanouts: line size to maximum NPS4.

#### **3.4 NON FREEZE WALL HYDRANTS**

- .1 Install 600 mm (24") above finished grade unless otherwise indicated.

#### **3.5 BACK FLOW PREVENTORS**

- .1 Pipe discharges to terminate over nearest drain and or service sink.

- .2 Test and certify each backflow preventor and provide report for inclusion in the commissioning report.
- .3 Acceptable testing contractor shall be Pennex.

### **3.6 BACKWATER VALVES**

- .1 Install in access pit as indicated.

### **3.7 HOSE BIBBS AND SEDIMENT FAUCETS**

- .1 Install at bottom of risers, at low points to drain systems, and as indicated.

### **3.8 TRAP SEAL PRIMERS**

- .1 Install for floor drains and elsewhere, as indicated.
- .2 Install on cold water supply to nearest frequently used plumbing fixture, in concealed space, to approval of Consultant.
- .3 Install plastic tubing to floor drain.
- .4 Identify on as-built drawings the location of each trap seal primer.
- .5 Ensure all trap seal primers are accessible for maintenance purposes. Install access doors if required.

### **3.9 STRAINERS**

- .1 Install with sufficient room to remove basket.

### **3.10 WATER MAKE-UP ASSEMBLY**

- .1 Pipe discharge from relief valve to nearest floor drain.

### **3.11 MASTER THERMOSTATIC MIXING VALVE**

- .1 Install in accordance with manufacturer's instructions.

### **3.12 START-UP**

- .1 General:
  - .1 In accordance with Section 01 91 13 - Commissioning: General Requirements, supplemented as specified herein.
- .2 Timing: Start-up only after:
  - .1 Pressure tests have been completed.
  - .2 Disinfection procedures have been completed.
  - .3 Certificate of static completion has been issued.
  - .4 Water treatment systems operational.
- .3 Provide continuous supervision during start-up.

### **3.13 TESTING AND ADJUSTING**

- .1 General:
  - .1 In accordance with Section 01 91 13 - Commissioning: General Requirements, supplemented as specified herein.
- .2 Timing:
  - .1 After start-up deficiencies rectified.
  - .2 After certificate of completion has been issued by authority having jurisdiction.
- .3 Application tolerances:
  - .1 Pressure at fixtures: +/- 70 kPa.
  - .2 Flow rate at fixtures: +/- 20%.
- .4 Adjustments:
  - .1 Verify that flow rate and pressure meet design criteria.
  - .2 Make adjustments while flow rate or withdrawal is (1) maximum and (2) 25% of maximum and while pressure is (1) maximum and (2) minimum.
- .5 Floor drains:
  - .1 Verify operation of trap seal primer.
  - .2 Prime, using trap primer. Adjust flow rate to suit site conditions.
  - .3 Check operations of flushing features.
  - .4 Check security, accessibility, removability of strainer.
  - .5 Clean out baskets.
- .6 Vacuum breakers, backflow preventers, backwater valves:
  - .1 Test tightness, accessibility for O&M of cover and of valve.
  - .2 Simulate reverse flow and back-pressure conditions to test operation of vacuum breakers, backflow preventers.
  - .3 Verify visibility of discharge from open ports.

- .7 Roof drains:
  - .1 Check location at low points in roof.
  - .2 Check security, removability of dome.
  - .3 Adjust weirs to suit actual roof slopes, meet requirements of design.
  - .4 Clean out sumps.
  - .5 Verify provisions for movement of roof systems.
  
- .8 Access doors:
  - .1 Verify size and location relative to items to be accessed.
  
- .9 Cleanouts:
  - .1 Verify covers are gas-tight, secure, yet readily removable.
  
- .10 Water hammer arrestors:
  - .1 Verify proper installation of correct type of water hammer arrester.
  
- .11 Wall hydrants:
  - .1 Verify complete drainage, freeze protection.
  - .2 Verify operation of vacuum breakers.
  
- .12 Pressure regulators, PRV assemblies:
  - .1 Adjust settings to suit locations, flow rates, pressure conditions.
  
- .13 Strainers:
  - .1 Clean out repeatedly until clear.
  - .2 Verify accessibility of cleanout plug and basket.
  - .3 Verify that cleanout plug does not leak.
  
- .14 Hydronic system water Make-up Assembly:
  - .1 Verify pressure setting to suit system operating parameters.
  
- .15 Water meters:
  - .1 Verify proper signal is being received by controls.
  
- .16 Commissioning Reports:
  - .1 In accordance with Section 01 91 13 - Commissioning: Reports, supplemented as specified herein.
  
- .17 Training:
  - .1 In accordance with Section 01 91 13 - Commissioning: Training of O&M Personnel, supplemented as specified herein.
  - .2 Demonstrate full compliance with Design Criteria.

**END OF SECTION**



## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .1 Canadian Standards Association (CSA)
  - .1 CAN/CSA B45 Series-02 (R2013), Plumbing Fixtures.
  - .2 CSA B125-01, Plumbing Fittings.
  - .3 CSA B651-12 (R2017), Accessible Design for the Built Environment.
- .2 National Research Council Canada
  - .1 NRCC NBCC-2015, National Building Code of Canada.

### **1.3 SHOP DRAWINGS**

- .1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Indicate, for all fixtures and trim:
  - .1 Dimensions, construction details, roughing-in dimensions.
  - .2 Factory-set water consumption per flush at recommended pressure.
  - .3 (For water closets, urinals): minimum pressure required for flushing.

### **1.4 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data including monitoring requirements for incorporation into manuals specified in Section 20 05 01 - Mechanical General Requirements.
- .2 Include:
  - .1 Description of fixtures and trim, giving manufacturer's name, type, model, year, capacity.
  - .2 Details of operation, servicing, maintenance.
  - .3 List of recommended spare parts.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURED UNITS**

- .1 Fixture piping.
  - .1 Hot and cold water supplies to each fixture:
    - .1 Stops supplies shall be all brass with full turn brass seams and washer replaceable attachment shall be IPS inlet x compression OD outlet to fixture. All fixture stop valves shall be screw driver type.
    - .2 Chrome plated in all exposed places.
  - .2 Waste:
    - .1 Cast brass adjustable style P-trap with cleanout on each fixture not having integral trap.
    - .2 Chrome plated in all exposed places.
    - .3 Sink and lavatory heavy gauge P-traps shall be cast brass adjustable style with 17 ga. seamless brass wall bend. Attachment nuts shall be brass, no zinc allowed. P-traps to be removable/union type or to include cleanout.
    - .4 Lavatory strainers shall be chrome plated cast brass with 17 ga. seamless brass tailpiece.
    - .5 All barrier-free lavatories and sinks shall have chrome plated offset tail piece in addition to P-trap with cleanout. Insulate P-trap and hot & cold water pipes with pre-formed & finished surface insulation. Armaflex insulation and tape not acceptable.
- .2 Fixtures:
  - .1 Manufacture in accordance with CSA B45.
  - .2 All products, where applicable, shall be marked with manufacturer's name or product #.
- .3 Trim, fittings: manufacture in accordance with CSA B125.
- .4 Number, locations: Architectural drawings to govern.
- .5 Fixtures in any one location to be product of one manufacturer and of same type.
- .6 Trim in any one location to be product of one manufacturer and of same type unless otherwise indicated.
- .7 Reference drawing schedule for configuration and type.

### **2.2 CARRIERS**

- .1 Provide for all wall mounted plumbing fixtures.

### **2.3 ROUGHING-IN OF FIXTURES**

- .1 Rough-in for equipment supplied by other to be complete with valved supplies, wastes and vents, capped and associated fitting piping & reducers.

### **2.4 PLUMBING FIXTURES**

- .1 Reference fixture schedule on Drawings.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 Mounting heights:
  - .1 Standard: to comply with manufacturer's recommendations unless otherwise indicated or specified.
  - .2 Wall-hung fixtures: as indicated on architectural elevations.
  - .3 Physically handicapped: to comply with most stringent of either NBCC, or CAN/CSA B651.

### **3.2 ADJUSTING**

- .1 Conform to water conservation requirements specified in this section.
- .2 Adjustments:
  - .1 Adjust water flow rate to design flow rates and sensors.
  - .2 Adjust pressure to fixtures to ensure no splashing at maximum pressures.
  - .3 Adjust flush valves to suit actual site conditions.
- .3 Checks:
  - .1 Water closets: flushing action.
  - .2 Aerators: operation, cleanliness.
  - .3 Vacuum breakers, backflow preventers: operation under all conditions.

**END OF SECTION**





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**PART 1 GENERAL**

**1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

**1.2 USE OF SYSTEMS**

- .1 Use of new and/or existing permanent heating and ventilating systems for supplying temporary heat and ventilation is permitted only under the following conditions:
  - .1 Entire system is complete, pressure tested, cleaned, flushed out.
  - .2 Specified water treatment system has been commissioned, water treatment is being continuously monitored.
  - .3 Building has been closed in. Areas to be heated/ventilated are clean and will not thereafter be subjected to dust-producing processes.
  - .4 There is no possibility of damage from any cause.
  - .5 Supply ventilation systems are protected by 60% filters, which shall be inspected daily, changed every 2 weeks or more frequently as required.
  - .6 Return systems have approved filters over all openings, inlets, outlets.
  - .7 All systems will be:
    - .1 operated as per manufacturer's recommendations or instructions.
    - .2 operated by Contractor.
    - .3 monitored continuously by Contractor.
  - .8 Warranties and guarantees do not commence until equipment is turned over to owner.
  - .9 Regular preventive and all other manufacturers recommended maintenance routines are performed by Contractor at his own expense and under supervision of Engineer.
  - .10 Before turn-over to owner, entire system to be refurbished, cleaned internally and externally and restored to "as- new" condition. Filters in air and water systems are to be replaced.
- .2 Filters referred to herein are over and above those specified elsewhere in this specification.
- .3 Exhaust systems are not included in any approvals for temporary heating ventilation.

**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 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

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

## **PART 2 PRODUCTS**

### **2.1 NOT USED**

- .1 Not Used.

## **PART 3 EXECUTION**

### **3.1 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.

### **3.2 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, and components.

### **3.3 DRAINS**

- .1 Install piping with grade in direction of flow except as indicated or specified otherwise.

- .2 Install drain valve at low points in piping systems, at equipment at section isolating valves and at base of all risers.
- .3 Pipe each drain valve discharge separately to above floor drain. Discharge to be visible.
- .4 Drain valves: NPS 3/4 full port ball valves unless indicated otherwise, with hose end male thread, cap and chain.

### **3.4 AUTOMATIC AIR VENTS**

- .1 Install automatic air vents at high points of piping systems.
- .2 Install full port ball at each automatic air vent.
- .3 Air vents must have minimum connection of 13 mm (1/2").

### **3.5 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.

### **3.6 PIPEWORK INSTALLATION**

- .1 Screwed fittings to be jointed with Teflon tape.
- .2 Protect openings against entry of foreign material.
- .3 Install so that equipment can be isolated and removed without interruption to operation of any other equipment or systems.
- .4 Assemble piping using fittings manufactured to ANSI standards.
- .5 Weldolets sockolets Saddle type branch fittings may be used on mains if branch line is no larger than half the size of the main. Hole saw (or drill) and ream main so as to maintain full inside diameter of branch line prior to welding saddle. Provide isolation valves at each branch connection.
- .6 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

- .7 Install concealed pipework so as to minimize furring space, maximize headroom, and conserve space.
- .8 Except where indicated otherwise, slope piping in direction of flow for positive drainage and venting.
- .9 Except where indicated, install so as to permit separate thermal insulation of each pipe.
- .10 Group piping wherever possible and as indicated.
- .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 and specified.
- .14 Contractor shall carry a structural engineer to design and certify the support system for any piping distribution system exceeding 100 mm (4") or where piping is grouped such that the distributed weight exceeds the building structure limits. (Note: In steel building structure the piping supports shall never be supported by a single joist or off the bottom chord of the joist or truss.

### **3.7 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: 6 mm minimum clearance all round between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Installation:
  - .1 Concrete, masonry walls, and concrete floors on grade: Terminate flush with finished surface.
  - .2 Other floors: Terminate 25 mm 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.

### **3.8 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.

### **3.9 FLUSHING OUT OF PIPING SYSTEMS**

- .1 In accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.
- .2 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.
- .3 Provide test results upon completion and retain written report on status after complete.

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

- .1 Advise Engineer 48 hours minimum prior to performance of pressure tests.
- .2 Pipework: Test to 1½ times normal operating pressure to a maximum of the piping systems working pressure including devices (i.e.: valves, fittings, accessories). Minimum test pressure to be 862 kPa (125 psi).
- .3 Maintain specified test pressure without loss for four 4 hours minimum. Temperature of system to remain constant during of test.
- .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 Engineer.
- .6 Bear costs for repairs or replacement, retesting, and making good. Engineer to determine whether repair or replacement is appropriate.
- .7 Insulate or conceal work only after approval and certification of tests by Engineer.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers.
  - .1 ASHRAE 90.1-2016, Energy Code for Buildings Except Low-Rise Residential Buildings.
- .2 Electrical Equipment Manufacturers' Advisory Council (EEMAC)
- .3 National Electrical Manufacturers Association (NEMA)
  - .1 NEMA MG 1-2016, Motors and Generators.
- .4 Ontario Regulation
  - .1 ONTARIO OBC-2012, 2012 Ontario Building Code Compendium.

### **1.3 ELECTRICAL**

- .1 Electrical work to conform to Division 26 including the following:
  - .1 Control wiring and conduit is specified in Division 26 except for conduit, wiring and connections below 50 V which are related to control systems specified in Divisions 20, 21, 22, 23 & 25. Refer to Division 26 for quality of materials and workmanship.

### **1.4 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 20 05 01 - Mechanical General Requirements.

### **1.5 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.



**PART 2 PRODUCTS**

**2.1 GENERAL**

- .1 Motors to be premium efficiency, in accordance with NEMA 1 premium motor standards and the requirements of ASHRAE 90.1 unless superceded by Ontario Building Code (OBC) Supplementary Standard SB-10.

**2.2 MOTORS**

- .1 Provide premium efficiency motors for mechanical equipment to NEMA MG 1 Part 31.
- .2 Motors efficiency must exceed the following:

Open Drip-Prrof (ODP) Type

Motor Size	1200	1800	3600
HP	NEMA Premium Nominal Efficiency		
1 & below	82.5%	85.5%	77.0%
1.5	86.5%	86.5%	84.0%
2	87.5%	86.5%	85.5%
3	88.5%	89.5%	85.5%
5	89.5%	89.5%	86.5%
7.5	91.0%	91.0%	88.5%
10	91.7%	91.7%	89.5%
15	91.7%	93.0%	90.2%
20	92.4%	93.0%	91.0%
25	93.0%	93.6%	91.7%
30	93.6%	94.1%	91.7%
40	94.1%	94.1%	92.4%
50	94.1%	94.5%	93.0%
60	94.5%	95.0%	93.6%
75	94.5%	95.0%	93.6%
100	95.0%	95.4%	93.6%
125	95.0%	95.4%	94.1%
150	95.4%	95.8%	94.1%
200	95.4%	95.8%	95.0%

Totally Enclosed Fan-Cooled (TEFC) Type			
Motor Size	1200	1800	3600
HP	NEPA Premium Nominal Efficiency		
1 & below	82.5%	85.5%	77.0%
1.5	87.5%	86.5%	84.0%
2	88.5%	86.5%	85.5%
3	89.5%	89.5%	86.5%
5	89.5%	89.5%	88.5%
7.5	91.0%	91.7%	89.5%
10	91.0%	91.7%	90.2%
15	91.7%	92.4%	91.0%
20	91.7%	93.0%	91.7%
25	93.0%	93.6%	91.7%
30	93.0%	93.6%	91.7%
40	94.1%	94.1%	92.4%
50	94.1%	94.5%	93.0%
60	94.5%	95.0%	93.6%
75	94.5%	95.4%	93.6%
100	95.0%	95.4%	94.1%
125	95.0%	95.4%	95.0%
150	95.8%	95.8%	95.0%
200	95.8%	96.2%	95.4%

- .3 Motors under 373 W (½ HP): speed as indicated, continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.
- .4 Motors 373 W (½ HP) to 14.92 kW (20 HP): EEMAC Class B/F, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 45°C/60°C over ambient of 30°C, 3 phase, 600 V, unless otherwise specified or indicated.
- .5 Motors 18.65 kW (25 HP) and larger: EEMAC Class B/F, squirrel cage induction, speed as indicated, continuous duty, drip proof, ball bearing, maximum temperature rise 45°C/60°C over ambient of 30°C, 3 phase, 600 V, c/w integral thermistor protection, unless otherwise specified or indicated. Thermistors shall be factory installed, copper RTD type, one on each phase, wired to identified terminals in motor terminal box and wired to starter/VFD (wiring, conduit & connections by Div. 26).
- .6 Two speed motors shall be double winding type.
- .7 Motors coupled with VFD shall be premium efficiency, inverter duty type to NEMA MG 1 Part 31 and shall have as a minimum EEMAC Class F insulation. Inverter ready motors shall not be acceptable.
- .8 Motors coupled with VFD's shall include a shaft grounding ring.

- .9 Motors located outside to be TEFC type, unless located in insulated weatherproof enclosure.

### **2.3 TEMPORARY MOTORS**

- .1 If delivery of specified motor will delay completion or commissioning work, install motor approved by Consultant for temporary use. Work will only be accepted when specified motor is installed.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 Fasten securely in place.
- .2 Ensure motor installation is easily removable for servicing.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .1 American Society of Mechanical Engineers (ASME).
  - .1 ASME B40.100-2013, Pressure Gauges and Gauge Attachments.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-14.4-M88, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.

### **1.3 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Indicate on manufacturers catalogue literature the following:
  - .1 Thermometers.
  - .2 Pressure gauges.
  - .3 Ball valve.
  - .4 Syphons.
  - .5 Wells.

### **1.4 MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- .1 Thermometers and pressure gauges to operate at mid point of scale or range.

## **2.2 DIRECT READING THERMOMETERS**

- .1 Industrial, variable angle type, liquid filled, 125 mm scale length: to CAN/CGSB-14.4.
  - .1 Acceptable Materials: Ashcroft, Taylor, Winters, Weiss, H.O. Terrice.

## **2.3 THERMOMETER WELLS**

- .1 For copper pipe use copper or bronze. For steel pipe use brass.

## **2.4 PRESSURE GAUGES**

- .1 Liquid filled, 112 mm, dial type: ASME B40.100, Grade 2A, having ½ of 1% accuracy over entire range, stem mounting.
  - .1 Acceptable Materials: Ashcroft, Taylor, Winters, Weiss, H.O. Terrice.
- .2 Provide ball valve and snubber for pulsating operation (pumps).

## **2.5 PRESSURE & TEMPERATURE TEST STATIONS**

- .1 Pressure and temperature test stations:
  - .1 Provide where indicated "Pete's Plug II" a 6 mm (1/4") fitting to receive either a temperature or pressure probe 3 mm (1/8") OD. Fitting shall be solid brass with two valve cores of Neoprene (max. 93°C (200°F) at 3447 kPa (500 psi), fitted with a colour coded cap strap with gasket, and shall be rated at 6,895 kPa (1,000 psi) at 60°C (140°F).
  - .2 In addition, the contractor shall supply the owner with three (3) pressure and temperature test kits consisting of a 0-100 psi, 0-230 ft. of water pressure gauge with a Number 500 gauge adapter, one 25-125°F and one 0-220°F pocket testing thermometer, an extra number 500 gauge adapter, and a protective carrying case.
  - .3 Acceptable material: Peterson Equipment Company Inc., Pete's Plug II.

## **PART 3 EXECUTION**

### **3.1 GENERAL**

- .1 Install so they can be easily read from floor or platform. If this cannot be accomplished, install remote reading units.
- .2 Install between equipment and first fitting or valve.

### **3.2 THERMOMETERS**

- .1 Install in wells on all piping. Provide heat conductive material for inside of well.
- .2 Install in locations as indicated and on inlet and outlet of:
  - .1 Boilers.
- .3 Use extensions where thermometers are installed through insulation.

### **3.3 PRESSURE GAUGES**

- .1 Install in following locations:
  - .1 Suction and discharge of pumps.
  - .2 Heat exchangers.
  - .3 In other locations as indicated.
- .2 Pressure gauges are to be manifolded between inlet and outlet of device ( pump, strainer, etc.) unless otherwise indicated. Provide ball type isolation valve between pressure gauge and device.

### **3.4 PRESSURE & TEMPERATURE TEST STATIONS**

- .1 Install in locations as indicated and on inlet and outlet of:
  - .1 Hydronic hot water radiation.

**END OF SECTION**



## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .1 American Society of Mechanical Engineers (ASME).
  - .1 ASME B1.20.1-2013, Pipe Threads, General Purpose (Inch).
  - .2 ASME B16.1-2015 Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
  - .3 ASME B16.34-2017, Valves - Flanged, Threaded and Welding End.
- .2 American Society for Testing and Materials (ASTM).
  - .1 ASTM A126-04(2014), Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
  - .2 ASTM A193/A193M-17, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.
  - .3 ASTM A194/A194M-17a, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
  - .4 ASTM A216/A216M-18, Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service.
  - .5 ASTM B16/B16M-10(2015), Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines.
  - .6 ASTM B62-17, Specification for Composition Bronze or Ounce Metal Castings.
- .3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).
  - .1 MSS SP-67-2017, Butterfly Valves.
  - .2 MSS SP-80-2013, Bronze Gate Globe, Angle and Check Valves.

### **1.3 PRODUCT DATA**

- .1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Submit data for all valves specified in this section.



#### **1.4 CLOSEOUT SUBMITTALS**

- .1 Submit maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

#### **1.5 ACCEPTABLE MANUFACTURERS**

- .1 Refer to Acceptable Products Table in Part 3 of this section.

### **PART 2 PRODUCTS**

#### **2.1 GENERAL**

- .1 All valves of the same type to be from one manufacturer.
- .2 All valves to have CRN registration numbers.

#### **2.2 GATE VALVES**

- .1 NPS 2 and under, bronze, solid wedge disc:
  - .1 Standard specification: MSS SP-80.
  - .2 Bonnet: with hex. shoulders.
  - .3 Connections: with hex. shoulders.
  - .4 Inspection and pressure testing: to MSS SP-80. Tests to be hydrostatic.
  - .5 Packing: high grade non-asbestos packing.
  - .6 Handwheel: non-ferrous. Nut: bronze to ASTM B62.
  - .7 Body: with long disc guides, screwed bonnet with stem retaining nut.
- .2 NPS 2½ - 8, cast iron, bronze iron trim, solid wedge disc:
  - .1 Body and multiple-bolted bonnet: with bosses in body and bonnet for taps and full drains, length disc guides designed to ensure correct re-assembly.
  - .2 Disc: solid offset taper wedge, bronze to ASTM B62 up to and including NPS 3, bronze rings rolled into cast iron disc on other sizes, secured to bronze stem to ASTM B62.
  - .3 Seat rings: renewable bronze to ASTM B62, screwed into body.
  - .4 Stem: bronze to ASTM B62.
- .3 NPS 10 - 24, cast iron, bronze trim, solid wedge disc:
  - .1 Body and multiple-bolted bonnet: cast iron to ASTM A126 Class B for sizes up to NPS 14, Class C for sizes NPS 16 and over, with bosses in body and bonnet for taps and drains, full length disc guides designed to ensure correct re-assembly, body tie ribs between bonnet and end flanges.
  - .2 Disc: solid offset taper wedge, with bronze rings to ASTM B62 rolled into cast iron disc, secured to stem.

- .3 Seat rings: renewable bronze to ASTM B62 screwed into body.
- .4 Stem: bronze to ASTM B62.
  
- .4 NPS 2½ - 12, cast steel rising stem, OS&Y, solid wedge disc:
  - .1 Body and multiple-bolted integral yoke and bonnet: cast steel to ASTM A216/A216M WCB, with full length disc guides designed to ensure correct re-assembly.
  - .2 Bonnet studs: to ASTM A193/A193M Type B7.
  - .3 Bonnet nuts: to ASTM A194/A194M Type 2H.
  - .4 Stuffing box: including non-galling two-piece ball jointed packing gland, with swing-type eye bolts and nuts.
  - .5 Gland packing: containing corrosion inhibitor to prevent stem pitting.
  - .6 Yoke sleeve: Ni-Resist, minimum melting point above 954°C.
  - .7 Hydraulic grease fitting: for lubrication of yoke sleeve bearing surfaces.
  - .8 Disc: with disc stem ring to connect to stem, guided throughout its travel.
    - .1 NPS 2½ - 6: Solid corrosion and heat resistant 13% chromium steel with minimum hardness of 350 HB.
    - .2 NPS 8 and larger: Carbon steel faced with corrosion and heat resistant 13 chromium steel with minimum hardness of 350 HB.
  - .9 Seat ring: seamless carbon steel with hard-faced cobalt-chromium-tungsten alloy seating surface, slipped in, seal welded, ground to match disc.
  - .10 Stem: heat treated corrosion and heat resistant 13% chromium steel with accurately-cut precision-machined Acme or 60° V threads, top screwed for handwheel nut, T-head disc-stem connection.

## 2.3 CHECK VALVES

- .1 NPS 2 and under, bronze swing type, bronze disc:
  - .1 Standard specification: MSS SP-80.
  - .2 Connections: with hex. shoulders.
  - .3 Body: Y-pattern with integral seat at 45°, screw-in cap with hex head.
  - .4 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.
  
- .2 NPS 2½ and over, cast iron:
  - .1 Body and bolted cover: with tapped and plugged opening on each side for hinge pin.
    - .1 Up to NPS 16: cast iron to ASTM A126 Class B.
    - .2 NPS 18 and over: cast iron to ASTM A126 Class C.
  - .2 Disc: Rotating for extended life.
    - .1 Up to NPS 6: bronze to ASTM B62.
    - .2 NPS 8 and over: bronze-faced cast iron.
  - .3 Seat rings: renewable bronze to ASTM B62 screwed into body.
  - .4 Hinge pin, bushings: renewable bronze to ASTM B62.
  
- .3 NPS 2½ and over, cast steel:
  - .1 Body and multiple-bolted cap: cast steel to ASTM A216/A216M WCB.
  - .2 Cap studs: to ASTM A193/A193M Type B7.
  - .3 Cap nuts: to ASTM A194/A194M Type 2H.

- .4 Body/cap joint: male-female face with corrugated metallic gasket.
- .5 Disc: heat treated corrosion and heat resistant 13% chromium steel.
- .6 Seat rings: heat treated corrosion and heat resistant 13% chromium steel, slipped in, seal welded, ground to match disc.

## 2.4 SEWAGE CHECK VALVES

- .1 NPS 1¼ to 3 full flow no restriction cast iron type:
  - .1 Application: Vertical or horizontal sewage installation.
  - .2 Neoprene polyester reinforced flapper with cast iron & non-corrosive metal backing plates and stainless steel hardware.
  - .3 Corrosion resistant powder coated epoxy finish.
  - .4 Rated at 345 kPa (50 psi) at 54°C (130°F).

## 2.5 BALL VALVES

- .1 NPS 4 and under:
  - .1 Body and cap: cast high tensile bronze to ASTM B62 or brass to ASTM B16/B16M C36000.
  - .2 Stem: tamperproof ball drive.
  - .3 Stem packing nut: external to body.
  - .4 Ball and seat: replaceable chrome plated brass solid full port ball and Teflon seats.
  - .5 Stem seal: TFE with external packing nut.
  - .6 Operator: removable lever handle.
  - .7 Extended handle on chilled water service.

## 2.6 BUTTERFLY VALVES

- .1 NPS 2½ and over, lug body, dead end type:
  - .1 To MSS SP-67, Class 150, 1.4 Mpa WOG, cast iron or semi-steel body, ductile iron or bronze disc, stainless steel stem, replaceable EPDM liner and nylon coated ductile iron seat, locking handle.
  - .2 Operators:
    - .1 NPS 2½ to 5: locking type lever handle.
    - .2 NPS 6 and over: gear operator.
  - .3 Extended handle on chilled water service.

## 2.7 Circuit Balancing Valves (CBV)

- .1 General:
  - .1 Y style globe valve, designed to provide precise flow measurement and control, with valved ports for connection to differential pressure meter.

- .2 Accuracy:
  - .1 Readout to be within plus or minus 2% of actual flow at design flow rate.
- .3 Pressure die-cast dezincification resistant copper alloy construction, Teflon disc, screw-in bonnet.
  - .1 Flow control: At least four 4 full turns of handwheel with digital handwheel and tamperproof concealed mechanical memory.
- .4 Insulation:
  - .1 Use prefabricated shipping packaging of 5.4 R polyurethane as insulation.
- .5 Drain connection:
  - .1 NPS 3/4 valved and capped, suitable for hose socket.
  - .2 Incorporated into valve body or provided as separate item.
- .6 Size:
  - .1 Valve to be sized for a minimum pressure drop of 6 kPa (2 ft.) at design flow at mid range. Ppipe reducers as required.
- .7 Acceptable material: Armstrong CBV, or Bell & Gossett, Tour & Anderson.

## 2.8 LUBRICATED PLUG VALVES

- .1 Valve:
  - .1 Body: cast iron to ASTM A126 Class B semi-steel.
  - .2 Plug: cylindrical or tapered, with regular Venturi or round pattern port - 90° from full open to fully closed.
  - .3 Number of ports: 2.
  - .4 Ends: with hexagon shoulders, ends screwed to ASME B1.20.1 up to NPS 3; Flanged to ASME B16.1 NPS 4 and over.
  - .5 Lubrication system, nickel-plated.
  - .6 Lubricant: to suit type, temperature and pressure of contained fluid.
  - .7 Feeding system: lubricant forced into lubrication grooves between seating surfaces of plug and body to form positive seal, leakproof operation, and corrosion preventing film. Lubricant receptacle to hold additional lubricant. Lubricant screw for lubrication. Check valve to prevent reverse flow of lubricant. O-rings between body and plug.
- .2 Operator: manual - lever.
- .3 Accessories: lubricant gun.
- .4 Testing: to ASME B16.34.

## **PART 3 EXECUTION**

### **3.1 ACCEPTABLE PRODUCTS TABLE**

- .1 Refer to Acceptable Products Table in Part 3 of this section.

### **3.2 Installation**

- .1 Install rising stem valves in upright position with stem above horizontal.
- .2 Handwheel with chain operators are to be installed on all valves more than 3 metres above floor.
- .3 Remove internal parts before soldering or brazing.
- .4 Install all valves such that adequate clearance is provided to allow for obstruction free operation.
- .5 Install valves at all branch take-offs and to isolate each piece of equipment, and as indicated.
- .6 For all threaded valves provide one screwed union beside each valve to allow easy replacement of valve.
- .7 Install all valves as per manufacturer's recommendation.

**Domestic, Chilled & Heating Water/Glycol up to 200 psi**

Valve Type			Crane	Jenkins	Toyo	Victaulic	Kitz
Ball	NPS 4 & Under	Solder	9202 ( up to 3")	202J ( up to 3")	5049A	-	59
		Threaded	9201 (up to 4")	201J ( up to 4")	5044A	722	58
Butterfly	NPS 2½ & Over	Flanged	44BXZ	2232EJ	928 BESL/G	-	6122 EL/G
		Grooved (steel)	-	-		Vic-300	-
		Grooved (copper)	-	-		Vic-608	-
Check	NPS 2 & Under	Solder	1342	4093J	237	-	23
		Threaded	37	4037	236	-	22
	NPS 2½ & Over	Flanged	373	587J	435	-	78
		Grooved	-	-		716	-
Balancing	NPS 2 & Under	Solder	<b>Tour &amp; Anderson</b> STAS	<b>Armstrong</b> CBV-S	<b>Bell &amp; Gossett</b> CB-S		
		Threaded	STAD	CBV-T	CB		
	NPS 2½ & Over	Flanged	STAF-SG	CBV-G	CB-F		
		Grooved	STAG	CBV-G	CB-G		

**Water Entry**

Valve Type			Watts
Gate	NPS 4 & Over	Flanged	4080 SYRW

**Low Pressure Steam & Condensate (0 to 15 psi)**

Valve Type			Crane	Jenkins	Toyo	Kitz
Gate	NPS 2 & Under	Threaded	428	810J	293	24
	NPS 2½ & Over	Flanged	465-1/2	454J	421	72
Check	NPS 2 & Under	Threaded	37	4037J	236	22
	NPS 2½ & Over	Flanged	373	587J	535	78

**High Pressure Steam (15 to 150 psi)**

Valve Type			Crane	Jenkins	Toyo	Bonney Forge	Kitz
Gate	NPS 2 & Under	Threaded	431UB	2810	298	-	42
	NPS 2½ & Over	Flanged	47UF	J1009B8F	-	1-11-RF	150 SCLS
Check	NPS 2 & Under	Threaded	137	4475J	238	-	29
	NPS 2½ & Over	Flanged	147XUF	J1025B2	-	1-61-RF	150 SCQS

**Natural Gas**

Valve Type			Crane	Jenkins	Toyo	Kitz
Ball	2" & Under	Threaded	9201	201J	5044A	58
Lubricated Plug	¾" - 2"	Threaded	<b>Newman Milliken</b> 170M	<b>Kitz</b>		
Lubricated Plug	2" & Over	Flanged	171M	150 SCTAM-FS		

**Sanitary & Storm Pump Discharge up to 200 psi**

Valve Type			Crane	Jenkins	Toyo	Victaulic	Kitz
Ball	NPS ½ to 4	Screwed	9201	201J	5044A	722	58
Check	NPS 1¼ to 3	Screwed	<b>Zoeller</b> 30-01 series				



## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME B31.1-2016, Power Piping, (SI Edition).
- .2 American Society for Testing and Materials (ASTM)
  - .1 ASTM A123/A123M-17, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - .2 ASTM A125-96(2013)e1, Specification for Steel Springs, Helical, Heat-Treated.
  - .3 ASTM A153/A153M-16a, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - .4 ASTM A307-14e1, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
  - .5 ASTM A563-15, Specification for Carbon and Alloy Steel Nuts (Metric).
  - .6 ASTM D1929-16, Standard Test Method for Determining Ignition Temperature of Plastics.
- .3 Factory Mutual (FM)
- .4 Manufacturer's Standardization Society of the Valves and Fittings Industry (MSS)
  - .1 MSS SP-58-2009, Pipe Hangers and Supports - Materials, Design, Selection, Manufacture, Application, and Installation.
- .5 Underwriter's Laboratories of Canada (ULC).

### **1.3 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 ASME B31.1 or MSS SP-58.
- .3 Ensure that supports, guides, anchors do not transmit excessive quantities of heat to building structure.



- .4 Design hangers and supports to support systems under all conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipework or connected equipment.
- .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment to be in accordance with MSS SP-58.

#### **1.4 DESIGN FOR SEISMIC EVENTS**

- .1 Design supports, platforms, hangers, racks to withstand seismic events as specified Section 20 05 49.01 - Seismic Restraint Systems (SRS).

#### **1.5 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Submit shop drawings and product data for following items:
  - .1 All bases, hangers and supports.
  - .2 Connections to equipment & structure.
  - .3 Structural assemblies.

#### **1.6 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

### **PART 2 sPRODUCTS**

#### **2.1 GENERAL**

- .1 Fabricate hangers, supports and sway braces in accordance with ANSI B31.1 and MSS SP-58.
- .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 copper plated or 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 2½ or greater, all hot piping: Malleable iron beam clamp, eye rod, jaws and extension with carbon steel retaining clip, tie rod, nuts and washers, UL listed to MSS SP-58.
- .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 to MSS SP-58.
  - .2 Cold piping NPS 2½ or greater, all hot piping: Malleable iron top-of-beam jaw-clamp with hooked rod, spring washer, plain washer and nut UL listed.
- .4 Upper attachment to concrete.
  - .1 Ceiling: Carbon steel welded rod, clevis plate, clevis pin and cotters with forged weldless steel nut.
  - .2 Concrete wedge anchor with knockout protector plate UL listed to MSS SP-58. Anchor installation to be via concrete pre-drilling. Impact insert type anchor not allowed.
- .5 Manufacturer assemblies:
  - .1 Sway braces for seismic restraint systems: to Section 20 05 49.01 - Seismic Restraint Systems (SRS).
- .6 Hanger rods: threaded rod material to MSS SP-58.
  - .1 Ensure that hanger rods are subject to tensile loading only.
  - .2 Provide linkages where lateral or axial movement of pipework is anticipated.
  - .3 Do not use 22 mm or 28 mm rod.
- .7 Pipe attachments: material to MSS SP-58.
  - .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.
- .8 Adjustable clevis: material to MSS SP-58 UL listed, clevis bolt with nipple spacer and vertical adjustment nuts above and below clevis. Ensure "U" has hole in bottom for riveting to insulation shields.
- .9 Yoke style pipe roll: carbon steel yoke, rod and nuts with cast iron roll, to MSS SP-58.
- .10 U-bolts: carbon steel to MSS SP-58 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.
- .11 Pipe rollers: cast iron roll and roll stand with carbon steel rod to MSS SP-58, Type 43.
  - .1 Finish: Hot dipped galvanized steel.
  - .2 Acceptable material: Tolco or approved equal.

### **2.3 RISER CLAMPS**

- .1 Steel or cast iron pipe: black carbon steel to MSS SP-58, type 42, UL listed.
- .2 Copper pipe: carbon steel copper plated to MSS SP-58, type 42.
- .3 Bolts: to ASTM A307.
- .4 Nuts: to ASTM A563.

### **2.4 INSULATION PROTECTION SHIELDS**

- .1 Insulated cold piping: 64 kg/m<sup>3</sup> density insulation plus insulation protection shield to: MSS SP-58, galvanized sheet carbon steel. Length designed for maximum 3 m span.
- .2 Insulated hot piping: Curved plate 300 mm long, with edges turned up, welded-in centre plate for pipe sizes NPS 12 and over, carbon steel to comply with MSS SP-58.

### **2.5 CONSTANT SUPPORT SPRING HANGERS**

- .1 Springs: alloy steel to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.
- .2 Load adjustability: 10% minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.
- .3 Provide upper and lower factory set travel stops.
- .4 Provide load adjustment scale for field adjustments.
- .5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.
- .6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

## **2.6 VARIABLE SUPPORT SPRING HANGERS**

- .1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.
- .2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with 2 springs in series in single casing.
- .3 Variable spring hanger to be complete with factory calibrated travel stops.
- .4 Steel alloy springs: to ASTM A125, shot peened, magnetic particle inspected, with +/-5% spring rate tolerance, tested for free height, spring rate, loaded height and provided with CMTR.

## **2.7 EQUIPMENT SUPPORTS**

- .1 Fabricate equipment supports not provided by equipment manufacturer from structural grade steel meeting requirements of Section 05 12 23 - Structural Steel. Submit calculations with shop drawings.

## **2.8 Equipment Anchor Bolts and Templates**

- .1 Provide templates to ensure accurate location of anchor bolts.
- .2 For attachment to concrete, provide concrete wedge anchors with knockout protection plate UL listed. Anchor installation to be via concrete pre-drilling. Impact insert type anchor not allowed.

## **2.9 HOUSE-KEEPING PADS**

- .1 For base-mounted equipment: Concrete, at least 100 mm high, 50 mm larger than equipment all around, with chamfered edges and anchored to the structural slab.
- .2 Concrete: to Section 03 30 00 - Cast-in-place Concrete.

## **2.10 PIPE, DUCT, CONDUIT PENETRATIONS THROUGH SLABS**

- .1 Where piping or conduits penetrate through the floor of mechanical room, a 100 mm high housekeeping pad shall be installed with minimum 150 mm between conduit/pipe and the edge of the pad. This pad shall be bonded to the existing slab through which the pipes, ducts or conduit shall pass.

## 2.11 ROOF MOUNTED SUPPORTS

- .1 Pressure treated lumber supports are only acceptable when roofed in/covered by general trades. Exposed applications are not acceptable.
- .2 Portable Support System: Engineered, portable system specifically designed for installation without the need for roof penetrations or flashings, and without damage to the roofing membrane.
  - .1 Design system using high density polypropylene bases and structural steel framing.
  - .2 Custom design system to fit piping, conduits, equipment, or walkways to be installed and actual conditions of service and loading.
  - .3 Piping Supports: Provide suitable hangers and supports.
  - .4 Pipe support system shall have seismic ratings and meet Section 20 05 49.01 - Seismic Restraint Systems (SRS).
- .3 Bases: Injection molded high density polypropylene with UV-inhibitors or recycled rubber conforming to the following:
  - .1 Moisture content: Negligible.
  - .2 Shrinkage/swelling due to moisture: Negligible.
  - .3 Density: 894 kg/m<sup>3</sup> (55.8 lbs./ft.<sup>3</sup>).
  - .4 Insect resistance: No known insect damage potential.
  - .5 Chemical resistance (oil, brake fluid, gasoline, diesel, antifreeze, battery acid, sulfuric acid: no visual or physical change apparent.
  - .6 Flammability: No ignition after 10 minutes, 25 kW/m, when tested in accordance with ASTM D1929.
  - .7 Sized as required by loading conditions and as indicated on the drawings.
  - .8 Shop fabricated with inserts for square tubing or threaded rods as required.
  - .9 Colour: Integral black colour as molded.
- .4 Steel Framing:
  - .1 Strut Types: 1-5/8 in. (41.3 mm) B22TH or 1-7/8 in. (47.6 mm) BTS22H, as required for loading conditions.
  - .2 Thickness: 12 gauge (2.7 mm).
  - .3 Form: Roll-formed 3-sided or tubular shape, perforated with 9/16 in. (14.3 mm) holes at 1-7/8 in. (47.6 mm) centres on three (3) sides.
  - .4 Finish: Hot dip galvanize in accordance with ASTM A123/A123M after fabrication, free of roughness, whiskers, unsightly spangles, icicles, runs, barbs, sags, droplets, and other surface blemishes.
- .5 Pipe Supports and Hangers: Conform to MSS SP-58 and as follows:
  - .1 Fabricate of carbon steel where framing is carbon steel; fabricate of stainless steel where framing is stainless steel; finished same as framing.
  - .2 Sizes 2-1/2 in. (63 mm) and smaller: Single roller supports for piping subject to expansion and contraction; 3-sided channels and pipe clamps.
  - .3 Sizes 3 in. (76 mm) and larger: Rollers, clevis hangers, or band hangers, to allow for expansion and contraction without movement of the bases or framing.

- .6 Accessories: Clamps, bolts, nuts, washers, and other devices as required for a complete system:
  - .1 Carbon steel: Hot-dip galvanized in accordance with ASTM A153/A153M.
  - .2 Stainless steel: mill finish.
- .7 Acceptable material: Portable Pipe Hangar Model PPH-D, Miro Industries Model 8-DS, Mifab CPORT-2015, Big Foot Systems, or approved equal.

### **PART 3 EXECUTION**

#### **3.1 INSTALLATION**

- .1 Install in accordance with: manufacturer's instructions and recommendations.
- .2 Vibration Control Devices:
  - .1 Install on piping systems at pumps and elsewhere 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 be to industry standards.
  - .3 Steel pipes: Install below coupling or shear lugs welded to pipe.
  - .4 Cast iron pipes: Install below joint.
- .4 Clevis plates:
  - .1 Attach to concrete with 4 minimum concrete inserts, one at each corner.
- .5 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .6 Use approved constant support type hangers where:
  - .1 vertical movement of pipework is 13 mm or more,
  - .2 transfer of load to adjacent hangers or connected equipment is not permitted.
- .7 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.
- .8 When attaching to open web steel joists provide additional hangers for pipes with diameters of 75 mm or greater in order to reduce the magnitude of the concentrated load and spread the load to the joists equally. In these cases the allowable spacing of hangers for pipes permitted under ASME / MSS SP-58 will be reduced and additional hangers will be required as directed by steel fabricator and/or structural engineer.

- .9 Locate hangers at the top of open web steel joists where the horizontal and diagonal members meet at a joint.
- .10 All installations must be in conjunction with Section 20 05 49.01 - Seismic Restraint System.

### 3.2 HANGER SPACING

- .1 Plumbing piping: most stringent requirements of Manufacturer's recommendations, Canadian Plumbing Code, Provincial Code, or authority having jurisdiction.
- .2 Fire protection: to applicable fire code.
- .3 Gas & fuel piping: to applicable code.
- .4 Copper piping: up to NPS ½: 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 300 mm of each elbow.

Maximum Pipe Size: NPS	Maximum Spacing Steel	Maximum Spacing Copper	Maximum Spacing XFR
up to 1¼	2.1 m	1.8 m	1.6 m
1½	2.7 m	2.4 m	1.6 m
2	3.0 m	2.7 m	1.8 m
2½	3.6 m	3.0 m	1.8 m
3	3.6 m	3.0 m	2.2 m
4	4.2 m	3.6 m	2.6 m
6	5.1 m		3.1 m
8	5.7 m		3.6 m
10	6.6 m		4.0 m
12	6.9 m		4.4 m

- .7 Pipework greater than NPS 12: to MSS SP-58.

### 3.3 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.

### **3.4 HORIZONTAL MOVEMENT**

- .1 Angularity of rod hanger resulting from horizontal movement of pipework from cold to hot position not to exceed 4° 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.

### **3.5 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: Follow manufacturer's recommended written instructions and torque values when tightening C-clamps to bottom flange of beam.
- .4 Beam clamps: Hammer jaw firmly against underside of beam.

**END OF SECTION**





## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .1 Canadian General Standards Board (CGSB).
  - .1 CAN/CGSB-24.3-92, Identification of Piping Systems.
- .2 Canadian Standards Association (CSA).
  - .1 CSA B149.1-15, Natural Gas and Propane Installation Code.
  - .2 CSA Z7396.1-1. Medical gas pipeline systems - Part 1: Pipelines for medical gases, medical vacuum, medical support gases, and anaesthetic gas scavenging systems.
- .3 National Fire Protection Association
  - .1 NFPA (Fire) 13, Installation of Sprinkler Systems, 2016 Edition.

### **1.3 PRODUCT DATA**

- .1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Product data to include paint colour chips, all other products specified in this section.

### **1.4 SAMPLES**

- .1 Submit samples in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Samples to include nameplates, labels, tags, lists of proposed legends.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- .1 Identification systems to be in accordance with existing building NRC standard. If there is

## 2.2 MANUFACTURER'S EQUIPMENT NAMEPLATES

- .1 Plastic laminate nameplate mechanically fastened to each piece of equipment by manufacturer.
- .2 Lettering and numbers to be 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.

## 2.3 SYSTEM NAMEPLATES

- .1 Colours:
  - .1 Hazardous: red letters, white background.
  - .2 Elsewhere: black letters, white background.
- .2 Construction:
  - .1 1/8" thick laminated plastic , matte finish, with square corners, letters accurately aligned and machine engraved into core.
- .3 Sizes:
  - .1 Conform to following table:

Size #	Height Sizes (mm)	No. of Lines	Height of Letters(mm)
1	40	1	20
2	75	1	50
  - .2 Use maximum of 25 letters/numbers per line.
- .4 Locations:
  - .1 Terminal cabinets, control panels: Use size #1.
  - .2 Equipment in Mechanical Rooms: Use size #2.

## 2.4 PIPING SYSTEMS GOVERNED BY CODES

- .1 Identification:
  - .1 Natural gas: To CSA B149.1.
  - .2 Sprinklers: To NFPA (Fire) 13.
  - .3 Medical Gas: To CSA Z7396.1.

## 2.5 IDENTIFICATION OF PIPING SYSTEMS

- .1 Identify contents by background colour marking, legend; direction of flow by arrows. To CAN/CGSB-24.3 except where specified otherwise.
- .2 Legend:
  - .1 Block capitals to sizes and colours listed in CAN/CGSB-24.3.
- .3 Arrows showing direction of flow:
  - .1 Continuous wrap full diameter of pipe at each end of pipe identification markers.
- .4 Extent of background colour marking:
  - .1 To full circumference of pipe or insulation.
  - .2 Length to accommodate full length of legend and arrows.
- .5 Materials for background colour marking, legend, arrows:
  - .1 Pipes and tubing 3/4" and smaller: Waterproof and heat-resistant pressure sensitive plastic marker tags.
  - .2 All other pipes: Pressure sensitive plastic-coated cloth or vinyl with protective overcoating, waterproof contact adhesive undercoating, suitable for ambient of 100% RH and continuous operating temperature of 300°F and intermittent temperature of 400°F.
- .6 Colours and Legends:
  - .1 Where not listed, obtain direction from Engineer.
  - .2 Colours for legends, arrows: To following table:
 

Background colour:	Yellow	Legend, arrows:	BLACK
	Green		WHITE
	Red		WHITE

- .3 Background colour marking and legends for piping systems:

	Background colour marking	Legend
Contents		
Chilled water supply	Green	CH. WTR. SUPPLY
Chilled water return	Green	CH. WTR. RETURN
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
Safety valve vent	Yellow	STEAM VENT
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HWS recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS (add source)
Storm water	Green	STORM
Sanitary	Green	SAN.
Plumbing vent	Green	SAN. VENT
Refrigeration suction	Yellow	REF. SUCTION
Refrigeration liquid	Yellow	REF. LIQUID
Refrigeration hot gas	Yellow	REF. HOT GAS

Contents	Background colour marking to codes	Legend
Natural gas	Green	COMP. AIR kPa
Compressed air (<700 kPa)	Green	VACUUM SAN
Vacuum Sanitary	Green	

## 2.6 IDENTIFICATION DUCTWORK SYSTEMS

- .1 150 mm (6") high stencilled letters and directional arrows 150 mm (6") long x 50 mm (2") high.
- .2 Colours: Black, or co-ordinated with base colour to ensure strong contrast.

## 2.7 MECHANICAL EQUIPMENT, VALVES CONTROLLERS, PUMPS, BOILERS, FAN COIL, ETC.

- .1 Lamicoid tag with 13 mm (½") stamped identification data filled with black paint.
- .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.
- .3 Brass tags with 13 mm (½") stamped identification data filled with black paint.
- .4 Brass tags to be stamped with system identification and valve number system as outlined below:

SYSTEM	BRASS TAG STAMP
Domestic Cold Water	DC-1,2, ...
Domestic Hot Water	DH-1,2, ...
Storm	ST-1,2, ...
Sanitary	SA-1,2, ...
Heating Water	HW-1,2, ...
Chilled Water	CH-1,2, ...
Compressed Air	CA-1,2, ...
Natural gas	NG-1,2, ...
Refrigerant	Re-1,2, ...

## 2.8 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.

## **2.9 LANGUAGE**

- .1 Identification to be in English.

## **PART 3 EXECUTION**

### **3.1 TIMING**

- .1 Provide identification only after all painting specified in Architectural section is complete re: Interior Painting has been completed.

### **3.2 INSTALLATION**

- .1 Perform work in accordance with CAN/CGSB-24.3 except as specified otherwise.
- .2 Provide ULC and CSA registration plates as required by respective agency.

### **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 in any way.

### **3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS**

- .1 On long straight runs in open areas in boiler rooms, equipment rooms, galleries, tunnels: At not more than 17 m (55 ft.) 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, other confined spaces, at entry and exit points, and at each access opening.
- .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, dampers, etc. Where this is not possible, place identification as close as possible, preferably on upstream side.
- .9 Identification to be easily and accurately readable from usual operating areas and from access points.
- .10 Position of identification to be 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.
- .11 At branch take-offs on both main and branch.

### **3.5 MECHANICAL EQUIPMENT, VALVES, CONTROLLERS**

- .1 Valves and operating controllers, except at 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 Engineer. Provide one copy (reduced in size if required) in each operating and maintenance manual.
- .3 Number valves in each system consecutively.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .1 American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE).

### **1.3 GENERAL**

- .1 TAB means to test, adjust and balance to perform in accordance with requirements of Contract Documents and to do all other work as specified in this section.

### **1.4 QUALIFICATIONS OF TAB PERSONNEL**

- .1 Names of all personnel it is proposed to perform TAB to be submitted to and approved by Engineer within 90 days of award of contract.
- .2 Provide documentation confirming qualifications, successful experience.
- .3 The following are acceptable TAB contractors:
  - .1 TAB Inspecting
  - .2 Aerodynamics & Associates Testing Services Ltd. (N.B.C.T.A., ASHRAE)
  - .3 Maxima Technical Services Inc.
  - .4 Kanata Air Balancing & Engineering (C.A.A.B.C.)
  - .5 Brassard Adjustments & Calibrations Inc.
  - .6 Evenflow Balancing Co.

### **1.5 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 so as to meet specified performance requirements and to achieve specified interaction with all other related systems under all normal and emergency loads and operating conditions.



- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

## **1.6 EXCEPTIONS**

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

## **1.7 CO-ORDINATION**

- .1 Schedule time required for TAB (including repairs, re-testing) into project construction and completion schedule so as 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.
- .3 Coordinate TAB with controls, mechanical and electrical contractors.

## **1.8 PRE-TAB REVIEW**

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

## **1.9 START-UP**

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.
- .2 Follow special start-up procedures specified elsewhere in Divisions 20, 21, 22, 23 & 25.

## **1.10 OPERATION OF SYSTEMS DURING TAB**

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

## 1.11 START OF TAB

- .1 Notify Engineer 7 days prior to start of TAB.
- .2 Start TAB only when building is essentially completed, including:
  - .1 Installation of ceilings, doors, windows, other construction affecting TAB.
  - .2 Application of weatherstripping, sealing, caulking.
  - .3 All pressure, leakage, other tests specified elsewhere in Divisions 20, 21, 22, 23 & 25.
  - .4 All provisions for TAB installed and operational.
- .3 Start-up, verification for proper, normal and safe operation of all 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 Filters 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 All 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.
  - .4 Combustion air:
    - .1 With all heating appliances, within the boiler room, operating on high fire, measure:
      - .1 Combustion air volume entering boiler room from outside.
    - .2 Differential pressure to:
      - .1 Outside
      - .2 Adjacent areas of the building.
    - .3 With all heating appliances on high fire, check each natural draft appliance diverter for any back draft.

## 1.12 APPLICATION TOLERANCES

- .1 Do TAB to following tolerances of design values:
  - .1 Laboratory HVAC systems: plus 10%, minus 0%.
  - .2 All other HVAC systems: plus 5%, minus 5%.
  - .3 Hydronic systems: plus or minus 10%.

### **1.13 ACCURACY TOLERANCES**

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

### **1.14 INSTRUMENTS**

- .1 Prior to TAB, submit to Engineer list of instruments to be 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 Engineer.

### **1.15 SUBMITTALS**

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

### **1.16 PRELIMINARY TAB REPORT**

- .1 Submit for checking and approval of Engineer, 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.

### **1.17 TAB REPORT**

- .1 Format to be in accordance with Associated Air Balancing Council (AABC/CAABC).
- .2 TAB report to show all results in SI units or Imperial (IP), to match drawings and specifications, and to include:
  - .1 Project record drawings.
  - .2 System schematics.
- .3 Submit pdf electronic copy of TAB Report to Engineer for verification and approval.

### **1.18 VERIFICATION**

- .1 All reported results subject to verification by Engineer.

- .2 Provide manpower and instrumentation to verify up to 30% of all reported results.
- .3 Number and location of verified results to be at discretion of Engineer.
- .4 Bear costs to repeat TAB as required to satisfaction of Engineer.
- .5 At request of commissioning agent, provide manpower and instrumentation to verify an additional 30% of all reported results.

### **1.19 SETTINGS**

- .1 After TAB is completed to satisfaction of Engineer, replace drive guards, close all access doors, lock all devices in set positions, ensure sensors are at required settings.
- .2 Permanently mark all settings to allow restoration at any time during life of facility. Markings not to be eradicated or covered in any way.

### **1.20 COMPLETION OF TAB**

- .1 TAB to be considered complete only when final TAB Report received and approved by Engineer.

### **1.21 SYSTEMS**

- .1 Quality assurance: Perform TAB under direction of supervisor qualified by AABC.
- .2 Air Systems: Include both specified and measured data.
  - .1 Air Handling Equipment:
    - .1 Maximum air flow volume.
    - .2 Fan total pressure.
    - .3 Motor volts, amps and power.
    - .4 Minimum outside air volume.
    - .5 Fan rotational speed.
    - .6 Fan Power, calculate fan efficiency.
    - .7 Inlet and outlet dry bulb, wet bulb and dewpoint temperatures.
    - .8 Equipment static pressure profile.
    - .9 Noise.
    - .10 Vibration.
  - .2 Duct Air Quantities - Mains and Branches:
    - .1 Duct size.
    - .2 Number of pressure/velocity readings per traverse.
    - .3 Sum of velocity measurements.
    - .4 Average velocity.
    - .5 Duct air flow volume.
    - .6 Barometric pressure and duct air temperature.

- .3 Air Outlets:
  - .1 Outlet location and designation.
  - .2 Manufacturers catalogue identification and type.
  - .3 Air outlet flow factors. Use 1.0 when flow hood is used.
  - .4 Air flow volumes.
  - .5 Deflector vane or diffuser cone settings.
  
- .3 Hydronic Systems: Include both specified and measured data.
  - .1 Pumps:
    - .1 Discharge and suction pressures, at design flow and no flow.
    - .2 Fluid flow rate. Calculate from pump curves if metering not provided.
    - .3 Motor volts, amps, power.
    - .4 RPM.
    - .5 Noise.
    - .6 Vibration.
  - .2 Piping Systems:
    - .1 Supply and return of each primary loop.
    - .2 Supply and return of each secondary loop.
  - .3 Heating Equipment:
    - .1 Equipment type, location and designation.
    - .2 Fluid used. Identify fluid used; water, % water/ethylene glycol mixes, steam, etc.
    - .3 Fluid flow rate.
    - .4 Fluid Specific Heat, at mean temperature.
    - .5 Fluid Specific Gravity, at mean temperature.
    - .6 Fluid entering and leaving temperatures and pressures.
    - .7 Heat transfer rate.

## **1.22 PLUMBING SYSTEMS**

- .1 Inlet and outlet temperature of each heater or tank.
- .2 Main supply piping main branch piping.
- .3 Flush valves adjusted to suit project pressure conditions.

## **1.23 OTHER SYSTEMS**

- .1 Plumbing systems:
  - .1 Controlled flow roof drain systems: adjust weirs to suit actual roof conditions, slopes, areas drained.
  - .2 Pumped sanitary and storm water systems: test for proper operation at all possible flow rates.

- .2 Building pressure conditions:
  - .1 Adjust HVAC systems, equipment, controls to ensure specified pressure conditions at all times.
- .3 Zone pressure differences:
  - .1 Adjust HVAC systems, equipment, controls to establish specified air pressure differentials, with all systems in all possible combinations of normal operating modes.

#### **1.24 POST- OCCUPANCY TAB**

- .1 Participate in systems checks twice during Warranty Period - #1 approximately 3 months after acceptance and #2 within 1 month of termination of Warranty Period.

#### **1.25 SOUND PRESSURE LEVEL DATA**

- .1 Overall A-weighted Sound Pressure Level readings.
- .2 Plot octave-band frequency, 63 to 8000 Hz, sound pressure readings on Noise Criteria graph paper to show relationship between measured level and specified NC level.
- .3 For outdoor equipment or community noise measurements provide a diagram or description of relationship of sound source to measuring instrument.
- .4 HVAC Noise Inside Building:
  - .1 The objective is to measure Sound Pressure Level within each occupied room created by entire HVAC system and to evaluate these in terms of the recommended maximum background noise levels for each type or area. Investigate areas found to be in excess of recommended maximum levels and take corrective action.
  - .2 Follow testing procedures specified under "Acoustic Measurement Procedure".
  - .3 Measure overall, A-weighted Sound Pressure Level in most cases. In more critical areas determine RC - Room Criteria level.
  - .4 Take minimum of one reading per 30 m<sup>2</sup> of floor area, but no less than one reading in any one enclosed room or open area which will be occupied.
  - .5 Take measurements with system operating in its loudest normal condition which is typically the summer mode.
  - .6 Take measurements in rooms equipped with exhaust fans or unit heaters or cabinet heaters with fan "on" and fan "off" conditions.
  - .7 Measure sound pressure levels in rooms directly beneath roof top towers, condensers, furnaces, etc. with units running at maximum speed or capacity.
  - .8 Compare results with following maximum noise criteria:
    - .1 Private Office, Library, Open Plan Office : 42 dB(A)
    - .2 Cafeteria, Washrooms, Circulation/Waiting Areas: 47 dB(A)
    - .3 Computer Equipment Room, Kitchen, Laboratory: 52 dB(A)
    - .4 Light Maintenance Shops: 57 dB(A)
  - .9 Determine RC levels for any areas found to be in excess of recommended maximum A-weighted noise level or where any unusually loud or distinct noises, rumble, hiss, tone,

ballast hum, etc., are heard. In these areas measure unweighted octave band sound pressure levels from 31.5 Hz to 8000 Hz. Plot this data on RC curve charts.

## **PART 2 PRODUCTS**

### **2.1 NOT USED**

- .1 Not used.

## **PART 3 EXECUTION**

### **3.1 BALANCING AND ADJUSTING PREPARATION**

- .1 Perform testing, adjusting and balancing work after equipment and systems starting procedures have been properly completed.
- .2 Perform balancing during heating and cooling season of first year of operation, and at times when directed by Engineer, to ensure proper settings of controls under both summer and winter peak load conditions.
- .3 Vary load to verify operation of system under partial load conditions. Test start-up, shut-down, emergency conditions, safety controls operation and automatic and manual resets and interlocks.
- .4 Cap all instrument test ports. Obtain caps from sheet metal contractor and install.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project. Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM).
  - .1 ASTM B209-14, Specification for Aluminum and Aluminum Alloy Sheet and Plate.
  - .2 ASTM C335/C335M-17, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
  - .3 ASTM C449-07(2013), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - .4 ASTM C921-10(2015), Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-51.10-92, Mineral Fibre Board Thermal Insulation.
  - .2 CAN/CGSB-51.11-92, Mineral Fibre Thermal Insulation Blanket.
  - .3 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .3 Manufacturer's Trade Associations: Thermal Insulation Association of Canada (TIAC): National Insulation Standards.
- .4 Underwriters Laboratories (UL)
  - .1 UL 723, Tests for Surface Burning Characteristics of Building Materials.
- .5 Underwriters Laboratories of Canada (ULC)
  - .1 CAN/ULC S102-10, Surface Burning Characteristics of Building Materials and Assemblies.

### **1.3 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" - will mean "not concealed" as defined herein.
  - .3 Insulation systems - insulation material, fasteners, jackets, and other accessories.
- .2 TIAC Codes:
  - .1 CRD: Code Round Ductwork,
  - .2 CRF: Code Rectangular Finish.



#### **1.4 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for duct jointing recommendations.

#### **1.5 SAMPLES**

- .1 Submit samples in accordance with Section 20 05 01 - Mechanical General Requirements, if requested by Consultant.
- .2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on ½" plywood board. Affix typewritten label beneath sample indicating service.

#### **1.6 Manufacturer's Instructions**

- .1 Submit manufacturer's installation instructions in accordance with Section 20 05 01 - Mechanical General Requirements, if requested by Engineer.
- .2 Installation instructions to include procedures to be used, installation standards to be achieved.

#### **1.7 Qualifications**

- .1 Installer to be specialist in performing work of this section, and have at least 5 years successful experience in this size and type of project, qualified to standards.

#### **1.8 Delivery, Storage and Handling**

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Protect from weather and construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions required by manufacturer.

## **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 as specified herein includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335/C335M.
- .3 TIAC Code C-1: Rigid mineral fibre board to CAN/CGSB-51.10, with 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 CAN/CGSB-51.11 faced with factory applied vapour retarder jacket to CGSB 51-GP-52Ma (as scheduled in PART 3 of this section).
  - .1 Mineral fibre: to CAN/CGSB-51.11.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: to CAN/CGSB-51.11.
  - .4 Density: 24 kg/m<sup>3</sup>.

### **2.3 JACKETS**

- .1 Canvas: 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.
- .3 Aluminum:
  - .1 To ASTM B209 with moisture barrier as scheduled in PART 3 of this section.
  - .2 Thickness: 0.50 mm sheet.
  - .3 Finish: Stucco embossed.
  - .4 Jacket banding and mechanical seals: 19 mm (3/4") wide, 0.5 mm thick stainless steel.
- .4 Acrylic Adhesive (Indoor Applications only):
  - .1 Thickness: 0.18 mm.
  - .2 Finish: Stucco embossed.
  - .3 Peel Adhesion: 18N/25 mm (65 oz./in.)
  - .4 Puncture: 130N (30 lbs.).
  - .5 UL 723 listed (10/20 flame/smoke rating).
  - .6 Acceptable material: VentureClad 1577CW.

## **2.4 ACCESSORIES**

- .1 Vapour retarder lap adhesive: Water based, fire retardant type, compatible with insulation.
- .2 Indoor Vapour Retarder Finish: Vinyl emulsion type acrylic, compatible with insulation.
- .3 Insulating Cement: hydraulic setting on mineral wool, to ASTM C449.
- .4 Outdoor Vapour Retarder Mastic:
  - .1 Vinyl emulsion type acrylic, compatible with insulation.
  - .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m<sup>2</sup>.
- .5 Tape: self-adhesive, aluminum, reinforced, 75 mm (3") wide minimum.
- .6 Contact adhesive: quick-setting
- .7 Canvas adhesive: washable.
- .8 Tie wire: 1.5 mm stainless steel.
- .9 Banding: 19 mm (3/4") wide, 0.5 mm thick stainless steel.
- .10 Facing: 25 mm (1") galvanized steel hexagonal wire mesh stitched on one face of insulation.
- .11 Fasteners: 2 mm diameter pins with 38 mm (1½") diameter clips, length to suit thickness of insulation.

## **PART 3 EXECUTION**

### **3.1 PRE- INSTALLATION REQUIREMENTS**

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

### **3.2 INSTALLATION**

- .1 Install in accordance with TIAC National Standards.
- .2 Apply materials in accordance with manufacturers instructions and this specification.
- .3 Use two layers with staggered joints when required nominal thickness exceeds 75 mm (3").

- .4 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Hangers, supports to be outside vapour retarder jacket.
- .5 Supports, Hangers in accordance with Section 23 05 29 - Bases, Hangers and Supports
  - .1 Apply high compressive strength insulation where insulation may be compressed by weight of ductwork.
- .6 Fasteners: At 300 mm (12") oc in horizontal and vertical directions, minimum two rows each side.

### 3.3 DUCTWORK INSULATION SCHEDULE

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

Thickness	TIAC	Vapour Code	Retarder mm (in.)
Rectangular cold and dual temperature supply & return air ducts in exposed areas including silencers (mechanical room, open ceiling, etc.)	C-1	yes	25 (1")
Cold and dual temperature supply air ducts in concealed ceiling space and all round cold ducts including silencers	C-2	yes	25 (1")
Outside air ducts to mixing plenum	C-1	yes	50 (2")
Supply and return ducts exposed in space being served	none		
Exhaust ducts within 3 m from roof/ exterior wall penetration	C-1	yes	50 (2")
Supply & exhaust rectangular ducts outside	C-1	yes	50 (2")
Acoustically lined ductwork inside building	none		

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

.3 Finishes: Conform to following table:

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

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM) (latest edition).
  - .1 ASTM B209M-14, Specification for Aluminum and Aluminum Alloy Sheet and Plate.
  - .2 ASTM C335/C335M-17, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
  - .3 ASTM C449-07(2013), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - .4 ASTM C921-10(2015), Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-51.2-95, Thermal Insulation, Calcium Silicate, for Piping, Machinery and Boilers.
  - .2 CAN/CGSB-51.9-92, Mineral Fibre Thermal Insulation for Piping and Round Ducting.
  - .3 CAN/CGSB-51.10-92, Mineral Fibre Board Thermal Insulation.
  - .4 CAN/CGSB-51.11-92, Mineral Fibre Thermal Insulation Blanket.
  - .5 CAN/CGSB-51.12-95, Cement, Thermal Insulating and Finishing.
  - .6 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .3 Manufacturer's Trade Associations
  - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.
- .4 Underwriters Laboratories of Canada (ULC) (latest edition).
  - .1 CAN/ULC S102-10, Surface Burning Characteristics of Building Materials and Assemblies.

### **1.3 PRODUCT DATA**

- .1 Submit Product Data in accordance with Section 20 05 01 - Mechanical General Requirements.

### **1.4 SAMPLES**

- .1 Submit samples in accordance with Section 20 05 01 - Mechanical General Requirements.

- .2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm plywood board. Affix typewritten label beneath sample indicating service.

### **1.5 MANUFACTURER'S INSTRUCTIONS**

- .1 Submit manufacturer's installation instructions in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Installation instructions to include procedures to be used, installation standards to be achieved.

### **1.6 QUALIFICATIONS**

- .1 Installer to be specialist in performing work of this section, and have at least 5 years successful experience in this size and type of project, qualified to standards of TIAC.

### **1.7 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Protect from weather and construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions required by manufacturer.

## **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 as specified herein includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°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/CGSB-51.9.
  - .2 Maximum "k" factor: to CAN/CGSB-51.9.
- .4 TIAC Code A-3: Rigid moulded mineral fibre with factory applied vapour retarder jacket.
  - .1 Mineral fibre: to CAN/CGSB-51.9.
  - .2 Jacket: to CGSB 1-GP-52Ma.
  - .3 Maximum "k" factor: to CAN/CGSB-51.9.
- .5 TIAC Code C-1: Rigid mineral fibre board, unfaced.
  - .1 Mineral fibre: to CAN/CGSB-51.10.
  - .2 Maximum "k" factor: to CAN/CGSB-51.10.
- .6 TIAC Code C-4: Rigid mineral fibre board faced with factory applied vapour retarder jacket.
  - .1 Mineral fibre: to CAN/CGSB-51.10.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: to CAN/CGSB-51.10.
- .7 TIAC Code C-2: Mineral fibre blanket unfaced or faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
  - .1 Mineral fibre: to CAN/CGSB-51.11.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: to CAN/CGSB-51.11.
- .8 TIAC Code A-2: Rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.
  - .1 Insulation: to CAN/CGSB-51.2.
  - .2 Maximum "k" factor: to CAN/CGSB-51.2.
  - .3 Design to permit periodic removal and re-installation.

## **2.3 CEMENT**

- .1 Thermal insulating and finish
  - .1 To CAN/CGSB-51.12.
  - .2 Hydraulic setting or Air drying on mineral wool, to ASTM C449/C449M.

## **2.4 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 Aluminum:
  - .1 To ASTM B209.
  - .2 Thickness: 0.50 mm sheet.



- .3 Finish: embossed.
- .4 Joining: Longitudinal and circumferential slip joints with 50 mm laps.
- .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
- .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300mm

## **2.5 INSULATION SECUREMENTS**

- .1 Tape: Self-adhesive, aluminum, reinforced, 50 mm wide minimum.
- .2 Contact adhesive: Quick setting.
- .3 Canvas adhesive: Washable.
- .4 Tie wire: 1.5 mm diameter stainless steel.
- .5 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.
- .6 Facing: 25 mm galvanized steel hexagonal wire mesh on one face.
- .7 Fasteners: 4 mm diameter pins with 35 mm diameter clips. Length of pin to suit thickness of insulation.

## **2.6 VAPOUR RETARDER LAP ADHESIVE**

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

## **2.7 INDOOR VAPOUR RETARDER FINISH**

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

## **2.8 OUTDOOR VAPOUR RETARDER MASTIC**

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

## **PART 3 EXECUTION**

### **3.1 PRE- INSTALLATION REQUIREMENTS**

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

### **3.2 INSTALLATION**

- .1 Install in accordance with TIAC National Standards:
  - .1 Hot equipment: To TIAC code 1503-H.
  - .2 Cold equipment: to TIAC code 1503-C.
- .2 Elastomeric Insulation: to remain dry at all times. Overlaps to be to manufacturer's instructions. Joints to be tight and sealed properly.
- .3 Provide vapour retarder as recommended by manufacturer.
- .4 Apply materials in accordance with insulation and equipment manufacturers instructions and this specification.
- .5 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .6 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Hangers, supports to be outside vapour retarder jacket.
- .7 Supports, Hangers:
  - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

### **3.3 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES**

- .1 Application: At expansion joints, chilled water and heating valves in mechanical rooms, primary flow measuring elements.
- .2 Installation to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

### **3.4 EQUIPMENT INSULATION SCHEDULES**

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.

- .2 Hot Equipment:
  - .1 TIAC code A-1 or C-1 with mechanical fastenings and 13 mm (½") cement reinforced with one layer of reinforcing mesh.
  - .2 TIAC code C-2 unfaced with wire and 13 mm cement precede by one layer of reinforcing mesh.
  - .3 Thicknesses: 50 mm (2").
  - .4 Application: pumps, expansion tanks, heat exchangers, filters & pot feeder, air/dirt separators and all associated accessories in heating piping system.
  
- .3 Cold equipment:
  - .1 TIAC A-3 or C-4 with mechanical fastenings and 13 mm cement reinforced with one layer of reinforcing mesh.
  - .2 TIAC C-2 faced with vapour retardant jacket and with wire and 13 mm cement preceded by one layer of reinforcing mesh.
  - .3 Thicknesses: 50 mm (2").
  - .4 Application: Pumps, expansion tanks, heat exchangers, filters & pot feeders, air/dirt separators and all associated accessories in chiller water piping system including pipe anchors and ridged supports.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM) (latest edition).
  - .1 ASTM B209-14, Specification for Aluminum and Aluminum Alloy Sheet and Plate.
  - .2 ASTM C335/C335M-17, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
  - .3 ASTM C449-07(2013), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
  - .4 ASTM C921-10(2015), Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-51.9-92 Mineral Fibre Thermal Insulation for Piping and Round Ducting.
  - .2 CAN/CGSB-51.11-92, Mineral Fibre Thermal Insulation Blanket.
  - .3 CAN/CGSB-51.12-95, Cement, Thermal Insulating and Finishing.
  - .4 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
- .3 Manufacturer's Trade Associations (latest edition).
  - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.
- .4 Underwriters' Laboratories of Canada (ULC)
  - .1 CAN/ULC S102-10, Surface Burning Characteristics of Building Materials and Assemblies.

### **1.3 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 defined herein.
- .2 TIAC ss:
  - .1 CRF: Code Rectangular Finish.
  - .2 CPF: Code Piping Finish.

#### **1.4 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Submit for approval manufacturer's catalogue literature related to installation, fabrication for pipe, fittings, valves and jointing recommendations.

#### **1.5 SAMPLES**

- .1 Submit samples in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Submit for approval: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed. Mount sample on 12 mm (½") plywood board. Affix typewritten label beneath sample indicating service.

#### **1.6 MANUFACTURER'S INSTRUCTIONS**

- .1 Submit manufacturer's installation instructions in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Installation instructions to include procedures to be used, installation standards to be achieved.

#### **1.7 QUALIFICATIONS**

- .1 Installer to be specialist in performing work of this section, and have at least 5 years successful experience in this size and type of project, qualified to standards.

#### **1.8 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
- .2 Protect from weather, construction traffic.
- .3 Protect against damage from any source.
- .4 Store at temperatures and conditions required by manufacturer.

## **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 as specified herein includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24°C mean temperature when tested in accordance with ASTM C335/C335M.
- .3 TIAC Code A-1: Rigid moulded mineral fibre without factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
  - .1 Mineral fibre: to CAN/CGSB-51.9.
  - .2 Maximum "k" factor: to CAN/CGSB-51.9.
- .4 TIAC Code A-3: Rigid moulded mineral fibre with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
  - .1 Mineral fibre: to CAN/CGSB-51.9.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: to CAN/CGSB-51.9.
- .5 TIAC Code C-2: Mineral fibre blanket faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
  - .1 Mineral fibre: to CAN/CGSB-51.11.
  - .2 Jacket: to CGSB 51-GP-52Ma.
  - .3 Maximum "k" factor: to CAN/CGSB-51.11.
  - .4 Density: 24 kg/m<sup>3</sup>.

### **2.3 INSULATION SECUREMENT**

- .1 Tape: Self-adhesive, aluminum, reinforced, 50 mm wide minimum.
- .2 Contact adhesive: Quick setting.
- .3 Canvas adhesive: Washable.
- .4 Tie wire: 1.5 mm diameter stainless steel.

- .5 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.

## **2.4 CEMENT**

- .1 Thermal insulating and finishing cement:
  - .1 To CAN/CGSB-51.12.
  - .2 Hydraulic setting or Air drying on mineral wool, to ASTM C449.

## **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 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.
  - .3 Random samples to be taken during installation c/w date & time on sample.
- .2 Aluminum:
  - .1 To ASTM B209.
  - .2 Thickness: 0.50 mm sheet.
  - .3 Finish: embossed.
  - .4 Joining: Longitudinal and circumferential slip joints with 50 mm laps.
  - .5 Fittings: 0.5 mm thick die-shaped fitting covers with factory-attached protective liner.
  - .6 Metal jacket banding and mechanical seals: stainless steel, 19 mm wide, 0.5 mm thick at 300 mm spacing.
- .3 PVC:
  - .1 Ontario Building Code compliant for 25/50 flame spread and smoke developed.
  - .2 Minimum thickness 0.015 mil.
  - .3 Colour white unless otherwise specified.
  - .4 Non yellowing UV stabilized.
  - .5 Minimum service temperatures: -20°C.
  - .6 Maximum service temperature: 65°C.
  - .7 Moisture vapour transmission: 0.02 perm.
  - .8 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 PRE- INSTALLATION REQUIREMENT**

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

#### **3.2 INSTALLATION**

- .1 Install in accordance with TIAC National Standards and NAIMA Guides..
- .2 Apply materials in accordance with manufacturers instructions and this specification.
- .3 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .4 All roof drain bodies shall be thermally insulated with 50 mm thick mineral fibre blanket faced with factory applied vapour retarder jacket.
- .5 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
  - .1 Hangers, supports to be outside vapour retarder jacket.
  - .2 Saddles to have ridges to limit movement while in hanger.
  - .3 To be edge flared to prevent cutting/damage to insulation coverage.
  - .4 Provide mastic with minimum 0.02 perm rating on all exposed edges of fittings supports & valves.
- .6 Supports, Hangers:
  - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

#### **3.3 Removable, Pre-fabricated, Insul and Enclosures**

- .1 Application: At expansion joints, valves, primary flow measuring elements flanges and ationunions at equipment.
- .2 Design: To permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.
- .3 Insulation:
  - .1 Insulation, fastenings and finishes: same as system.



- .2 Jacket: PVC.

### 3.4 INSTALLATION OF ELASTOMERIC INSULATION

- .1 Insulation to remain dry at all times. Overlaps to manufacturers instructions. Ensure n tight joints.
- .2 Provide vapour retarder as recommended by manufacturer.

### 3.5 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 TIAC Code: A-1.
  - .1 Securements: Tape at 300 mm oc.
  - .2 Seals: lap seal adhesive, lagging adhesive.
  - .3 Installation: TIAC Code 1501-H.
- .3 TIAC Code: A-3.
  - .1 Securements: Tape at 300 mm oc.
  - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
  - .3 Installation: TIAC Code: 1501-C.
- .4 TIAC Code: C-2.
  - .1 Insulation securements: combination of wire and bands.
  - .2 Seals: lap seal adhesive, lagging adhesive.
  - .3 Installation: TIAC Code: 1501-C.
- .5 Thickness of insulation to be as listed in following table:

Application	Temp °C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)			
			½ to 1¼	1½ to 3	4 to 6	8 & over
Hot Water Heating	61 - 93	A-1	38	50	50	50
Hot Water Heating	up to 60	A-1	25	38	38	38
Glycol Heating 38	61 - 93	A-1	38	50	50	50
Glycol Heating	up to 60	A-1	25	38	38	38
Domestic Hot Water		A-1	25	38	38	38

Domestic Hot Water Recirc r)		A-1	25	38	38	38
Chilled Water with Vapour Barrier (Interior)	5 - 13	A-3	25	25	25	38
Chilled Water with Vapour Barrier (Exterior)	5 - 13	A-3	38	38	50	50
Heating/Cooling with Vapour Barrier		A-3	25	38	38	38
Domestic Cold Water		A-3	25	25	25	25
Storm Piping		A-3	25	25	25	25
Storm Roof Drains		C-2	50	50	50	50
Steam (105 kPa, 15 psi)		A-1	65	65	75	75
On top of Radiant Panels		C-2	----	---	- 50	-----
Steam Condensate		A-1	385	505	50	50

- .6 Finishes:
- .1 Exposed indoors: PVC.
  - .2 Exposed piping & fittings in mechanical rooms: PVC.
  - .3 Exposed exterior: Aluminum.
  - .4 Concealed, indoors: PVC on valves and fittings only. No further finish.
  - .5 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
  - .6 Finish attachments: Stainless steel bands at 150 mm oc. Seals: wing or closed.
  - .7 Installation: To appropriate TIAC code CRF/1 through CPF/5.
- .7 Storm piping & fittings to be insulated from all roof drain bodies to storm piping at grade level.
- .8 Domestic hot & cold and recirc piping shall be completely thermally insulated to fixtures, except exposed supply assembly at fixtures.

**END OF SECTION**



## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

## **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 GENERAL**

- .1 Provide all material & labour associated with flushing and cleaning of system including full size bypass and associated accessories.

### **3.2 CLEANING HYDRONIC AND STEAM SYSTEMS**

- .1 Timing: Systems to be operational, hydrostatically tested and with safety devices functional, before cleaning is carried out.
- .2 Cleaning Agency: 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 4 weeks prior to proposed starting date. Report to include:
    - .1 Cleaning procedures, flow rates, elapsed time.
    - .2 Chemicals and concentrations to be 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 to be used to ensure water will not damage systems or equipment.
- .5 Conditions at time of cleaning of systems
  - .1 Systems to be free from construction debris, dirt and other foreign material.
  - .2 Control valves to be operational, fully open to ensure that terminal units can be cleaned properly.
  - .3 Strainers to be 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. 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 meter 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°C for at least 36 h. Drain as quickly as possible. Refill with water plus inhibitors. Test concentrations and adjust to recommended levels.
  - .6 Flush velocity in system mains and branches to be adequate so as 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 or 82°C minimum. Circulate for 12 h, ensuring flow in all circuits. Remove heat, continue to circulate until temperature is below 38°C. Drain as quickly as possible. Refill with clean water. Circulate for 6 h 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 all 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 pressurization to ensure proper operation and to prevent water hammer, flashing, cavitation. Eliminate water hammer and all other noises.
- .7 Bring system up to design temperature and pressure slowly over a 24 hour period.
- .8 Perform TAB as specified Section 23 05 93 - Testing, Adjusting and Balancing (TAB).
- .9 Adjust pipe supports, hangers, springs as necessary.
- .10 Monitor pipe movement, performance of expansion joints, loops, guides, anchors.
- .11 If sliding type expansion joints bind or if bellows type expansion joints flex incorrectly, shut down system, re-align, repeat start-up procedures.
- .12 Re-tighten all bolts, etc. using torque wrench, to compensate for heat-caused relaxation. Repeat several times during commissioning.
- .13 Check operation of drain valves.
- .14 Adjust valve stem packings as systems settle down.
- .15 Fully open all balancing valves (except those that are factory-set).
- .16 Check operation of over-temperature protection devices on circulating pumps.
- .17 Adjust alignment of piping at pumps to ensure flexibility, adequacy of pipe movement, absence of noise or vibration transmission.

**END OF SECTION**



## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME A120.1-2014, Safety Requirements for Powered Platforms and Traveling Ladders and Gentries for Building Maintenance.
  - .2 ASME B16.5-2017, Pipe Flanges and Flanged Fittings.
  - .3 ASME B16.20-2017, Metallic Gaskets for Pipe Flanges.
  - .4 ASME B16.21-2016, Nonmetallic Flat Gaskets for Pipe Flanges.
  - .5 ASME B18.2.1-2012, Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).
  - .6 ASME BPVC.IV-2017, 2017 ASME Boiler and Pressure Vessel Code, Section IV: Heating Boilers.
- .2 American Society for Testing and Materials (ASTM)
  - .1 ASTM A47/A47M-99(2014), Specification for Ferritic Malleable Iron Castings.
  - .2 ASTM A53/A53M-18, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
- .3 Canadian Standards Association (CSA)
  - .1 CSA B149.1-15, Natural Gas and Propane Installation Code.
  - .2 CSA B149.2-15, Propane Storage and Handling Code
  - .3 CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel Structures.

### **1.3 PRODUCT DATA**

- .1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Indicate on manufacturers catalogue literature following: - valves.

### **1.4 MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.



## **PART 2 PRODUCTS**

### **2.1 PIPE**

- .1 Above ground steel pipe: to ASME A120.1 or ASTM A53/A53M, Schedule 40, seamless as follows:
  - .1 NPS ½ to 2, screwed outside, with socket welded fittings inside building.
  - .2 NPS 2½ and over, welded.

### **2.2 JOINTING MATERIAL**

- .1 Screwed fittings: pulverized lead paste.
- .2 Welded fittings: to CSA W47.1.
- .3 Flange gaskets: to ASME B16.21 or ASME B16.20.

### **2.3 FITTINGS**

- .1 Steel pipe fittings, screwed, flanged or welded:
  - .1 Malleable iron: screwed, banded, Class 150.
  - .2 Steel pipe flanges and flanged fittings: to ASME B16.5.
  - .3 Steel butt-welding fittings.
  - .4 Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M.
  - .5 Bolts and nuts: to ASME B18.2.1.
  - .6 Nipples: Schedule 40, to ASTM A53/A53M.

### **2.4 VALVES**

- .1 Provincial Code approved, lubricated plug or ball type as per specification Section 23 05 23 - Valves.

### **2.5 PRESSURE REDUCING VALVE**

- .1 (PRV): Provide gas service regulator self-contained to reduce pressure to design capacity.
- .2 Spring loaded self-operated regulator, molded diaphragm, 6:1 lever ratio, c/w internal or remote relief valve.
- .3 Extend remote safety relief valve to atmosphere; terminate in safe location.

- .4 Reference equipment schedules for performance & capacities.
- .5 Relief valve shall be sized to protect the downstream equipment in accordance with the equipment manufacturer's recommendations.
- .6 Acceptable material: Norgas/Itron, Sensus, Maxitrol, Fisher.

## **2.6 ROOF PIPE SUPPORTS**

- .1 Non seismic, surface mounted 300 x 300 x 65 mm high wide body 100% recycled rubber base, UV resistant, pipe supports with 14 gauge galvanized steel strut & strut pipe clamp, two (2) 13 mm dia. electro zinc plated all threaded rod risers (200-400 mm high rods).  
Maximum load: 364 kg (800 lbs.). Provide tape between pipe & strut clamps. Acceptable material: Mifab C-Port #CEW.

## **2.7 METER REGULATOR ASSEMBLY**

- .1 Coordinate Enbridge Gas for provision of new meter/regulator assembly.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 Install in accordance with ASME Boiler and Pressure Vessels Code Section IV, regulations of Province having jurisdiction, except where specified otherwise, and manufacturers recommendations.
- .2 Make required piping connections recommended by equipment manufacturer.
- .3 Maintain clearances as indicated or if not indicated, as recommended by manufacturer installation instruction for operation, servicing and maintenance without disruption of operation of any other equipment/system.
- .4 All equipment, venting and gas assembly work shall be installed & certified by a provincially certified gas fitter I Level mechanic.

### **3.2 PIPING**

- .1 Install in accordance with applicable Provincial/Territorial Codes.

- .2 Install in accordance with CSA B149.1 and CSA B149.2.
- .3 Assemble piping using fittings manufactured to ASME standards.
- .4 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.
- .5 Slope piping down in direction of flow to low points as per Gas Utilization Code.
- .6 Install drip points:
  - .1 At all low points in piping system.
  - .2 At each connection to equipment.
- .7 Use eccentric reducers at pipe size change installed to provide positive drainage.
- .8 Provide clearance for access and for maintenance.
- .9 Ream pipes, clean scale and dirt, inside and out.
- .10 Install piping to minimize pipe dismantling for equipment removal.
- .11 Install buried piping within sand backfilled compacted trench with tracer wire (minimum AWG 14, and coated) extend up above grade at both ends of run. Allow for 3rd party inspection prior to backfill.
- .12 Relief valve piping shall terminate outdoors with clearances to openings, intakes, etc. in accordance with CSA B149.1

### **3.3 VALVES**

- .1 Install valves with stems upright or horizontal unless otherwise approved by Engineer.
- .2 Install valves at all branch take-offs to isolate each piece of equipment, and as indicated.
- .3 Vent reliefs at pressure regulating valves to outdoors and minimum 3 metres for intakes.
- .4 All valves on exterior of building or where prone to vandalism, install lubricated plug type valve, regardless of size.

### **3.4 TESTING**

- .1 Test system in accordance with CSA B149.1 and CSA B149.2.

- .2 On new natural gas service, Enbridge gas or authority having jurisdiction shall conduct a field review of all new equipment appliance venting & piping systems and submit a certificate of acceptance from a Certified G-1 Gas Fitter.

### **3.5 PURGING**

- .1 Purge after pressure test in accordance with CSA B149.1 and CSA B149.2.

### **3.6 PRE-START-UP INSPECTIONS**

- .1 Check vents from regulators, control valves, terminate outside building in approved location, protected against blockage, damage.
- .2 Check gas trains, entire installation is approved by authority having jurisdiction.

### **3.7 CLEANING AND START-UP**

- .1 In accordance with requirements of CSA B149.1 & CSA B149.2.

**END OF SECTION**



## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .1 American Society of Mechanical Engineers (ASME)
  - .1 ASME B16.15-2013, Cast Bronze Threaded Fittings: Classes 125 and 250.
  - .2 ASME B16.18-2018, Cast Copper Alloy, Solder Joint Pressure Fittings.
  - .3 ASME B16.22-2013, Wrought Copper and Copper-Alloy Solder Joint Pressure Fittings.
- .2 American Society for Testing and Materials (ASTM)
  - .1 ASTM B32-08(2014), Specification for Solder Metal.
  - .2 ASTM B88M-18, Specification for Seamless Copper Water Tube Metric.
  - .3 ASTM E202-18, Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.
- .3 American Welding Society (AWS)
  - .1 AWS A5.8/A5.8M:2011-AMD 1, Specification Filler Metals for Brazing and Bronze Welding.

### **1.3 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 20 05 01 - Mechanical General Requirements.

### **1.4 MAINTENANCE DATA**

- .1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

## **PART 2 PRODUCTS**

### **2.1 PIPING**

- .1 Type L hard drawn copper: to ASTM B88M of North American manufacturer.

## **2.2 FITTINGS**

- .1 Cast bronze threaded fittings: to ASME B16.15.
- .2 Wrought copper and copper alloy solder joints pressure fittings: to ASME B16.22.
- .3 Cast copper alloy solder joint pressure fittings: to ASME B16.18.
- .4 Of North American manufacturer.

## **2.3 DI-ELECTRIC COUPLINGS**

- .1 Provide wherever pipes of dissimilar metals are jointed.
- .2 For pipe sizes 2 NPS and under, provide di-electric unions or couplings.

## **2.4 JOINTS**

- .1 Solder, tin-antimony, 95:5: to ASTM B32.
- .2 Silver solder BCUP: to AWS A5.8.
- .3 Brazing: as indicated.
- .4 Application: All closed loop hydronic systems except steam & condensate systems; refer to Section 23 21 13.02 - Steel Piping and Fittings - Hydronic Systems.

## **2.5 VALVES**

- .1 Refer to Section 23 05 23 - Valves.

## **PART 3 EXECUTION**

### **3.1 PIPING INSTALLATION**

- .1 Connect to equipment in accordance with manufacturer's instruction unless otherwise indicated.
- .2 Install concealed pipes close to building structure to keep furring space to minimum. Install to conserve headroom and space. Run exposed piping parallel to walls. Group piping wherever practical.

- .3 Slope piping in direction of drainage and for positive venting.
- .4 Use eccentric reducers at pipe size change installed to provide positive drainage or positive venting.
- .5 Provide clearance for installation of insulation and access for maintenance of equipment, valves and fittings.
- .6 Ream pipes, clean scale and dirt, inside and outside, before and after assembly.
- .7 Assemble piping using fittings manufactured to ASME standards.
- .8 Saddle type branch fittings may be used on mains if branch line is no larger than half the size of main. Hole saw or drill and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .9 Install all pipe wells or other devices supplied by Controls Contractor.

### **3.2 FLUSHING AND CLEANING**

- .1 As per Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

### **3.3 FILLING OF SYSTEM**

- .1 Refill system with clean water adding water treatment as specified and/or glycol as per Section 23 25 00 - HVAC Water Treatment Systems where indicated.

### **3.4 TESTING**

- .1 Test system in accordance with Section 23 05 05 - Installation of Pipework.
- .2 For glycol systems, retest with specified quality of glycol after cleaning. Repair any leaking joints, fittings or valves.

### **3.5 BALANCING**

- .1 Install flow measuring stations and flow balancing valves as indicated.
- .2 Refer to Section 23 05 93 - Testing Adjusting and Balancing of Systems for applicable procedures.



**3.6 GLYCOL CHARGING**

- .1 Provide mixing tank and positive displacement pump for glycol charging.
- .2 Retest for concentration to ASTM E202 after cleaning.
- .3 Provide report to Engineer.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .1 American Society of Mechanical Engineers (ASME).
  - .1 ASME B16.1-2015, Cast Iron Pipe Flanges and Flanged Fittings, Class 125 and 250.
  - .2 ASME B16.3-2016, Malleable-Iron Threaded Fittings, Classes 150 and 300.
  - .3 ASME B16.5-2017, Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and other Special Alloys.
  - .4 ASME B16.9-2012, Factory-Made Wrought Steel Buttwelding Fittings.
  - .5 ASME B18.2.1-2012, Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).
  - .6 ASME B18.2.2-2015, Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange and Coupling Nuts (Inch Series).
- .2 American Society for Testing and Materials (ASTM).
  - .1 ASTM A47/A47M-99(2014), Specification for Ferritic Malleable Iron Castings.
  - .2 ASTM A53/A53M-18, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
  - .3 ASTM A536-84(2014), Specification for Ductile Iron Castings.
- .3 American Water Works Association (AWWA)
  - .1 AWWA C111/A21.11-17, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .4 Canadian Standards Association (CSA).
  - .1 CSA W47.1-09 (R2014), Certification of Companies for Fusion Welding of Steel.

### **1.3 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 20 05 01 - Mechanical General Requirements.

### **1.4 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

## **PART 2 PRODUCTS**

### **2.1 PIPE**

- .1 Steel pipe: to ASTM A53/A53M, Grade B, as follows:
  - .1 NPS 2½ to 10, Schedule 40.
  - .2 NPS 12 and over, standard schedule.

### **2.2 PIPE JOINTS**

- .1 Application: Hydronic water & glycol systems: NPS 2½ and over.
  - .1 NPS 2 and under: shall be copper - refer to Section 23 21 13.01 - Copper Piping and Fittings - Hydronic Systems.
  - .2 Cooling systems NPS 2½ and over: welded, flanged or grooved mechanical couplings. No grooved coupling on glycol systems.
  - .3 Heating and glycol systems NPS 2½ and over: welded or flanged. Grooved joints are not accepted.
  - .4 Welding fittings and flanges to CSA W47.1. Reference Section 23 05 17 - Pipe Welding.
  - .5 Flanges: raised face, weld neck.
  - .6 Flange gaskets: to AWWA C111/A21.11.
  - .7 Pipe thread: taper.
  - .8 Bolts and nuts: to ASME B18.2.1 and ASME B18.2.2.

### **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 125.
  - .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: malleable iron to ASTM A47/A47M, ductile iron to ASTM A536, manufactured by Victaulic are acceptable as listed.

### **2.4 VALVES**

- .1 Refer to Section 23 05 23 - Valves.

## **PART 3 EXECUTION**

### **3.1 APPLICATIONS**

- .1 For hydronic closed loop water & glycol systems, reference Section 23 05 17 - Pipe Welding.

### **3.2 PIPING INSTALLATION**

- .1 In accordance with Section 23 05 05 - Installation of Pipework.

### **3.3 FLUSHING AND CLEANING**

- .1 As per Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

### **3.4 FILLING OF SYSTEM**

- .1 Refill system with clean water adding water treatment or ethylene glycol as per Section 23 25 00 - HVAC Water Treatment Systems.

### **3.5 TESTING**

- .1 Test system in accordance with Section 23 05 05 - Installation of Pipework.

### **3.6 BALANCING**

- .1 Refer to Section 23 05 93 - Testing Adjusting and Balancing for applicable procedures.

**END OF SECTION**



---

**PART 1 GENERAL**

**1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

**1.2 REFERENCES**

- .1 American Society of Mechanical Engineers (ASME).
- .2 American Society for Testing and Materials (ASTM)
  - .1 ASTM A278/A278M-01(2015), Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures Up to 650 degrees F (350 degrees C).
  - .2 ASTM B62-17, Specification for Composition Bronze or Ounce Metal Castings.

**1.3 PRODUCT DATA**

- .1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.

**1.4 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 20 05 01 - Mechanical General Requirements.

**1.5 CLOSEOUT SUBMITTALS**

- .1 Submit maintenance data in accordance with Section 20 05 01 - Mechanical General Requirements.

**PART 2 - PRODUCTS**

**2.1 EXPANSION TANKS**

- .1 Horizontal or vertical steel pressurized removable bladder and/or diaphragm type expansion tank.
- .2 Bladder in EPDM suitable for 115°C (240°F) operating temperature (water and glycol).
- .3 Diaphragm sealed in EPDM suitable for 115°C operating temperature.

- .4 Working pressure: 862 kPa (125 psi) with ASME stamp and certification including Canadian Registration Number (CRN).
- .5 Air precharged to initial fill pressure of system.
- .6 Saddles for horizontal installation, base mount for vertical installation.
- .7 Supports: Provide supports with hold down bolts and installation templates incorporating seismic restraint systems.
- .8 Schedule.
  - .1 38EXT02 - Hot Water Heating System - Extrol AX-60V
  - .2 38EXT03 - Glycol System - Extrol AX-15C
  - .3 38EXT04 - Chilled Water System - Extrol AX-40V
- .9 Acceptable materials: Amtrol, Expanflex, Bell & Gossett.

## **2.2 AUTOMATIC AIR VENT**

- .1 System vents (hot water, glycol & chilled water):
  - .1 Industrial float vent: cast iron body and NPS 3/4 connection and rated at 1034 kPa working pressure.
  - .2 Float: solid material suitable for 115°C working temperature.
  - .3 Acceptable materials: Spirax/Sarco Model 13WS.
- .2 Coil Vents (all equipment headers & high points in system):
  - .1 Industrial float vent: brass alloy body and NPS 1/2 connection and rated at 1034 kPa working pressure.
  - .2 Float: stainless steel with viton rubber valve seal suitable for 115°C working temperature.
  - .3 Acceptable materials: Spirax/Sarco Model AE30.

## **2.3 WATER MAKE-UP COMBINATION LOW PRESSURE RELIEF AND REDUCING VALVE**

- .1 Adjustable pressure setting.
- .2 Low inlet pressure check valve.
- .3 Removable strainer.
- .4 Working pressure: 1034 kPa.

## 2.4 IN-LINE AIR & DIRT SEPARATOR

- .1 Full flow air eliminator for removal of air and microbubbles and separates dirt simultaneously, c/w manual bleed valve. Mild steel construction, with centre line inlet and outlet ports, copper wire woven mesh & copper tubes inside housing, integrated or separate venting mechanism on top, side valve for floating liquids and debris, and bottom flange c/w threaded blow-down. Maximum working pressure 860 kPa (125 psi), maximum working temperature 175°C (350°F), maximum pressure drop 3 kPa (1 ft.) of water. Provide pipe reducers as required.
- .2 Schedule:
  - .1 38ADS01 - Heating loop - Spirovent **VDT250** or approved equal 65 mm.
  - .2 38ADS02 - Chilled water loop - Spirovent VDT300 or approved equal 75 mm.
  - .3 **38ADS03 – Glycol heat rejection loop – VDT400 or approved equal.**
- .4 Acceptable material: Spirotherm Spirovent Dirt, Bell & Gossett CRS Series.

## 2.5 PIPE LINE STRAINER

- .1 NPS ½ to 2: bronze body to ASTM B62, Class 250 screwed connections.
- .2 NPS 2½ to 12: cast steel body to ASTM A278M, Class 250, flanged connections.
- .3 Blowdown connection: NPS 1.
- .4 Screen: stainless steel with perforations between 5 mm and 6 mm.
- .5 Working pressure: 1034 kPa (150 psi).
- .6 Acceptable material: Crane, Watts, Victaulic, Kitz, Jenkins, Toyo, Conbraco.

## PART 3 EXECUTION

### 3.1 GENERAL

- .1 Install as indicated and to manufacturer's recommendations.
- .2 Run drain lines and blow off connections to terminate above nearest drain.
- .3 Maintain proper clearance to permit service and maintenance.
- .4 Should deviations beyond allowable clearances arise, request and follow Engineer's directive.



- .5 Check shop drawings for conformance of all tappings for ancillaries and for equipment operating weights.
- .6 During filling of hydronic systems or equipment, vent systems & equipment properly to remove air prior to opening equipment piping to overall system. Air propagating to system, will be the responsibility of contractor to remove.

### **3.2 STRAINERS**

- .1 Install in horizontal or down flow lines.
- .2 Ensure clearance for removal of basket.
- .3 Install ahead of each pump.
- .4 Install ahead of each automatic control valve larger than NPS 1 and radiation and as indicated.

### **3.3 AUTOMATIC AIR VENTS**

- .1 Install automatic air vents at high points of piping systems.
- .2 Install full port ball at each automatic air vent.
- .3 Air vents must have minimum connection of 13 mm (½").

### **3.4 EXPANSION TANKS**

- .1 Adjust expansion tank pressure to suit design criteria.
- .2 Provide isolation valve on water inlet and drain valve between isolation valve and tank.
- .3 Install tee connection at air inlet to tank c/w pressure gauge and isolation valves for pressure gauge and fill connection.
- .4 Charge tank with nitrogen to required minimum operating pressure.

### **3.5 PRESSURE SAFETY RELIEF VALVES**

- .1 Water run discharge pipe to terminate above nearest drain.
- .2 Glycol run discharge pipe to terminate at glycol tank.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .1 CSA Group (CSA)
- .2 Hydraulic Institute Standards.
- .3 National Electrical Manufacturers Association (NEMA)
  - .1 NEMA MG 1-2016, Motors and Generators.
- .4 Underwriters Laboratories (UL)
  - .1 UL 778, Motor Operated Water Pumps.

### **1.3 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Submit manufacturer's detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories and controllers.
- .3 Submit product data of pump curves for review showing points of operation.
- .4 Indicate piping, valves and fittings shipped loose by packaged equipment supplier, showing their final location in field assembly.

### **1.4 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

## **1.5 FACILITY COMMISSIONING**

- .1 Refer and comply to Section 25 01 11 – Commissioning – Mechanical General Requirements.

## **1.6 MOTORS**

- .1 Provide motors in accordance with Section 20 05 01 - Mechanical General Requirements, and hereafter.

## **1.7 VARIABLE SPEED DRIVE**

- .1 All pump motors served by variable speed drives shall be Inverter duty class motors to NEMA MG 1 Part 31.

## **1.8 INERTIA BASES**

- .1 All base mounted pumps shall be mounted on inertia bases unless noted otherwise. Reference Vibration Isolation specification section.

## **PART 2 PRODUCTS**

### **2.1 VARIABLE SPEED INLINE PUMP**

- .1 Circulating pumps shall be rated to a minimum 1000 kPa (145 psi) and 110°C (230° F) and where applicable, bear the approval symbol of the required regulatory body.
- .2 Electrical assemblies (circuitry, wiring terminals and internal connections) of the circulating pumps shall be certified and registered to bear the emblem of UL, CSA or ETL as required. Electrical assembly shall meet codes and standards established by national bodies.
- .3 Terminal Boxes:
  - .1 The circulating pumps shall have a high quality composite terminal box with NPT electrical connections and a secure, gasketed cover, Class 2 protection level. Included on the face of the terminal box cover is the single adjustment button, front readable graphical pump display, field adjustable for horizontal or vertical positioning of the terminal box .
  - .2 The display shall indicate:
    - .1 Operation status
    - .2 Control mode
    - .3 Differential pressure or speed/setpoint Fault and warning signals

- .4 Electrical Connections:
  - .1 Circulating pump shall have a coded terminal strip indicating common/neutral/ ground within the minimal box for field connections for 120 V, single phase 60 Hz power.
  
- .5 Electrical General
  - .1 All low voltage interface (IF) wiring shall be of 18 gauge or larger, UL/CSA approved, 104°C (220°F) maximum 75°C (167°F) minimum temperature.
  - .2 All 208 V main power wiring shall be of 14 gauge or larger, UL/CSA approved, 104°C maximum 75°C (167°F) minimum temperature.
  - .3 The motor shall be a minimum of class H winding insulation as defined by UL 778 and shall be to Section 23 05 13 - Motors, Drives and Guards for Mechanical Systems.
  - .4 Voltage variances shall be less than +/-10% from rated voltage with pump under load conditions. Maximum amperage not to be exceeded is indicated on the pump nameplate. Electrical power to the pump is confirmed when the face of the graphic display is lit.
  
- .6 Control, Operation and Diagnostics:
  - .1 Wet rotor, glandless inline circulating pumps shall include electronic variable speed control to operate at constant variable differential pressure control without external sensors. Automatic night setback control available as standard using "self taught, FUZZ!" technology.
  - .2 Pumps to include integrated synchronous motors using ECM technology with permanent magnetic rotors, special sensorless control electronics and single phase electronic converters.
  - .3 Pumps to include IR (Infra-red) interface for wireless communication with the optional infra-red monitor.
  - .4 Integrated overload motor protection shall protect the pump against over/under voltage, over temperature of motor and/or electronics, over current, locked rotor and dry run (no load condition).
  - .5 Fault contact "FC" terminals shall be included in the terminal box and are to be potentially free, normally closed contacts that open on the event of a failure.
  
- .7 Materials and Construction:
  - .1 Circulating pumps shall be constructed with Cast-Iron bodies with factory applied Catephoresic coating.
  - .2 Shafts shall be constructed of high quality stainless steel. Motor bearings shall be metal impregnated carbon sleeve bearing type. Impellers will be constructed of a high strength, glass filled polypropylene engineered composite.
  
- .8 Capacity: Refer to Schedule on drawing.
  
- .9 Acceptable material: Wilo Stratos, Armstrong, Zylem, Grundfos, Plad.

## 2.2 WET ROTOR CIRCULATING PUMP

- .1 Wet rotor:
  - .1 Integrated pump and motor assembly without shaft seal and with only two gaskets for sealing. The bearings are lubricated by the pumped liquid.
    - .1 Motor with three speeds,
    - .2 Ceramic radial bearings,
    - .3 Carbon thrust bearing,
    - .4 Stainless steel rotor can, bearing plate and rotor cladding,
    - .5 Stator housing in aluminium alloy,
    - .6 Cast iron or bronze housing,
    - .7 Stator with built-in thermal overload switch.
  - .2 In-line cast iron and bronze spiral pump housing:
    - .1 Flange dimensions for USA are according to individual submittal data the flanges have ¼ NPT pressure gauge tapings. Tapped holes are provided on the underside of the pumps. These holes can be used for fitting the pump to a base plate or bracket by means of hexagon screws. The pump housing is provided with a receptacle stainless steel/Teflon neck ring. The ring reduces to a minimum amount of liquid running from the discharge side of the impeller to the suction side.
  - .3 Impeller:
    - .1 The impeller is made of stainless steel, AISI 304 SS.
  - .4 Motors: High efficiency to Section 23 05 13 - Motors, Drives and Guards for Mechanical Systems.
  - .5 Design maximum pressure: 860 kPa (125 psi).
  - .6 Design maximum temperature: 110°C (230°F).
  - .7 Capacity: as per drawing schedule.
  - .8 Acceptable material: Wilo, ITT Bell & Gossett, Armstrong Astro, Grundfos, Plad ,Flo Fab.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- .1 In line circulators: install as indicated by flow arrows. Support at inlet and outlet flanges or unions. Install with bearing lubrication points accessible. Install motor in orientation as recommended by manufacturer.

- .2 Base mounted type: supply templates for anchor bolt placement. Furnish anchor bolts with sleeves. Place level, shim unit and grout. Align coupling in accordance with manufacturer's recommended tolerance. Check oil level and lubricate. After run-in, tighten glands.
- .3 Ensure that pump body does not support piping or equipment. Provide stanchions or hangers for this purpose. Refer to manufacturer's installation instructions for details.
- .4 Pipe drain tapping to nearest floor drain c/w full port ball valve.
- .5 Install volute venting pet cock in accessible location.
- .6 Check rotation prior to start-up.
- .7 Install ball valves on pump suction & discharge tap-ins for pressure gauge.
- .8 All pumps to be installed in accordance with Hydraulic Institute Standards.
- .9 Provide flexible connectors on suction and discharge of all pumps with exception of **wet/dry rotor** circulators.
- .10 On vertical in-line pumps, where specified, replace flush line filter following commissioning & start-up.

### 3.2 START-UP

- .1 General
  - .1 In accordance with Section 25 01 11 - Commissioning - Mechanical Systems; supplemented as specified herein.
  - .2 In accordance with manufacturer's recommendations & Hydraulic Institute Standards.
- .2 Procedures:
  - .1 Before starting pump, check that cooling water system, over-temperature and other protective devices are installed and operative.
  - .2 After starting pump, check for proper, safe operation.
  - .3 Check installation, operation of mechanical seals. Adjust as necessary.
  - .4 Check base for free-floating, no obstructions under base.
  - .5 Run-in pumps for 12 continuous hours.
  - .6 Verify operation of over-temperature and other protective devices under low- and no-flow condition.
  - .7 Eliminate air from scroll casing.
  - .8 Adjust water flow rate through water-cooled bearings.
  - .9 Adjust flow rate from pump shaft stuffing boxes to manufacturer's recommendation.
  - .10 Adjust alignment of piping and conduit to ensure true flexibility at all times.
  - .11 Eliminate cavitation, flashing and air entrainment.
  - .12 Adjust pump shaft seals, stuffing boxes, glands.
  - .13 Measure pressure drop across strainer when clean and with flow rates as finally set.

- .14 Replace seals if pump used to degrease system or if pump used for temporary heat.
- .15 Verify lubricating oil levels.
- .16 Remove end suction diffuser start-up strainers after one week of pump operation.

### **3.3 PERFORMANCE VERIFICATION (PV)**

- .1 General
  - .1 In accordance with manufacturer's recommendations.
- .2 Exclusions:
  - .1 Performance verification does not apply to small in-line circulators.
- .3 Assumptions: These PV procedures assume that:
  - .1 Manufacturer's performance curves are accurate.
  - .2 Valves on pump suction and discharge provide tight shut-off.
- .4 Net Positive Suction Head (NPSH):
  - .1 Application: Measure NPSH for pumps which operate on open systems and with water at elevated temperatures.
  - .2 Measure using procedures prescribed in the Standard.
  - .3 Where procedures do not exist, discontinue PV, report to Engineer and await instructions.
- .5 Multiple Pump Installations - Series and Parallel:
  - .1 Repeat PV procedures specified above for pump performance and pump BHP for combinations of pump operations.
- .6 Mark points of design and actual performance at design conditions as finally set upon completion of TAB.
- .7 Commissioning Reports: In accordance with Section 25 01 11 - Commissioning - Mechanical Systems, supplemented as specified herein. Reports to include:
  - .1 Record of point(s) of actual performance at maximum and minimum conditions and for single and parallel operation as finally set at completion of commissioning on pump curves.
  - .2 Report forms as specified Section 25 01 11 - Commissioning - Mechanical Systems.
  - .3 Pump performance curves (family of curves).

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 20 05 01 - Mechanical General Requirements.

### **1.3 CLOSEOUT SUBMITTALS**

- .1 Submit operation and maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.
- .2 Include following:
  - .1 Log sheets as required by manufacturer.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURER**

- .1 Equipment, chemicals & service by one supplier:
  - .1 Ashland Canada Corp.
  - .2 Magnus.
  - .3 Klenzoid.
  - .4 Water Management Consultant (WMC).

### **2.2 CONDUCTIVITY PROBES**

- .1 Dual carbon elements in PVC holder, quick disconnect, self-locking connection.

### **2.3 WATER TREATMENT FOR CLOSED HYDRONIC SYSTEMS**

- .1 Application: Hot water heating system and chilled water system: **pot feeder and micron filter across system pumps.**



- .2 Micron filter:
  - .1 Capacity 5% of pump recirculating rate at operating pressure.
  - .2 Six (6) sets of filter cartridges for each type, size of micron filter.
  - .3 Betz Dearborn LMO, or approved equal
- .3 Pot Feeder:
  - .1 Welded steel, pressure rating of 1200 kPa, and temperature rating of 90°C.
  - .2 Size: 20 L.

## 2.4 CHEMICALS

- .1 Chilled water, heating water: CorrShield OR4407, **unless otherwise approved by NRC.**
- .2 Provide 1 year supply.

## 2.5 TEST EQUIPMENT

- .1 Provide one set of test equipment for each system to verify performance.
- .2 Complete with carrying case, reagents for chemicals, all specialized or supplementary equipment.

## PART 3 EXECUTION

### 3.1 INSTALLATION

- .1 Install HVAC water treatment systems in accordance with ASME Boiler Code Section VII, and requirements and standards of authorities having jurisdiction, except where specified otherwise.
- .2 Ensure adequate clearances to permit performance of servicing and maintenance of equipment.

### 3.2 CHEMICAL FEED PIPING

- .1 Install crosses at all changes in direction. Install plugs in all unused connections.

### 3.3 CLEANING OF MECHANICAL SYSTEM

- .1 Provide copy of recommended cleaning procedures and chemicals for approval by Engineer.
- .2 Thoroughly flush all mechanical systems and equipment with approved cleaning chemicals designed to remove deposition from construction such as pipe dope, oils, loose mill scale and other

extraneous materials. Chemicals to inhibit corrosion of various system materials and be safe to handle and use.

- .3 During circulation of cleaning solution, periodically examine and clean filters and screens and monitor changes in pressure drop across equipment.
- .4 Drain and flush systems until alkalinity of rinse water is equal to make-up water. Refill with clean water treated to prevent scale and corrosion during system operation.
- .5 Disposal of cleaning solutions to be approved by authority having jurisdiction.

### **3.4 START-UP**

- .1 Start up water treatment systems in accordance with manufacturer's instructions.
- .2 Coordinate start-up within schedule for all mechanical systems.

### **3.5 COMMISSIONING**

- .1 Timing:
  - .1 After start-up deficiencies rectified.
  - .2 After start-up and before TAB of connected systems.
- .2 Pre-commissioning Inspections:
  - .1 Verify:
    - .1 Presence of test equipment, reagents, chemicals, details of specific tests to be performed, operating instructions.
    - .2 Suitability of log book.
    - .3 Currency and accuracy of initial water analysis.
    - .4 Required quality of treated water.
- .3 Commissioning procedures - applicable to all Water Treatment Systems:
  - .1 Establish, adjust as necessary and record all automatic controls and chemical feed rates.
  - .2 Monitor performance continuously during commissioning of all connected and systems until acceptance of project.
  - .3 Establish test intervals, regeneration intervals.
  - .4 Record on approved report forms all commissioning procedures, test procedures, dates, times, quantities of chemicals added, raw water analysis, treated water analysis, test results, instrument readings, adjustments made, results obtained.
  - .5 Establish, monitor and adjust automatic controls and chemical feed rates as necessary.
  - .6 Visit project at specified intervals after commissioning is satisfactorily completed to verify that performance remains as set during commissioning (more often as required until system stabilizes at required level of performance).
  - .7 Advise Engineer in writing on all matters regarding installed water treatment systems.

- .4 Commissioning procedures - Closed Circuit Hydronic Systems:
  - .1 Analyse water in system.
  - .2 Based upon an assumed rate of loss approved by Engineer, establish rate of chemical feed.
  - .3 Record types, quantities of chemicals applied.
  
- .5 Training:
  - .1 Commission systems, perform tests in presence of, and using assistance of, assigned O&M personnel.
  
- .6 Certificates:
  - .1 Upon completion, furnish certificates confirming satisfactory installation and performance.
  
- .7 Commissioning Reports:
  - .1 To include system schematics, test results, test certificates, raw and treated water analyses, design criteria, all other data required by Engineer.
  
- .8 Demonstrations: Co-ordinate as part of schedule for all mechanical systems.
  
- .9 Commissioning activities during Warranty Period:
  - .1 Check out water treatment systems on regular basis and submit written report to Engineer.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM A480/A480M-17, Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet and Strip.
  - .2 ASTM A924/A924M-17a, Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
- .2 Canadian Standards Association (CSA)
  - .1 CSA B228.1-1968, Pipe, Ducts and Fittings for Residential Type Air Conditioning Systems.
  - .2 CSA W48.2-M1992 (R1998), Chromium and Chromium-Nickel Steel Covered Electrodes for Shielded Metal Arc Welding.
- .3 National Fire Protection Association (NFPA)
  - .1 NFPA (Fire) 90A, Installation of Air Conditioning and Ventilating Systems, 2018 Edition.
  - .2 NFPA (Fire) 90B, Installation of Warm Air Heating and Air Conditioning Systems, 2018 Edition.
  - .3 NFPA (Fire) 96, Ventilation Control and Fire Protection of Commercial Cooking Operations, 2017 Edition.
- .4 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)
  - .1 SMACNA 016-2012, HVAC Air Duct Leakage Test Manual, 2nd Edition.

### **1.3 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Indicate following:
  - .1 Sealants
  - .2 Tape
  - .3 Proprietary Joints

## 1.4 CERTIFICATION OF RATINGS

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

## PART 2 PRODUCTS

### 2.1 SEAL CLASSIFICATION

- .1 Classification as follows:

Maximum System Total Pressure Pa	SMACNA Seal Class
500	A
250	A
125	A

- .2 Seal classification:
  - .1 Class A: longitudinal seams, transverse joints, duct wall penetrations and connections made airtight with sealant.
- .3 Application:
  - .1 All new & existing supply ductwork.
  - .2 All new return & exhaust ductwork.

### 2.2 SEALANT

- .1 Sealant: oil resistant, polymer type flame resistant duct sealant. Temperature range of minus 22°F to plus 200°F.
  - .1 Acceptable material: Duro Dyne S-2.

### 2.3 DUCT LEAKAGE

- .1 In accordance with SMACNA 016.

### 2.4 FITTINGS

- .1 Fabrication: to SMACNA.

- .2 Radiused elbows:
  - .1 Rectangular: standard radius: 1.5 times width of duct.
  - .2 Round: 1.5 times diameter.
- .3 Mitred elbows, rectangular:
  - .1 To 400 mm (16"): with single thickness turning vanes.
  - .2 Over 400 mm (16"): with double thickness turning vanes.
- .4 Branches:
  - .1 Rectangular main and branch: with 45° entry on branch.
  - .2 Round main and branch: enter main duct at 45° with conical connection.
  - .3 Provide volume control damper in branch duct near connection to main duct.
- .5 Transitions:
  - .1 Diverging: 20° maximum included angle.
  - .2 Converging: 30° maximum included angle.
- .6 Offsets:
  - .1 Full radiused elbows.
- .7 Obstruction deflectors: maintain full cross-sectional area. Maximum included angles: as for transitions.

## **2.5 FIRESTOPPING**

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

## **2.6 GALVANIZED STEEL**

- .1 Lock forming quality: to ASTM A924/A924M, Z90 zinc coating.
- .2 Thickness, fabrication and reinforcement: to SMACNA.
- .3 Joints: to SMACNA.

## **2.7 ESCUTCHEON ANGLES**

- .1 40 mm x 40 mm angle iron frame on both sides of exposed rectangular or round ducts, on both sides of non-rated partitions. Escutcheon angles material & gauge shall be equal to base material.

## **2.8 KITCHEN EXHAUST DUCTWORK**

- .1 Black steel all welded, construct in accordance with NFPA (Fire) 96.

## **2.9 DISHWASHER & STEAMER EXHAUST**

- .1 Material: Aluminum type: 3003-H-14. Thickness, fabrication and reinforcement : to ASHRAE & SMACNA. Joints: to ASHRAE & SMACNA.

## **2.10 STAINLESS STEEL (FUME HOOD & AUTOCLAV EXHAUST**

- .1 Material: To ASTM A480/A480M, type 316 L stainless steel sheets with longitudinal joints. Passivate and anneal stainless steel sheets before welding. For round ducts, roll sheets circular and weld flush. Provide integral 1.6 mm (1/16") flanges on abutting ends of manufactured ducts.
- .2 Continuously weld all joints using Inert Gas Metal Arc process without burning parent metal, using filler rods type ER 316 L to CSA W48.2. Grind smooth and polish all joints.
- .3 Construction:
  - .1 Construct ductwork from following thickness of stainless steel sheet.
    - .1 Rectangular ducts: 18 gauge.
    - .2 Round ducts up to 500 mm (20") diameter: 22 gauge.
    - .3 Round ducts over 500 mm (20") diameter: 20 gauge.
  - .2 Reinforce rectangular ducts with galvanized angle frames at 1,200 (48") on centres, 25 mm x 25 mm x 3 mm (1" x 1" x 1/8") up to 900 mm (36") maximum dimensions and 50 mm x 50 mm x 6 mm (2" x 2" x 4") for larger ducts.
- .4 Flexible connectors: neoprene coated glass fibre, coated both sides, minimum mass 39 oz/yd<sup>2</sup>, secured to ducts and fans with 50 mm x 50 mm x 6 mm (1" x 1" x 1/8") stainless steel type 316 L flat bars and bands using type 316 L stainless steel screws or bolts at 100 mm (4") intervals.

## **2.11 HANGERS AND SUPPORTS**

- .1 Strap hangers: of same material as duct but next sheet metal thickness heavier than duct. Maximum size duct supported by strap hanger: 500 mm (20").
- .2 Hanger configuration: to SMACNA.

- .3 Hangers: black steel angle with black steel rods to SMACNA and following table:

Duct Size (in.)	Angle Size (in.)	Rod Size (in.)
up to 30	1 x 1 x 1/8	1/4
31 to 42	1½ x 1½ x 1/8	1/4
43 to 60	1½ x 1½ x 1/8	2/5
61 to 84	2 x 2 x 1/8	2/5
85 to 96	2 x 2 x 1/5	2/5
97 and over	2 x 2 x 1/4	2/5

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

### **PART 3 EXECUTION**

#### **3.1 GENERAL**

- .1 Do work in accordance with NFPA (Fire) 90A, NFPA (Fire) 90B, CSA B228.1 and SMACNA.
- .2 Do not break continuity of insulation vapour barrier with hangers or rods. Insulate strap hangers 100 mm (4") beyond insulated duct.
- .3 Support risers in accordance with ASHRAE and SMACNA.
- .4 Install breakaway joints in ductwork on each side of fire separation.
- .5 Install proprietary manufactured flanged duct joints in accordance with manufacturer's instructions.
- .6 Manufacture duct in lengths to accommodate installation of acoustic duct lining.
- .7 Install escutcheon sheet metal angles on both sides of exposed rectangular or round ducts on both sides of non-rated partitions. Seal void with acoustic sealant.

#### **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 SMACNA as follows:

Duct Size mm (in.)	Spacing m (ft.)
to 1500 (60)	3 (10)
1525 (61) and over	2.5 (8)

### 3.3 WATERTIGHT DUCT

- .1 Provide watertight duct for:
- .1 All exterior ductwork.
  - .2 Fresh air intake/exhaust plenums.
  - .3 Minimum 3000 mm from duct mounted humidifier in all directions.
- .2 All joints to be fully welded and pressure tested to 8" wc, on exterior ductwork from desiccant dehumidifier.
- .3 Fit base of riser with 150 mm deep drain sump and 32 mm drain connected, with deep seal trap and valve and discharging to open funnel drain.

### 3.4 SEALING

- .1 Apply sealant to outside of joint to manufacturer's recommendations.

### 3.5 LEAKAGE TESTS

- .1 In accordance with SMACNA 016 & mandatory pressure test on exterior ductwork from desiccant dehumidifier.
- .2 Do leakage tests for supply duct; maximum leakage rate 1% at 1½ times operating static pressure.
- .3 Make trial leakage tests as instructed to demonstrate workmanship.
- .4 Install no additional ductwork until trial test has been passed.
- .5 Test section minimum of 100 ft. long with not less than 3 branch takeoffs and two 90° elbows.
- .6 Complete test before insulation or concealment.

**END OF SECTION**

## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .1 Canadian Standards Association (CSA)
  - .1 CSA B228.1-1968, Pipes, Ducts and Fittings for Residential Type Air Conditioning.

### **1.3 PRODUCT DATA**

- .1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Indicate the following:
  - .1 Flexible connections.
  - .2 Duct access doors.
  - .3 Instrument test ports.

### **1.4 CERTIFICATION OF RATINGS**

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

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- .1 Manufacture in accordance with CSA B228.1.

### **2.2 FLEXIBLE CONNECTIONS**

- .1 Frame: galvanized sheet metal frame 0.6 mm thick 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°C to plus 90°C, density of 1.3 kg/m<sup>2</sup>.

### **2.3 ACCESS DOORS IN DUCTS**

- .1 Non-insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame.
- .2 Insulated ducts: sandwich construction of same material as duct, one sheet metal thickness heavier, minimum 0.6 mm thick complete with sheet metal angle frame and 25 mm thick rigid glass fibre insulation.
- .3 Gaskets: neoprene.
- .4 Hardware:
  - .1 Up to 300 x 300 mm: 2 sash locks complete with safety chain.
  - .2 301 to 450 mm: 4 sash locks complete with safety chain.
  - .3 451 to 1000 mm: piano hinge and minimum 2 sash locks.
  - .4 Doors over 1000 mm: piano hinge and 2 handles operable from both sides.
  - .5 Hold open devices.

### **2.4 INSTRUMENT TEST PORTS**

- .1 1.6 mm thick steel zinc plated after manufacture.
- .2 Cam lock handles with neoprene expansion plug and handle chain.
- .3 28 mm minimum inside diameter. Length to suit insulation thickness.
- .4 Neoprene mounting gasket.
- .5 Acceptable material: Duro Dyne IP1 or IP2.

### **2.5 SPIN-IN COLLARS**

- .1 Conical galvanized sheet metal spin-in collars with lockable butterfly damper.
- .2 Sheet metal thickness to co-responding round duct standards.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 Flexible connections:
  - .1 Install in following locations:
    - .1 Inlets and outlets to supply air units and fans.
    - .2 Inlets and outlets of exhaust and return air fans.
    - .3 Penetrations of all acoustic chambers.
  - .2 Length of connection: 100 mm.
  - .3 Minimum distance between metal parts when system in operation: 75 mm.
  - .4 Install in accordance with recommendations of SMACNA.
  - .5 When fan is running:
    - .1 Ducting on each side of flexible connection to be in alignment.
    - .2 Ensure slack material in flexible connection.
- .2 Access doors and viewing panels:
  - .1 Size:
    - .1 450 x 450 mm for person size entry.
    - .2 450 x 450 mm for servicing entry.
    - .3 300 x 300 mm for viewing.
    - .4 As indicated.
  - .2 Location:
    - .1 At fire and smoke dampers.
    - .2 At control dampers.
    - .3 At devices requiring maintenance.
    - .4 At locations required by code.
    - .5 At reheat coils.
    - .6 Elsewhere as indicated.
- .3 Instrument test ports.
  - .1 General:
    - .1 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
  - .2 Locate to permit easy manipulation of instruments.
  - .3 Install insulation port extensions as required.
  - .4 Locations.
    - .1 For traverse readings:
      - .1 At ducted inlets to roof and wall exhausters.
      - .2 At inlets and outlets of other fan systems.
      - .3 At main and sub-main ducts.
      - .4 And as indicated.
    - .2 For temperature readings:
      - .1 At outside air intakes.
      - .2 In mixed air applications in locations as approved by Engineer.
      - .3 At inlet and outlet of coils.

- .4 Downstream of junctions of two converging air streams of different temperatures.
- .5 And as indicated.

**END OF SECTION**

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**PART 1 GENERAL**

**1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

**1.2 REFERENCES**

- .1 Sheet Metal and Air Conditioning Contractors' National Association (SMACA).

**1.3 PRODUCT DATA**

- .1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.

**PART 2 PRODUCTS**

**2.1 GENERAL**

- .1 Manufacture to SMACNA standards.

**2.2 SINGLE BLADE DAMPERS**

- .1 Of same material as duct, but one sheet metal thickness heavier. V-groove stiffened.
- .2 Size and configuration to recommendations of SMACNA, except maximum height 100 mm (4").
- .3 For rectangular ducts adjustable lever with shaft extension to accommodate insulation thickness.
- .4 For round branch ducts adjustable lever with shaft extension to accommodate insulation thickness.
- .5 Inside and outside nylon end bearings.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.

**2.3 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: 100 mm (4").
- .4 Bearings: self-lubricating nylon.
- .5 Linkage: shaft extension with locking quadrant.
- .6 Channel frame of same material as adjacent duct, complete with angle stop.
- .7 Maximum leakage: 0.07% at 750 Pa.

### **PART 3 EXECUTION**

#### **3.1 INSTALLATION**

- .1 Install where indicated.
- .2 Install in accordance with recommendations of SMACNA and in accordance with manufacturer's instructions.
- .3 For supply, return and exhaust systems, locate balancing dampers in each branch duct.
- .4 Runouts to registers and diffusers: install single blade damper located as close as possible to main ducts.
- .5 All dampers to be vibration free.
- .6 Ensure damper operators are observable and accessible.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

**1.2 PRODUCT DATA**

- .1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Indicate the following:
  - .1 Performance data.

**1.3 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.

**1.4 CERTIFICATION OF RATINGS**

- .1 Catalogue or published ratings shall be those obtained from tests carried out by manufacturer or those ordered by him from independent testing agency.

**PART 2 PRODUCTS**

**2.1 ACCEPTABLE MANUFACTURER**

- .1 Tamco.
- .2 Nailor.
- .3 Ruskin.
- .4 Ventex/Alumavent.
- .5 Greenheck.
- .6 E.H. Price.



## 2.2 MULTI-LEAF DAMPERS

- .1 Opposed or Parallel blade type as indicated.
- .2 Extruded aluminum, interlocking blades, complete with extruded vinyl seals, spring stainless steel side seals, extruded aluminum frame.
- .3 Pressure fit self-lubricated bronze bearings.
- .4 Linkage: plated steel tie rods, brass pivots and plated steel brackets, complete with plated steel control rod.
- .5 Control Damper Operators:
  - .1 Electronic:
    - .1 Push-pull proportional type as indicated.
    - .2 Spring return for "fail-safe" in Normally Open or Normally Closed position as indicated.
    - .3 Operator: size so as to control dampers against maximum pressure or dynamic closing pressure (whichever is greater).
    - .4 Power requirements: as required for application.
    - .5 Operating range: 0 - 20 V DC.
    - .6 Acceptable material: Belimo.
  - .6 Performance:
    - .1 Leakage Class: 1A.
    - .2 Pressure drop: at full open position to be less than 4 Pa differential across damper at 5 m/s.
  - .7 Insulated aluminum dampers:
    - .1 Frames: insulated with extruded polystyrene foam with R factor of 2.3.
    - .2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, R factor of 2.3.
  - .8 Acceptable material:
    - .1 Exhaust & Intake: Tamco 9000, Ventex, Ruskin.
    - .2 Return: Tamco 1000, Ventex, Ruskin.

## 2.3 BACK DRAFT DAMPERS

- .1 Automatic gravity operated, multi leaf, aluminum construction with nylon bearings, spring assisted or counterweighted.

## **2.4 RELIEF DAMPERS**

- .1 Automatic multi-leaf aluminum dampers with ball bearing centre pivoted and counter-weights set to open at static pressure, as indicated.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 Install where indicated, and when supplied by others.
- .2 Install in accordance with recommendations of SMACNA and manufacturer's instructions.
- .3 Seal multiple damper modules with silicon sealant.
- .4 Install access door adjacent to each damper. See Section 23 33 00 - Duct Accessories.
- .5 Ensure dampers are observable and accessible.

**END OF SECTION**



## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM)
  - .1 ASTM C177-13, Standard Test Method for Steady-State Heat Flux and Thermal Measurements Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-51.10-92, Thermal Insulation, Mineral Fibre, Block or Board, for Ducting, Machinery and Boilers.
- .3 National Fire Protection Association (NFPA)
  - .1 NFPA (Fire) 90A, Installation of Air Conditioning and Ventilating Systems, 2018 Edition.
  - .2 NFPA (Fire) 90B, Installation of Warm Air Heating and Air Conditioning Systems, 2018 Edition.
- .4 Underwriters' Laboratories of Canada
  - .1 CAN/ULC S102-10, Surface Burning Characteristics of Building Materials and Assemblies.

### **1.3 PRODUCT DATA**

- .1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.

## **PART 2 PRODUCTS**

### **2.1 DUCT LINER**

- .1 General:
  - .1 Fibrous glass or "textile" fibrous glass duct liner: air stream side faced with mat facing.
  - .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50 when tested in accordance with CAN/ULC-S102.
- .2 Rigid:
  - .1 Use on flat surfaces where indicated.
  - .2 25 mm (1") thick, to CAN/CGSB-51.10, fibrous glass rigid board duct liner.
  - .3 Density: 36 kg/m<sup>3</sup> minimum.

- .4 Thermal resistance to be minimum  $0.76 \text{ m}^2 \cdot \text{C}/\text{W}$  for 25 mm thickness when tested in accordance with ASTM C177, at  $24^\circ\text{C}$  mean temperature.

## **2.2 FASTENERS**

- .1 Weld pins 2.0 mm diameter, length to suit thickness of insulation. Metal retaining clips, 32 mm square.

## **2.3 JOINT TAPE**

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

## **2.4 SEALER**

- .1 Meet requirements of NFPA (Fire) 90A and NFPA (Fire) 90B.
- .2 Flame spread rating shall not exceed 25. Smoke development rating shall not exceed 50. Temperature range minus  $68^\circ\text{C}$  to plus  $93^\circ\text{C}$ .

## **PART 3 EXECUTION**

### **3.1 GENERAL**

- .1 Do work in accordance with recommendations of SMACNA duct liner standards as indicated in SMACNA HVAC Duct Construction Standards, Metal and Flexible, 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.
  - .2 In addition to adhesive, install weld pins not less than 2 rows per surface and not more than 425 mm on centres.

### **3.3 JOINTS**

- .1 Seal all butt joints, exposed edges, weld pin and clip penetrations and all damaged areas of liner with joint tape and sealer. Install joint tape in accordance with manufacturer's recommendations, and as follows:
  - .1 Bed tape in sealer.
  - .2 Apply 2 coats of sealer over tape.
- .2 Replace badly damaged areas of liner at discretion of Engineer.
- .3 Protect leading and trailing edges of each duct section with sheet metal nosing having 25 mm overlap and fastened to duct.

**END OF SECTION**



## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .1 Air Movement and Control Association (AMCA)
  - .1 AMCA 99-16, Standards Handbook.
  - .2 AMCA 210-16, Laboratory Methods of Testing Fans for Rating.
  - .3 AMCA 300-14, Reverberant Room Method for Sound Testing of Fans.
  - .4 AMCA 301-14, Methods for Calculating Fan Sound Ratings from Laboratory Test Data.
- .2 American Bearing Manufacturers Association (ABMA)
  - .1 ABMA 9:2015, Load Ratings and Fatigue Life for Ball Bearings.
  - .2 ABMA 11:2014, Load Ratings and Fatigue Life for Roller Bearings.
- .3 ASHRAE/Air Movement and Control Association
  - .1 ASHRAE 51-2016, Laboratory Methods of Testing Fans for Rating Aerodynamic Performance Rating.
- .4 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-1.181-99, Coating, Zinc Rich, Organic, Ready Mixed.

### **1.3 SHOP DRAWINGS AND PRODUCT DATA**

- .1 Submit shop drawings and product data in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Provide:
  - .1 Fan performance curves showing point of operation, kW (BHP) and efficiency.
  - .2 Sound rating data at point of operation.

### **1.4 OPERATION AND MAINTENANCE DATA**

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.



- .2 Furnish list of individual manufacturer's recommended spare parts for equipment such as bearings and seals, and addresses of suppliers, together with list of specialized tools necessary for adjusting, repairing or replacing, for placement into operating manual.

## **1.5 MAINTENANCE MATERIALS**

- .1 Provide maintenance materials in accordance with Section 20 05 01 - Mechanical General Requirements.

## **1.6 CERTIFICATION OF RATINGS**

- .1 Catalogued or published ratings shall be those obtained from tests carried out by manufacturer or those ordered from independent testing agency signifying adherence to codes and standards in force.
- .2 Provide confirmation of testing.

## **PART 2 PRODUCTS**

### **2.1 FANS GENERAL**

- .1 Capacity: flow rate, total static pressure, bhp, efficiency, revolutions per minute, power, model, size, sound power data and as indicated on schedule.
- .2 Statically and dynamically balanced. Constructed in conformity with AMCA 99.
- .3 Sound ratings: comply with AMCA 301, tested to AMCA 300. Unit shall bear AMCA certified sound rating seal.
- .4 Performance ratings: based on tests performed in accordance with AMCA 210, and ASHRAE 51, unit to bear AMCA certified rating seal.
- .5 Performance ratings: based on tests performed in accordance with AMCA 210, and ASHRAE 51. Unit shall bear AMCA certified rating seal, except for propeller fans smaller than 300 mm diameter.
- .6 Bearings: sealed lifetime oilite ball bearings heavy duty grease lubricated ball or roller bearings of self aligning type with oil retaining, dust excluding seals and a certified minimum rated life of 200,000 h in accordance with ABMA L50 life standard. Bearings to be rated and selected in accordance with ABMA 9 and ABMA 11.

- .7 Motors:
  - .1 In accordance with Section 23 05 13 - Motors, Drives and Guards supplemented as specified herein.
  - .2 For use with variable speed controllers where applicable.
  - .3 Sizes as indicated.
  - .4 Two speed with two windings and speeds where applicable.
  - .5 Two speed with split winding, where applicable.
- .8 Accessories and hardware: matched sets of V-belt drives, adjustable slide rail motor bases, belt guards, coupling guards fan inlet and/or outlet safety screens as indicated and as specified in Section 23 05 13 - Motors, Drives and Guards.
- .9 Factory primed before assembly in colour standard to manufacturer.
- .10 Scroll casing drains: as indicated.
- .11 Bearing lubrication systems plus extension lubrication tubes where bearings are not easily accessible.
- .12 Flexible connections: to Section 23 33 00 - Duct Accessories.

## 2.2 IN-LINE CABINET EXHAUST

- .1 Fan housing construction of corrosion resistant galvanized steel c/w sound absorbing lined insulation.
- .2 Removable bottom housing panel allows easy access to the power assembly for inspection or service.
- .3 Outlet duct connection with integral backdraft damper can be converted from horizontal to vertical discharge.
- .4 Fan scroll is constructed of galvanized steel.
- .5 Fan wheels are double width forward curved centrifugal type. All wheels are dynamically balanced for vibration free operation.
- .6 Motors 115/60/1. All motors are sized to match fan loads, have thermal overload protection and are mounted on vibration isolators. Power assemblies can be easily unplugged and removed for inspection or service.
- .7 Angle mounting brackets can be adjusted to any typical ceiling material thickness.
- .8 Acceptable material: PennBarry, Greenheck, Loren Cook, Twin City, Soler & Palau.

### **2.3 CEILING HUNG PROPELLER FANS**

- .1 38CAF01 High performance, 1500 mm (60"), reversible motor, industrial, ceiling mounted propeller fan & 900 mm down rod. Performance: 21,700 L/s at 992 RPM, 120 V/1Ø/ 60 Hz, 97 Watts.
- .2 Provide speed controller suitable for controlling three (3) fans with one (1) controller. Turn over to Division 26 for installation and wiring where indicated. Canarm FRMC5.
- .3 Acceptable material: Canarm Model CP60HPWP or approved equal.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 Install in accordance with manufacturer's instructions.
- .2 Fans shall be supported with spring isolation minimum 1.5" deflection.

### **3.2 ANCHOR BOLTS AND TEMPLATES**

- .1 Size anchor bolts to withstand seismic acceleration and velocity forces as specified in Section 20 05 49.01 - Seismic Restraint System.

**END OF SECTION**

**PART 1 GENERAL**

**1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

**1.2 PRODUCT DATA**

- .1 Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Indicate the following:
  - .1 Capacity.
  - .2 Throw and terminal velocity.
  - .3 Noise criteria.
  - .4 Pressure drop.
  - .5 Neck velocity.

**1.3 MAINTENANCE MATERIALS**

- .1 Provide maintenance materials in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Include:
  - .1 Keys for volume control adjustment.
  - .2 Keys for air flow pattern adjustment.

**1.4 MANUFACTURED ITEMS**

- .1 Grilles, registers and diffusers of same generic type to be product of one manufacturer.

**1.5 CERTIFICATION OF RATINGS**

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

## **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 and as specified.
  - .3 Concealed fasteners.
- .3 Concealed operators.
- .4 Acceptable material: E.H Price Ltd., Nailor, Titus, Krueger, Metal-aire or approved equal.

### **2.2 SUPPLY DIFFUSERS**

- .1 Type SG1: high capacity drum louvres composed heavy gauge aluminum adjustable inner drum section and a outer frame, manually adjustable without the use of tools allowing the discharge jet to be directed a full 70 degrees, constructed using a felt gasket seal providing smooth adjustment without leakage, outer frame to be c/w closed cell neoprene gasket to prevent leakage between the outlet and mounting surface, integral damper, c/w adjustment knob constructed from aluminum, spiral duct frame. Finish shall be clear anodized finish. Equivalent to E.H. Price AHCD2.

### **2.3 RETURN AND EXHAUST GRILLES AND REGISTER**

- .1 Type RG1: aluminum construction, 45° deflection, fixed louvres, 20 mm (¾") spacing, off-white baked enamel finish. Size as indicated. Equivalent to E.H. Price Model 630.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 Install in accordance with manufacturers instructions.
- .2 Install with flat head cadmium plated screws in countersunk holes where fastenings are visible.

**END OF SECTION**

## **PART 1      GENERAL**

### **1.1          RELATED SECTIONS**

- .1      This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2          REFERENCES**

- .1      American Architectural Manufacturers Association (AAMA)
  - .1      AAMA 2605-11, Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
  - .2      American Society for Testing and Materials International (ASTM)
    - .1      ASTM E90-09(2016), Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
  - .2      Sheet Metal and Air Conditioning Contractors' National Association (SMACNA)

### **1.3          PRODUCT DATA**

- .1      Submit product data in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2      Indicate the following: schedule of sizes indicating free area, airflow and pressure drops, finish, curb & construction.

### **1.4          CERTIFICATION OF RATINGS**

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

### **1.5          TEST REPORTS**

- .1      Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90.

## **PART 2 PRODUCTS**

### **2.1 STATIONARY LOUVRES (L)**

- .1 Construction: welded with exposed joints ground flush and smooth.
- .2 Material: extruded aluminum alloy 6063-T5.
- .3 Blade: stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm for all louvres.
- .4 Frame, head, sill and jamb: 100 mm (4") deep. One piece extruded aluminum, minimum 3 mm thick with approved caulking slot, integral to unit.
- .5 Mullions: at 1500 mm maximum centres.
- .6 Fastenings: stainless steel SAE-194-8F with SAE-194-SFB nuts and resilient neoprene washers between aluminum and head of bolt, or between nut, ss washer and aluminum body.
- .7 Screen: 19 mm mesh, 2 mm diam wire aluminum birdscreen on inside face of louvres in formed U-frame.
- .8 Finish:
  - .1 Finish exposed surfaces of exterior aluminum components with factory applied polyvinylidene fluoride (PVF2) coating meeting performance requirements of AAMA 2605, dry film thickness of 0.025 mm.
    - .1 Colours to match PPG Duranar colour as approved by Architect.
    - .2 Gloss: Medium.
    - .3 Appearance: visibly free of flow.
- .9 Performance: as per drawing schedule.
- .10 Acceptable Materials: Reversomatic.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 In accordance with manufacturers and SMACNA recommendations.
- .2 Reinforce and brace air vents, intakes and to withstand local wind speeds as indicated.
- .3 Anchor securely into opening.

- .4 Seal with caulking around to ensure weather tight

**END OF SECTION**





## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .1 American Boiler Manufacturer's Association (ABMA)
- .2 American Society of Mechanical Engineers (ASME)
  - .1 ASME BPVC-IV-2017, 2017 ASME Boiler and Pressure Vessel Code (BPVC), Section IV: Rules for Construction of Heating Boilers.
- .3 Canadian Standards Association (CSA International)
  - .1 CSA 3.1-77 (R2016), Industrial and Commercial Gas-Fired Package Boilers.
  - .2 CSA 4.9-2014/ANSI Z21.13-2014, Gas-Fired Low Pressure Steam and Hot Water Boilers.
  - .3 CSA B51-14, Boiler, Pressure Vessel, and Pressure Piping Code.
  - .4 CSA B149.1-15, Natural Gas Installation Code.
  - .5 CAN/CSA C22.2 No. 110-94 (R2014), Construction and Test of Electric Storage Tank Water Heaters.
  - .6 CSA ANSI Z21.20-2007/C22.2 No. 199-2007 (R2012), Automatic Electrical Controls for Household and Similar Use Part 2: Particular Requirements for Automatic Burner Ignition Systems and Components.
  - .7 CSA ANSI Z21.20-2007/C22.2 No. 60730-2-5-14), Automatic Electrical Controls for Household and Similar Use - Part 2-5: Particular Requirements for Automatic Electrical Burner Control Systems.
- .4 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
  - .1 Material Safety Data Sheets (MSDS).
- .6 Underwriters Laboratories of Canada (ULC)
  - .1 UL 174, Household Electric Storage Tank Water Heaters.
  - .2 UL 60730-2-5, Standard for Automatic Electrical Controls for Household and Similar Use; Part 2: Particular Requirements for Automatic Electrical Burner Control Systems.

## **PART 2 PRODUCTS**

### **2.1 GENERAL**

- .1 Packaged Modulating Condensing Boiler:
  - .1 Complete with burner and necessary accessories and controls.
  - .2 Factory tested at rated capacity to, and bearing seal or nameplate certifying compliance with, CSA 3.1, witnessed and certified by Departmental Representative.
  - .3 Ready for attachment to piping, electrical power, controls, flue gases exhaust.
  - .4 Designed and constructed to ASME Boiler and Pressure vessel Code.
  - .5 CRN (Canadian Registration Number), to CSA B51.
  - .6 Boiler/burner package to bear CSA label.
- .2 Performance:
  - .1 In accordance with or CSA 4.9/ANSI Z21.13 testing procedures.
  - .2 Capacity: Refer to schedule on drawings.
  - .3 Gas pressure at meter outlet: 1743 Pa (7" wc).
  - .4 Flue gas temperature leaving boiler:
    - .1 Not to exceed 260°C.
- .3 Electrical:
  - .1 Power: 120 V, 1 phase, 60 Hz.
- .4 Controls: 24 V, 1 phase, 60 Hz.
  - .1 Electrical components: CSA approved.
- .5 Controls: factory wired. Enclosed in Electrical and Electronic Manufacturers' Association of Canada (EEMAC) steel cabinet.
- .6 Thermal insulation:
  - .1 25 mm thick mineral fibre. Seal insulation at all handholes, piping connections with insulating cement or asphaltic paint. Finish with heat resisting paint.
- .7 Jackets: heavy gauge metal, finished with heat resisting paint.
- .8 Mounting:
  - .1 Structural steel base.
- .9 Anchor bolts and templates:
  - .1 Supply for installation by other Divisions.
- .10 Start-up, instruction, on-site performance tests: 1 day.
- .11 Trial usage:
  - .1 Engineer may use boilers for test purposes prior to acceptance and commencement of warranty period.
  - .2 Supply labour, materials and instruments required for tests.

- .12 Temporary use by contractor:
  - .1 Contractor may use boilers only after written approval from Departmental Representative.
  - .2 Monitor and record performance continuously. Keep log of maintenance activities carried out.
  - .3 Refurbish to as-new condition before final inspection and acceptance.

## 2.2 BOILER

- .1 The boiler shall have a modulating input rating as per schedule on drawing and shall be operated on (Natural Gas). The boiler shall be capable of full modulation firing down to 10% of rated input with a turndown ratio of 10:1.
- .2 The boiler shall be designed with a vertical combustion chamber and a down firing burner to allow free gravity drainage of condensate from the heat exchanger. Its heat exchanger is to be manufactured with 439 stainless steel. Heat exchanger performance shall be maximized through a multi-tube, counter-flow fire-tube design.
- .3 The boiler shall be constructed in accord with CSA 4.9-2014/ANSI Z21.13 and the ASME Boiler and Pressure Vessel Code, Section IV and bear the H stamp as per ASME code. The boiler shall carry a CRN# for the Province of installation.
- .4 The boiler enclosure panel shall be of stainless steel with black powder coat base. Enclosure panels shall be designed for installation after all piping, insulation, and venting has been completed, provided all recommended clearances are respected.
- .5 The burner shall be of metal fiber knit burner c/w direct spark ignition, brushless dc fan, and fully referenced zero governor 24V gas valve.
- .6 The boiler control shall be built in complete with full outdoor reset, multiple load control with relays for five pumps, variable speed signal for system pump or air handler, clear constantly bright LCD display providing plain English information, and USB port for software upgrades. Altitude compensation shall be automatic, for maintenance of operation to 12,000 ft. The boiler shall offer internal multiple boiler staging and rotation control, for management of up to 24 boilers.
- .7 The boiler control shall be able to accept an external 0-10 VDC or 4-20 mA input signal, as well as being fully capable of a BACnet interface.
- .8 The boiler shall offer venting up to 340 feet (170' each side for combustion air and exhaust) using approved 3 inch PVC, CPVC, PP or stainless steel venting material. Both sealed combustion and indoor combustion air options shall be permissible.
- .9 Required clearances as per manufactures recommendation: top 12 inches, left side 1 inch, right side 1 inch, back 0 inches, and bottom 12 inches.

## **2.3 AUXILIARIES**

- .1 Additional standard equipment shall include the following items:
  - .1 SIM (Safety Ignition Module) Certified to CSA C22.2 No. 60730-2-5 and Conforming to UL 60730-2-5 & CSA ANSI Z21.20 providing ignition, flame proving and safety monitoring including:
    - .1 Electronic flue gas temperature sensor
    - .2 Electronic, probe-type Low Water Cut-Off
    - .3 Internal, Manual Reset Electronic High limit switch – testable and resettable on Touchscreen
  - .2 Electronic water pressure sensing, for digital display of system pressure.
  - .3 Mechanical water pressure and temperature sensing (built-in Tridicator).

## **2.4 DOMESTIC HOT WATER STORAGE TANK (INDIRECT)**

- .1 Airlock resistant wall coils.
- .2 Welded stainless steel dip tube.
- .3 2" of insulation for low standby heat loss.
- .4 Non-corrosive thermoplastic jacket.
- .5 10K $\Omega$  temperature sensor supplied with indirect water heaters for use with condensing boilers.
- .6 Brass ball valve style drain and T+P.
- .7 Conforms to UL 174, Certified to CAN/CSA C22.2 No. 110.

## **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 ASME Boiler and Pressure Vessels Code Section IV, regulations of Province having jurisdiction, except where specified otherwise, and manufacturers recommendations.
- .2 Make required piping connections to inlets and outlets recommended by boiler manufacturer.
- .3 Maintain clearances as indicated or if not indicated, as recommended by manufacturer for operation, servicing and maintenance without disruption of operation of any other equipment/system.
- .4 Mount unit level.
- .5 Pipe hot water relief valves full size to drain.
- .6 Natural gas fired installations - in accordance with CAN/CSA-B149.1.

### **3.3 MOUNTINGS AND ACCESSORIES**

- .1 Safety valves and relief valves:
  - .1 Run separate discharge from each valve.
  - .2 Terminate discharge pipe as indicated.

### **3.4 FIELD QUALITY CONTROL**

- .1 Commissioning:
  - .1 Manufacturer to:
    - .1 Certify installation.
    - .2 Start up and commission installation.
    - .3 Carry out on-site performance verification tests.
    - .4 Demonstrate operation and maintenance.
  - .2 Provide Departmental Representative at least 48 hours notice prior to inspections, tests, and demonstrations. Submit written report of inspections and test results.

**END OF SECTION**



## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .1 Air-Conditioning, Heating, and Refrigeration Institute (formerly ARI)
  - .1 ARI 340/360-2007, Performance Rating of Commercial and Industrial Unitary Air-Conditioning and Heat Pump Equipment
- .2 American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE)
  - .1 ASHRAE 90.1-2016, Energy Standard for Buildings Except Low-Rise Residential Buildings.
- .3 American Society for Testing and Materials International (ASTM)
  - .1 ASTM B117-16, Standard Practice for Operating Salt Spray (Fog) Apparatus
- .4 Canadian Standards Association (CSA)
  - .1 CSA C22.1-18, Canadian Electrical Code, Part I, Safety Standard for Electrical Installations (24th Edition).
- .5 Underwriters Laboratories (UL).

### **1.3 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 20 05 01 - Mechanical General Requirements.
- .2 Indicate:
  - .1 Equipment, piping, and connections, together with valves, strainers, control assemblies, thermostatic controls, auxiliaries and hardware, and recommended ancillaries which are mounted, wired and piped ready for final connection to building system, its size and recommended bypass connections.
  - .2 Piping, valves, fitting shipped loose showing final location in assembly.
  - .3 Control equipment shipped loose, showing final location in assembly.
  - .4 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, mounting curb details, sizes and location of mounting bolt holes; include mass distribution drawings showing point loads.
  - .5 Detailed composite wiring diagrams for control systems showing factory installed wiring and equipment on packaged equipment or required for controlling devices or ancillaries, accessories, controllers.
  - .6 Fan performance curves.
  - .7 Details of seismic vibration isolation.
  - .8 Estimate of sound levels to be expected across each individual octave band in dB referred to A rating.



- .9 Type of refrigerant used.

#### **1.4 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for incorporation into manual specified in Section 20 05 01 - Mechanical General Requirements.
- .2 Indicate:
- .1 Brief description of unit, indexed, with details of function, operation, control, and service for each component.
- .3 Manufacturer's installation instructions shall govern and unless otherwise noted, operation, maintenance and service of items. Include names and addresses of spare part suppliers.
- .4 Include following:
- .1 Provide for each unit, manufacturer's name, type, year, number of units, and capacity.

#### **1.5 WARRANTY**

- .1 For refrigeration compressors, the 12 months warranty period prescribed in subsection GC32.1 of General Conditions "C" is extended to 24 months.

### **PART 2 PRODUCTS**

#### **2.1 GENERAL DESCRIPTION**

- .1 Unit(s) furnished and installed shall be combination heating/cooling packaged rooftops as specified on the contract documents and within these specifications. Cooling capacity ratings shall be based upon ARI 340/360. Unit(s) shall consist of insulated weathertight casing with compressors, air cooled condenser coil, condenser fans, evaporator coil, filters, economizer, dampers, supply and return fan motors and drives, unit controls, natural gas heating section, and humidifier distributor section.
- .2 Unit(s) shall be factory run tested to include the operation of all fans, compressors, heat exchangers, and control sequences.
- .3 Unit shall conform to ASHRAE 90.1 and cannot exceed 265W per L/s.
- .4 Unit capacity & performance: as per mechanical schedule.
- .5 Acceptable materials: Engineered Air.

## **2.2 UNIT CASING**

- .1 Cabinet: Double wall galvanized steel, phosphatized, and finished with an air-dry paint coating durable enough to withstand 670 consecutive-hour salt spray application in accordance with standard ASTM B117. Structural members shall be 14 gauge with access doors and removable panels of minimum 18 gauge steel. Roof panels shall be sloped to provide positive drainage of rain water/melting snow away from the cabinet.
- .2 Access Doors: Fully gasketed hinged doors with fluted knob fasteners and chained "tie-backs" to provide access to filters, heating section, return/exhaust air fan section, supply air fan section and evaporator coil section. The unit control panel section shall be compartmented to separate high and low voltage components. The control panels shall also be fully gasketed, hinged and provided with quick release latches for easy access.
- .3 Insulation: Provide 50 mm thick fibreglass insulation with internal sheet metal liners on all exterior panels except the condensing section. Sheet metal liners shall be solid except in fan sections which shall be perforated.
- .4 Cabinet Colour: Unit shall be factory painted to standard colour selected by Architect.

## **2.3 AIR FILTERS**

- .1 Air Filters: Draw through filters shall mount integral within unit casing and be accessible via hinged access panels. Filters shall be 50 mm thick 30% efficient pleated pre-filters and 300 mm deep 85% efficient cartridge filters.

## **2.4 FANS - SUPPLY AND RETURN**

- .1 Provide an airfoil supply and return fan with fixed-pitch sheave drive assemblies. Dynamically balance all fans and the unit's running fan assembly fan mounted on actual shaft, bearings and in scroll housing to assure smooth operation of the fan and it's associated assembly. Balancing of the fan only shall not be acceptable.
- .2 Mount fan motor(s) and fan on a common base assembly. Provide thrust restraint isolation on the fan housing/fan board to assure smooth fan startup transitioning and operation.
- .3 Fan shaft shall be mounted on grease lubricated ball bearings with extended grease lines to allow lubrication of bearings from filter housing area.
- .4 Motor shall have a standard T-frame and a minimum service factor of 1.15. All drive components shall be accessible without the use of scaffolds or ladders, to facilitate periodic maintenance checks and for operator safety.

## **2.5 GAS FIRED HEATING SECTION**

- .1 Completely assembled and factory installed heating system integral to unit. UL or CSA approved specifically for outdoor applications for use downstream from refrigerant cooling coils. Provide capability for threaded gas piping connection through side or bottom of unit.
- .2 Heating section shall be factory tested prior to shipment.
- .3 Gas Burner: Forced draft type burner with adjustable combustion air supply, gas valve, manual shut-off, direct spark or pilot ignition, and flame sensing monitoring electrode. Provide air proving switch to prevent burner operation when burner is open for maintenance or inspection. Burner efficiency shall be a minimum of 80%.
- .4 Gas Burner Safety Controls: Provide electronic flame controls for the proving of combustion air prior to ignition sequence with prepurge cycle, and continuous electronic flame supervision.
- .5 Combustion Blower: Provide centrifugal type fan with thermal overload protection on fan motor.
- .6 Heat Exchanger: Provide factory pressure and leak tested tubular two pass heat exchanger of free floating design manufactured of 16-gauge stainless steel primary surface and 18-gauge stainless steel secondary surface.

## **2.6 EVAPORATOR COIL SECTION**

- .1 Provide heavy duty aluminum fins mechanically bonded to seamless copper tubes. Evaporator coil shall be inter-circuited to maintain active coil face area at part load conditions. Coil shall also utilize internally enhanced tubing for maximum efficiency.
- .2 Provide a thermostatic expansion valve (TXV) for each refrigerant circuit. Factory pressure and leak test coil at 2.07 MPa.
- .3 Provide 3-way pitched drain pan to assure positive drainage of condensate from the unit casing.
- .4 Provide P-traps at each condensate outlet, sized for fan static pressure.

## **2.7 CONDENSER SECTION**

- .1 Provide heavy duty aluminum fins mechanically bonded to seamless copper tubes. Factory leak test coil under 3.10 MPa pressure.
- .2 Provide subcooling circuit(s) integral with condense to maximize efficiency and prevent premature flashing of liquid refrigerant, to a gaseous state, ahead of the expansion valve.

- .3 Provide vertical discharge, direct drive fans with s blades, and three phase motors. Fans shall be statically and dynamically balanced. Motors shall be permanently lubricated, with built-in current and thermal overload protection in a weathertight casing.
- .4 Provide factory installed louvred steel coil guards perimeter of condensing section to protect the condenser coils, refrigerant piping and control components. Louvred panels shall be fabricated from minimum 1.01 mm thick galvanized steel and be rigid enough to provide permanent protection for shipping and pre-/post-installation. Course wire mesh is not an acceptable material for coil guards.
- .5 Condenser coils shall be V-banked for cleaning ease. Coils shall not exceed 14 fins per inch density in order to permit routine cleaning, and prevent excessive air pressure drop across the condenser coil.

## **2.8 REFRIGERATION SYSTEM**

- .1 Compressor: Hermetic compliant 2-step unloading 3-D scroll operating rpm with vibration isolation mounting, centrifugal reversible oil pump, oil sight glass and discharge valves.
- .2 Provide with thermostatic motor winding temperature to protect against excessive motor temperatures resulting from over-/under- voltage or loss of charge. Provide high and low pressure cutouts, and reset relay. Provide factory installed compressor lockout thermostat to prevent compressor operation at low ambient conditions.
- .3 On specific units, as noted in equipment schedule, lead refrigeration circuit shall be provided with hot gas reheat coil, modulating valves, electronic controller, supply air temperature sensor and a control signal terminal which allow the unit to have a dehumidification mode of operation, which includes supply air temperature control to prevent supply air temperature swings and overcooling of the space.

## **2.9 MIXING BOX SECTION**

- .1 Provide 100% modulating enthalpy-based economizer system fully integrated with unit outdoor air, return and exhaust air dampers. Unit operation is through primary temperature and space pressure controls that automatically modulate dampers to maintain desired space conditions.
- .2 Outdoor air and exhaust air openings shall be sized for 100% design airflow.
- .3 Equip with automatic outdoor enthalpy lockout sensor.
- .4 Provide adjustable minimum position control through BAS control system.
- .5 Provide spring return motor for outside air damper closure during unit shutdown or power interruption.
- .6 Provide airflow measuring stations integrated to economizer capable of measuring 5 to 100% of total airflow. Controller shall modulate airflow station's damper(s) to maintain minimum outside air rate with accuracy within 5%. During unoccupied periods, outside air shall be fully closed.

- .7 Section shall be complete with outdoor air intake multiple hoods c/w bird screen max. face velocity 2.54 m/s.

## **2.10 DAMPERS**

- .1 Construction: blades, 152 mm wide, 1219 mm long, maximum. Modular maximum size, 1219 mm wide x 2438 mm high. Multiple sections to have stiffening mullions and jack shafts.
- .2 Materials:
- .1 Frame: 2.03 mm minimum thickness extruded aluminum.
  - .2 Blades: extruded aluminum with two sheets 0.5 mm thick or otherwise reinforced to ensure specified low leakage when fully closed.
  - .3 Bearings: oil impregnated sintered bronze. Provide thrust bearings for vertical blades.
  - .4 Linkage and shafts: zinc plated steel.
  - .5 Seals: blade gaskets shall be extruded EPDM secured in an integral slot within aluminum blade extrusions. Frame seals shall be extruded TFE.
- .3 Performance:
- .1 Capacity: refer to drawings.
  - .2 Maximum 2% of rated airflow allowable leakage against 1000 Pa static pressure.
  - .3 Temperature range: minus 50°C to plus 100°C.
- .4 Arrangements:
- .1 Mixing dampers to be opposed blade arrangement.
  - .2 Outdoor air dampers to be parallel blade arrangement.
- .5 Outdoor Air & Exhaust Dampers:
- .1 Frames: insulated with extruded polystyrene foam with R factor of 2.3.
  - .2 Blades: constructed from aluminum extrusions with internal hollows insulated with polyurethane or polystyrene foam, R factor of 2.3.

## **2.11 ROOF CURBS**

- .1 Existing curb on site.
- .2 The frame must provide continuous support for the equipment and must resist wind and seismic forces.
- .3 All hardware must be plated with a rust resistant finish.
- .4 Curb waterproofing shall consist of a continuous galvanized counter flashing nailed over the curbs waterproofing.
- .5 Curbs shall have provision for 50 mm of insulation.
- .6 The rooftop unit must be solidly fastened to the curb, and the curb anchored to the roof structure.

- .7 Roof curb construction to conform to requirements of National Roofing Contractors Association (NRCA).
- .8 Provide seismic restraint calculations from P.Eng. For all equipment connections to the structure.

## **2.12 OPERATING CONTROLS**

- .1 Provide standalone microprocessor unit mounted control.
- .2 Provide factory installed indoor evaporator defrost control to prevent compressor slugging by interrupting compressor operation.
- .3 Provide the following factory installed and wired operating controls:
  - .1 Provide a minimum three minute off timer to prevent compressor from short cycling.
- .4 Provide wall mounted 7-day programmable thermostat with touch screen digital display.

## **2.13 MISCELLANEOUS FEATURES**

- .1 Provide unit mounted 115 volt convenience outlet.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- .1 Install as per manufacturer's instructions on roof curbs provided by manufacturer.
- .2 Manufacturer to certify installation. Provide start-up and commissioning of unit c/w manufacturer's start-up report.

- END OF SECTION

## **PART 1 GENERAL**

### **1.1 RELATED SECTIONS**

- .1 This section shall be read in conjunction with specification Section 20 05 01 - Mechanical General Requirements, all mechanical sections, and all other disciplines related to the project.

### **1.2 REFERENCES**

- .1 American Society for Testing and Materials (ASTM).
  - .1 ASTM F876-17, Standard Specification for Crosslinked Polyethylene (PEX) Tubing.
  - .2 ASTM F877-18, Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot- and Cold-Water Distribution Systems.
- .2 Canadian Standards Association (CSA).
  - .1 CAN/CSA B137 Series-17, Thermoplastic pressure piping compendium.

### **1.3 GENERAL**

- .1 Provide all labour, materials, products, equipment and services to supply and install underfloor heating systems for perimeter heating indicated on the drawings and specified in this Section of the Specification.
- .2 Manufacturer to provide heating system loop lay-out.
- .3 Acceptable materials: Wirsbo, Rehau, IPEX.

### **1.4 SHOP DRAWINGS**

- .1 Submit shop drawings in accordance with Section 20 05 01 - Shop Drawings.
- .2 Indicate:
  - .1 Connections, piping and fittings, valves, strainers, control assemblies and ancillaries, identifying factory and field assembled.
  - .2 Wiring as assembled and schematically.
  - .3 Dimensions, construction details, recommended installation and support, mounting bolt hole sizes and locations and point loads.
  - .4 Vibration control measures.
  - .5 Manufacturers recommended clearances.

## 1.5 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for incorporation into manual specified in Section 20 05 01 - Shop Drawings.
- .2 Include:
  - .1 Description of equipment giving manufacturers name, type, model year and capacity.
  - .2 Start-up and commissioning procedures.
  - .3 Details of operation, servicing and maintenance.
  - .4 Recommended spare parts list.

## 1.6 WARRANTY

- .1 The manufacturer shall furnish, at the completion of installation as described herein, a Certificate of Inspection signed by his authorized representative. Manufacturers 25 years piping warranty.

## PART 2 PRODUCTS

### 2.1 SLAB FLOOR HEATING EQUIPMENT

- .1 **Radiant in floor tubing is to be designed and installed in slab c/w manifolds, pumps, three-way valve, controls (including slab temperature sensor) and cabinets to meet loads indicated on drawings. Tubing layout to be coordinated to avoid future NRC installations and to approval of NRC.**
- .2 Provide underground tubing rated for 82°C (180°F) maximum working temperature and 690 kPa (100 psi) working pressure in accordance with ASTM F876 and ASTM F877 and CAN/CSA B137.5 with an oxygen diffusion barrier. Provide tubing with 13 mm (½") inside diameter. The pipe shall be manufactured by the "Engel Method". The pipe shall have a 2 layer oxygen diffusion barrier capable of limiting oxygen diffusion through the pipe to no greater than 0.005 g/m day at 4°C (40°F).

Pipe shall have 100% thermal memory when heated to 130°C (266°F).

The minimum bend radius for cold bending of the pipe shall not be less than 8 times the outside diameter. Bends with a radius less than stated will require the use of a bend support by the pipe manufacturer.

- .3 Tubing fittings shall be manufactured of dezincification resistant brass. These fittings must be supplied by the pipe manufacturer. The pipe fitting consists of a barbed insert, a serrated compression ring, and a nut capable of connecting to the manifold.



- .4 Manifolds shall be of cast bronze construction and shall have integral loop balancing, and loop control valves. Supply and return manifolds shall be able to vent air from the system and shall be provided with support brackets. Manifolds shall be isolated from supply and return piping with valves that are suitable for isolation and balancing.
- .5 Manifold & pump cabinet c/w locking door. Reference drawing for layout. Stainless steel checker plate front.

### **PART 3 EXECUTION**

#### **3.1 INSTALLATION**

- .1 Tubing embedded in concrete shall be secured to a welded wire fabric or approved alternate fabric (provided by others) with wire ties provided by the pipe manufacturer.
- .2 Contractor to supply field coordination and supervision of the pressure testing of the field tubing. The system shall be pressure tested at 413 kPa (60 psi) for minimum of 24 hours prior to and during the concrete application. Test equipment to be supplied by and installed by the contractor. Test shall be witnessed by Engineer.
- .3 The system shall be thoroughly checked for possible tubing punctures by the authorized supervisor and shall be repaired by the contractor prior to and during the concrete application.
- .4 Assemble to provide smooth air flow through all components. Limit air leakage to 1% of rated air flow at 2.5 kPa suction pressure.
- .5 Paint inside casing surfaces with zinc coating to CAN/CGSB-1.181, 0.075 mm minimum thickness when dry.
- .6 **Piping joints or splices are not permitted in underground services.**

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 lighting switches, recessed and surface mounted receptacles such as those in offices and service rooms and used to plug in office equipment, telecommunication equipment or small portable tools. Indicate only the source of power (Ex. for a receptacle fed from panel L32 circuit #1: "L32-1").
- .2 Light fixtures are the only exceptions for electrical equipment identification (except as noted in 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 Lamicoid nameplates shall be rigid lamicoid, 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 lamicoid nameplates, mount nameplates using two-sided tape.
- .11 For all exterior lamicoid 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 lamicoid nameplates to be 3.7 mm (3/16") diameter to allow for expansion of lamicoid 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 lamicoid nameplates shall have a minimum border of 3 mm (1/8"). Characters shall be 9 mm (3/8") in size unless otherwise specified.
- .13 Identify lighting fixtures which are connected to emergency power with a label "EMERGENCY LIGHTING/ÉCLAIRAGE D'URGENCE", black letters on a yellow background. These labels are available from NRC's Facilities Maintenance group in building M-19.
- .14 Provide neatly typed updated circuit directories in a plastic holder on the inside door of new panelboards.
- .15 Carefully update panelboard circuit directories whenever adding, deleting, or modifying existing circuitry.
- .16 Identify molded case breaker with lamicoid nameplate.

## **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 All new conduits to be factory painted, colour-coded EMT, type as follows:
  - .1 Fire alarm – red conduit
  - .2 Emergency power circuits – yellow conduit
  - .3 Voice/data – blue conduit
  - .4 Gas detection system – purple conduit
  - .5 Building Automation system – orange conduit

- .6 Security system – green conduit
- .7 Control system – black conduit
- .2 All other systems need not be coloured.

## **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 T90 stranded for applications using wires sized No. 10 and smaller.
    - .3            For fire alarm wiring refer to Section 283100.
    - .4            Approved heat resistant wire for wiring through and at lighting and heating fixtures. Where insulation types are shown on the drawings other types shall not be used unless the specification is more restrictive.
  - .6            Use **stranded** 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%.

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**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.

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**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            Steel coupling for EMT.
- .3            Fittings for liquid-tight flexible conduits shall be liquid-tight connectors.
- .4            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.
- .5            Factory bends are not permitted to be modified. Ensure conduit bends other than factory bends are made with an approved bender. Making offsets and other bends by cutting and rejoining factory bends are not permitted.

**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 16mm (1/2").
  - .3            Conduit to be coloured as required for systems described in section 260500.9.
- .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 conduit of any size. 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 except the colored EMT specified in 260500.

**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.
- .3        Prior to any installation of circuit breakers in either a new or existing installation, Contractor must submit three (3) copies of a certificate of origin, from the manufacturer, duly signed by the factory and the local manufacturer's representative, certifying that all circuit breakers come from this manufacturer, they are new and they meet standards and regulations. These certificates must be submitted to the Departmental Representative for approval.
  - .1        The above applies to all breakers rated above 240V.
  - .2        The above applies to all breakers rated up to 240V and 100A or more.
- .4        A delay in the production of the certificate of origin won't justify any extension of the contract and additional compensation.
- .5        Any work of manufacturing, assembly or installation should begin only after acceptance of the certificate of origin by Departmental Representative. Unless complying with this requirement, Departmental Representative reserves the right to mandate the manufacturer listed on circuit breakers to authenticate all new circuit breakers under the contract at the Contractor's expense.
- .6        In general, the certificate of origin must contain:
  - .1        The name and address of the manufacturer and the person responsible for authentication. The responsible person must sign and date the certificate;
  - .2        The name and address of the licensed dealer and the person of the distributor responsible for the Contractor's account.
  - .3        The name and address of the Contractor and the person responsible for the project.
  - .4        The name and address of the local manufacturer's representative. The local representative must sign and date the certificate.
  - .5        The name and address of the building where circuit breakers will be installed:
    - .1        Project title.
    - .2        End user's reference number.
    - .3        The list of circuit breakers.

**1.2            IDENTIFICATION**

- .1        Identification as per Section 26 05 00.

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**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, or approved equal.

**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                DRY TYPE TRANSFORMER**

- .1        Type ANN, C802.2.
- .2        Single or three phase, KVA rating, input and output voltage as indicated.
- .3        Class 200, 130°C temperature rise insulation rating for 15kva and 30kva transformer. Class 220, 150°C temperature rise insulation system for other sizes.
- .4        Copper windings.
- .5        Four 2.5% taps, 2-FCAN and 2-FCBN.
- .6        EEMAC 1 enclosure with lifting lugs, removable metal front and side panels.
- .7        Drip shield.
- .8        Standard of acceptance: Hammond or approved equal.

**2.4                PANELBOARDS**

- .1        600 volt rated power panelboards: bus and breakers rated for 25,000 amp r.m.s. symmetrical interrupting capacity at 600V or as indicated.
- .2        250 volt lighting panelboards to have minimum interrupting capacity of 10,000 amp r.m.s. symmetrical.



- .3 Panelboards that have a main breaker indicated in plan shall be service entranced approved (i.e. barrier to separate main breaker from remainder of panels).
- .4 Sequence phase bussing with odd numbered breakers on left and even on right, with each breaker identified by permanent number identification as to circuit number and phase.
- .5 Panelboards: mains, number of circuits, number and size of branch circuit breakers as indicated.
- .6 Two keys for each panelboard and all panelboards to be keyed alike.
- .7 Copper bus, neutral and ground bar with neutral of same ampere rating as mains.
- .8 Suitable for: plug-in breaker for molded case circuit breaker, bolt-on breakers for miniature circuit breaker
- .9 Hinged door, trim finish: baked grey enamel.
- .10 Drip shield.
- .11 Surface mount with hinge door, unless otherwise indicated on drawing.
- .12 Complete circuit directory with typewritten legend showing description of each circuit.
- .13 Manufacturer: Square D or approved equal.

## **2.5 MOLDED 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.  
  
Circuit breakers minimum interrupt rating: 25KA for 600/347V or greater if indicated.
- .6 Electronic trip unit as indicated by drawing.  
  
LI: long time and instantaneous  
  
LSI: long time, short time and instantaneous  
  
LSIG: long time, short time , instantaneous and grounding  
  
A: with Ammeter

E: with energy meter

- .7 On board control power for trip unit
- .8 Standard of acceptance: Square D or approved equal.

## **2.6 FUSES**

- .1 250V and 600V time delay, rejection style, HRC-I, Class RK5.
- .2 Standard of acceptance: Gould-Shawmut or approved equal.

## **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 DRY TYPE TRANSFORMER**

- .1 Transformers above 75 kVA mount on floor.
- .2 Provide adequate clearance around transformer for ventilation.
- .3 Install transformers in level upright position.
- .4 Remove shipping supports only after transformer is installed and just before putting into service.
- .5 Loosen isolation pad bolts until no compression is visible.
- .6 Make primary and secondary connections shown on wiring diagram.
- .7 Energize transformers immediately after installation is completed, where practicable.
- .8 Provide equipment identification in accordance with Section 26 05 00.
- .9 Connect transformer through side of housing.

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**3.4 PANELBOARDS**

- .1 Locate panelboards as indicated and mount securely, plumb, and square, to adjoining surfaces.
- .2 Mount panels to height specified in section 26 27 26 or as indicated.
- .3 Connect loads to circuits as indicated.
- .4 Connect neutral conductors to common neutral bus.

**3.5 MOLDED CASE CIRCUIT BREAKERS**

- .1 Install circuit breakers as indicated.

**3.6 FUSES**

- .1 Install fuses in mounting devices immediately before energizing circuit.
- .2 Install fuses correctly sized to assigned electrical circuits.
- .3 Provide 3 spare fuses for each rating supplied.

END OF SECTION

**Part 1            General**

**1.1                RELATED WORK**

- .1            Motors and controls to Sections 26 22 19, 26 29 03 & 26 29 10.

**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                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            LED Dimming Switches:
  - .1            0-10VDC, electronic, suitable for use with installed light fixture.
  - .2            Rated for 1200W.
  - .3            Suitable for use in "3-way" configuration where indicated.
  - .4            Standard of acceptance:
    - .1            Philips SR1200ZTUNV or equivalent approved by NRC Departmental Representative.
    - .2            3-way style to be Philips SR3W or equivalent approved by NRC Departmental Representative.

- .3 LED occupancy sensor (wall mounted):
  - .1 120V, suitable for use with installed light fixture.
  - .2 Rated for 600W LED.
  - .3 Can be set to Manual-ON/Automatic-OFF or Auto-ON/Auto-OFF.
  - .4 Adjustable delayed-OFF time.
  - .5 Suitable for use in “3-way” configuration where indicated.
  - .6 Fire year warranty.
  - .7 Standard of acceptance: Hubbell, Leviton, Philips or equivalent approved by NRC Departmental Representative.
- .4 LED occupancy sensor (ceiling mounted):
  - .1 120V, suitable for use with installed light fixture.
  - .2 360° coverage pattern.
  - .3 No minimum load requirements.
  - .4 Adjustable delayed-OFF time.
  - .5 No field calibration or sensitivity adjustments required.
  - .6 Fire year warranty.
  - .7 Standard of acceptance: Philips LRM2377 or equivalent approved by NRC Departmental Representative.
- .5 LED dimmable motion switches:
  - .1 Dimmer with passive infrared sensors to control LED fixtures.
  - .2 180° sensor field-of-view.
  - .3 Up to 30’x30’ major motion coverage and 20’x20’ minor motion coverage.
  - .4 Occupancy sensor can be set too auto-on/auto-off or manual-on/auto-off.
  - .5 Adjustable timeout and high/low sensitivity adjustment.
  - .6 Adjustable settings for auto-on light level: 100%, 50%, last light level, or locked pre-set light level.
  - .7 Off warning fades lights to off over a period of 10 seconds.
  - .8 120V.
  - .9 5 year warranty.
  - .10 Standard of acceptance: Lutron MSCL-OP153M-WH.
- .6 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.

- .7 Rooftop maintenance receptacles:
  - .1 Class A type ground fault protection.
  - .2 CSA 5-20R configuration.
  - .3 Supplied by a dedicated circuit.
- .8 Outdoor GFCI Receptacles cover:
  - .1 Non-metallic In-Use cover.
  - .2 Single gang. Deep cover. Clear color.
  - .3 Horizontal or vertical mount.
  - .4 Includes attached gasket and mounting hardware.
  - .5 Standard of acceptance: Hubbell MM510C.
- .9 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 Multi-outlet covers as indicated.
- .10 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.
- .4 Locate roof top maintenance receptacle within 7.5m of the rooftop electrical equipment.

#### **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 Clock receptacles 2.4m (8'-0") to centreline.
  - .4 Lighting panels 1.8m (6'-0") to top.
  - .5 Telephone and data communications outlet 400mm (1'-4") to centreline.
  - .6 Fan coil speed control switch 1.2m (3'-11") to centreline.
  - .7 Roof top maintenance receptacle: 750mm above the finished roof.

### **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                RELATED WORK SPECIFIED ELSEWHERE**

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

**1.2                SHOP DRAWINGS AND PRODUCT DATA**

- .1            Submit shop drawings and product data in accordance with Section 00 10 00.
- .2            Include schematic, wiring, interconnection diagrams.
- .3            Indicate:
  - .1            Mounting method and dimensions.
  - .2            Starter size and type.
  - .3            Layout of identified internal and front panel components.
  - .4            Enclosure types.
  - .5            Wiring diagram for each type of starter.
  - .6            Interconnection diagrams.
- .4            Motors specified and supplied with mechanical equipment. Refer to Division 23.

**1.3                OPERATION AND MAINTENANCE DATA**

- .1            Provide operation and maintenance data for motor starters for incorporation into manual specified in Section 00 10 00.
- .2            Include operation and maintenance data for each type and style of starter.

**Part 2            Products**

**2.1                MATERIALS**

- .1            Starters:
  - .1            IEC rated starters not acceptable.

**2.2                MANUAL MOTOR STARTERS**

- .1            Single and three phase manual motor starters of size, type, rating, and enclosure type as indicated, with components as follows:
  - .1            Switching mechanism, quick make and break.
  - .2            One and three overload heaters as indicated, manual reset, trip indicating handle.
- .2            Accessories:
  - .1            Toggle switch, key switch or pushbutton as specified.
  - .2            Indicating light: type and colour as indicated.
  - .3            Locking tab to permit padlocking in "ON" or "OFF" position.



- .3 Standard of acceptance: Square D, Class 2510 or approved equal.

## **2.3 FULL VOLTAGE MAGNETIC STARTERS**

- .1 Magnetic and combination magnetic starters of size, type, rating and enclosure type as indicated with components as follows:
  - .1 Contactor solenoid operated, rapid action type.
  - .2 Motor overload protective device in each phase, manually reset from outside enclosure.
  - .3 Power and control terminals.
  - .4 Wiring and schematic diagram inside starter enclosure in visible location.
  - .5 Identify each wire and terminal for external connections, within starter, with permanent number marking identical to diagram.
- .2 Combination type starters to include motor circuit interrupter or circuit breaker with operating lever on outside of enclosure to control motor circuit interrupter or circuit breaker and provision for:
  - .1 Locking in "OFF" position with up to 3 padlocks.
  - .2 Locking in "ON" position.
  - .3 Independent locking of enclosure door.
  - .4 Provision for preventing switching to "ON" position while enclosure door open.
- .3 Accessories:
  - .1 Pushbuttons and selector switches: type and labelled as indicated.
  - .2 Indicating lights: type and color as indicated.
  - .3 1-N/O and 1-N/C spare auxiliary contacts unless otherwise indicated.
- .4 Standard of acceptance: Square D, Class 8539 or approved equal.

## **2.4 MULTI-SPEED STARTERS**

- .1 2-Speed starters of size, type, rating, and enclosure type as indicated. Starter suitable for constant torque and variable torque type motor with components as follows:
  - .1 One-3 pole contactor for each winding for separate winding motors.
  - .2 Three overload relays with 3 heater elements and manual reset for each speed.
- .2 Accessories:
  - .1 Selector switches: standard labelled as indicated.
  - .2 Indicating lights: standard type and color as indicated.
  - .3 Auxiliary control devices as indicated.

## **2.5 FINISHES**

- .1 Apply finishes to enclosure in accordance with Section 26 05 00.

## **2.6 EQUIPMENT IDENTIFICATION**

- .1 Provide equipment identification in accordance with Section 260500.

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**Part 3            Execution**

**3.1                INSTALLATION**

- .1        Install starters, connect power and control as indicated.
- .2        Install control devices and relay panels and interconnect as indicated.
- .3        Install correct fuses and overload device elements.
- .4        Megger all motors. Dry out motor if dampness is present in accordance with manufacturer's recommendations.
- .5        For installation of motor with mechanical equipment refer to Division 23.
- .6        Make connection to motor as indicated. Use liquid-tight PVC jacketed flexible conduit between rigid conduit and motor.
- .7        Make flexible conduit long enough to permit movement of motor.

**3.2                TESTS**

- .1        Perform tests in accordance with Section 26 05 00 and Manufacturer's instructions.
- .2        Operate switches, contactors to verify correct functioning.
- .3        Perform starting and stopping sequences of contactors and relays.
- .4        Check that sequence controls, interlocking with other separate related starters, equipment, control devices, operate as indicated.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED WORK SPECIFIED ELSEWHERE**

- .1        Common Work Results - Electrical Section 26 05 00
- .2        Variable Frequency Drives – Mechanical Section 23 05 14

**1.2                DESCRIPTION**

- .1        This specification is to cover a complete Variable Frequency motor Drive (VFD) consisting of a pulse width modulated (PWM) inverter designed for use on a standard NEMA Design B induction motor.
- .2        The drive manufacturer shall supply the drive and all necessary controls as herein specified. The manufacturer shall have been engaged in the production of this type of equipment for a minimum of twenty years. All VFDs installed on this project shall be from the same manufacturer.

**1.3                QUALITY ASSURANCE**

- .1        Referenced Standards:
  - 1.        Institute of Electrical and Electronic Engineers (IEEE)
    - .1        Standard 519-1992, IEEE Guide for Harmonic Content and Control.
  - .2        Underwriters laboratories
    - .1        UL508C
  - .3        National Electrical Manufacturer’s Association (NEMA)
    - .1        ICS 7.0, AC Adjustable Speed Drives
  - .4        IEC 16800 Parts 1 and 2
  - .5        CSA 22.2
- .2        Qualifications:
  - .1        VFDs and options shall be UL listed and CSA approved as a complete assembly. VFDs that require the customer to supply external fuses for the VFD to be UL listed are not acceptable. VFDs requiring additional branch circuit protection are not acceptable. The base VFD shall be UL listed for 100 KAIC without the need for input fusing.

**1.4                SHOP DRAWINGS AND PRODUCT DATA**

- .1        Submit shop drawings and product data in accordance with Section 00 10 00.
- .2        Include schematic, wiring, interconnection diagrams.
- .3        Indicate:
  - .1        Outline dimensions, conduit entry locations and weight.
  - .2        Customer connection and power wiring diagrams.

- .3 Complete technical product description include a complete list of options provided. **Any portions of the specifications not complied with must be clearly indicated or the supplier and contractor shall be liable to provide all components required to meet the specification.**
- .4 Compliance to IEEE 519 – harmonic analysis for particular jobsite including total harmonic voltage distortion and total harmonic current distortion (TDD).
  - .1 The VFD manufacturer shall provide calculations, where required on the drawing; specific to the installation, showing total harmonic voltage distortion is less than 5%.
  - .2 Input filters shall be sized and provided as required by the VFD manufacturer to ensure compliance with the IEEE electrical system standard 519. All VFDs shall include a minimum of 5% equivalent impedance reactors, **no exceptions.**
- .4 Motors specified and supplied with mechanical equipment. Refer to Division 23.

## 1.5 OPERATION AND MAINTENANCE DATA

- .1 Provide operation and maintenance data for motor starters for incorporation into manual specified in Section 00 10 00.
- .2 Include operation and maintenance data for each type and style of starter.
- .3 On completion of the installation, the supplier shall provide the following:
  - .1 Full commissioning report documenting all programmable settings, AC input voltage, DC Bus voltage, current draw at maximum speed, and a description of ambient conditions.
  - .2 One operator's manual for each VFD installed.
  - .3 One 8.5" x 11" wiring diagram for each VFD installed.

## 1.6 GENERAL DESIGN CHARACTERISTICS

- .1 The VFD shall be of the Pulse Width Modulated (PWM) type.
- .2 The VFD shall be rated for variable torque applications, with an overload rating of 110% for 60 seconds.
- .3 All VFD's shall be factory UL/cUL Listed.
- .4 All packaged drive systems shall be CSA Listed.
- .5 The VFD shall have the capability of operating multiple motors. The minimum VFD continuous current rating shall be the sum of the full load current ratings of the connected motors.
- .6 The VFD shall have a minimum displacement power factor of 0.96 or higher at all output frequencies.
- .7 The VFD manufacturer shall have a minimum of ten years experience in the Canadian Market.

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**Part 2 Products**

**2.1 VARIABLE FREQUENCY DRIVES**

- .1 Variable Frequency Drives are supplied by Division 23 and installed by Division 26.
- .2 Coordinate all supply and installation requirements with Division 23 Contractor.
- .3 Refer to Mechanical drawings and specifications for more information.
- .4 Standard of acceptance: ABB ACH550-VDR (Vertical E-Clipse Bypass).

**Part 3 Execution**

**3.1 INSTALLATION**

- .1 Installation shall be the responsibility of the electrical contractor. The contractor shall install the drive in accordance with the requirements of the VFD manufacturer's installation manual.
- .2 The contractor is to verify that the jobsite conditions for installation meet the factory recommendations and code required conditions for the VFD installation prior to installation. These shall include as a minimum:
  - .1 Clearance spacing.
  - .2 Compliance with environmental ratings of the VFD system.
  - .3 Separate conduit installation of the input wiring, the motor wiring, and control wiring. At no time does any of this wiring run in parallel with each other.
  - .4 All power and control wiring is complete.
- .3 The VFD is to be covered and protected from installation dust and contamination until the environment is cleaned and ready for operation. The VFD system shall not be operated while the unit is covered.

**3.2 ON-SITE STARTUP**

- .1 The manufacturer shall provide start-up and commissioning of the variable frequency drive and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. The commissioning personnel shall be the same personnel that will provide the factory service and warranty repairs at the customer site. Sales personnel and other agents who are not factory certified technicians for drive repair shall not be acceptable as commissioning agents.
- .2 Start-up services shall include checking for verification of proper operation and installation of the VFD, its options and its interface wiring to the building automation system. Included in this service shall be as a minimum:
  - .1 Verification of contractor wire terminations and conduit runs to and from the VFD.
  - .2 Up to four hours of customer operator training on the operation and service diagnostics at the time of commissioning. On-site training is to be provided by the same factory trained application engineering and service personnel to demonstrate

full programming and operating features and procedures. Date and time for this training is to be coordinated with the NRC Departmental Representative.

- .3 Measurement for verification of proper operation of the following:
  - .1 Motor voltage and frequency. Verification of proper motor operation.
  - .2 Control input for proper building automation system interface and control calibration.
  - .3 Calibration check for the following set-points:
    - .1 minimum speed
    - .2 maximum speed
    - .3 acceleration and deceleration rates.
- .3 Commissioning agent to verify the programming of the VFD and to provide a written copy of the settings to the engineer.
- .4 Commissioning agent to lock out critical frequencies throughout the operating curve of the equipment as identified and required by the engineer. The agent shall record amperages at six (minimum) different frequencies from minimum to maximum speed.

### **3.3 PRODUCT SUPPORT**

- .1 Factory trained application engineering and service personnel that are thoroughly familiar with the VFD products offered shall be locally available at both the specifying and installation locations. A toll free 24/365 technical support line shall be available.
- .2 A computer based training CD or 8-hour professionally generated video (VCR format) shall be provided to the owner at the time of project closeout. The training shall include installation, programming and operation of the VFD, bypass and serial communication.

### **3.4 WARRANTY**

- .1 Warranty shall be 24 months from the date of certified start-up. The warranty shall include all parts, labor, travel time and expenses

**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 001000.
- .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                LIGHTING CONTROL RELAY PANEL**

- .1            Lighting control relay panel rated at 347V.
- .2            16 gauge steel enclosure and doors coated with ANSI/ASA 61 grey baked enamel.
- .3            Operation:
  - .1            Fully programmable time clock, compatible with occupancy sensors.
  - .2            2 minute warning that lights will turn off unless overridden.
  - .3            Override "lights off" via local switch.
- .4            Includes the following features:
  - .1            BACnet protocol to interface with NRC BAS system.
  - .2            Heavy duty relays (16) rated at 20A and 120,000 operations.

- .5 Include all components necessary for a complete, fully functional system including low voltage switches and wiring for zones to be time controlled. Refer to drawings.
- .6 Standard of acceptance:
  - .1 Panel: Schneider Electric SERPB16HS series or approved equivalent.
  - .2 Push button switches: Schneider Electric SERPWSxGyB or approved equal.

## 2.4 LUMINAIRES

- .1 LED
  - .1 Type A:
    - .1 347V, 400mm x 1120mm, 209W, suitable for suspension mounting.
    - .2 Die formed aluminum chassis, natural convection cooling.
    - .3 Semi-diffuse acrylic lens.
    - .4 L70 at 100,000 hours, L85 at 52,000 hours.
    - .5 5-year warranty.
    - .6 4000k colour temperature, minimum 24,000 Lumen output.
    - .7 Medium light distribution.
    - .8 Standard of acceptance: Lithonia IBH24LHVOLT, Philips FBX24L40347M or equivalent approved by the NRC Departmental Representative.
  - .2 Type B:
    - .1 347V, 400mm x 1120mm, 209W, suitable for surface mounting.
    - .2 Die formed aluminum chassis, natural convection cooling.
    - .3 Semi-diffuse acrylic lens.
    - .4 L70 at 100,000 hours, L85 at 52,000 hours.
    - .5 5-year warranty.
    - .6 4000k colour temperature, minimum 24,000 Lumen output.
    - .7 Medium light distribution.
    - .8 Standard of acceptance: Lithonia IBH24LHVOLT, Philips FBX24L40347M with ALSTK surface mounting kit or equivalent approved by the NRC Departmental Representative.
  - .3 Type C:
    - .1 347V, 1140-1220mm long, LED linear strip, suitable for surface or suspended mounting.
    - .2 Surface mount unless otherwise noted on drawings.
    - .3 5-year warranty.
    - .4 Rated to deliver L70 performance for 100,000 hours.
    - .5 4000k colour temperature, minimum 4000 lumen output.  
Standard of acceptance: Lithonia CLX L48 4000LM SEF RDL 347 GZ10 40K 80CRI WH, Philips Fluxstream FSS440L840-347-DIM or equivalent approved by the NRC Departmental Representative.
  - .4 Type D:
    - .1 347V, 305mm x 1219mm, LED troffer, suitable for recessed mounting in T-bar or drywall ceiling.



- .2 5-year warranty.
- .3 Suitable for dimming.
- .4 Include mounting kit for appropriate ceiling type.
- .5 Removable LED boards and driver for ease of service/replacement.
- .6 Rated to deliver L70 performance for 50,000 hours.
- .7 4000k colour temperature, 82 CRI, minimum 4000 lumen output minimum.
- .8 Standard of acceptance: Lithonia BLT4 40L ADP 347 EZ1 LP840, Philips T-Grid 1T42L840-4-FS-02F-347V-DIM or equivalent approved by the NRC Departmental Representative.
- .5 Type E:
  - .1 347V, 610mm x 610mm, LED troffer, suitable for recessed mounting in T-bar or drywall ceiling.
  - .2 5-year warranty.
  - .3 Suitable for dimming.
  - .4 Include mounting kit for appropriate ceiling type.
  - .5 Removable LED boards and driver for ease of service/replacement.
  - .6 Rated to deliver L70 performance for 50,000 hours.
  - .7 4000k colour temperature, 82 CRI, minimum 2000 lumen output minimum.
  - .8 Standard of acceptance: Lithonia 2BLT2 20L ADP 347 EZ1 LP840, Philips T-Grid 2TG20L-840-2-FS-02F-347-DIM or equivalent approved by the NRC Departmental Representative.
- .6 Type F:
  - .1 347V, 305mm x 1219mm, LED, suitable for recessed mounting in T-bar or drywall ceiling.
  - .2 5-year warranty.
  - .3 Suitable for damp location.**
  - .4 Include mounting kit for appropriate ceiling type.
  - .5 Removable LED boards and driver for ease of service/replacement.
  - .6 Rated to deliver L70 performance for 50,000 hours.
  - .7 4000k colour temperature, 82 CRI, minimum 4000 lumen output minimum.
  - .8 Standard of acceptance: Lithonia BLT4 40L ADP 347 EZ1 LP840, Philips 1T42L840-4-FS-02F-347-DIM or equivalent approved by the NRC Departmental Representative.
- .2 LED Pot light
  - .1 Type G:
    - .1 120V, 150mm LED downlight, suitable for recessed mounting in drywall ceiling.
    - .2 5-year warranty.
    - .3 4000k colour temperature, 82 CRI, minimum 1500 lumen output.
    - .4 Suitable for wet location.

- .5 Standard of acceptance: Lithonia LDN6 40/15 LO6AR LSS MVOLT EZ10 WL, Philips LyteProfile P6RD15NUVB-P6RD840-VB-P6RDCL or equivalent approved by the NRC Departmental Representative.
- .2 Type K:
  - .1
  - .2 120V, 175mm open LED downlight, suitable for surfaced mounting in drywall ceiling.
  - .3 Rated for wet location.
  - .4 5-year warranty.
  - .5 3500k colour temperature, 80 CRI, minimum 1000 lumen output.
  - .6 Standard of acceptance: Philips S-7-R-8-35K-10-AL, Juno Slimform JSF-7IN 10LM-35K-90CRI-120FRPC-WH+JSFTRIM 7IN-SN or equivalent approved by the NRC Departmental Representative.

## 2.5 EXTERIOR FLOOD LIGHTS

- .1 Outdoor weatherproof floodlight
  - .1 Type H:
    - .1 Wall-mounted 45W, 347V, LED wall pack.
    - .2 Die-cast aluminum housing, bronze in colour.
    - .3 18 LEDs, type 4 optics, full cut-off. 3311 lumen output.
    - .4 Built in photo control.
    - .5 Standard of Acceptance: Hubbell outdoor lighting Laredo Series LNC2-18LU-5K-4-1-PCI or equivalent approved by the NRC Departmental Representative.
  - .2 Type I:
    - .1 Wall-mounted 45W, 347V, LED wall pack.
    - .2 Die-cast aluminum housing, bronze in colour.
    - .3 18 LEDs, type 3 optics, full cut-off. 3311 lumen output.
    - .4 Built in photo control.
    - .5 Standard of Acceptance: Hubbell outdoor lighting Laredo Series LNC2-18LU-5K-3-1-PCI or equivalent approved by the NRC Departmental Representative.
  - .3 Type J:
    - .1 Wall-mounted 71W, 347V, LED wall pack.
    - .2 Die-cast aluminum housing, bronze in colour.
    - .3 18 LEDs, type 4 optics, full cut-off. 4673 lumen output.
    - .4 Built in photo control.
    - .5 Standard of Acceptance: Hubbell outdoor lighting Laredo Series LMC30LU-4-1-PCI or equivalent approved by the NRC Departmental Representative.

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**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.

**3.5 EXTERIOR FLOODLIGHTS**

- .1 Install floodlights in accordance with manufacturer's instructions and as indicated.
- .2 Aim energized floodlights as indicated during darkness and in the presence of the NRC Departmental Representative.

**3.6 PHOTOELECTRIC LIGHTING CONTROL**

- .1 Install photoelectric controls in accordance with manufacturer's instructions.

**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.

**Part 2 Products**

**2.1 EXIT LIGHTS**

- .1 New
  - .1 Housing: Metal construction using Canadian cold-rolled steel. Frame and back plate shall each be of a one-piece construction.
  - .2 Faceplate(s) shall be constructed of robust clear poly-carbonate panels with an opaque border colored factory-white.
  - .3 Universal pictogram sign. Two pictogram films per face, for direction selection.
  - .4 Long-life white LED light source. Consumes less than 2.5W in AC mode and 1W in DC mode.
  - .5 Meets or exceeds CSA 22.2 No.141-10 standard for pictogram exit signs.
  - .6 Two-wire universal AC input: 120 to 347V. Two-wire standard DC input: 6 to 24Vdc.
  - .7 Universal mounting: end, wall or ceiling.
  - .8 Standard of acceptance: Thomas&Betts LS series. LS1WU for single face and LS2WU for double face.
- .2 Existing
  - .1 Housing: one piece extruded aluminum with aluminum grey baked epoxy finish.
  - .2 Face plates:
    - .1 Extruded 2.5 mm (0.1") thick aluminum complete with knock-out arrows.
    - .2 Single and double face (refer to drawings).
    - .3 Letters: 114 mm (6") high reading EXIT and SORTIE.
    - .4 Mounting: universal-surface-end and ceiling with canopy.
    - .5 Downlight: prismatic plastic.

- .6 Lamp: LED 120VAC
- .7 To meet CAN/CSA C860-01

**Part 3 Execution**

**3.1 EXIT LUMINAIRES**

- .1 Connect fixtures to emergency power circuits as indicated.
- .2 Ensure that the exit light circuit breaker is locked in the "ON" position.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED WORK SPECIFIED ELSEWHERE**

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

**1.2                REFERENCES**

- .1            Telecommunications Industry Association (TIA)
  - .1            ANSI/TIA/EIA 569-D, Commercial Building Standard for Telecommunications Pathways and Spaces.

**1.3                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. Factory painted blue as per section 26 05 00.
- .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            Conduit and cable pathways installation shall comply with ANSI/TIA/EIA 569-D.
- .2            Run conduit from wall outlets to 150mm (6") above false ceiling or to a point indicated on drawings.
- .3            Install a steel pull box after every two 90° bends, or equivalent; or where there is a (U-shaped) bend in the run.
- .4            Install additional steel pull boxes where necessary so that throughout the entire system, wires may be pulled in or withdrawn with reasonable ease. No section of conduit shall be longer than 30m (100ft) between pull points.
- .5            Pull boxes shall be placed in a straight section of conduit and shall not be used in lieu of a bend. The corresponding conduit ends shall be aligned with each other.

- .6 Where a pull box is required with conduits equal or smaller than 27mm (1"), an outlet box may be used as a pull box. For conduits above 27mm (1"), the pull box shall be size as per ANSI/TIA/EIA 569-D or as noted on the drawings.
- .7 Bending radius for conduits equal or less than 50mm (2") shall be no less than 6 times the internal diameter of the conduit. Bending radius for conduits more than 50mm (2") shall be no less 10 times the internal diameter.
- .8 No conduit body (Condulet), LB type or other, shall be used unless otherwise indicated on the drawings or pre-approved by the departmental representative.
- .9 Conduits shall be reamed to eliminate sharp edges and terminated with insulating nylon bushings.
- .10 Install nylon pull-cords in all empty conduits.
- .11 Clearly identify conduits at each end.
- .12 Conduit to be colored EMT. Refer to 260500 for conduit color coding.
- .13 Do not run communications cables in the same raceway as power and lighting conductors.
- .14 Grounding and bonding to the Canadian Electrical Code (CEC).

### **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 QUALIFICATION**

- .1 The contractor must ensure the supervisor, site foreman and electrician working on site hold 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 Addressable system
  - .1 Intelligent heat detector. Rate-of-rise rated at 8.3°C (15°F)/min. Optional carbon monoxide sensor. Automatic device mapping, self-diagnostic. Stand-alone operation. Edwards model No. SIGA2-HRS.
  - .2 Intelligent photoelectric smoke detector. Self-diagnostics and history mapping. Automatic device mapping. Stand-alone operation. Edwards model No. SIGA2-PS.
  - .3 Intelligent duct smoke detector. Can be installed in ducts up to 10ft. remote LED and test station accessories. Edwards model No. SIGA-DH.

### **2.2 MANUAL ALARM STATIONS**

- .1 Addressable system
  - .1 Pull lever, breakglass, wall mounted, red, bilingual and with electronic addressing. Edwards model No. SIGC-270B.

### **2.3 AUDIBLE, VISUAL DEVICES**

- .1 Combination horn/strobe device:
  - .1 Fire alarm Horn/strobe combination device, red in colour.
  - .2 Adjustable cd output of 15, 20, 75 & 110. Selectable hi/low dB output.
  - .3 Red with red trim ring.
  - .4 Include Synchronization module to synchronize strobes.
  - .5 Standard of acceptance: Chubb Edwards G1R-HDVM.
- .2 Visual Device:
  - .1 Fire alarm strobe only, red in colour.
  - .2 Adjustable cd output of 15, 20, 75 & 110.

- .3 Red with red trim ring.
- .4 Include Synchronization module to synchronize strobes.
- .5 Standard of acceptance: Chubb Edwards G1R-VM.

## **2.4 CONDUIT AND WIRING**

- .1 Raceway to be 21mm colored 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 fire alarm initiating device circuits wiring to be class "A" using #18 minimum FAS-105 red jacketed twisted shielded pairs cable, and in accordance with manufacturer's requirements. Run each pair of wire in separate conduit to make it true class 'A'.
- .3 All fire alarm signal circuits wiring to be R90/ T90 #16 minimum, and in accordance with manufacturer's requirements.
- .4 Refer to 26 05 00 for fire alarm conduit color coding.

## **Part 3 Execution**

### **3.1 MOUNTING OF EQUIPMENT**

- .1 Recess mount equipment in all areas except where specified in unfinished areas.
- .2 Mounting heights from floor level to centerline of equipment are as follows:
  - .1 Fire alarm stations 1.2m (3'-11") to centreline.
  - .2 Fire alarm bells, horns, strobes 2.1m (7'-0") to centreline.

### **3.2 CONDUIT AND WIRING**

- .1 All conduit to include a #16 TW stranded copper green ground wire.
- .2 Use only uninsulated ring-type STA-KON lugs on screw connections.
- .3 Run conduit tight along underside of ceiling slab or roof deck, unless noted otherwise on drawings.
- .4 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.
- .5 Use Tee bar electrical box hangers (Caddy #51224 for 610mm T-bar spacing) to mount heat detectors on T-bar ceiling tiles.
- .6 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.

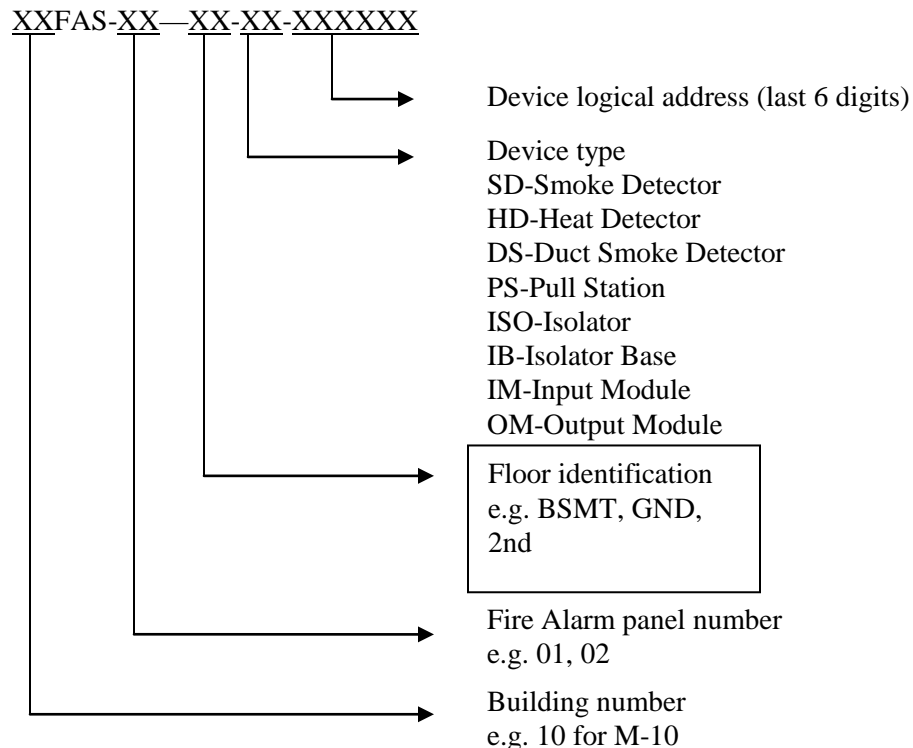
- .7 Leave 6 inch loops of wire in all junction boxes.
- .8 For new installations, no splicing of wires is to be made.
- .9 Prior to installing raceways, submit to the NRC Departmental Representative a proposed method and layout of conduit for approval.

### 3.3 EQUIPMENT IDENTIFICATION

- .1 Label each manual alarm station and each audible signal device with its unique identification number as per drawings. Use lamicoid nameplates as per Section 26 05 00.
- .2 Label each initiating device use P-Touch type as per Section 26 05 00. Devices are to be numbered per the format shown below.

Example M-10 fire alarm #1 Heat detector 000001

10FAS-01-GND-HD-000001



- .3 Refer to 26 05 00 for fire alarm conduit color coding.
- .4 Label wires as per drawing and as per Section. 26 05 00.

### 3.4 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.**

### 3.5 INTEGRATION INTO SYSTEM MONITORING AT BUILDING M-1

Presently all NRC buildings in Ottawa report back their fire alarm status to the M1 building central monitoring station. The monitoring station consists of a computer graphics terminal showing building layouts of each building, and is linked on an internal NRC network. The new fire alarm system under this contract must communicate all addressable input points to the existing computer graphics monitoring station, Fireworks by Chubb Edwards. All required modifications to the existing Fireworks station are to be included in this tender.

- .1 Addressable devices:
  - .1 Integrate any new addressable devices installed as part of this project into the monitoring system at building M-1.
  - .2 Remove from the monitoring system at building M-1 any addressable devices removed as part of this project.
  - .3 Make appropriate changes to the monitoring system at building M-1 to reflect any relocated addressable devices.
  - .4 All work on the monitoring system at building M-1 is to be done by factory trained technician.

### 3.6 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 Record amperage drawn by audible signal device circuits if new audible signal devices have been added to the circuit.
- .6 Give the NRC Departmental Representative one set of marked in red prints labelled "As Built".
- .7 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.
- .8 For new fire alarm systems provide the NRC Departmental Representative with a certificate of verification stating that the equipment has been installed as per the latest CAN/ULC-S537 and CAN/ULC-S524 standards and as per the latest edition of the National Building Code.

**END OF SECTION**

**APPENDIX A:**  
**SUMP PUMPS SHOP DRAWINGS**

**NRC - M38 ADDITION**  
**Acoustic Facility**  
**1200 Montreal Road**

**Sump Pumps**  
**(Storm & Sanitary)**

	
<b>GOODKEY, WEEDMARK &amp; ASSOCIATES LIMITED</b> <b>Consulting Engineers</b> 1688 Woodward Dr., Ottawa, ON Canada K2C 3R8 Tel.: 613-727-5111, Fax: 613-727-5115, info@gwal.com	
<b>REVIEWED</b> <input type="checkbox"/>	<b>REVISE &amp; RESUBMIT</b> <input type="checkbox"/>
<b>REVIEWED AS NOTED</b> <input checked="" type="checkbox"/>	<b>REJECTED</b> <input type="checkbox"/>
For general conformance only. Contractor remains responsible for equipment & system details, performance, accuracy, dimensions and coordination.	Date: <b>July 3, 2018</b>
	GWA #: <b>2017-584</b>
	SD #: <b>SM20</b>
	By: <b>R.Leonard</b>

**Float cable lengths to be coordinated to suit conduit routing and panel location as installed on site.**



Date: May 15<sup>th</sup>, 2018

## SHOP DRAWING SUBMITTAL

**M-38 NRC  
1200 Montreal**

**TPH Job #18-106**

**FOR  
NRC Allan Smith**

Shop Drawing Content

- Sanitary Pump
- Storm Pump

**M. SULLIVAN & SON LIMITED**  
Received and Reviewed for Submission  
To Consultant.

Log Number: 22.10.10-1.0

Date: June 5, 2018

Signature: 

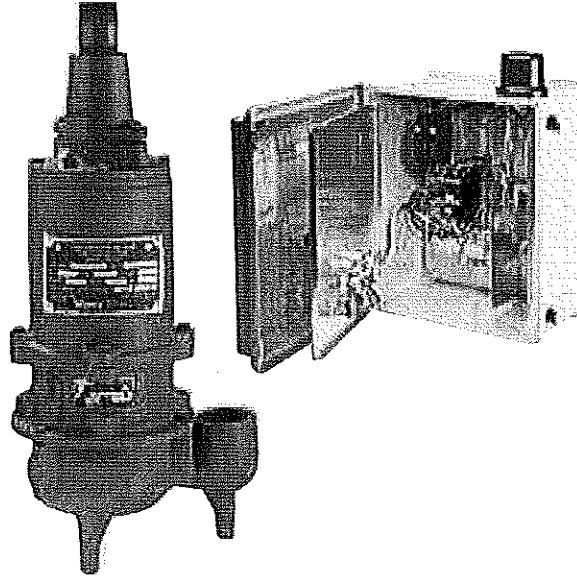
Sub-Contractor's Responsibility For  
Dimensions, Omissions, Errors Etc. Is  
Not Hereby Relieved.



SUBMERSIBLE SUMP PUMPS & CONTROL PANEL PACKAGES

MYERS® SX50/SX50H

Myers SX50 series pumps are versatile performers designed for commercial, municipal and industrial applications. The SX50 (high flow) and the SX50H (high pressure) are designed to pump contaminated water containing a wide range of pollutants. Each pump is matched with a safety-proven Myers® control box (simplex or duplex, single- and three-phase models).



APPLICATIONS

Service stations, "quick-lube" stations, car/truck washes, truck docks

SPECIFICATIONS

- Capacities – Up to 95 GPM (360 LPM)
- Shut-off Head – Up to 34' (10 m)
- Operation: On/Off – Turns on/off with tethered switch hooked to control box
- Solids Handling – (SX50; SX50H) 2"/3/4" (50 mm / 19 mm)
- Liquids Handling – Domestic effluent and drain water
- Intermittent Liquid Temperature – Up to 140°F (60°C)
- Motor/Electrical Data – 1/2 HP, 1750 RPM, capacitor start, 60Hz; see Ordering Information chart for voltage and phase
- Acceptable pH Range – 6-9
- Winding Insulation Temperature (Class B) – 266°F (up to 120°C)
- Specific Gravity – .9-1.1
- Viscosity – 28-35 SSU
- Discharge, NPT – SX50: 2" (50 mm)  
SX50H: 1-1/2" (38.1 mm)
- Min. Sump Diameter – Simplex: 24" (61.0 mm)  
Duplex: 36" (91.4 mm)

FEATURES

PUMP

**Tough, Safe Performance**  
Rugged and explosion-proof pump design commercial, industrial and municipal applications

**Hazardous Duty**  
UL listed for use in Class 1, Division 1, Group D hazardous locations with contaminated water

**Tough Against Corrosion**  
All cast iron construction resists the most extreme corrosive environments

**Cool Running**  
Oil-filled motor for continuous bearing lubrication and maximum heat dissipation

**Longer Bearing Life**  
Recessed impeller reduces radial bearing loads, increasing bearing life

**Built-in Protection**  
Sensor and probe protect against overheating and seal leak

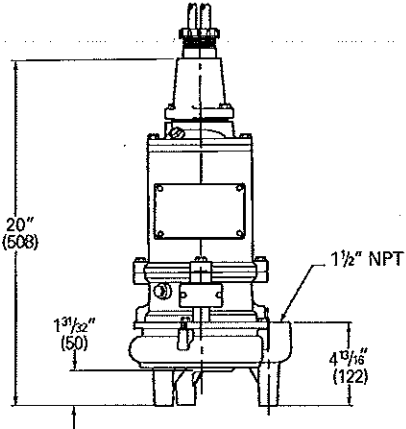
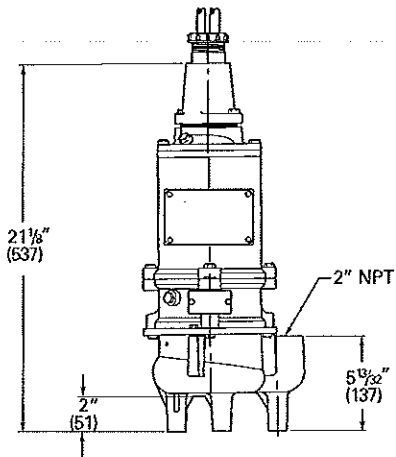
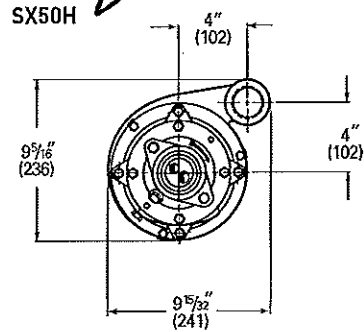
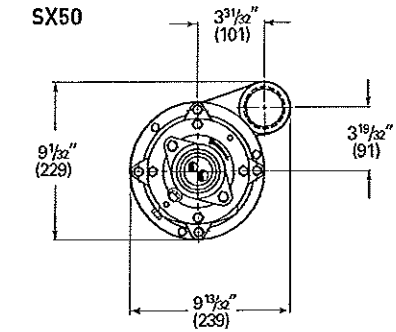
**Easy Starting**  
High-torque capacitor start, single phase motor for assured starting under heavy load

**CONTROL PANEL**  
**NEMA 4X Enclosure with Inner Door**  
**Separate Pump and Control Circuit Breaker**

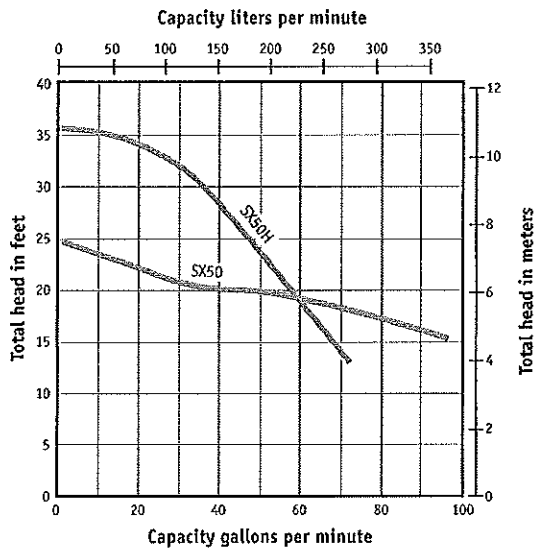
**H-O-A Switch**  
**Run, Seal, Leak Alarm Light**

# MYERS® SX50/SX50H

### DIMENSIONS



### PUMP PERFORMANCE



# MYERS® SX50/SX50H

## SPECIFICATIONS

**Pump Model** – Pump shall be of the centrifugal type Myers model SX50/SX50H with an integrally built in submersible type motor. Discharge shall be 1-1/2" NPT  OR 2" NPT . Pump shall be capable of passing a full 3/4"  or 2"  diameter solid. Motor shall be UL listed for Class 1, Div. 1, Group D.

**Operating Conditions** – Pump shall have a capacity of \_\_\_\_\_ GPM at a total head of \_\_\_\_\_ feet and shall use a 1/2 HP motor operating at 1750 RPM.

**Motor** – Pump motor shall be of the submersible type rated 1/2 horsepower at 1750 RPM. Motor shall be for single phase 208 volts , 230 volts  or three phase 200 volts , 230 volts , 460 volts  or 575 volts . Single phase motors shall be of P.S.C. type NEMA N type. Three phase motors shall be NEMA B type.

Stator winding shall be of the open type with Class B insulation good for 130°C (266°F) maximum operating temperature. Winding housing shall be filled with a clean high dielectric oil that lubricates bearings and seals and transfers heat from windings and rotor to outer shell. Air-filled motors which do not have the superior heat dissipating capabilities of oil-filled motors shall not be considered equal.

Motor shall have two heavy duty ball bearings to support pump shaft and take radial and thrust loads and a sleeve guide bushing directly above the lower seal to take radial load and act as flame path for seal chamber. Ball bearings shall be designed for 50,000 hours B-10 life. Stator shall be pressed into motor housing.

A heat sensor thermostat shall be attached to top end of motor winding and shall be connected in series with the magnetic contactor coil in control box to stop motor if motor winding temperature reaches 221°F. Thermostat to reset automatically when motor cools. Two heat sensors shall be used on 3 phase motors.

The motor pump shaft shall be of #416 stainless steel threaded to take pump impeller.

**Seals** – Motor shall be protected by two mechanical seals mounted in tandem with a seal chamber between the seals. Seal chamber shall be oil filled to lubricate seal face and to transmit heat from shaft to outer shell.

Seal face shall be carbon and ceramic and lapped to a flatness of one light band. Lower seal faces shall be \_\_\_\_\_ carbide (optional).

A double electrode shall be mounted in the seal chamber to detect any water entering the chamber through the lower seal. Water in the chamber shall cause a red light to turn on at the control box. This signal shall not stop motor but shall act as a warning only, indicating service is required.

**Pump Impeller** – The pump impeller shall be of the recessed Myers type to provide an open unobstructed passage through the volute for solids. Impeller shall be of cast iron and shall be threaded onto stainless steel shaft.

**Pump Case** – The pump case shall be designed for a recessed vortex impeller and have unobstructed passageways to handle full spherical solids. The pump volute shall be constructed of Class 30 gray cast iron.

**Motor Castings** – The motor housing castings shall be high tensile strength Class 30 gray cast iron.

**Corrosion Protection** – All iron castings shall be pretreated with phosphate and chromic rinse and to be painted before machining and all machined surfaces exposed to the sewage water to be repainted. All fasteners to be 302 stainless steel.

**Bearing End Cap** – Upper motor bearing cap shall be a separate casting for easy mounting and replacement.

**Power Cables** – Power cord and control cord shall be double sealed. The power and control conductor shall be single strand sealed with epoxy potting compound and then clamped in place with rubber seal bushing to seal outer jacket against leakage and to provide for strain pull. Cords shall withstand a pull of 300 pounds to meet UL requirements.

Insulation of power and control cords shall be type SOOW. Both control and power cords shall have a green carrier ground conductor that attaches to motor frame.

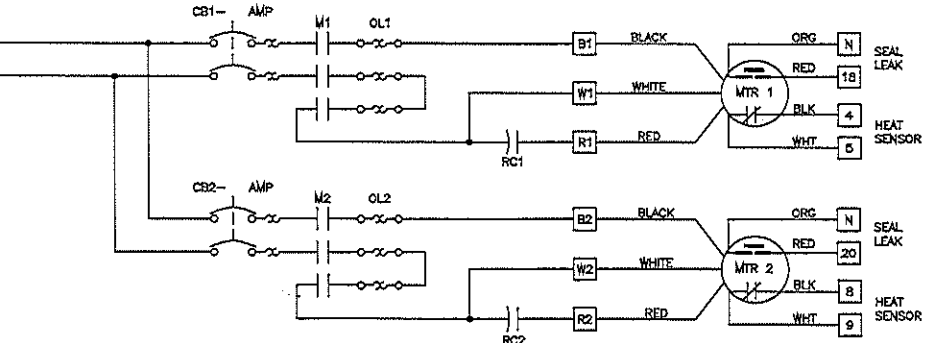
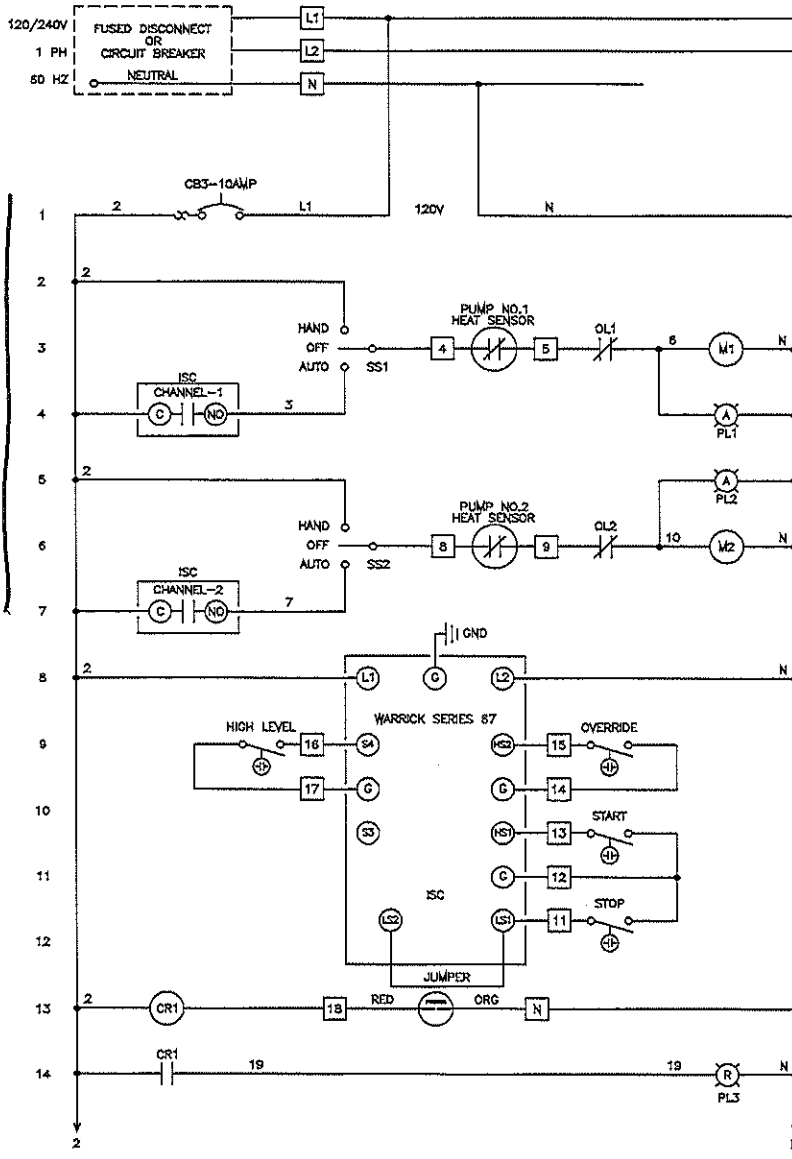


USA  
293 WRIGHT STREET, DELAVAN, WI 53115 WWW.FEMYERS.COM  
PH: 888-987-8677 ORDERS FAX: 800-426-9446

CANADA  
490 PINEBUSH ROAD, UNIT 4, CAMBRIDGE, ONTARIO N1T 0A5  
PH: 800-363-7867 ORDERS FAX: 888-606-5484

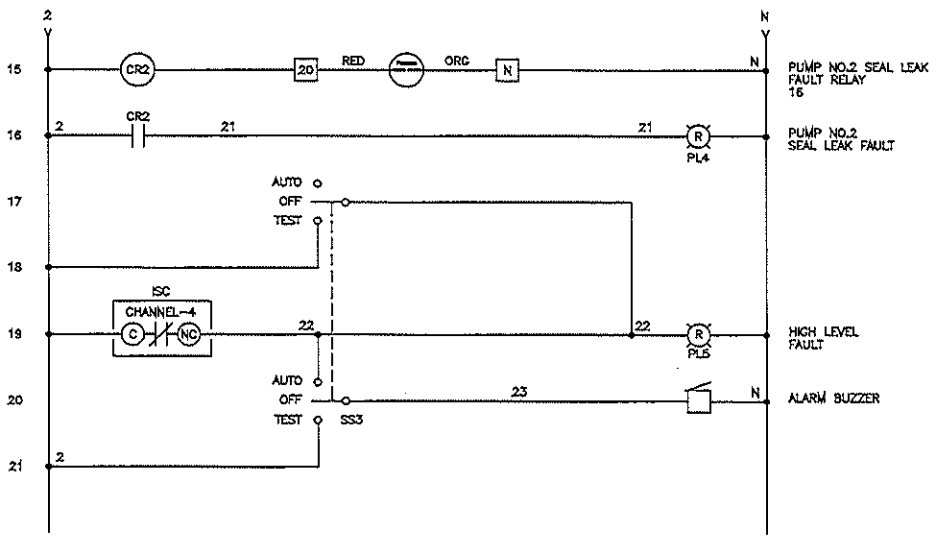
Because we are continuously improving our products and services, Pentair reserves the right to change specifications without prior notice.

M2114-



PUMP NO.1  
HP / AMPS

PUMP NO.2  
HP / AMPS



PUMP NO.2 SEAL LEAK  
FAULT RELAY  
16

PUMP NO.2  
SEAL LEAK FAULT

HIGH LEVEL  
FAULT

ALARM BUZZER

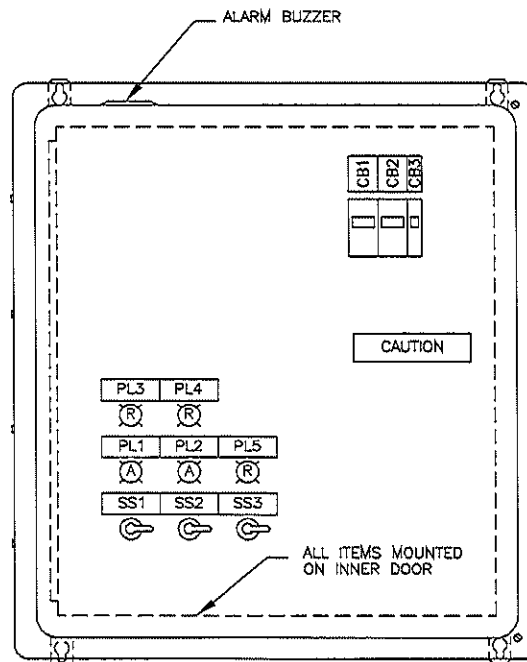
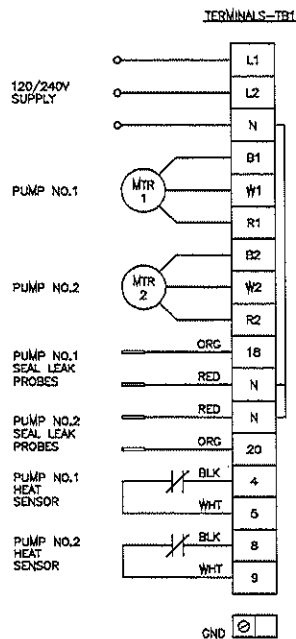
WARRICK SERIES 87  
INTRINSICALLY SAFE  
CONTROLLER  
4, 7, 12

DIP SWITCH SETTINGS  
CHANNEL 1-DOWN  
CHANNEL 2-DOWN  
CHANNEL 4-UP

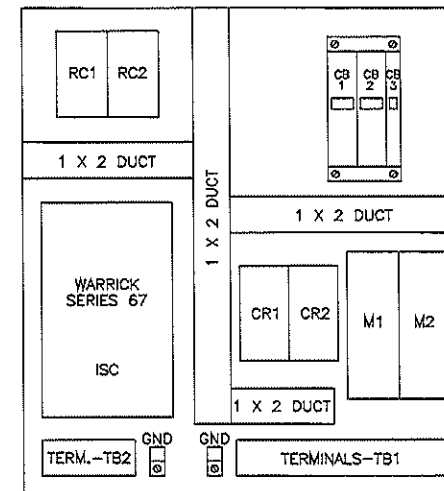
DESIGNED E. IRWIN	
DRAWN J. HARVEY	
REVIEWED	
DATE APRIL 28, 2003	
SCALE N.T.S.	
TITLE	SHEET NO. 1 OF 2
DUPLIX PUMP CONTROL SYSTEM MODEL NO. CPSG3-21D	
REVISION D	
CAD REF. MY19288-1	
REF:	DWG. NO. M2114-

Storm Pump

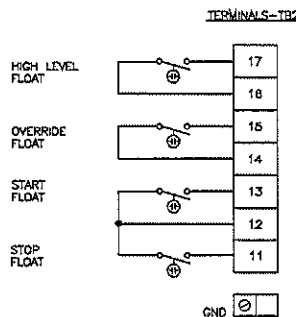
Storm Pump



FEMAC 1 ENCLOSURE 18" X 16" X 8"



PANEL LAYOUT



NOTES: A) INTRINSICALLY SAFE FLOAT WIRING MUST BE RUN IN SEPARATE CONDUIT TO TERMINALS IN CONTROL PANEL

B) IF FLOATS ARE NOT WIRED DIRECTLY TO TERMINALS IN CONTROL PANEL, CAUTION MUST BE TAKEN TO PREVENT CONDENSATION FROM FORMING ACROSS FLOAT CONTACT CIRCUIT. THIS MAY CAUSE FALSE OPERATION OF INTRINSICALLY SAFE RELAY.

<b>F.E. Myers Company</b> DIVISION OF PENTAIR CANADA, INC. P.O. BOX 9138, 269 TRILLIUM DR. KITCHENER, ONTARIO N2G 4W5	DESIGNED B. IRWIN
	DRAWN J. HARVEY
	REVIEWED
	DATE APRIL 28, 2003
	SCALE 1/4" = 1"
TITLE: DUPLEX PUMP CONTROL SYSTEM MODEL NO. CPSX5-21D	SHEET NO. 2 OF 2
	REVISION 0
	CAD REF. MY19285-2
REF:	DWG. NO. M2114-

# Pentair Sensor Level Control Switch

Mechanically-activated, narrow-angle float switch designed to activate pump control panels and alarms.

This narrow-angle sensing device is used to accurately monitor liquid levels in:

- potable water
- water
- sewage applications

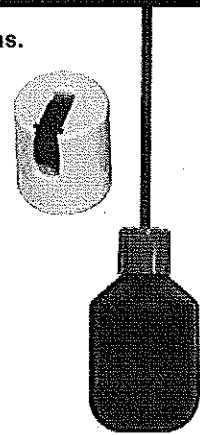
The Sensor Level control switch is not sensitive to rotation.

### Normally Open Model (high level).

The control switch turns on (closes) when the float tips slightly above horizontal signaling a high level, and turns off (opens) when the float drops slightly below horizontal.

### Normally Closed Model (low level)

The control switch turns on (closes) when the float tips slightly below horizontal signaling a low level, and turns off (opens) when the float tips slightly above horizontal.



## FEATURES

- Passed NSF Standard 61 protocol by an approved Water Quality Association laboratory.
- Mechanically-activated, snap action contacts.
- High impact, corrosion resistant, polypropylene float housing.
- Not sensitive to rotation.
- Control differential of 1.5 inches (4 cm) above or below horizontal.
- Yellow colored cap for easy identification of normally open control switch.
- White colored cap for easy identification of normally closed control switch.
- UL Listed for use in water and sewage.
- CSA Certified.
- Three-year limited warranty.



## SPECIFICATIONS

**CABLE:** flexible 18 gauge, 2 conductor (UL, CSA) SJOW, water-resistant (CPE)

**FLOAT:** 2.74 inch diameter x 4.83 inch long (7.0 x 12.3 cm) high impact, corrosion resistant, polypropylene housing for use in sewage and water up to 140°F (60°C)

**MAXIMUM WATER DEPTH:** 30 feet (9 meters), 13 psi (90 kPa)

**ELECTRICAL:** 5 amp, 125/250 VAC, 50/60 Hz

**NOTE:** This switch is not recommended for controlling:

- electric loads less than 100 milliamps, 12 VAC
- non-arcing electric loads

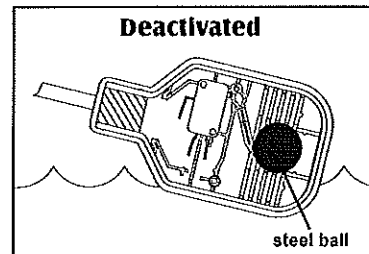
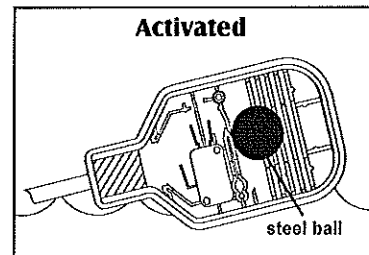
## OPTIONS

This switch is available:

- CE certified unit available upon request.
- for normally open (high level) applications or normally closed (low level) applications.
- in standard cable lengths of 10, 15, 20, or 30 feet and 3, 5, 6, or 10 meters (longer lengths available)
- with two mounting options that allow for flexibility in installation:

**Mounting Clamp:** for applications where the switch can be attached to a discharge pipe or similar mounting device.

**Externally Weighted:** for applications where the switch can be suspended from above.



CONTROL SWITCHES (MECHANICAL)

## Pentair Canada, Inc.

269 Trillium Drive, Kitchener, ON  
N2G 4W5  
1-800-387-4386  
Ph: 519-748-5470  
Fax: 888-606-5484



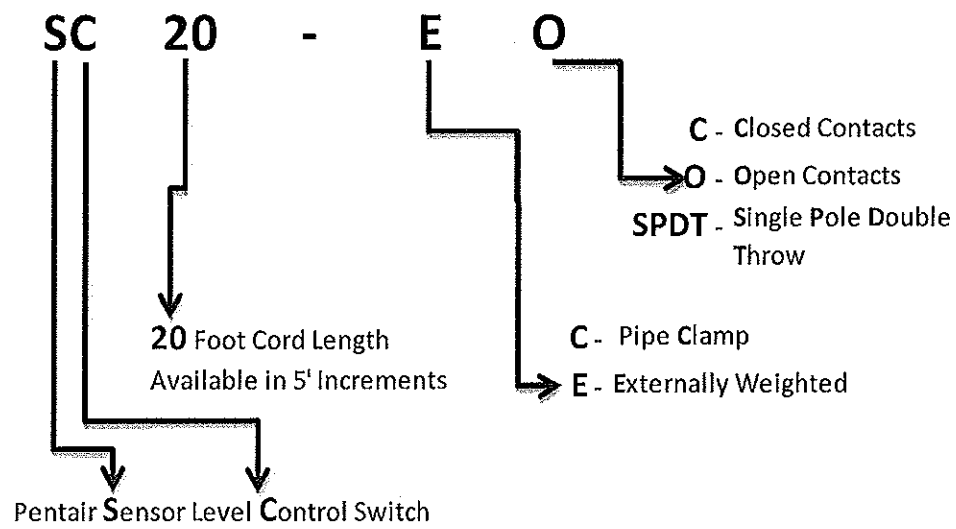
STORM PUMP

# Pentair Sensor Level Control Switch

Mechanically-activated, narrow-angle float switch designed to activate pump control panels and alarms.

## ORDERING INFORMATION

### Narrow Angle, 5 Amp, Panel Duty Level Controls



Passed NSF standard 61 protocol by an approved Water Quality Association laboratory.



## SPECIFICATIONS

- CABLE:** flexible 18 gauge, 2 conductor (UL) SJOW, water-resistant (CPE)
  - FLOAT:** 2.74 inch diameter x 4.83 inch long (7 x 12.3 cm), high impact, corrosion resistant polypropylene for use in sewage and water up to 140°F (60°C)
  - MAXIMUM WATER DEPTH:** 30 feet (9 meters), 13 psi
  - ELECTRICAL:** 5 amp, 125/250 VAC, 50/60 Hz
- This switch is not recommended for controlling:
- electric loads less than 100 milliamps, 12 VAC
  - non-arcing electric loads

CONTROL SWITCHES (MECHANICAL)

## OTHER INFORMATION

- NORMALLY OPEN (high level) OPERATION**  
The control switch closes (turns on) when the float tips slightly **above** horizontal signaling a high level, and opens (turns off) when the float drops slightly below horizontal in potable water, water or sewage applications.
- NORMALLY CLOSED (low level) OPERATION**  
The control switch closes (turns on) when the float tips slightly **below** horizontal signaling a low level, and opens (turns off) when the float tips slightly **above** horizontal in potable water, water or sewage applications.

## Pentair Canada, Inc.

269 Trillium Drive, Kitchener, ON  
N2G 4W5  
1-800-387-4386  
Ph: 519-748-5470  
Fax: 888-606-5484

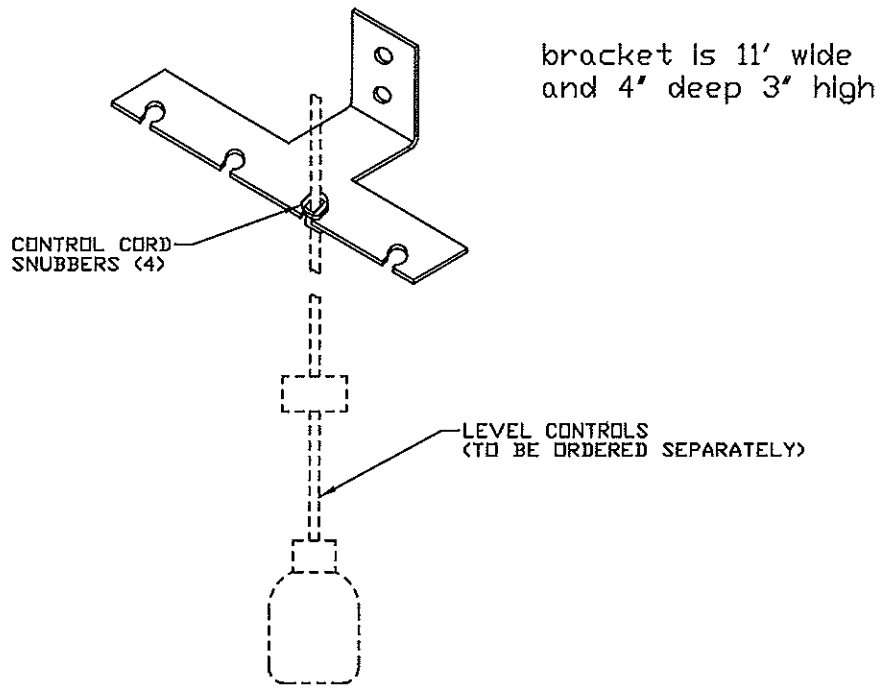
[www.pentair.com](http://www.pentair.com)

Storm Pump

**Myers**

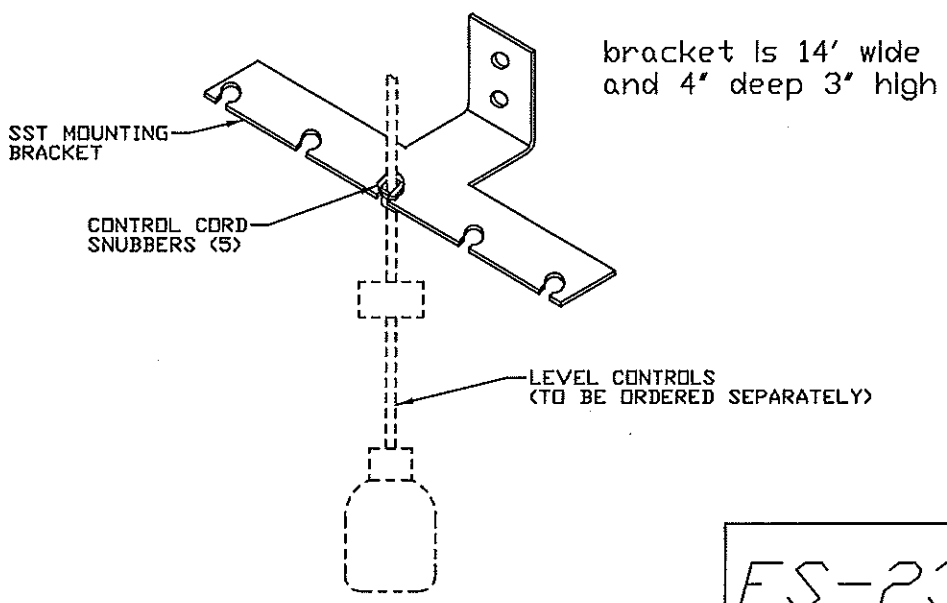
# CSB4-SS ✓

FLOAT BRACKET FOR MOUNTING UP TO (4) FOUR CONTROLS



# CSB5-SS

FLOAT BRACKET FOR MOUNTING UP TO (5) FIVE CONTROLS



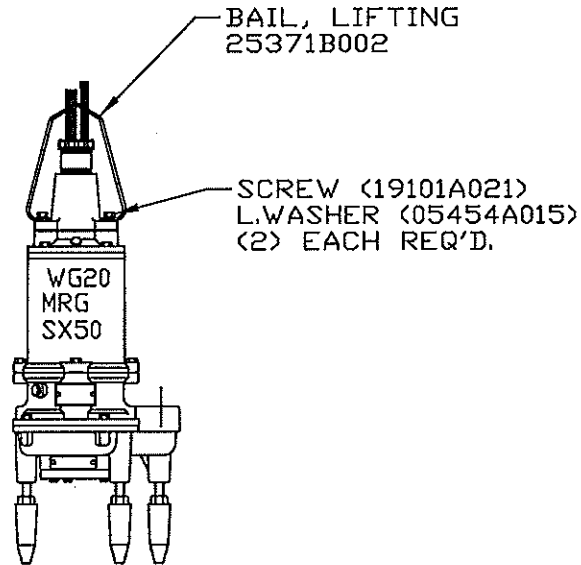
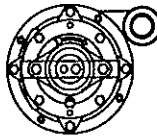
ES-2365A



23833A299

STERM PUMP

NOTE: (2) EXISTING 3/8"-16 CAP SCREWS IN CAP ASSEMBLY MUST BE REPLACED BY SCREWS AND LOCK WASHERS IN PACKAGE.



MyersCADD

25371A016  
USED ON

CONFIDENTIAL

PROPERTY OF

**Myers**

F.E. Myers  
A Pentair Company  
Ashland, Ohio

CHANGES

G	
F	
E	
D	
C	
B	
A	

DO NOT SCALE DRAWING

Tol. Unless Specified  
Angular  $\pm 1/2^\circ$   
Fractional  $\pm 1/64$   
Decimal  $\pm .005$

READ ALL NOTES  
Break all corners .010 Max.  
unless otherwise specified

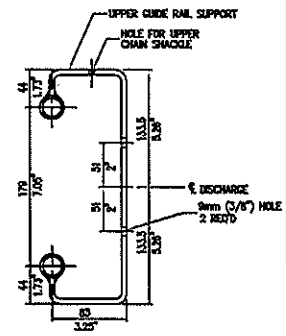
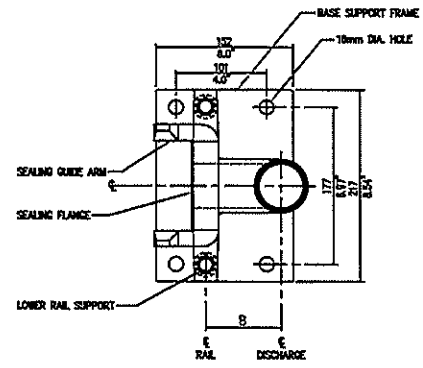
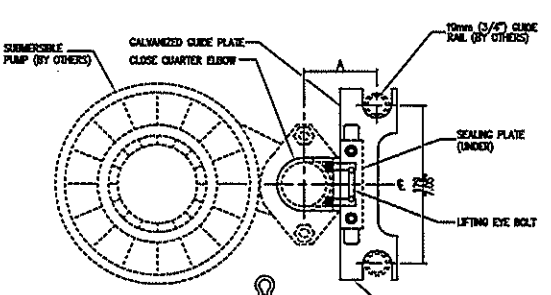
MATERIALS SPEC. AS NOTED

DSGN		
DWG	S. ETZEL	29 NOV 93
CHK		
APP		
M. E.		

INSTRUCTIONS, LIFT  
BAIL WG SX50 MRG PUMP

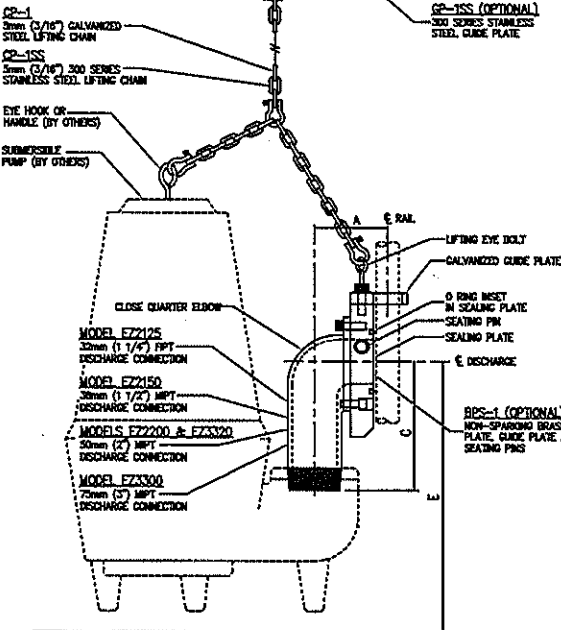
SCALE  
NTS 23833A299

Storm Pump

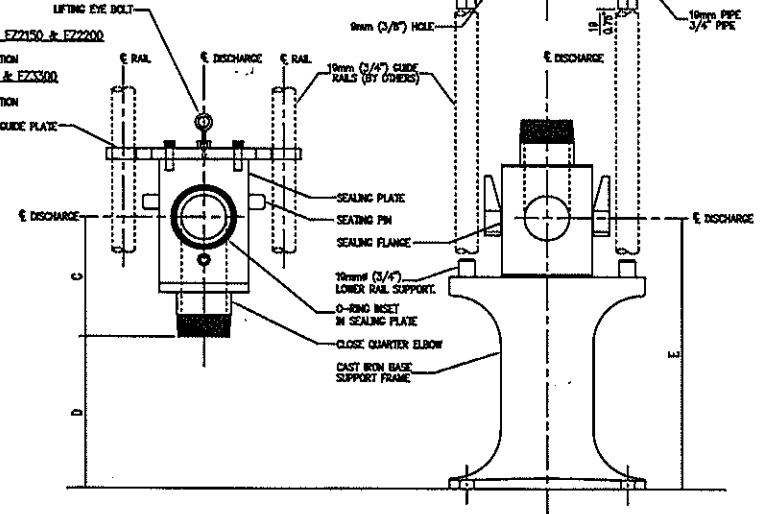
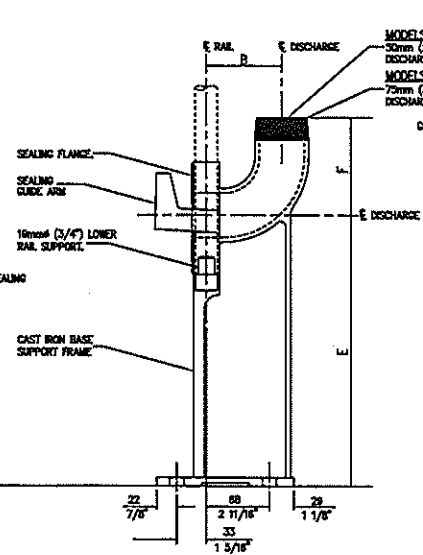


MODEL	A	B	C	D	E	F
EZ2125	2.875"	3.31"	4.75"	7.52"	12.07"	4.33"
	73mm	84mm	121mm	191mm	307mm	110mm
EZ2150	2.875"	3.31"	4.75"	7.52"	12.07"	4.33"
	73mm	84mm	121mm	191mm	307mm	110mm
EZ2200	3.2"	3.31"	5.32"	6.75"	12.07"	4.33"
	81mm	84mm	135mm	171mm	307mm	110mm
EZ3320	3.2"	4.68"	5.32"	9.85"	14.96"	4.92"
	81mm	119mm	135mm	245mm	380mm	125mm
EZ3300	3.97"	4.68"	5.64"	9.33"	14.96"	4.92"
	101mm	119mm	143mm	237mm	380mm	125mm

Note  
For basins with a depth of 3.7m (12') or greater intermediate guide rail supports must be used. One required for every 3.7m (12') of basin depth in excess of 3.7m (12'). See drawing EZ-51 & EZ-52.



SIDE VIEWS



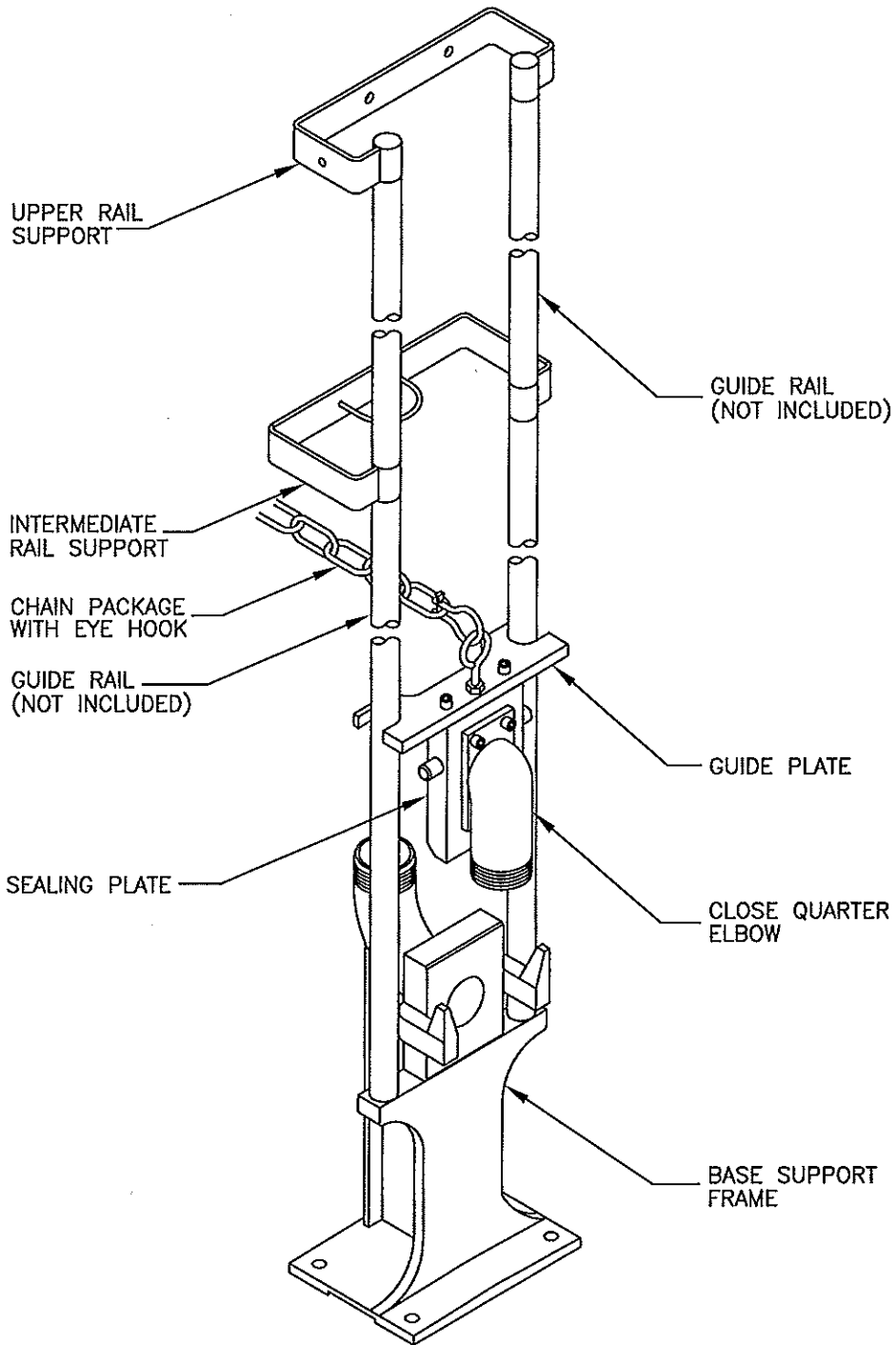
FRONT VIEWS

Note  
Dimensions shown are assumed to be correct as of the release date, however for exact dimensions confirm with factory.

This drawing and all appurtenant matter contains information proprietary to E-Z OUT MANUFACTURING INC. and is loaned subject to return upon demand and is not to be used directly or indirectly in any way detrimental to our interests.

SCALE: 1:5	U.S. PATENT 5,507,628	DRAWN BY: RFN Tech. & JB
DATE: JULY/94	LIFT OUT ASSEMBLY DETAILS	
7 26/01/98 RELEASE TO MANUFACTURER	JB E.M. G.B.	
ISSUE No D/M/Y	DR CH APP	E-Z OUT MANUFACTURING INC. DRAWING NUMBER: EZ-50

# Storm Pump



This drawing and all appurtenant matter contains information proprietary to E-Z OUT MANUFACTURING INC. and is loaned subject to return upon demand and is not to be used directly or indirectly in any way detrimental to our interests.

SCALE: NTS  
DATE: OCT/94

U.S. PATENT 5,507,628

DRAWN BY: RFN Tech. & JB

## E-Z OUT LIFT-OUT RAIL ASSEMBLY PARTS LIST

ISSUE No	D/M/Y	DESCRIPTION	DR	CH	APP
2	26/01/98	RELEASE TO MANUFACTURER	JB	EM	GB

E-Z OUT MANUFACTURING INC.

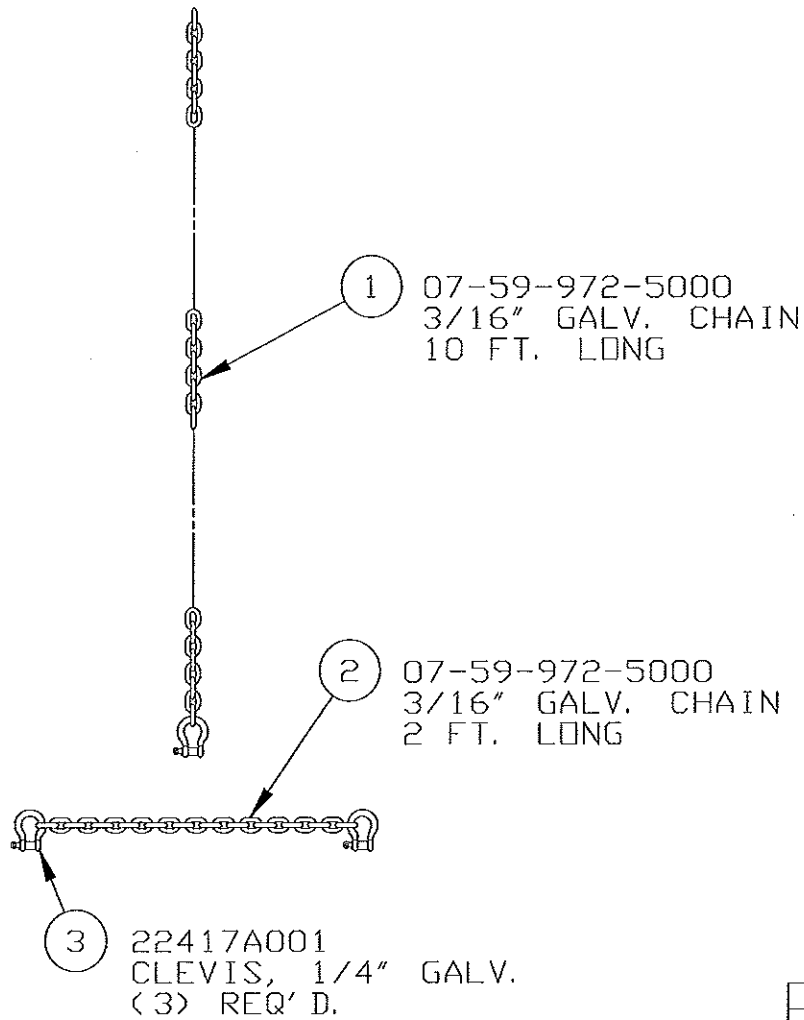
DRAWING NUMBER:  
EZ-PARTS

# Storm Pump

PRINT DISTRIBUTION CODE: 34 31A

A20

25193A100



REL. #533S

MyersCADD

USED ON

CONFIDENTIAL

PROPERTY OF

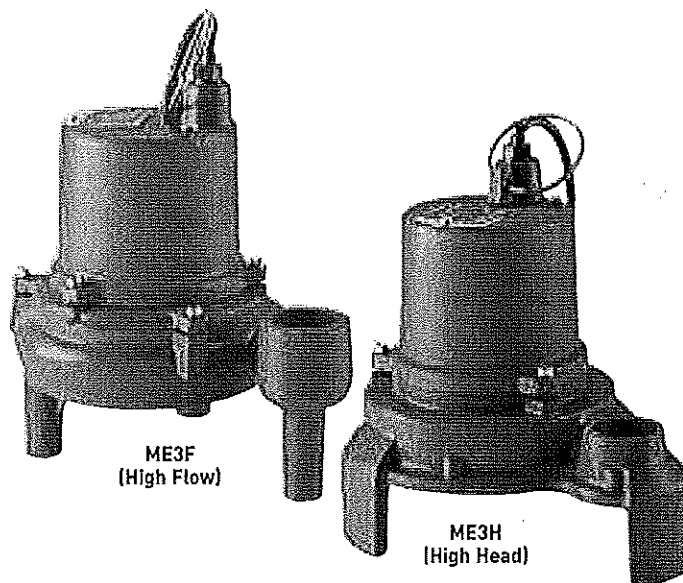
**Myers**

F. E. Myers  
A Pentair Company  
Ashland, Ohio

<b>CHANGES</b>	<b>DO NOT SCALE DRAWING</b>	<b>MATERIALS SPEC. AS NOTED</b>		<b>ASSEMBLY CAT. NO. CP-75-2 ✓</b>
G	Tol. Unless Specified Angular ± 1/2° Fractional ± 1/64 Decimal ± .005  <b>READ ALL NOTES</b> Break all corners .010 Max. unless otherwise specified	DSGN		<b>SCALE</b>
F		DWG	S. ETZEL 08 MAR 96	
E		CHK		<b>DATES</b>
D		APP		
C		M. E.		
B			<b>NONE</b>	<b>25193A100</b>
A				

# MYERS® ME3 SERIES ✓

The Myers ME3 series submersible effluent pumps are constructed of the most durable combination of materials to withstand the harshest environments. The ME3 is available with a recessed impeller for high-head applications or an enclosed impeller for high-flow installations. Available in tethered automatic piggyback models or manual models for use with external controls.



## APPLICATIONS

Effluent removal, sump drainage, water transfer, flood control

## SPECIFICATIONS

**Capacities** – ME3H: 36 GPM (136 LPM); ME3F: 66 GPM (249 LPM)  
**Shut-off Head** – ME3H: 35' (10.7 m); ME3F: 31' (9.5 m)  
**Maximum Spherical Solids** – 3/4" (19 mm)  
**Liquids Handling** – Domestic effluent and drain water  
**Intermittent Liquid Temperature** – Up to 140°F (60°C)  
**Motor/Electrical Data** – 1/3 HP, 1550 RPM, shaded pole, oil-filled; 115V, 12A, 1Ø, 60Hz; 230V, 6A, 1Ø, 60Hz  
**Acceptable pH Range** – 6-9  
**Specific Gravity** – .9-1.1  
**Viscosity** – 28-35 SSU  
**Discharge, NPT** – 1-1/2" (50.8 mm)  
**Housing** – Heavy cast iron  
**Minimum Sump Diameter** – Simplex: 24" (61 cm)  
Duplex: 36" (91.4 cm)  
**Power Cord** – 20', 16/3, SJTW

## FEATURES

### Two Powerful Pumps

High head (ME3H), High flow (ME3F)

### Maximum Heat-handling

Durable, oil-filled motor for continuous bearing lubrication and maximum heat dissipation

### Powerful Starts

High-torque, no starting switches or relays to wear out

### Thermal Protection

Heat sensor overload protection with automatic reset when motor cools to a safe operating temperature

### Longer-lasting Motor

Lower ball bearing eliminates sleeve bearing wear and reduces motor wear

### Manual Operation

Tethered automatic models can be operated manually by unplugging piggyback switch and plugging pump directly into outlet

# MYERS® ME3 SERIES

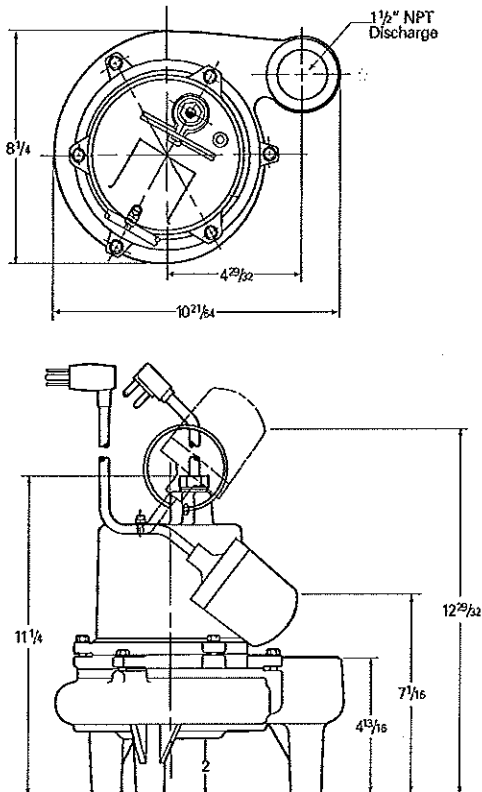
## ORDERING INFORMATION

Catalog Number	HP	Volts	Phase/Cycles	Amps	Discharge Size	Switch Type	Cord Length	Approx. Wt. Lbs.
ME3H-11	1/3	115	1/60	12	1-1/2"	Manual	20'	37
ME3H-11P	1/3	115	1/60	12	1-1/2"	Automatic*	20'	38
ME3H-21	1/3	230	1/60	6	1-1/2"	Manual	20'	37
ME3H-21P	1/3	230	1/60	6	1-1/2"	Automatic*	20'	38
ME3F-11	1/3	115	1/60	12	1-1/2"	Manual	20'	37
ME3F-11P	1/3	115	1/60	12	1-1/2"	Automatic*	20'	38
ME3F-21	1/3	230	1/60	6	1-1/2"	Manual	20'	37
ME3F-21P	1/3	230	1/60	6	1-1/2"	Automatic*	20'	38

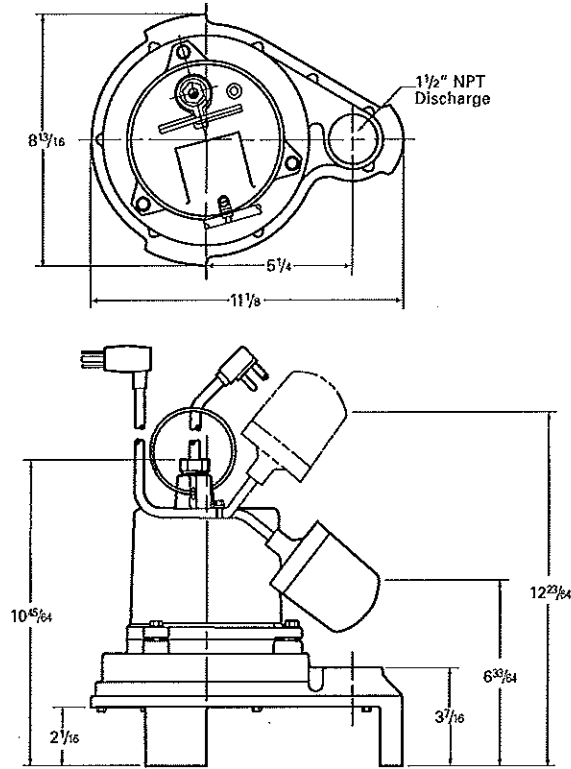
\*Piggyback

## DIMENSIONS

ME3F (High Flow)

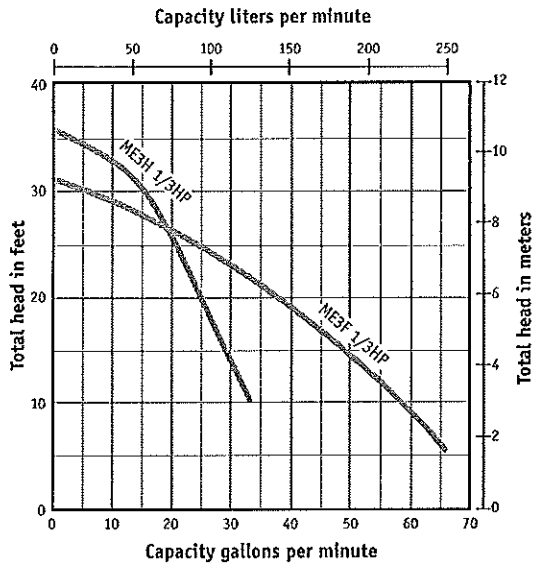


ME3H (High Head)

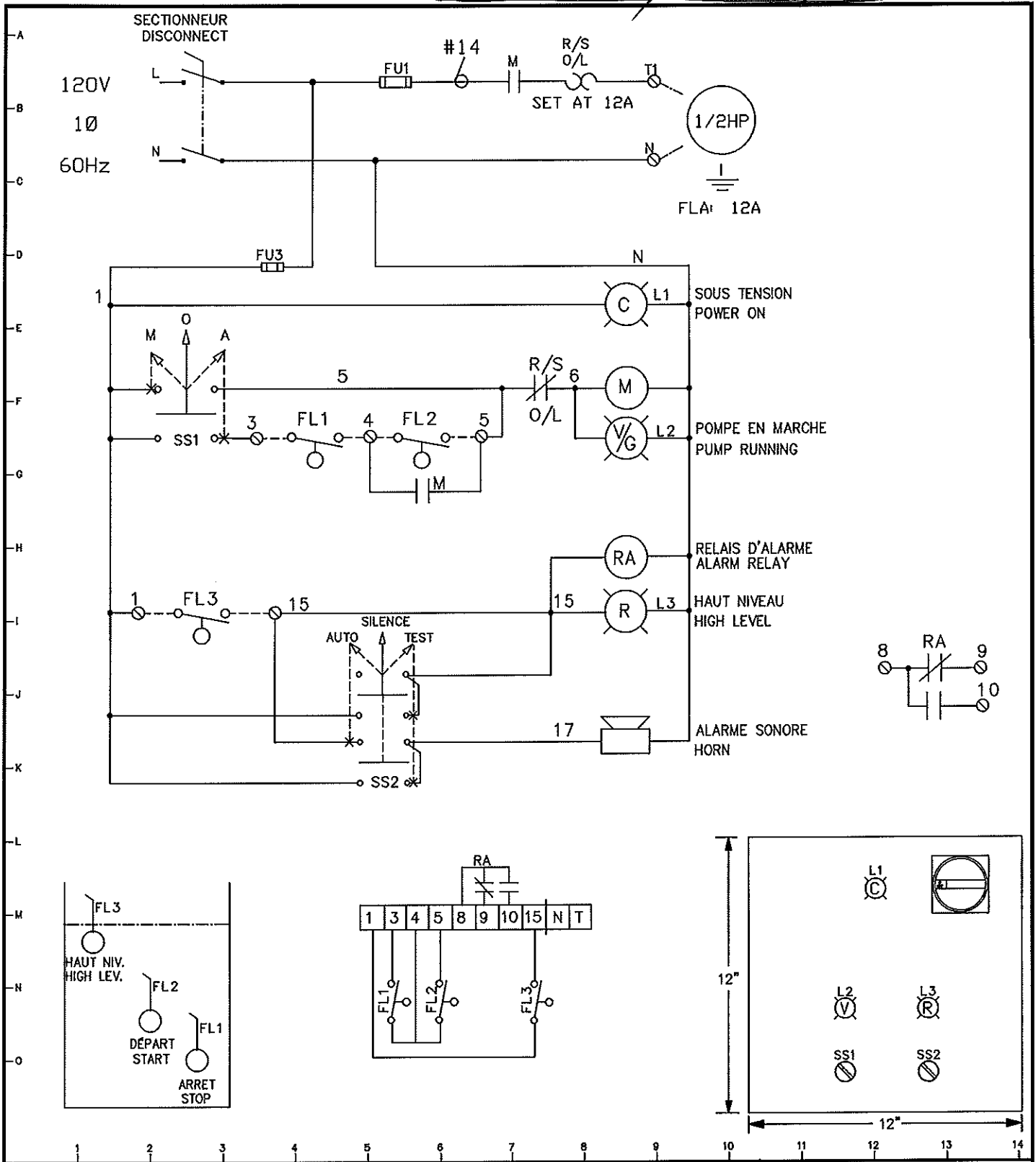


# MYERS® ME3 SERIES

## PUMP PERFORMANCE



# SANITARY PUMP



REMARKS: REMARQUES :						REV.      DESCRIPTION					
<b>CONTROLS CAROSTAN CONTROLS</b> <small>CONTROL CAROSTAN INC.      P.H. (514) 332-2111          3594 BOUL. POIRIER      FAX (514) 332-0788          ST LAURENT-QUEBEC-CANADA      WEBSITE www.carostan.com          H4R 2J5      EMAIL carostan@cpq.qlrc.com</small>						TITRE: <b>SIMPLEX D'ÉGOUT/CONDENSÉ</b> <b>SEWAGE SIMPLEX/CONDENSATE</b>		DESSIN #: <b>S. D. 8506-A</b>		DPT. I <b>00</b>	
PROJET:		DATE: <b>12-05-2000</b>		PAGE 1 DE 1							
DESSINÉ PAR: <b>S. DeMONTIGNY</b>		CONTROLÉ PAR:									



SANITARY PUMP

## MYERS® ME3 SERIES

## SPECIFICATIONS

**Effluent Pumps** – Pump(s) shall be F. E. Myers ME3F / ME3H series sump pumps selected in accordance with the following design criteria:

Number of Pumps:	<u>1</u>	Motor Horsepower:	1/3
Primary Design Flow:	<u>0.32 LIS</u>	Motor Speed:	1550 RPM
Primary Design Head:	<u>106.3 KPA</u>	Electrical:	115 Volts, 1Ø, 60 Hz or 230 Volts, 1Ø, 60 Hz

Minimum Shut-off Head: 36

**Pump** – The pump shall be designed to handle septic tank effluent and be capable of passing 3/4 inch spherical solids. The pump shall be capable of handling liquids with temperatures to 140°F intermittent.

**Motor** – The pump motor shall be of the submersible type rated 1/3 hp at 1550 RPM and shall be for \_\_\_\_ 115 volts or \_\_\_\_ 230 volts single phase, 60 cycles. Single phase motor shall be of the shaded pole type with no relays or starting switches. Stator winding shall be of the open type with Class A insulation rated for 105°C maximum operating temperature. The winding housing shall be filled with clean dielectric oil to lubricate bearings and seals, and transfer heat from the windings to the outer shell. The motor winding assembly shall be pressed into the stator housing for best alignment and heat transfer.

The motor shall be capable of operating over the full range of the performance curve without overloading the motor and causing any objectionable noise or vibration. The motor shall have two bearings to support the rotor; an upper sleeve bearing to accommodate radial loads and a lower sleeve bearing with thrust pad to take thrust and radial loads.

A heat sensor thermostat and overload shall be attached to the top end of the motor windings and shall be wired in series with the windings to stop the motor if the motor winding temperature reaches 221°F. The overload thermostat shall reset automatically when the motor cools to a safe operating temperature.

**Power Cord** – The motor power cord shall be 20 feet SJTW type. The cord shall have a molded compression grommet to insulate electrical connections. The grommet shall thread into the motor housing to provide a positive seal and to prevent leaking of liquid into the motor housing. The sealing grommet shall provide strain relief for the power cord assembly.

**Optional Control Switch** – The effluent pump shall be controlled by an optional piggyback float switch. The float switch shall be of a non-mercury type and be capable of directly controlling the pump motor without the need for an external control panel.

**Shaft Seal** – The motor shall be protected by a rotating mechanical shaft seal. The seals shall have carbon and ceramic seal faces lapped to a tolerance of one light band. Metal parts and springs for seals shall be 300 series stainless steel.

**Pump Impeller (ME3F)** – The pump impeller shall be of the two vane enclosed type. The impeller shall be constructed of engineered thermoplastic. A stainless steel wear ring shall be molded into the neck of the impeller to provide a sealing surface. A replaceable Buna-N sealing cup shall effect a seal between the volute and impeller in order to maintain high efficiency and prevent recirculation.

**Pump Impeller (ME3H)** – The pump impeller shall be of the recessed type. The impeller shall be constructed of engineered thermoplastic.

**Motor Castings** – The motor housing castings shall be of high tensile strength Class 30 gray cast iron. Castings shall be treated with phosphate and chromate rinse and painted with a high quality air dry alkyd enamel for corrosion protection.

**Pump Case** – The pump case shall be a high efficiency volute design capable of passing 3/4 inch spherical solids. The pump volute shall be constructed of Class 30 gray cast iron.

**Fasteners** – All exposed fasteners shall be of 300 series stainless steel.



USA  
293 WRIGHT STREET, DELAVAN, WI 53115 WWW.FEMYERS.COM  
PH: 888-987-8677 ORDERS FAX: 800-426-9446

CANADA  
490 PINEBUSH ROAD, UNIT 4, CAMBRIDGE, ONTARIO N1T 0A5  
PH: 800-363-7867 ORDERS FAX: 888-606-5484

Because we are continuously improving our products and services, Pentair reserves the right to change specifications without prior notice.

## Pentair Sensor Level Control Switch

Mechanically-activated, narrow-angle float switch designed to activate pump control panels and alarms.

This narrow-angle sensing device is used to accurately monitor liquid levels in:

- potable water
- water
- sewage applications

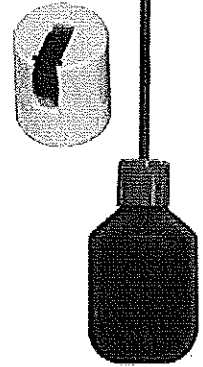
The Sensor Level control switch is not sensitive to rotation.

### Normally Open Model (high level).

The control switch turns on (closes) when the float tips slightly **above** horizontal signaling a high level, and turns off (opens) when the float drops slightly below horizontal.

### Normally Closed Model (low level)

The control switch turns on (closes) when the float tips slightly **below** horizontal signaling a low level, and turns off (opens) when the float tips slightly above horizontal.



### FEATURES

- Passed NSF Standard 61 protocol by an approved Water Quality Association laboratory.
- Mechanically-activated, snap action contacts.
- High impact, corrosion resistant, polypropylene float housing.
- Not sensitive to rotation.
- Control differential of 1.5 inches (4 cm) above or below horizontal.
- Yellow colored cap for easy identification of normally open control switch.
- White colored cap for easy identification of normally closed control switch.
- UL Listed for use in water and sewage.
- CSA Certified.
- Three-year limited warranty.



### SPECIFICATIONS

**CABLE:** flexible 18 gauge, 2 conductor (UL, CSA) SJOW, water-resistant (CPE)

**FLOAT:** 2.74 inch diameter x 4.83 inch long (7.0 x 12.3 cm) high impact, corrosion resistant, polypropylene housing for use in sewage and water up to 140°F (60°C)

**MAXIMUM WATER DEPTH:** 30 feet (9 meters), 13 psi (90 kPa)

**ELECTRICAL:** 5 amp, 125/250 VAC, 50/60 Hz

**NOTE:** This switch is not recommended for controlling:

- electric loads less than 100 milliamps, 12 VAC
- non-arcing electric loads

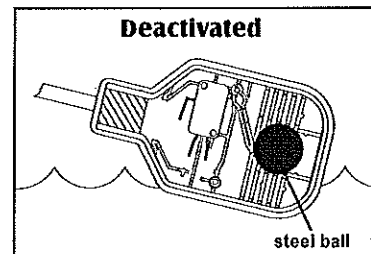
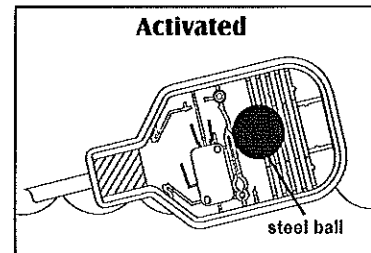
### OPTIONS

This switch is available:

- CE certified unit available upon request.
- for normally open (high level) applications or normally closed (low level) applications.
- in standard cable lengths of 10, 15, 20, or 30 feet and 3, 5, 6, or 10 meters (longer lengths available)
- with two mounting options that allow for flexibility in installation:

**Mounting Clamp:** for applications where the switch can be attached to a discharge pipe or similar mounting device.

**Externally Weighted:** for applications where the switch can be suspended from above.



CONTROL SWITCHES  
(MECHANICAL)

## Pentair Canada, Inc.

269 Trillium Drive, Kitchener, ON  
 N2G 4W5  
 1-800-387-4386  
 Ph: 519-748-5470  
 Fax: 888-606-5484

SEE BACKSIDE FOR ORDERING INFORMATION.

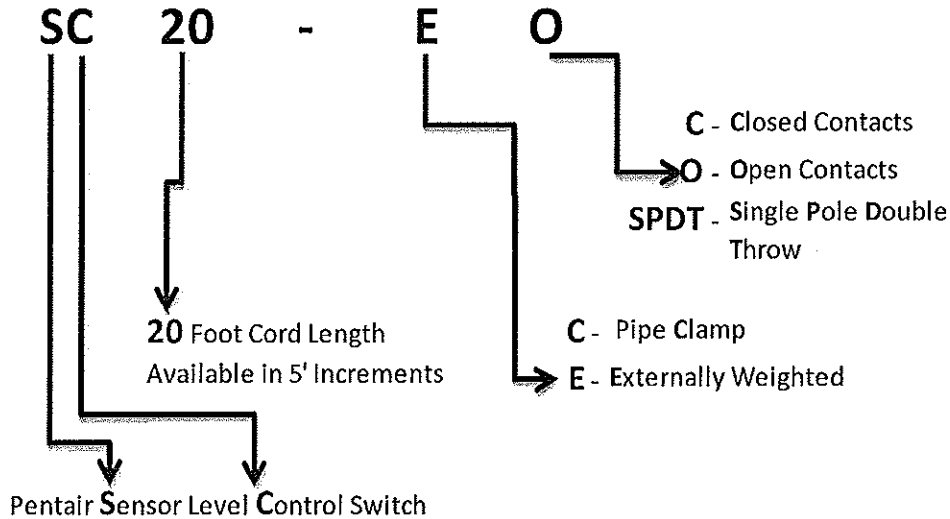
[www.pentair.com](http://www.pentair.com)

# Pentair Sensor Level Control Switch

Mechanically-activated, narrow-angle float switch designed to activate pump control panels and alarms.

## ORDERING INFORMATION

### Narrow Angle, 5 Amp, Panel Duty Level Controls



Passed NSF standard 61 protocol by an approved Water Quality Association laboratory.



## SPECIFICATIONS

- CABLE:** flexible 18 gauge, 2 conductor (UL) SJOW, water-resistant (CPE)
- FLOAT:** 2.74 inch diameter x 4.83 inch long (7 x 12.3 cm), high impact, corrosion resistant polypropylene for use in sewage and water up to 140°F (60°C)
- MAXIMUM WATER DEPTH:** 30 feet (9 meters), 13 psi
- ELECTRICAL:** 5 amp, 125/250 VAC, 50/60 Hz

This switch is not recommended for controlling:

- electric loads less than 100 milliamps, 12 VAC
- non-arcing electric loads

## OTHER INFORMATION

### NORMALLY OPEN (high level) OPERATION

The control switch closes (turns on) when the float tips slightly **above** horizontal signaling a high level, and opens (turns off) when the float drops slightly **below** horizontal in potable water, water or sewage applications.

### NORMALLY CLOSED (low level) OPERATION

The control switch closes (turns on) when the float tips slightly **below** horizontal signaling a low level, and opens (turns off) when the float tips slightly **above** horizontal in potable water, water or sewage applications.

CONTROL SWITCHES (MECHANICAL)

## Pentair Canada, Inc.

269 Trillium Drive, Kitchener, ON  
N2G 4W5  
1-800-387-4386  
Ph: 519-748-5470  
Fax: 888-606-5484

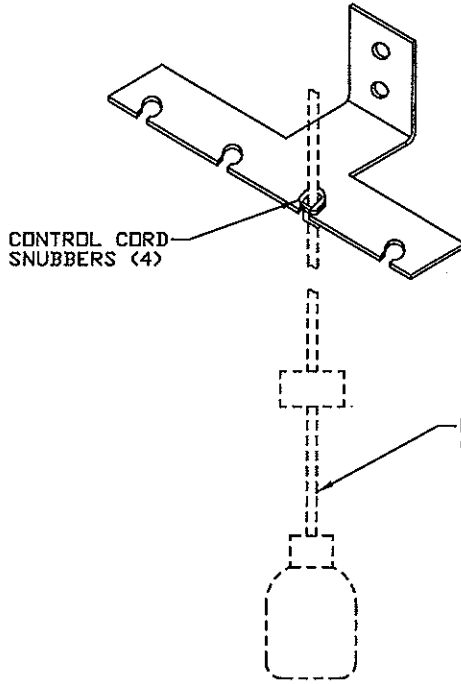
[www.pentair.com](http://www.pentair.com)

*SANITARY PUMP*

**Myers**

# CSB4-SS ✓

FLOAT BRACKET FOR MOUNTING UP TO (4) FOUR CONTROLS



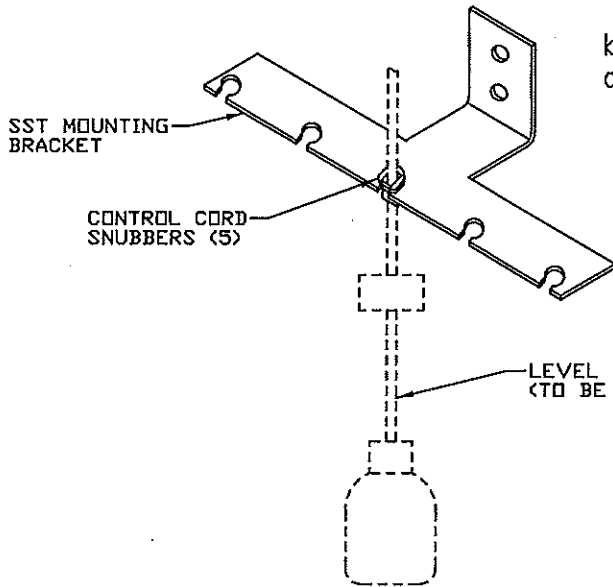
bracket is 11' wide and 4' deep 3' high

CONTROL CORD SNUBBERS (4)

LEVEL CONTROLS (TO BE ORDERED SEPARATELY)

# CSB5-SS

FLOAT BRACKET FOR MOUNTING UP TO (5) FIVE CONTROLS



bracket is 14' wide and 4' deep 3' high

SST MOUNTING BRACKET

CONTROL CORD SNUBBERS (5)

LEVEL CONTROLS (TO BE ORDERED SEPARATELY)

ES-2365A



**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 of Her Majesty who is designated pursuant to the Articles of Agreement and includes a person specially authorized by him to perform, on his behalf, any of his functions under the contract and is so designated in writing to the Contractor;
- 1.1.5 “material” includes all commodities, articles and things required to be furnished by or for the Contractor under the contract for incorporation into the work;
- 1.1.6 “Minister” includes a person acting for, or if the office is vacant, in place of the Minister and his successors in the office, and his or their lawful deputy and any of his or their representatives appointed for the purposes of the contract;
- 1.1.7 “person” includes, unless the context otherwise requires, a partnership, proprietorship, firm, joint venture, consortium and a corporation;
- 1.1.8 “plant” includes all animals, tools, implements, machinery, vehicles, buildings, structures, equipment and commodities, articles and things other than material, that are necessary for the due performance of the contract;
- 1.1.9 “subcontractor” means a person to whom the Contractor has, subject to GC4, subcontracted the whole or any part of the work;
- 1.1.10 “superintendent” means the employee of the Contractor who is designated by the Contractor to act pursuant to GC19;
- 1.1.11 “work includes, subject only to any express stipulation in the contract to the contrary, everything that is necessary to be done, furnished or delivered by the Contractor to perform the contract.

1.2 The headings in the contract documents, other than in the Plans and Specifications, form no part of the contract but are inserted for convenience of reference only.

1.3 In interpreting the contract, in the event of discrepancies or conflicts between anything in the Plans and Specifications and the General Conditions, the General Conditions govern.



- 1.4 In interpreting the Plans and Specifications, in the event of discrepancies or conflicts between
- 1.4.1 the Plans and Specifications, the Specifications govern;
  - 1.4.2 the Plans, the Plans drawn with the largest scale govern; and
  - 1.4.3 figured dimensions and scaled dimensions, the figured dimensions govern.

**GC2 Successors and Assigns**

- 2.1 The contract shall inure to the benefit of and be binding upon the parties hereto and their lawful heirs, executors, administrators, successors and assigns.

**GC3 Assignment of Contract**

- 3.1 The contract may not be assigned by the Contractor, either in whole or in part, without the written consent of the Minister.

**GC4 Subcontracting by Contractor**

- 4.1 Subject to this General Condition, the Contractor may subcontract any part of the work.
- 4.2 The Contractor shall notify the Departmental Representative in writing of his intention to subcontract.
- 4.3 A notification referred to in GC4.2 shall identify the part of the work, and the subcontractor with whom it is intended to subcontract.
- 4.4 The Departmental Representative may object to the intended subcontracting by notifying the Contractor in writing within six days of receipt by the Departmental Representative of a notification referred to in GC4.2.
- 4.5 If the Departmental Representative objects to a subcontracting pursuant to GC4.4, the Contractor shall not enter into the intended subcontract.
- 4.6 The contractor shall not, without the written consent of the Departmental Representative, change a subcontractor who has been engaged by him in accordance with this General Condition.
- 4.7 Every subcontract entered into by the Contractor shall adopt all of the terms and conditions of this contract that are of general application.
- 4.8 Neither a subcontracting nor the Departmental Representative's consent to a subcontracting by the Contractor shall be construed to relieve the Contractor from any obligation under the contract or to impose any liability upon Her Majesty.

**GC5 Amendments**



- 5.1 No amendment or change in any of the provisions of the contract shall have any force or effect until it is reduced to writing.

**GC6 No Implied Obligations**

- 6.1 No implied terms or obligations of any kind by or on behalf of Her Majesty shall arise from anything in the contract and the express covenants and agreements therein contained and made by Her Majesty are the only covenants and agreements upon which any rights against Her Majesty are to be founded.
- 6.2 The contract supersedes all communications, negotiations and agreements, either written or oral, relating to the work that were made prior to the date of the contract.

**GC7 Time of Essence**

- 7.1 Time is of the essence of the contract.

**GC8 Indemnification by Contractor**

- 8.1 The Contractor shall indemnify and save Her Majesty harmless from and against all claims, demand, losses, costs, damages, actions, suits, or proceedings by whomever made, brought or prosecuted and in any manner based upon, arising out of, related to, occasioned by or attributable to the activities of the Contractor, his servants, agents, subcontractors and sub-subcontractors in performing the work including an infringement or an alleged infringement of a patent of invention or any other kind of intellectual property.
- 8.2 For the purpose of GC8.1, "activities" includes any act improperly carried out, any omission to carry out an act and any delay in carrying out an act.

**GC9 Indemnification by Her Majesty**

- 9.1 Her Majesty shall, subject to the Crown Liability Act, the Patent Act, and any other law that affects Her Majesty's rights, powers, privileges or obligations, indemnify and save the Contractor harmless from and against all claims, demands, losses, costs, damage, actions, suits or proceedings arising out of his activities under the contract that are directly attributable to
- 9.1.1 lack of or a defect in Her Majesty's title to the work site whether real or alleged; or
- 9.1.2 an infringement or an alleged infringement by the Contractor of any patent of invention or any other kind of intellectual property occurring while the Contractor was performing any act for the purposes of the contract employing a model, plan or design or any other thing related to the work that was supplied by Her Majesty to the Contractor.

**GC10 Members of House of Commons Not to Benefit**



- 10.1 As required by the Parliament of Canada Act, it is an express condition of the contract that no member of the House of Commons shall be admitted to any share of part of the contract or to any benefit arising therefrom.

### **GC11 Notices**

- 11.1 Any notice, consent, order, decision, direction or other communication, other than a notice referred to in GC11.4, that may be given to the Contractor pursuant to the contract may be given in any manner.
- 11.2 Any notice, consent, order, decision, direction or other communication required to be given in writing, to any party pursuant to the contract shall, subject to GC11.4, be deemed to have been effectively given
- 11.2.1 to the Contractor, if delivered personally to the Contractor or the Contractor's superintendent, or forwarded by mail, telex or facsimile to the Contractor at the address set out in A4.1, or
- 11.2.2 to Her Majesty, if delivered personally to the Departmental Representative, or forwarded by mail, telex or facsimile to the Departmental Representative at the address set out in A1.2.1.
- 11.3 Any such notice, consent, order, decision, direction or other communication given in accordance with GC11.2 shall be deemed to have been received by either party
- 11.3.1 if delivered personally, on the day that it was delivered,
- 11.3.2 if forwarded by mail, on the earlier of the day it was received and the sixth day after it was mailed, and
- 11.3.3 if forwarded by telex or facsimile, 24 hours after it was transmitted.
- 11.4 A notice given under GC38.1.1, GC40 and GC41, if delivered personally, shall be delivered to the Contractor if the Contractor is doing business as sole proprietor or, if the Contractor is a partnership or corporation, to an officer thereof.

### **GC12 Material, Plant and Real Property Supplied by Her Majesty**

- 12.1 Subject to GC12.2, the Contractor is liable to Her Majesty for any loss of or damage to material, plant or real property that is supplied or placed in the care, custody and control of the Contractor by Her Majesty for use in connection with the contract, whether or not that loss or damage is attributable to causes beyond the Contractor's control.
- 12.2 The Contractor is not liable to Her Majesty for any loss or damage to material, plant or real property referred to in GC12.1 if that loss or damage results from and is directly attributable to reasonable wear and tear.
- 12.3 The Contractor shall not use any material, plant or real property referred to in GC12.1 except for



the purpose of performing this contract.

- 12.4 When the Contractor fails to make good any loss or damage for which he is liable under GC12.1 within a reasonable time after being required to do so by the Departmental Representative, the Departmental Representative may cause the loss or damage to be made good at the Contractor's expense, and the Contractor shall thereupon be liable to Her Majesty for the cost thereof and shall, on demand, pay to Her Majesty an amount equal to that cost.
- 12.5 The Contractor shall keep such records of all material, plant and real property referred to in GC12.1 as the Departmental Representative from time to time requires and shall satisfy the Departmental Representative, when requested, that such material, plant and real property are at the place and in the condition which they ought to be.

### **GC13 Material, Plant and Real Property Become Property of Her Majesty**

- 13.1 Subject to GC14.7 all material and plant and the interest of the Contractor in all real property, licenses, powers and privileges purchased, used or consumed by the Contractor for the contract shall, after the time of their purchase, use or consumption be the property of Her Majesty for the purposes of the work and they shall continue to be the property of Her Majesty.
- 13.1.1 in the case of material, until the Departmental Representative indicates that he is satisfied that it will not be required for the work, and
- 13.1.2 in the case of plant, real property, licenses, powers and privileges, until the Departmental Representative indicates that he is satisfied that the interest vested in Her Majesty therein is no longer required for the purposes of the work.
- 13.2 Material or plant that is the property of Her Majesty by virtue of GC13.1 shall not be taken away from the work site or used or disposed of except for the purposes of the work without the written consent of the Departmental Representative.
- 13.3 Her Majesty is not liable for loss of or damage from any cause to the material or plant referred to in GC13.1 and the Contractor is liable for such loss or damage notwithstanding that the material or plant is the property of Her Majesty.

### **GC14 Permits and Taxes Payable**

- 14.1 The Contractor shall, within 30 days after the date of the contract, tender to a municipal authority an amount equal to all fees and charges that would be lawfully payable to that municipal authority in respect of building permits as if the work were being performed for a person other than Her Majesty.
- 14.2 Within 10 days of making a tender pursuant to GC14.1, the Contractor shall notify the Departmental Representative of his action and of the amount tendered and whether or not the municipal authority has accepted that amount.
- 14.3 If the municipal authority does not accept the amount tendered pursuant to GC14.1 the Contractor shall pay that amount to Her Majesty within 6 days after the time stipulated in GC14.2.



- 14.4 For the purposes of GC14.1 to GC14.3 “municipal authority” means any authority that would have jurisdiction respecting permission to perform the work if the owner were not Her Majesty.
- 14.5 Notwithstanding the residency of the Contractor, the Contractor shall pay any applicable tax arising from or related to the performance of the work under the contract.
- 14.6 In accordance with the Statutory Declaration referred to in TP4.9, a Contractor who has neither residence nor place of business in the province in which work under the contract is being performed shall provide Her Majesty with proof of registration with the provincial sales tax authorities in the said province.
- 14.7 For the purpose of the payment of any applicable tax or the furnishing of security for the payment of any applicable tax arising from or related to the performance of the work under the contract, the Contractor shall, notwithstanding the fact that all material, plant and interest of the Contractor in all real property, licenses, powers and privileges, have become the property of Her Majesty after the time of purchase, be liable, as a user or consumer, for the payment or for the furnishing of security for the payment of any applicable tax payable, at the time of the use or consumption of that material, plant or interest of the Contractor in accordance with the relevant legislation.

#### **GC15 Performance of Work under Direction of Departmental Representative**

- 15.1 The Contractor shall
- 15.1.1 permit the Departmental Representative to have access to the work and its site at all times during the performance of the contract;
  - 15.1.2 furnish the Departmental Representative with such information respecting the performance of the contract as he may require; and
  - 15.1.3 give the Departmental Representative every possible assistance to enable the Departmental Representative to carry out his duty to see that the work is performed in accordance with the contract and to carry out any other duties and exercise any powers specially imposed or conferred on the Departmental Representative under the contract.

#### **CG16 Cooperation with Other Contractors**

- 16.1 Where, in the opinion of the Departmental Representative, it is necessary that other contractors or workers with or without plant and material, be sent onto the work or its site, the Contractor shall, to the satisfaction of the Departmental Representative, allow them access and cooperate with them in the carrying out of their duties and obligation.
- 16.2 If
- 16.2.1 the sending onto the work or its site of other contractors or workers pursuant to GC16.1 could not have been reasonably foreseen or anticipated by the Contractor when entering into the contract, and





16.2.2 the Contractor incurs, in the opinion of the Departmental Representative, extra expense in complying with GC16.1, and

16.2.3 The Contractor has given the Departmental Representative written notice of his claim for the extra expense referred to in GC16.2.2 within 30 days of the date that the other contractors or workers were sent onto the work or its site,

Her Majesty shall pay the Contractor the cost, calculated in accordance with GC48 to GC50, of the extra labour, plant and material that was necessarily incurred.

### **GC17 Examination of Work**

17.1 If, at any time after the commencement of the work but prior to the expiry of the warranty or guarantee period, the Departmental Representative has reason to believe that the work or any part thereof has not been performed in accordance with the contract, the Departmental Representative may have that work examined by an expert of his choice.

17.2 If, as a result of an examination of the work referred to in GC17.1, it is established that the work was not performed in accordance with the contract, then, in addition to and without limiting or otherwise affecting any of Her Majesty's rights and remedies under the contract either at law or in equity, the Contractor shall pay Her Majesty, on demand, all reasonable costs and expenses that were incurred by Her Majesty in having that examination performed.

### **GC18 Clearing of Site**

18.1 The Contractor shall maintain the work and its site in a tidy condition and free from the accumulation of waste material and debris, in accordance with any directions of the Departmental Representative.

18.2 Before the issue of an interim certificate referred to in GC44.2, the Contractor shall remove all the plant and material not required for the performance of the remaining work, and all waste material and other debris, and shall cause the work and its site to be clean and suitable for occupancy by Her Majesty's servants, unless otherwise stipulated in the contract.

18.3 Before the issue of a final certificate referred to in GC44.1, the Contractor, shall remove from the work and its site all of the surplus plant and material and any waste material and other debris.

18.4 The Contractor's obligations described in GC18.1 to GC18.3 do not extend to waste material and other debris caused by Her Majesty's servants or contractors and workers referred to in GC16.1.

### **GC19 Contractor's Superintendent**

19.1 The Contractor shall, forthwith upon the award of the contract, designate a superintendent.

19.2 The Contractor shall forthwith notify the Departmental Representative of the name, address and telephone number of a superintendent designate pursuant to GC19.1.



- 19.3 A superintendent designated pursuant to GC19.1 shall be in full charge of the operations of the Contractor in the performance of the work and is authorized to accept any notice, consent, order, direction, decision or other communication on behalf of the Contractor that may be given to the superintendent under the contract.
- 19.4 The Contractor shall, until the work has been completed, keep a competent superintendent at the work site during working hours.
- 19.5 The Contractor shall, upon the request of the Departmental Representative, remove any superintendent who, in the opinion of the Departmental Representative, is incompetent or has been conducting himself improperly and shall forthwith designate another superintendent who is acceptable to the Departmental Representative.
- 19.6 Subject to GC19.5, the Contractor shall not substitute a superintendent without the written consent of the Departmental Representative.
- 19.7 A breach by the Contractor of GC19.6 entitles the Departmental Representative to refuse to issue any certificate referred to in GC44 until the superintendent has returned to the work site or another superintendent who is acceptable to the Departmental Representative has been substituted.

#### **GC20 National Security**

- 20.1 If the Minister is of the opinion that the work is of a class or kind that involves the national security, he may order the Contractor
- 20.1.1 to provide him with any information concerning persons employed or to be employed by him for purposes of the contract; and
  - 20.1.2 to remove any person from the work and its site if, in the opinion of the Minister, that person may be a risk to the national security.
- 20.2 The Contractor shall, in all contracts with persons who are to be employed in the performance of the contract, make provision for his performance of any obligation that may be imposed upon him under GC19 to GC21.
- 20.3 The Contractor shall comply with an order of the Minister under GC20.1

#### **GC21 Unsuitable Workers**

- 21.1 The Contractor shall, upon the request of the Departmental Representative, remove any person employed by him for purposes of the contract who, in the opinion of the Departmental Representative, is incompetent or has conducted himself improperly, and the Contractor shall not permit a person who has been removed to return to the work site.

#### **GC22 Increased or Decreased Costs**



- 22.1 The amount set out in the Articles of Agreement shall not be increased or decreased by reason of any increase or decrease in the cost of the work that is brought about by an increase or decrease in the cost of labour, plant or material or any wage adjustment arising pursuant to the Labour Conditions.
- 22.2 Notwithstanding GC22.1 and GC35, an amount set out in the Articles of Agreement shall be adjusted in the manner provided in GC22.3, if any change in a tax imposed under the Excise Act, the Excise Tax Act, the Old Age Security Act, the Customs Act, the Customs Tariff or any provincial sales tax legislation imposing a retail sales tax on the purchase of tangible personal property incorporated into Real Property
- 22.2.1 occurs after the date of the submission by the Contractor of his tender for the contract,
- 22.2.2 applies to material, and
- 22.2.3 affects the cost to the Contractor of that material.
- 22.3 If a change referred to in GC22.2 occurs, the appropriate amount set out in the Articles of Agreement shall be increased or decreased by an amount equal to the amount that is established by an examination of the relevant records of the Contractor referred to in GC51 to be the increase or decrease in the cost incurred that is directly attributable to that change.
- 22.4 For the purpose of GC22.2, where a tax is changed after the date of submission of the tender but public notice of the change has been given by the Minister of Finance before that date, the change shall be deemed to have occurred before the date of submission of the tender.

### **GC23 Canadian Labour and Material**

- 23.1 The Contractor shall use Canadian labour and material in the performance of the work to the full extent to which they are procurable, consistent with proper economy and expeditious carrying out of the work.
- 23.2 Subject to GC23.1, the Contractor shall, in the performance of the work, employ labour from the locality where the work is being performed to the extent to which it is available, and shall use the offices of the Canada Employment Centres for the recruitment of workers wherever practicable.
- 23.3 Subject to GC23.1 and GC23.2, the Contractor shall, in the performance of the work, employ a reasonable proportion of persons who have been on active service with the armed forces of Canada and have been honourably discharged therefrom.

### **GC24 Protection of Work and Documents**

- 24.1 The Contractor shall guard or otherwise protect the work and its site, and protect the contract, specifications, plans, drawings, information, material, plant and real property, whether or not they are supplied by Her Majesty to the Contractor, against loss or damage from any cause, and he shall not use, issue, disclose or dispose of them without the written consent of the Minister, except as may be essential for the performance of the work.



- 24.2 If any document or information given or disclosed to the Contractor is assigned a security rating by the person who gave or disclosed it, the Contractor shall take all measures directed by the Departmental Representative to be taken to ensure the maintenance of the degree of security that is ascribed to that rating.
- 24.3 The Contractor shall provide all facilities necessary for the purpose of maintaining security, and shall assist any person authorized by the Minister to inspect or to take security measures in respect of the work and its site.
- 24.4 The Departmental Representative may direct the Contractor to do such things and to perform such additional work as the Departmental Representative considers reasonable and necessary to ensure compliance with or to remedy a breach of GC24.1 to GC24.3.

### **GC25 Public Ceremonies and Signs**

- 25.1 The Contractor shall not permit any public ceremony in connection with the work without the prior consent of the Minister.
- 25.2 The Contractor shall not erect or permit the erection of any sign or advertising on the work or its site without the prior consent of the Departmental Representative.

### **GC26 Precautions against Damage, Infringement of Rights, Fire, and Other Hazards**

- 26.1 The Contractor shall, at his own expense, do whatever is necessary to ensure that
- 26.1.1 no person, property, right, easement or privilege is injured, damaged or infringed by reasons of the Contractor's activities in performing the contract;
  - 26.1.2 pedestrian and other traffic on any public or private road or waterway is not unduly impeded, interrupted or endangered by the performance or existence of the work or plant;
  - 26.1.3 fire hazards in or about the work or its site are eliminated and, subject to any direction that may be given by the Departmental Representative, any fire is promptly extinguished;
  - 26.1.4 the health and safety of all persons employed in the performance of the work is not endangered by the method or means of its performance;
  - 26.1.5 adequate medical services are available to all persons employed on the work or its site at all times during the performance of the work;
  - 26.1.6 adequate sanitation measures are taken in respect of the work and its site; and
  - 26.1.7 all stakes, buoys and marks placed on the work or its site by or under the authority of the Departmental Representative are protected and are not removed, defaced, altered or destroyed.
- 26.2 The Departmental Representative may direct the Contractor to do such things and to perform such additional work as the Departmental Representative considers reasonable and necessary to ensure



compliance with or to remedy a breach of GC26.1.

- 26.3 The Contractor shall, at his own expense, comply with a direction of the Departmental Representative made under GC26.2.

#### **GC27 Insurance**

- 27.1 The Contractor shall, at his own expense, obtain and maintain insurance contracts in respect of the work and shall provide evidence thereof to the Departmental Representative in accordance with the requirements of the Insurance Conditions "E".

- 27.2 The insurance contracts referred to in GC27.1 shall

27.2.1 be in a form, of the nature, in the amounts, for the periods and containing the terms and conditions specified in Insurance Conditions "E", and

27.2.2 provide for the payment of claims under such insurance contracts in accordance with GC28.

#### **GC28 Insurance Proceeds**

- 28.1 In the case of a claim payable under a Builders Risk/Installation (All Risks) insurance contract maintained by the Contractor pursuant to GC27, the proceeds of the claim shall be paid directly to Her Majesty, and

28.1.1 the monies so paid shall be held by Her Majesty for the purposes of the contract, or

28.1.2 if Her Majesty elects, shall be retained by Her Majesty, in which event they vest in Her Majesty absolutely.

- 28.2 In the case of a claim payable under a General Liability insurance contract maintained by the Contractor pursuant to GC27, the proceeds of the claim shall be paid by the insurer directly to the claimant.

- 28.3 If an election is made pursuant to GC28.1, the Minister may cause an audit to be made of the accounts of the Contractor and of Her Majesty in respect of the part of the work that was lost, damaged or destroyed for the purpose of establishing the difference, if any, between

28.3.1 the aggregate of the amount of the loss or damage suffered or sustained by Her Majesty, including any cost incurred in respect of the clearing and cleaning of the work and its site and any other amount that is payable by the Contractor to Her Majesty under the contract, minus any monies retained pursuant to GC28.12, and

28.3.2 the aggregate of the amounts payable by Her Majesty to the Contractor pursuant to the contract up to the date of the loss or damage.

- 28.4 A difference that is established pursuant to GC28.3 shall be paid forthwith by the party who is determined by the audit to be the debtor to the party who is determined by the audit to be the



creditor.

- 28.5 When payment of a deficiency has been made pursuant to GC28.4, all rights and obligations of Her Majesty and the Contractor under the contract shall, with respect only to the part of the work that was the subject of the audit referred to in GC28.3, be deemed to have been expended and discharged.
- 28.6 If an election is not made pursuant to GC28.1.2 the Contractor shall, subject to GC28.7, clear and clean the work and its site and restore and replace the part of the work that was lost, damaged or destroyed at his own expense as if that part of the work had not yet been performed.
- 28.7 When the Contractor clears and cleans the work and its site and restores and replaces the work referred to in GC 28.6, Her Majesty shall pay him out of the monies referred to in GC28.1 so far as they will thereunto extend.
- 28.8 Subject to GC28.7, payment by Her Majesty pursuant to GC28.7 shall be made in accordance with the contract but the amount of each payment shall be 100% of the amount claimed notwithstanding TP4.4.1 and TP4.4.2.

### **GC29 Contract Security**

- 29.1 The Contractor shall obtain and deliver contract security to the Departmental Representative in accordance with the provisions of the Contract Security Conditions.
- 29.2 If the whole or a part of the contract security referred to in GC29.1 is in the form of a security deposit, it shall be held and disposed of in accordance with GC43 and GC45.
- 29.3 If a part of the contract security referred to in GC29.1 is in the form of a labour and material payment bond, the Contractor shall post a copy of that bond on the work site.

### **GC30 Changes in the Work**

- 30.1 Subject to GC5, the Departmental Representative may, at any time before he issues his Final Certificate of Completion,
- 30.1.1 order work or material in addition to that provided for in the Plans and Specifications;  
and
- 30.1.2 delete or change the dimensions, character, quantity, quality, description, location or position of the whole or any part of the work or material provided for in the Plans and Specifications or in any order made pursuant to GC30.1.1,
- if that additional work or material, deletion, or change is, in his opinion, consistent with the general intent of the original contract.
- 30.2 The Contractor shall perform the work in accordance with such orders, deletions and changes that are made by the Departmental Representative pursuant to GC30.1 from time to time as if they had appeared in and been part of the Plans and Specifications.



- 30.3 The Departmental Representative shall determine whether or not anything done or omitted by the Contractor pursuant to an order, deletion or change referred to in GC30.1 increased or decreased the cost of the work to the Contractor.
- 30.4 If the Departmental Representative determines pursuant to GC30.3 that the cost of the work to the Contractor has been increased, Her Majesty shall pay the Contractor the increased cost that the Contractor necessarily incurred for the additional work calculated in accordance with GC49 or GC50.
- 30.5 If the Departmental Representative determines pursuant to GC30.3 that the cost of the work to the Contractor has been decreased, Her Majesty shall reduce the amount payable to the Contractor under the contract by an amount equal to the decrease in the cost caused by the deletion or change referred to in GC30.1.2 and calculated in accordance with GC49.
- 30.6 GC30.3 to GC30.5 are applicable only to a contract or a portion of a contract for which a Fixed Price Arrangement is stipulated in the contract.
- 30.7 An order, deletion or change referred to in GC30.1 shall be in writing, signed by the Departmental Representative and given to the Contractor in accordance with GC11.

### **GC31 Interpretation of Contract by Departmental Representative**

- 31.1 If, at any time before the Departmental Representative has issued a Final Certificate of Completion referred to in GC44.1, any question arises between the parties about whether anything has been done as required by the contract or about what the Contractor is required by the contract to do, and, in particular but without limiting the generality of the foregoing, about
- 31.1.1 the meaning of anything in the Plans and Specification,
  - 31.1.2 the meaning to be given to the Plans and Specifications in case of any error therein, omission therefrom, or obscurity or discrepancy in their working or intention,
  - 31.1.3 whether or not the quality or quantity of any material or workmanship supplied or proposed to be supplied by the Contractor meets the requirements of the contract,
  - 31.1.4 whether or not the labour, plant or material provided by the Contractor for performing the work and carrying out the contract are adequate to ensure that the work will be performed in accordance with the contract and that the contract will be carried out in accordance with its terms,
  - 31.1.5 what quantity of any kind of work has been completed by the Contractor, or
  - 31.1.6 the timing and scheduling of the various phases of the performance of the work,
- the question shall be decided by the Departmental Representative whose decision shall be final and conclusive in respect of the work.
- 31.2 The Contractor shall perform the work in accordance with any decisions of the Departmental



Representative that are made under GC31.1 and in accordance with any consequential directions given by the Departmental Representative.

### **GC32 Warranty and Rectification of Defects in Work**

- 32.1 Without restricting any warranty or guarantee implied or imposed by law or contained in the contract documents, the Contractor shall, at his own expense,
- 32.1.1 rectify and make good any defect or fault that appears in the work or comes to the attention of the Minister with respect to those parts of the work accepted in connection with the Interim Certificate of Completion referred to GC44.2 within 12 months from the date of the Interim Certificate of Completion;
- 32.1.2 rectify and make good any defect or fault that appears in or comes to the attention of the Minister in connection with those parts of the work described in the Interim Certificate of Completion referred to in GC44.2 within 12 months from the date of the Final Certificate of Completion referred to in GC44.1.
- 32.2 The Departmental Representative may direct the Contractor to rectify and make good any defect or fault referred to in GC32.1 or covered by any other expressed or implied warranty or guarantee.
- 32.3 A direction referred to in GC32.2 shall be in writing, may include a stipulation in respect of the time within which a defect or fault is required to be rectified and made good by the Contractor, and shall be given to the Contractor in accordance with GC11.
- 32.4 The Contractor shall rectify and make good any defect or fault described in a direction given pursuant to GC32.2 within the time stipulated therein.

### **GC33 Non-Compliance by Contractor**

- 33.1 If the Contractor fails to comply with any decision or direction given by the Departmental Representative pursuant to GC18, GC24, GC26, GC31 or GC32, the Departmental Representative may employ such methods as he deems advisable to do that which the Contractor failed to do.
- 33.2 The Contractor shall, on demand, pay Her Majesty an amount that is equal to the aggregate of all cost, expenses and damage incurred or sustained by Her Majesty by reason of the Contractor's failure to comply with any decision or direction referred to in GC33.1, including the cost of any methods employed by the Departmental Representative pursuant to GC33.1.

### **GC34 Protesting Departmental Representative's Decisions**

- 34.1 The Contractor may, within ten days after the communication to him of any decision or direction referred to in GC30.3 or GC33.1, protest that decision or direction.
- 34.2 A protest referred to in GC34.1 shall be in writing, contain full reasons for the protest, be signed





by the Contractor and be given to Her Majesty by delivery to the Departmental Representative.

- 34.3 If the Contractor gives a protest pursuant to GC34.2, any compliance by the Contractor with the decision or direction that was protested shall not be construed as an admission by the Contractor of the correctness of that decision or direction, or prevent the Contractor from taking whatever action he considers appropriate in the circumstances.
- 34.4 The giving of a protest by the Contractor pursuant to GC34.2 shall not relieve him from complying with the decision or direction that is the subject of the protest.
- 34.5 Subject to GC34.6, the Contractor shall take any action referred to in GC34.3 within three months after the date that a Final Certificate of Completion is issued under GC44.1 and not afterwards.
- 34.6 The Contractor shall take any action referred to in GC34.3 resulting from a direction under GC32 within three months after the expiry of a warranty or guarantee period and not afterwards.
- 34.7 Subject to GC34.8, if Her Majesty determines that the Contractor's protest is justified, Her Majesty shall pay the Contractor the cost of the additional labour, plant and material necessarily incurred by the Contractor in carrying out the protested decision or direction.
- 34.8 Costs referred to in GC34.7 shall be calculated in accordance with GC48 to GC50.

### **GC35 Changes in Soil Conditions and Neglect or Delay by Her Majesty**

- 35.1 Subject to GC35.2 no payment, other than a payment that is expressly stipulated in the contract, shall be made by Her Majesty to the Contractor for any extra expense or any loss or damage incurred or sustained by the Contractor.
- 35.2 If the Contractor incurs or sustains any extra expense or any loss or damage that is directly attributable to
- 35.2.1 a substantial difference between the information relating to soil conditions at the work site that is contained in the Plans and Specifications or other documents supplied to the Contractor for his use in preparing his tender or a reasonable assumption of fact based thereon made by the Contractor, and the actual soil conditions encountered by the Contractor at the work site during the performance of the contract, or
- 35.2.2 any neglect or delay that occurs after the date of the contract on the part of Her Majesty in providing any information or in doing any act that the contract either expressly requires Her Majesty to do or that would ordinarily be done by an owner in accordance with the usage of the trade,

he shall, within ten days of the date the actual soil conditions described in GC35.2.1 were encountered or the neglect or delay described in GC35.2.2 occurred, give the Departmental Representative written notice of his intention to claim for that extra expense or that loss or damage.

- 35.3 When the Contractor has given a notice referred to in GC35.2, he shall give the Departmental Representative a written claim for extra expense or loss or damage within 30 days of the date that



a Final Certificate of Completion referred to in GC44.1 is issued and not afterwards.

- 35.4 A written claim referred to in GC35.3 shall contain a sufficient description of the facts and circumstances of the occurrence that is the subject of the claim to enable the Departmental Representative to determine whether or not the claim is justified and the Contractor shall supply such further and other information for that purpose as the Departmental Representative requires from time to time.
- 35.5 If the Departmental Representative determines that a claim referred to in GC35.3 is justified, Her Majesty shall make an extra payment to the Contractor in an amount that is calculated in accordance with GC47 to GC50.
- 35.6 If, in the opinion of the Departmental Representative, an occurrence described in GC35.2.1 results in a savings of expenditure by the Contractor in performing the contract, the amount set out in the Articles of Agreement shall, subject to GC35.7, be reduced by an amount that is equal to the saving.
- 35.7 The amount of the saving referred to in GC35.6 shall be determined in accordance with GC47 to GC49.
- 35.8 If the Contractor fails to give a notice referred to in GC35.2 and a claim referred to in GC35.3 within the times stipulated, an extra payment shall not be made to him in respect of the occurrence.

### **GC36 Extension of Time**

- 36.1 Subject to GC36.2, the Departmental Representative may, on the application of the Contractor made before the day fixed by the Articles of Agreement for completion of the work or before any other date previously fixed under this General Condition, extend the time for its completion by fixing a new date if, in the opinion of the Departmental Representative, causes beyond the control of the Contractor have delayed its completion.
- 36.2 An application referred to in GC36.1 shall be accompanied by the written consent of the bonding company whose bond forms part of the contract security.

### **GC37 Assessments and Damages for Late Completion**

- 37.1 For the purposes of this General Condition
- 37.1.1 the work shall be deemed to be completed on the date that an Interim Certificate of Completion referred to in GC44.2 is issued, and
- 37.1.2 "period of delay" means the number of days commencing on the day fixed by the Articles of Agreement for completion of the work and ending on the day immediately preceding the day on which the work is completed but does not include any day within a period of extension granted pursuant to GC36.1, and any other day on which, in the opinion of the Departmental Representative, completion of the work was delayed for reasons beyond the control of the Contractor.



- 37.2 If the Contractor does not complete the work by the day fixed for its completion by the Articles of Agreement but completes it thereafter, the Contractor shall pay Her Majesty an amount equal to the aggregate of
- 37.2.1 all salaries, wages and travelling expenses incurred by Her Majesty in respect of persons overseeing the performance of the work during the period of delay;
  - 37.2.2 the cost incurred by Her Majesty as a result of the inability to use the completed work for the period of delay; and
  - 37.2.3 all other expenses and damages incurred or sustained by Her Majesty during the period of delay as a result of the work not being completed by the day fixed for its completion.
- 37.3 The Minister may waive the right of Her Majesty to the whole or any part of the amount payable by the Contractor pursuant to GC37.2 I, in the opinion of the Minister, it is in the public interest to do so.

#### **GC38 Taking the Work Out of the Contractor's Hands**

- 38.1 The Minister may, at his sole discretion, by giving a notice in writing to the Contractor in accordance with GC11, take all or any part of the work out of the Contractor's hands, and may employ such means as he sees fit to have the work completed if the Contractor
- 38.1.1 Has not, within six days of the Minister or the Departmental Representative giving notice to the Contractor in writing in accordance with GC11, remedied any delay in the commencement or any default in the diligent performance of the work to the satisfaction of the Departmental Representative;
  - 38.1.2 has defaulted in the completion of any part of the work within the time fixed for its completion by the contract;
  - 38.1.3 has become insolvent;
  - 38.1.4 has committed an act of bankruptcy;
  - 38.1.5 has abandoned the work;
  - 38.1.6 has made an assignment of the contract without the consent required by GC3.1; or
  - 38.1.7 has otherwise failed to observe or perform any of the provisions of the contract.
- 38.2 If the whole or any part of the work is taken out of the Contractor's hands pursuant to GC38.1,
- 38.2.1 the Contractor's right to any further payment that is due or accruing due under the contract is, subject only to GC38.4, extinguished, and
  - 38.2.2 the Contractor is liable to pay Her Majesty, upon demand, an amount that is equal to the amount of all loss and damage incurred or sustained by Her Majesty in respect of the



Contractor's failure to complete the work.

- 38.3 If the whole or any part of the work that is taken out of the Contractor's hands pursuant to GC38.1 is completed by Her Majesty, the Departmental Representative shall determine the amount, if any, of the holdback or a progress claim that had accrued and was due prior to the date on which the work was taken out of the Contractor's hands and that is not required for the purposes of having the work performed or of compensating Her Majesty for any other loss or damage incurred or sustained by reason of the Contractor's default.
- 38.4 Her Majesty may pay the Contractor the amount determined not to be required pursuant to GC38.3.

**GC39 Effect of Taking the Work Out of the Contractor's Hands**

- 39.1 The taking of the work or any part thereof out of the Contractor's hands pursuant to GC38 does not operate so as to relieve or discharge him from any obligation under the contract or imposed upon him by law except the obligation to complete the performance of that part of the work that was taken out of his hands.
- 39.2 If the work or any part thereof is taken out of the Contractor's hands pursuant to GC38, all plant and material and the interest of the Contractor is all real property, licenses, powers and privileges acquired, used or provided by the Contractor under the contract shall continue to be the property of Her Majesty without compensation to the Contractor.
- 39.3 When the Departmental Representative certifies that any plant, material, or any interest of the Contractor referred to in GC39.2 is no longer required for the purposes of the work, or that it is not in the interest of Her Majesty to retain that plant, material or interest, it shall revert to the Contractor.

**G40 Suspension of Work by Minister**

- 40.1 The Minister may, when in his opinion it is in the public interest to do so, require the Contractor to suspend performance of the work either for a specified or an unspecified period by giving a notice of suspension in writing to the Contractor in accordance with GC11.
- 40.2 When a notice referred to in GC40.1 is received by the Contractor in accordance with GC11, he shall suspend all operations in respect of the work except those that, in the opinion of the Departmental Representative, are necessary for the care and preservation of the work, plant and material.
- 40.3 The Contractor shall not, during a period of suspension, remove any part of the work, plant or material from its site without the consent of the Departmental Representative.
- 40.4 If a period of suspension is 30 days or less, the Contractor shall, upon the expiration of that period, resume the performance of the work and he is entitled to be paid the extra cost, calculated in accordance with GC48 to GC50, of any labour, plant and material necessarily incurred by him as a result of the suspension.



- 40.5 If, upon the expiration of a period of suspension of more than 30 days, the Minister and the Contractor agree that the performance of the work will be continued by the Contractor, the Contractor shall resume performance of the work subject to any terms and conditions agreed upon by the Minister and the Contractor.
- 40.6 If, upon the expiration of a period of suspension of more than 30 days, the Minister and the Contractor do not agree that performance of the work will be continued by the Contractor or upon the terms and conditions under which the Contractor will continue the work, the notice of suspension shall be deemed to be a notice of termination pursuant to GC41.

#### **GC41 Termination of Contract**

- 41.1 The Minister may terminate the contract at any time by giving a notice of termination in writing to the Contractor in accordance with GC11.
- 41.2 When a notice referred to in GC41.1 is received by the Contractor in accordance with GC11, he shall, subject to any conditions stipulated in the notice, forthwith cease all operations in performance of the contract.
- 41.3 If the contract is terminated pursuant to GC41.1, Her Majesty shall pay the Contractor, subject to GC41.4, an amount equal to
- 41.3.1 the cost to the contractor of all labour, plant and material supplied by him under the contract up to the date of termination in respect of a contract or part thereof for which a Unit Price Arrangement is stipulated in the contract, or
  - 41.3.2 the lesser of
    - 41.3.2.1 an amount, calculated in accordance with the Terms and Payment, that would have been payable to the Contractor had he completed the work, and
    - 41.3.2.2 an amount that is determined to be due to the Contractor pursuant to GC49 in respect of a contract or part thereof for which a Fixed Price Arrangement is stipulated in the contract
- less the aggregate of all amounts that were paid to the Contractor by Her Majesty and all amounts that are due to Her Majesty from the Contractor pursuant to the contract.
- 41.4 If Her Majesty and the Contractor are unable to agree about an amount referred to in GC41.3 that amount shall be determined by the method referred to in GC50.

#### **GC42 Claims Against and Obligations of the Contractor or Subcontractor**

- 42.1 Her Majesty may, in order to discharge lawful obligations of and satisfy claims against the Contractor or a subcontractor arising out of the performance of the contract, pay any amount that is due and payable to the Contractor pursuant to the contract directly to the obligees of and the claimants against the Contractor or the subcontractor but such amount if any, as is paid by Her Majesty, shall not exceed that amount which the Contractor would have been obliged to pay to



such claimant had the provisions of the Provincial or Territorial lien legislation, or, in the Province of Quebec, the law relating to privileges, been applicable to the work. Any such claimant need not comply with the provisions of such legislation setting out the steps by way of notice, registration or otherwise as might have been necessary to preserve or perfect any claim for lien or privilege which claimant might have had;

- 42.2 Her Majesty will not make any payment as described in GC42.1 unless and until that claimant shall have delivered to Her Majesty:
- 42.2.1 a binding and enforceable Judgment or Order of a court of competent jurisdiction setting forth such amount as would have been payable by the Contractor to the claimant pursuant to the provisions of the applicable Provincial or Territorial lien legislation, or, in the Province of Quebec, the law relating to privileges, had such legislation been applicable to the work; or
  - 42.2.2 a final and enforceable award of an arbitrator setting forth such amount as would have been payable by the Contractor to the claimant pursuant to the provisions of the applicable Provincial or Territorial lien legislation, or, in the Province of Quebec, the law relating to privileges, had such legislation been applicable to the work; or
  - 42.2.3 the consent of the Contractor authorizing a payment.
- For the purposes of determining the entitlement of a claimant pursuant to GC42.2.1 and GC42.2.2, the notice required by GC42.8 shall be deemed to replace the registration or provision of notice after the performance of work as required by any applicable legislation and no claim shall be deemed to have expired, become void or unenforceable by reason of the claimant not commencing any action within the time prescribed by any applicable legislation.
- 42.3 The Contractor shall, by the execution of his contract, be deemed to have consented to submit to binding arbitration at the request of any claimant those questions that need be answered to establish the entitlement of the claimant to payment pursuant to the provisions of GC42.1 and such arbitration shall have as parties to it any subcontractor to whom the claimant supplied material, performed work or rented equipment should such subcontractor wish to be adjoined and the Crown shall not be a party to such arbitration and, subject to any agreement between the Contractor and the claimant to the contrary, the arbitration shall be conducted in accordance with the Provincial or Territorial legislation governing arbitration applicable in the Province or Territory in which the work is located.
- 42.4 A payment made pursuant to GC42.1 is, to the extent of the payment, a discharge of Her Majesty's liability to the Contractor under the contract and may be deducted from any amount payable to the Contractor under the contract.
- 42.5 To the extent that the circumstances of the work being performed for Her Majesty permit, the Contractor shall comply with all laws in force in the Province or Territory where the work is being performed relating to payment period, mandatory holdbacks, and creation and enforcement of mechanics' liens, builders' liens or similar legislation or in the Province of Quebec, the law relating to privileges.
- 42.6 The Contractor shall discharge all his lawful obligations and shall satisfy all lawful claims against him arising out of the performance of the work at least as often as the contract requires Her



Majesty to pay the Contractor.

- 42.7 The Contractor shall, whenever requested to do so by the Departmental Representative, make a statutory declaration deposing to the existence and condition of any obligations and claims referred to in GC42.6.
- 42.8 GC42.1 shall only apply to claims and obligations
- 42.8.1 the notification of which has been received by the Departmental Representative in writing before payment is made to the Contractor pursuant to TP4.10 and within 120 days of the date on which the claimant
- 42.8.1.1 should have been paid in full under the claimant's contract with the Contractor or subcontractor where the claim is for money that was lawfully required to be held back from the claimant; or
- 42.8.1.2 performed the last of the services, work or labour, or furnished the last of the material pursuant to the claimant's contract with the Contractor or subcontractor where the claim is not for money referred to in GC42.8.1.1, and
- 42.8.2 the proceedings to determine the right to payment of which, pursuant to GC42.2. shall have commenced within one year from the date that the notice referred to in GC42.8.1 was received by the Departmental Representative, and
- the notification required by GC42.8.1 shall set forth the amount claimed to be owing and the person who by contract is primarily liable.
- 42.9 Her Majesty may, upon receipt of a notice of claim under GC42.8.1, withhold from any amount that is due and payable to the Contractor pursuant to the contract the full amount of the claim or any portion thereof.
- 42.10 The Departmental Representative shall notify the Contractor in writing of receipt of any claim referred to in GC42.8.1 and of the intention of Her Majesty to withhold funds pursuant to GC42.9 and the Contractor may, at any time thereafter and until payment is made to the claimant, be entitled to post, with Her Majesty, security in a form acceptable to Her Majesty in an amount equal to the value of the claim, the notice of which is received by the Departmental Representative and upon receipt of such security Her Majesty shall release to the Contractor any funds which would be otherwise payable to the Contractor, that were withheld pursuant to the provisions of GC42.9 in respect of the claim of any claimant for whom the security stands.

### **GC43 Security Deposit – Forfeiture or Return**

- 43.1 If
- 43.1.1 the work is taken out of the Contractor's hands pursuant to GC38,
- 43.1.2 the contract is terminated pursuant to GC41, or
- 43.1.3 the Contractor is in breach of or in default under the contract,



Her Majesty may convert the security deposit, if any, to Her own use.

- 43.2 If Her Majesty converts the contract security pursuant to GC43.1, the amount realized shall be deemed to be an amount due from Her Majesty to the Contractor under the contract.
- 43.3 Any balance of an amount referred to in GC43.2 that remains after payment of all losses, damage and claims of Her Majesty and others shall be paid by Her Majesty to the Contractor if, in the opinion of the Departmental Representative, it is not required for the purposes of the contract.

#### **GC44 Departmental Representative's Certificates**

44.1 On the date that

44.1.1 the work has been completed, and

44.1.2 the Contractor has complied with the contract and all orders and directions made pursuant thereto,

both to the satisfaction of the Departmental Representative, the Departmental Representative shall issue a Final Certificate of Completion to the Contractor.

44.2 If the Departmental Representative is satisfied that the work is substantially complete he shall, at any time before he issues a certificate referred to in GC44.1, issue an Interim Certificate of Completion to the Contractor, and

44.2.1 for the purposes of GC44.2 the work will be considered to be substantially complete,

44.2.1.1 when the work under the contract or a substantial part thereof is, in the opinion of the Departmental Representative, ready for use by Her Majesty or is being used for the purpose intended; and

44.2.1.2 when the work remaining to be done under the contract is, in the opinion of the Departmental Representative, capable of completion or correction at accost of not more than

44.2.1.2.1 -3% of the first \$500,000, and

44.2.1.2.2 -2% of the next \$500,000, and

44.2.1.2.3 -1% of the balance

of the value of the contract at the time this cost is calculated.

44.3 For the sole purpose of GC44.2.1.2, where the work or a substantial part thereof is ready for use or is being used for the purposes intended and the remainder of the work or a part thereof cannot be completed by the time specified in A2.1, or as amended pursuant to GC36, for reasons beyond the control of the Contractor or where the Departmental Representative and the Contractor agree not to complete a part of the work within the specified time, the cost of that part of the work





which was either beyond the control of the Contractor to complete or the Departmental Representative and the Contractor have agreed not to complete by the time specified shall be deducted from the value of the contract referred to GC44.2.1.2 and the said cost shall not form part of the cost of the work remaining to be done in determining substantial completion.

44.4 An Interim Certificate of Completion referred to in GC44.2 shall describe the parts of the work not completed to the satisfaction of the Departmental Representative and all things that must be done by the Contractor

44.4.1 before a Final Certificate of Completion referred to in GC44.1 will be issued, and

44.4.2 before the 12-month period referred to in GC32.1.2 shall commence for the said parts and all the said things.

44.5 The Departmental Representative may, in addition to the parts of the work described in an Interim Certificate of Completion referred to in GC44.2, require the Contractor to rectify any other parts of the work not completed to his satisfaction and to do any other things that are necessary for the satisfactory completion of the work.

44.6 If the contract or a part thereof is subject to a Unit Price Arrangement, the Departmental Representative shall measure and record the quantities of labour, plant and material, performed, used and supplied by the Contractor in performing the work and shall, at the request of the Contractor, inform him of those measurements.

44.7 The Contractor shall assist and co-operate with the Departmental Representative in the performance of his duties referred to in GC44.6 and shall be entitled to inspect any record made by the Departmental Representative pursuant to GC44.6.

44.8 After the Departmental Representative has issued a Final Certificate of Completion referred to in GC44.1, he shall, if GC44.6 applies, issue a Final Certificate of Measurement.

44.9 A Final Certificate of Measurement referred to in GC44.8 shall

44.9.1 contain the aggregate of all measurements of quantities referred to in GC44.6, and

44.9.2 be binding upon and conclusive between Her Majesty and the Contractor as to the quantities referred to therein.

#### **GC45 Return of Security Deposit**

45.1 After an Interim Certificate of Completion referred to in GC44.2 has been issued, Her Majesty shall, if the Contractor is not in breach of or in default under the contract, return to the Contractor all or any part of the security deposit that, in the opinion of the Departmental Representative, is not required for the purposes of the contract.

45.2 After a Final Certificate of Completion referred to in GC44.1 has been issued, Her Majesty shall return to the Contractor the remainder of any security deposit unless the contract stipulates otherwise.



- 45.3 If the security deposit was paid into the Consolidated Revenue Fund of Canada, Her Majesty shall pay interest thereon to the Contractor at a rate established from time to time pursuant to section 21(2) of the Financial Administration Act.

#### **GC46 Clarification of Terms in GC47 to GC50**

- 46.1 For the purposes of GC47 to GC50,
- 46.1.1 "Unit Price Table" means the table set out in the Articles of Agreement, and
- 46.1.2 "plant" does not include tools customarily provided by a tradesman in practicing his trade.

#### **GC47 Additions or Amendments to Unit Price Table**

- 47.1 Where a Unit Price Arrangement applies to the contract or a part thereof the Departmental Representative and the Contractor may, by an agreement in writing,
- 47.1.1 add classes of labour or material, and units of measurement, prices per unit and estimated quantities to the Unit Price Table if any labour, plant or material that is to be included in the Final Certificate of Measurement referred to in GC44.8 is not included in any class of labour, plant or material set out in the Unit Price Table; or
- 47.1.2 subject to GC47.2 and GC47.3, amend a price set out in the Unit Price Table for any class of labour, plant or material included therein if the Final Certificate of Measurement referred to in GC44.8 shows or is expected to show that the total quantity of that class of labour, plant or material actually performed, used or supplied by the Contractor in performing the work is
- 47.1.2.1 less than 85% of that estimated total quantity, or
- 47.1.2.2 in excess of 115% of that estimated total quantity.
- 47.2 In no event shall the total cost of an item set out in the Unit Price Table that has been amended pursuant to GC47.1.2.1 exceed the amount that would have been payable to the Contractor had the estimated total quantity actually been performed, used or supplied.
- 47.3 An amendment that is made necessary by GC47.1.2.2 shall apply only to the quantities that are in excess of 115%.
- 47.4 If the Departmental Representative and the Contractor do not agree as contemplated in GC47.1, the Departmental Representative shall determine the class and the unit of measurement of the labour, plant or material and, subject to GC47.2 and GC47.3, the price per unit therefore shall be determined in accordance with GC50.

#### **GC48 Determination of Cost – Unit Price Table**



- 48.1 Whenever, for the purposes of the contract, it is necessary to determine the cost of labour, plant or material, it shall be determined by multiplying the quantity of that labour, plant or material expressed in the unit set out in column 3 of the Unit Price Table by the price of that unit set out in column 5 of the Unit Price Table.

#### **GC49 Determination of Cost – Negotiation**

- 49.1 If the method described in GC48 cannot be used because the labour, plant or material is of a kind or class that is not set out in the Unit Price Table, the cost of that labour, plant or material for the purposes of the contract shall be the amount agreed upon from time to time by the Contractor and the Departmental Representative.
- 49.2 For the purposes of GC49.1, the Contractor shall submit to the Departmental Representative any necessary cost information requested by the Departmental Representative in respect of the labour, plant and material referred to in GC49.1

#### **GC50 Determination of Cost – Failing Negotiation**

- 50.1 If the methods described in GC47, GC48 or GC49 fail for any reason to achieve a determination of the cost of labour, plant and material for the purposes referred to therein, that cost shall be equal to the aggregate of
- 50.1.1 all reasonable and proper amounts actually expended or legally payable by the Contractor in respect of the labour, plant and material that falls within one of the classes of expenditure described in GC50.2 that are directly attributable to the performance of the contract,
  - 50.1.2 an allowance for profit and all other expenditures or costs, including overhead, general administration cost, financing and interest charges, and every other cost, charge and expenses, but not including those referred to in GC50.1.1 or GC50.1.3 or a class referred to in GC50.2, in an amount that is equal to 10% of the sum of the expenses referred to in GC50.1.1, and
  - 50.1.3 interest on the cost determined under GC50.1.1 and GC50.1.2, which interest shall be calculated in accordance with TP9,

provide that the total cost of an item set out in the Unit Price Table that is subject to the provisions of GC47.1.2.1 does not exceed the amount that would have been payable to the Contractor had the estimated total quantity of the said item actually be performed, used or supplied.

- 50.2 For purposes of GC50.1.1 the classes of expenditure that may be taken into account in determining the cost of labour, plant and material are,
- 50.2.1 payments to subcontractors;
  - 50.2.2 wages, salaries and travelling expenses of employees of the Contractor while they are actually and properly engaged on the work, other than wages, salaries, bonuses, living



and travelling expenses of personnel of the Contractor generally employed at the head office or at a general office of the Contractor unless they are engaged at the work site with the approval of the Departmental Representative,

- 50.2.3 assessments payable under any statutory authority relating to workmen's compensation, unemployment insurance, pension plan or holidays with pay;
- 50.2.4 rent that is paid for plant or an amount equivalent of the said rent if the plant is owned by the Contractor that is necessary for and used in the performance of the work, if the rent of the equivalent amount is reasonable and use of that plant has been approved by the Departmental Representative;
- 50.2.5 payments for maintaining and operating plant necessary for and used in the performance of the work, and payments for effecting such repairs thereto as, in the opinion of the Departmental Representative, are necessary to the proper performance of the contract other than payments for any repairs to the plant arising out of defects existing before its allocation to the work;
- 50.2.6 payments for material that is necessary for and incorporated in the work, or that is necessary for and consumed in the performance of the contract;
- 50.2.7 payments for preparation, delivery, handling, erection, installation, inspection protection and removal of the plant and material necessary for and used in the performance of the contract; and
- 50.2.8 any other payments made by the Contractor with the approval of the Departmental Representative that are necessary for the performance of the contract.

#### **GC51 Records to be kept by Contractor**

##### **51.1 The Contractor shall**

- 51.1.1 maintain full records of his estimated and actual cost of the work together with all tender calls, quotations, contracts, correspondence, invoices, receipts and vouchers relating thereto.
- 51.1.2 make all records and material referred to in GC5.1.1 available to audit and inspection by the Minister and the Deputy Receiver General for Canada or by persons acting on behalf of either of both of them, when requested;
- 51.1.3 allow any of the person referred to in GC51.1.2 to make copies of and to take extracts from any of the records and material referred to in GC51.1.1; and
- 51.1.4 furnish any person referred to in GC51.1.2 with any information he may require from time to time in connection with such records and material.

51.2 The records maintained by the Contractor pursuant to GC51.1.1 shall be kept intact by the Contractor until the expiration of two years after the date that a Final Certificate of Completion referred to in GC44.1 was issued or until the expiration of such other period of time as the



Minister may direct.

- 51.3 The Contractor shall cause all subcontractors and all other persons directly or indirectly controlled by or affiliated with the Contractor and all persons directly or indirectly having control of the Contractor to comply with GC51.1 and GC51.2 as if they were the Contractor.

**GC52 Conflict of Interest**

- 52.1 It is a term of this contract that no former public office holder who is not in compliance with the Conflict of Interest and Post-Employment Code for Public Office Holders shall derive a direct benefit from this contract.

**GC53 Contractor Status**

- 53.1 The Contractor shall be engaged under the contract as an independent contractor.
- 53.2 The Contractor and any employee of the said Contractor is not engaged by the contract as an employee, servant or agent of Her Majesty.
- 53.3 For the purposes of GC53.1 and GC53.2 the Contractor shall be solely responsible for any and all payments and deductions required to be made by law including those required for Canada or Quebec Pension Plans, Unemployment Insurance, Worker's Compensation or Income Tax.



## **GENERAL CONDITONS**

- IC 1 Proof of Insurance**
- IC 2 Risk Management**
- IC 3 Payment of Deductible**
- IC 4 Insurance Coverage**

## **GENERAL INSUANCE COVERAGES**

- GCI 1 Insured**
- GIC 2 Period of Insurance**
- GIC 3 Proof of Insurance**
- GIC 4 Notification**

## **COMMERCIAL GENERAL LIABILITY**

- CGL 1 Scope of Policy**
- CGL 2 Coverages/Provisions**
- CGL 3 Additional Exposures**
- CGL 4 Insurance Proceeds**
- CGL 5 Deductible**

## **BUILDER'S RISK – INSTALLATION FLOATER – ALL RISKS**

- BR 1 Scope of Policy**
- BR 2 Property Insured**
- BR 3 Insurance Proceeds**
- BR 4 Amount of Insurance**
- BR 5 Deductible**
- BR 6 Subrogation**
- BR 7 Exclusion Qualifications**

## **INSURER'S CERTIFICATE OF INSURANCE**



## **General Conditions**

### **IC 1 Proof of Insurance (02/12/03)**

Within thirty (30) days after acceptance of the Contractor's tender, the Contractor shall, unless otherwise directed in writing by the Contracting Officer, deposit with the Contracting Officer an Insurer's Certificate of Insurance in the form displayed in this document and, if requested by the Contracting Officer, the originals or certified true copies of all contracts of insurance maintained by the Contractor pursuant to the Insurance Coverage Requirements shown hereunder.

### **IC 2 Risk Management (01/10/94)**

The provisions of the Insurance Coverage Requirements contained hereunder are not intended to cover all of the Contractor's obligations under GC8 of the General Conditions "C" of the contract. Any additional risk management measures or additional insurance coverages the Contractor may deem necessary to fulfill its obligations under GC8 shall be at its own discretion and expense.

### **IC 3 Payment of Deductible (01/10/94)**

The payment of monies up to the deductible amount made in satisfaction of a claim shall be borne by the Contractor.

### **IC 4 Insurance Coverage (02/12/03)**

The Contractor has represented that it has in place and effect the appropriate and usual liability insurance coverage as required by these Insurance Conditions and the Contractor has warranted that it shall obtain, in a timely manner and prior to commencement of the Work, the appropriate and usual property insurance coverage as required by these Insurance Conditions and, further, that it shall maintain all required insurance policies in place and effect as required by these Insurance Conditions.



## INSURANCE COVERAGE REQUIREMENTS

### PART I GENERAL INSURANCE COVERAGES (GIC)

#### **GCI 1 Insured (02/12/03)**

Each insurance policy shall insure the Contractor, and shall include, as an Additional Named Insured, Her Majesty the Queen in right of Canada, represented by the National Research Council Canada.

#### **GIC 2 Period of Insurance (02/12/03)**

Unless otherwise directed in writing by the Contracting Officer or otherwise stipulated elsewhere in these Insurance Conditions, the policies required hereunder shall be in force and be maintained from the date of the contract award until the day of issue of the Departmental Representative's Final Certificate of Completion.

#### **GIC 3 Proof of Insurance (01/10/94)**

Within twenty five (25) days after acceptance of the Contractor's tender, the Insurer shall, unless otherwise directed by the Contractor, deposit with the Contractor an Insurer's Certificate of Insurance in the form displayed in the document and, if requested, the originals or certified true copies of all contracts of insurance maintained by the Contractor pursuant to the requirements of these Insurance Coverages.

#### **GIC 4 Notification (01/10/94)**

Each Insurance policy shall contain a provision that (30) days prior written notice shall be given by the Insurer to Her Majesty in the event of any material change in or cancellation of coverage. Any such notice received by the Contractor shall be transmitted forthwith to Her Majesty.

### PART II COMMERCIAL GENERAL LIABILITY

#### **CGL 1 Scope of Policy (01/10/94)**

The policy shall be written on a form similar to that known and referred to in the insurance industry as IBC 2100 – Commercial General Liability policy (Occurrence form) and shall provide for limit of liability of not less than \$2,000,000 inclusive for Bodily Injury and Property Damage for any one occurrence or series of occurrences arising out of one cause. Legal or defence cost incurred in respect of a claim or claims shall not operate to decrease the limit of liability.

#### **CGL 2 Coverages/Provisions (01/10/94)**





The policy shall include but not necessarily be limited to the following coverages/provisions.

- 2.1 Liability arising out of or resulting from the ownership, existence, maintenance or use of premises by the Contractor and operations necessary or incidental to the performance of this contract.
- 2.2 "Broad Form" Property Damage including the loss of use of property.
- 2.3 Removal or weakening of support of any building or land whether such support be natural or otherwise.
- 2.4 Elevator liability (including escalators, hoists and similar devices).
- 2.5 Contractor's Protective Liability
- 2.6 Contractual and Assumed Liabilities un this contact.
- 2.7 Completed Operations Liability – The insurance, including all aspects of this Part II of these Insurance Conditions shall continue for a period of at least one (1) year beyond the date of the Departmental Representative's Final Certificate of Completion for the Completed Operations.
- 2.8 Cross Liability – The Clause shall be written as follows:

Cross Liability – The insurance as is afforded by this policy shall apply in respect to any claim or action brought against any one Insured by any other Insured. The coverage shall apply in the same manner and to the same extent as though a separate policy had been issued to each Insured. The inclusion herein of more than one Insured shall not increase the limit of the Insurer's liability.

- 2.9 Severability of Interests – The Clause shall be written as follows:

Severability of Interests – This policy, subject to the limits of liability stated herein, shall apply separately to each Insured in the same manner and to the same extent as if a separate policy had been issued to each. The inclusion herein of more than one insured shall not increase the limit of the Insurer's liability.

### **CGL 3 Additional Exposures (02/12/03)**

The policy shall either include or be endorsed to include the following exposures of hazards if the Work is subject thereto:

- 3.1 Blasting
- 3.2 Pile driving and calsson work
- 3.3 Underpinning
- 3.4 Risks associated with the activities of the Contractor on an active airport



- 3.5 Radioactive contamination resulting from the use of commercial isotopes
- 3.6 Damage to the portion of an existing building beyond that directly associated with an addition, renovation or installation contract.
- 3.7 Marine risks associated with the contraction of piers, wharves and docks.

**CGL 4 Insurance Proceeds  
(01/10/94)**

Insurance Proceeds from this policy are usually payable directly to a Claimant/Third Party.

**CGL 5 Deductible  
(02/12/03)**

This policy shall be issued with a deductible amount of not more than \$10,000 per occurrence applying to Property Damage claims only.

**PART III  
BUILDER'S RISK – INSTALLATION FLOATER – ALL RISKS**

**BR 1 Scope of Policy  
(01/10/94)**

The policy shall be written on an "All Risks" basis granting coverages similar to those provided by the forms known and referred to in the insurance industry as "Builder's Risk Comprehensive Form" or "Installation Floater – All Risks".

**BR 2 Property Insured  
(01/10/94)**

The property insured shall include:

- 2.1 The Work and all property, equipment and materials intended to become part of the finished Work at the site of the project while awaiting, during and after installation, erection or construction including testing.
- 2.2 Expenses incurred in the removal from the construction site of debris of the property insured, including demolition of damaged property, de-icing and dewatering, occasioned by loss, destruction or damage to such property and in respect of which insurance is provided by this policy.

**BR 3 Insurance Proceeds  
(01/10/94)**

- 3.1 Insurance proceeds from this policy are payable in accordance with GC28 of the General Conditions "C" of the contract.
- 3.2 This policy shall provide that the proceeds thereof are payable to Her Majesty or as the Minister may direct.



- 3.3 The Contractor shall do such things and execute such documents as are necessary to effect payment of the proceeds.

**BR 4 Amount of Insurance**  
(01/10/94)

The amount of insurance shall not be less than the sum of the contract value plus the declared value (if any) set forth in the contract documents of all material and equipment supplied by Her Majesty at the site of the project to be incorporated into and form part of the finished Work.

**BR 5 Deductible**  
(02/12/03)

The Policy shall be issued with a deductible amount of not more than \$10,000.

**BR 6 Subrogation**  
(01/10/94)

The following Clause shall be included in the policy:

"All rights of subrogation or transfer of rights are hereby waived against any corporation, firm, individual or other interest, with respect to which, insurance is provided by this policy".

**BR 7 Exclusion Qualifications**  
(01/10/94)

The policy may be subject to the standard exclusions but the following qualifications shall apply:

- 7.1 Faulty materials, workmanship or design may be excluded only to the extent of the cost of making good thereof and shall not apply to loss or damage resulting therefrom.
- 7.2 Loss or damage caused by contamination by radioactive material may be excluded except for loss or damage resulting from commercial isotopes used for industrial measurements, inspection, quality control radiographic or photographic use.
- 7.3 Use and occupancy of the project or any part of section thereof shall be permitted where such use and occupancy is for the purpose for which the project is intended upon completion.



**INSURER'S CERTIFICATE OF INSURANCE**

(TO BE COMPLETED BY INSURER (NOT BOKER) AND DELIVERD TO NATIONAL RESEARCH COUNCIL CANADA WITH 30 DAYS FOLLOWING ACCEPTANCE OF TENDER)

**CONTRACT**

DESCRIPTION OF WORK	CONTRACT NUMBER	AWARD DATE
LOCATION		

**INSURER**

NAME
ADDRESS

**BROKER**

NAME
ADDRESS

**INSURED**

NAME OF CONTRACTOR
ADDRESS

**ADDITIONAL INSURED**

HER MAJESTY THE QUEEN IN RIGHT OF CANADA AS REPRESENTED BY THE NATIONAL RESEARCH COUNCIL CANADA
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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 unknown
Security Classification / Classification de sécurité unclassified

**SECURITY REQUIREMENTS CHECK LIST (SRCL)  
LISTE DE VÉRIFICATION DES EXIGENCES RELATIVES À LA SÉCURITÉ (LVERS)**

**PART A - CONTRACT INFORMATION / PARTIE A - INFORMATION CONTRACTUELLE**

1. Originating Government Department or Organization / Ministère ou organisme gouvernemental d'origine	NRC	2. Branch or Directorate / Direction générale ou Direction	ASPM
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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
--	---

4. Brief Description of Work / Brève description du travail  
M-98 Phase 3. Mechanical and electrical systems for addition.

5. a) Will the supplier require access to Controlled Goods?  
Le fournisseur aura-t-il accès à des marchandises contrôlées?  No / Non  Yes / Oui

5. b) Will the supplier require access to unclassified military technical data subject to the provisions of the Technical Data Control Regulations?  
Le fournisseur aura-t-il accès à des données techniques militaires non classifiées qui sont assujetties aux dispositions du Règlement sur le contrôle des données techniques?  No / Non  Yes / Oui

6. Indicate the type of access required / Indiquer le type d'accès requis

6. a) Will the supplier and its employees require access to PROTECTED and/or CLASSIFIED information or assets?  
Le fournisseur ainsi que les employés auront-ils accès à des renseignements ou à des biens PROTÉGÉS et/ou CLASSIFIÉS? (Specify the level of access using the chart in Question 7. c)  
(Préciser le niveau d'accès en utilisant le tableau qui se trouve à la question 7. c)  No / Non  Yes / Oui

6. b) Will the supplier and its employees (e.g. cleaners, maintenance personnel) require access to restricted access areas? No access to PROTECTED and/or CLASSIFIED information or assets is permitted.  
Le fournisseur et ses employés (p. ex. nettoyeurs, personnel d'entretien) auront-ils accès à des zones d'accès restreintes? L'accès à des renseignements ou à des biens PROTÉGÉS et/ou CLASSIFIÉS n'est pas autorisé.  No / Non  Yes / Oui

6. c) Is this a commercial courier or delivery requirement with no overnight storage?  
S'agit-il d'un contrat de messagerie ou de livraison commerciale sans entreposage de nuit?  No / Non  Yes / Oui

7. a) Indicate the type of information that the supplier will be required to access / Indiquer le type d'information auquel le fournisseur devra avoir accès

Canada <input checked="" type="checkbox"/>	NATO / OTAN <input type="checkbox"/>	Foreign / Étranger <input type="checkbox"/>
--	--------------------------------------	---

7. b) Release restrictions / Restrictions relatives à la diffusion

No release restrictions / Aucune restriction relative à la diffusion <input checked="" type="checkbox"/>	All NATO countries / Tous les pays de l'OTAN <input type="checkbox"/>	No release restrictions / Aucune restriction relative à la diffusion <input type="checkbox"/>
Not releasable / À ne pas diffuser <input type="checkbox"/>		
Restricted to: / Limité à: <input type="checkbox"/>	Restricted to: / Limité à: <input type="checkbox"/>	Restricted to: / Limité à: <input type="checkbox"/>
Specify country(ies): / Préciser le(s) pays:	Specify country(ies): / Préciser le(s) pays:	Specify country(ies): / Préciser le(s) pays:

7. c) Level of Information / Niveau d'information

PROTECTED A / PROTÉGÉ A <input type="checkbox"/>	NATO UNCLASSIFIED / NATO NON CLASSIFIÉ <input type="checkbox"/>	PROTECTED A / PROTÉGÉ A <input type="checkbox"/>
PROTECTED B / PROTÉGÉ B <input type="checkbox"/>	NATO RESTRICTED / NATO DIFFUSION RESTREINTE <input type="checkbox"/>	PROTECTED B / PROTÉGÉ B <input type="checkbox"/>
PROTECTED C / PROTÉGÉ C <input type="checkbox"/>	NATO CONFIDENTIAL / NATO CONFIDENTIEL <input type="checkbox"/>	PROTECTED C / PROTÉGÉ C <input type="checkbox"/>
CONFIDENTIAL / CONFIDENTIEL <input type="checkbox"/>	NATO SECRET <input type="checkbox"/>	CONFIDENTIAL / CONFIDENTIEL <input type="checkbox"/>
SECRET / SECRET <input type="checkbox"/>	COSMIC TOP SECRET / COSMIC TRÈS SECRET <input type="checkbox"/>	SECRET / SECRET <input type="checkbox"/>
TOP SECRET / TRÈS SECRET <input type="checkbox"/>		TOP SECRET / TRÈS SECRET <input type="checkbox"/>
TOP SECRET (SIGINT) / TRÈS SECRET (SIGINT) <input type="checkbox"/>		TOP SECRET (SIGINT) / TRÈS SECRET (SIGINT) <input type="checkbox"/>



Contract Number / Numéro du contrat unknown
Security Classification / Classification de sécurité unclassified

**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 unknown
Security Classification / Classification de sécurité unclassified

**PART C - (continued) / PARTIE C - (suite)**

For users completing the form manually use the summary chart below to indicate the category(ies) and level(s) of safeguarding required at the supplier's site(s) or premises.

Les utilisateurs qui remplissent le formulaire manuellement doivent utiliser le tableau récapitulatif ci-dessous pour indiquer, pour chaque catégorie, les niveaux de sauvegarde requis aux installations du fournisseur.

For users completing the form online (via the Internet), the summary chart is automatically populated by your responses to previous questions. Dans le cas des utilisateurs qui remplissent le formulaire en ligne (par Internet), les réponses aux questions précédentes sont automatiquement saisies dans le tableau récapitulatif.

**SUMMARY CHART / TABLEAU RÉCAPITULATIF**

Category / Catégorie	PROTECTED / PROTÉGÉ			CLASSIFIED / CLASSIFIÉ			NATO				COMSEC					
	A	B	C	CONFIDENTIAL / CONFIDENTIEL	SECRET	TOP SECRET / TRÈS SECRET	NATO RESTRICTED / NATO DIFFUSION RESTREINTE	NATO CONFIDENTIAL / NATO CONFIDENTIEL	NATO SECRET	COSMIC TOP SECRET / COSMIC TRÈS SECRET	PROTECTED / PROTÉGÉ			CONFIDENTIAL / CONFIDENTIEL	SECRET	TOP SECRET / TRÈS SECRET
											A	B	C			
Information / Assets / Renseignements / Biens / Production																
IT-Media / Support TI / IT Link / Lien électronique																

12. a) Is the description of the work contained within this SRCL PROTECTED and/or CLASSIFIED?  
La description du travail visé par la présente LVERS est-elle de nature PROTÉGÉE et/ou CLASSIFIÉE?

No / Non  Yes / Oui

If Yes, classify this form by annotating the top and bottom in the area entitled "Security Classification".  
Dans l'affirmative, classifiez le présent formulaire en indiquant le niveau de sécurité dans la case intitulée « Classification de sécurité » au haut et au bas du formulaire.

12. b) Will the documentation attached to this SRCL be PROTECTED and/or CLASSIFIED?  
La documentation associée à la présente LVERS sera-t-elle PROTÉGÉE et/ou CLASSIFIÉE?

No / Non  Yes / Oui

If Yes, classify this form by annotating the top and bottom in the area entitled "Security Classification" and indicate with attachments (e.g. SECRET with Attachments).  
Dans l'affirmative, classifiez le présent formulaire en indiquant le niveau de sécurité dans la case intitulée « Classification de sécurité » au haut et au bas du formulaire et indiquez qu'il y a des pièces jointes (p. ex. SECRET avec des pièces jointes).



Contract Number / Numéro du contrat unknown
Security Classification / Classification de sécurité unclassified

**PART D - AUTHORIZATION / PARTIE D - AUTORISATION**

13. Organization Project Authority / Chargé de projet de l'organisme

Name (print) - Nom (en lettres moulées) Derek Foot	Title - Titre Construction Project Manager	Signature 
Telephone No. - N° de téléphone 613-991-4451	Facsimile No. - N° de télécopieur	E-mail address - Adresse courriel derek.foot@nrc.ca
		Date Nov. 21, 2018

14. Organization Security Authority / Responsable de la sécurité de l'organisme

Name (print) - Nom (en lettres moulées) Richard Bramucci	Title - Titre Analyst, Security in Contracting	Signature 
Telephone No. - N° de téléphone (613) 991-1093	Facsimile No. - N° de télécopieur (613) 990-0946	E-mail address - Adresse courriel richard.bramucci@nrc-cnrc.gc.ca
		Date 2018.11.22

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) 	Title - Titre Senior Proj. Officer	Signature 
Telephone No. - N° de téléphone 613 991-9980	Facsimile No. - N° de télécopieur	E-mail address - Adresse courriel
		Date 20-12-2018

17. Contracting Security Authority / Autorité contractante en matière de sécurité

Name (print) - Nom (en lettres moulées)	Title - Titre	Signature
Telephone No. - N° de téléphone	Facsimile No. - N° de télécopieur	E-mail address - Adresse courriel
		Date