NRC·CNRC Administrative Services and Property Management

SPECIFICATIONS

SOLICITATION #:	**17-22019**
BUILDING:	**M-2, M-59** **1200 Montreal Road Campus** **Ottawa, Ontario**
PROJECT:	**Phase II M-2, M-59 Washroom Renovations**
PROJECT #:	**M2-5378 M59-5379**
Date:	**May 2017**

National Research Council Canada | Conseil national de recherches Canada

Canada

SPECIFICATION

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NRC·CNRC

From **Discovery** to **Innovation...**

Directions to the Ottawa Research Facilities — Montreal Road

1200 Montréal Road
Ottawa, Ontario, Canada K1A 0R6

Tel: 613-993-9101

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Information/Security	M-1
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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

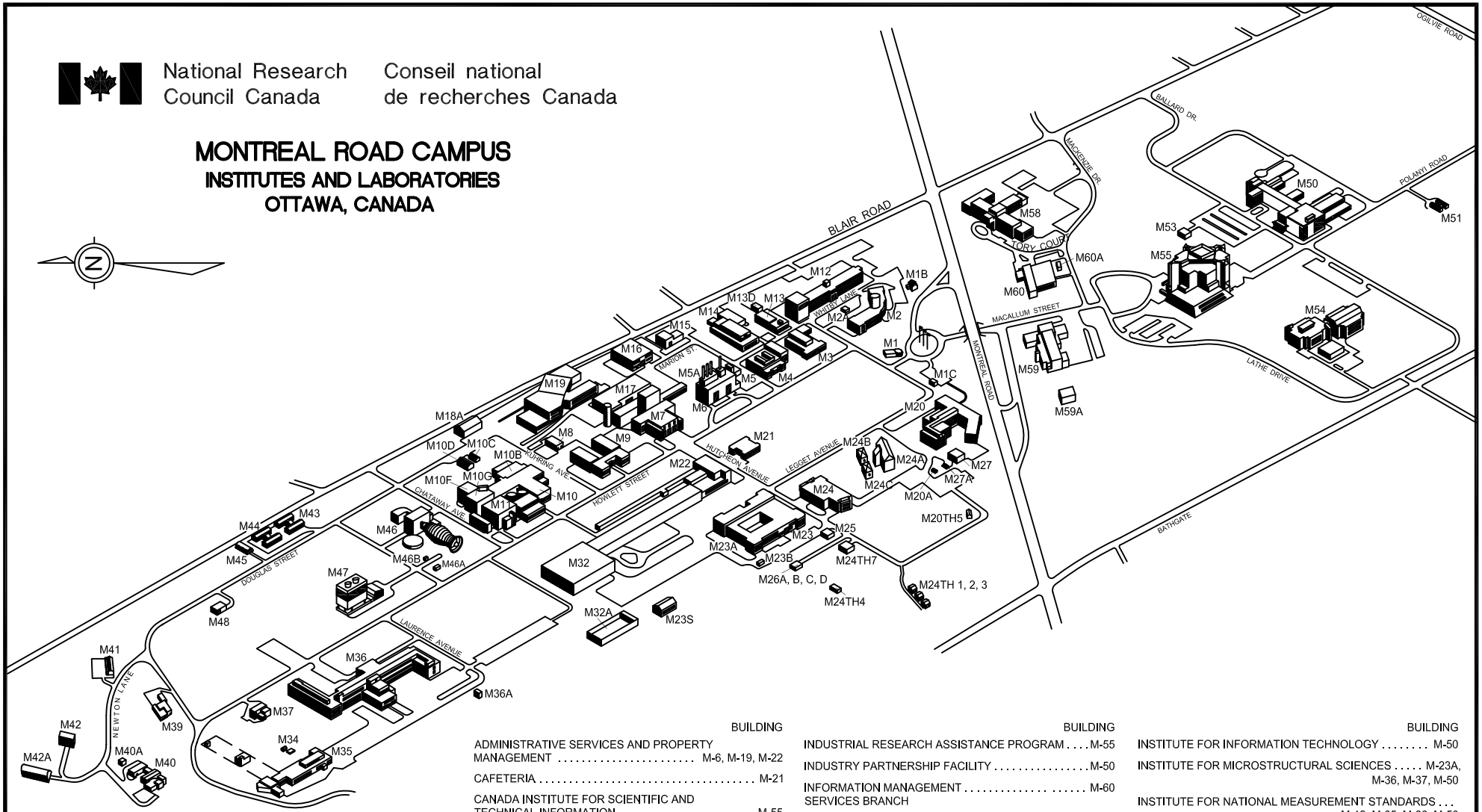
1. Take MÉTROPOLITAIN 40 WEST and follow signs for OTTAWA and HIGHWAY 417 WEST
2. Follow 417 WEST to reach OTTAWA
3. Exit at HIGHWAY 174 EAST (ROCKLAND) when entering OTTAWA
4. Follow 174 EAST and exit at BLAIR RD NORTH (first exit after entering 174 EAST)
5. Follow BLAIR RD NORTH, cross OGILVIE RD, 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.


1 Sussex Facilities
2 Montreal Road Facilities
3 Uplands Facilities
4 NRC-CSTT
N
GATINEAU
OTTAWA
QUÉBEC
ONTARIO
Outaouais
Aylmer
Taché
Rockcliffe
Montréal
Vanier
Aviation
Blair
Sussex
Wellington
Bank
Bronson
Island Park
Ottawa River
Carling
Fisher
Prince of Wales
Walkley
Heron
Hawthorne
Hunt Club
Baseline
Riverside
Conroy
Airport
Uplands
Lester
Davidson
Albion
Hunt Club (W)
Merivale
Woodroffe
Greenbank
Fallowfield
Leitrim
50
5
148
19
34
174
417
38
73
31
416
0 1 2 km
NRC Institute
Trans Canada HWY
Major HWY
Secondary HWY
Airport
Train Station
Ferry
Bus Station
Metro


N
Howlett
Blair
Leggett
2
Montréal
17B
Montréal
Mackenzie
Macallum
Lathe
Ballard
17B
Blair
Aviation
Bathgate
St. Laurent
Ogilvie
174
417
417
0
500
1000 m
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



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Updated: July 2008

Project # 5378: M2 Washrooms Renovation Project (phase 2) / Project # 5379: M59 Washrooms Renovation Project (phase 2)

Appendix 1 - Tender bid form - Breakdown costs information

1.1 **Business Name and Address of Tenderer**

Name_____

Address_____

_____

Contact Person (Print Name)_____

Telephone (_____) _____ **Fax**: (_____) _____

1.2 **Breakdown cost for M2 building**

$_____. _____ in lawful money of Canada (excluding GST/HST)

1.3 **Breakdown cost for M59 building**

$_____. _____ in lawful money of Canada (excluding GST/HST)

End of Appendix 1

Project # 5378: M2 Washrooms Renovation Project (phase 2) / Project # 5379: M59 Washrooms Renovation Project

Appendix 2 - Additional conditions

1. Hours of construction work

1.1 Contractors must ensure that all work (all disciplines included) deemed to be noisy, disruptive to the building occupants or that can cause vibration must be done after regular business hours. The remaining portions of the work can be done during the regular business hours.
1.2 Contractors must ensure to estimate adequately the extent of the after-hours work.
1.3 Contractors must carry the after-hours work at his / her expenses.

2. Sequence of the work

2.1 Building M2

2.1.1 Room 124

2.1.1.1 This room is the first one to be renovated. All work to be done in regard to room 124 must be 100% completed before the contractor can start the work in building M59.

2.2 Building M59

2.1.1 Room 115

2.1.1.1 This room is the second one to be completed. All work in this room must 100% completed before the work can start elsewhere in building M59.

2.1.2 Rooms 104, 105, 106, 107, 128 and 129

2.1.2.1 All work related to those areas can be completed at the same time.

2.3 General

2.3.1 Contractors must take into consideration that both buildings are Research and Testing Facilities and in such he / she may have to leave specific areas of work or the site during testing periods. These testing periods' times and durations are unknown and the project team can be notice only a few hours or at the beginning of such type of tests.

3. Extent of the work

3.1 Abatement Contractor must include all costs related to the required removal of the concrete slabs and or trenching. All sub trades are to identify the extent of the work in advance for the Abatement Contractor.

3.2 Bidders do not have to supply the following products: both types of partitions for the washrooms and shower stalls, lockers and lighting fixtures (1' x 4' and 2' x 2' only, other lighting fixtures will have to be provided by the winning bidder as specified in the contractual documents).

3.3 The winning bidder will be responsible to assemble both kinds of partitions and install them at all locations, assemble and install lockers at all locations and install the provided lighting fixtures where specified in the contractual documents.

3.4 Some of the partitions will have to be install in room 124 of the building M2 and the remaining partitions are to be installed in building M59. The winning bidder will be responsible of the transportation of the lockers, partitions and lighting fixtures at the different locations where they will need to be installed as per the contractual documents.

3.5 The labor required to assemble the lockers, partitions and lights that are already pre-purchased for this project will have to be covered in the overall warranty period of this project. The shop drawings for both types of partitions will be provided to the winning bidder in order to proceed with the assembly.

End of Appendix 2

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

Construction Tender Form

Project Identification **5378-M2 and 5379-M59 - Washrooms Renovation Project (phase 2)**

Tender No.: **17-22019**

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.

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 from as described in Article 5 of the General Instructions to Tenderers, my/our tender is subject to disqualification.

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)

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

5378-M2 and 5379-M59 - Washrooms Renovation Project (phase 2)

This project consists to renovate several washrooms / shower rooms located in buildings M2 and M59 situated on the NRC property at 1200, Montreal Road in Ottawa. This project involves the following disciplines which are described below: Architectural, Mechanical, Electrical, Abatement and Structural. The renovation to be executed will be in the followings rooms: 124 in building M2 and 104, 105, 106, 107, 115, 128 and 129 in building M59.

Architectural Scope of Work:

Scope includes but not limited to;
- Demolition work,
- Construction of new walls,
- Refurbishment of ceilings, walls, flooring finishes, washroom accessories, partitions, counter tops, showers and doors.

Mechanical Scope of Work:

Scope includes but not limited to;
- Demolition work,
- Refurbishment of plumbing fixtures (water closets, urinals, lavatories and floor drains),
- Piping, sanitary drains and HVAC systems modifications.

Electrical Scope of Work:

Scope includes but not limited to;
- Demolition work,
- Refurbishment of lighting fixtures,
- Modification to emergency lighting, heat detectors, occupancy sensors, fire alarm bells, power outlets, light switches, controls, exit signs,
- Installation of door operators, emergency power packs, GFCI outlets and exhaust fans.

Structural Scope of Work:

Scope includes but not limited to;
- Concrete slab modification.

Abatement Scope of Work:

Scope includes but not limited to;
- Refer to drawings and specifications.

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 June 6th and June 8th, 2016 at **9:00** . Meet Janik Leroux at Building M-2, 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 June 29th , 2017 at 14:00.

4. TENDER RESULTS

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

5. SECURITY REQUIREMENT FOR CANADIAN CONTRACTORS

5.1 MANDATORY SECURITY REQUIREMENT:

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.

2 Contract Administration

The parties understand that the Procurement Ombudsman appointed pursuant to Subsection 22.1(1) of the *Department of Public Works and Government Services Act* will review a complaint filed by [*the supplier or the contractor or the name of the entity awarded this contract*] respecting administration of this contract if the requirements of Subsection 22.2(1) of the *Department of Public Works and Government Services Act* and Sections 15 and 16 of the *Procurement Ombudsman Regulations* have been met, and the interpretation and application of the terms and conditions and the scope of the work of this contract are not in dispute. The Office of the Procurement Ombudsman may be contacted by telephone at 1-866-734-5169 or by e-mail at boa.opo@boa-opo.gc.ca.

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

The Departmental Representative or his designate for this project is: **Janik Leroux**
Telephone: **613 223-6252.**

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

INSTRUCTIONS TO BIDDERS

Article 1 – Receipt of Tender

1a) Tenders must be received not later than the specified tender closing time. Tenders received after this time are invalid and shall not be considered, regardless of any reason for their late arrival.

1b) A letter of printed telecommunication from a bidder quoting a price shall not be considered as a valid tender unless a formal tender has been received on the prescribed Tender Form.

1c) Bidders may amend their tenders by letter or printed telecommunication provided that such amendments are received not later than the specified tender closing time.

1d) Any amendments to the tender which are transmitted by telefax must be signed and must clearly identify the tenderer.

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

Fax: (613) 991-3297

Article 2 – Tender Form & Qualifications

1) All tenders must be submitted on the Construction Tender Form and the tender must be signed in compliance with the following requirements:

a) Limited Company: The full names of the Company and the name(s) and status of the authorized signing officer(s) must be printed in the space provided for that purpose. The signature(s) of the authorized officer(s) and the corporate seal must be affixed.

b) Partnership: The firm name and the name(s) of the person(s) signing must be printed in the space provided. One or more of the partners must sign in the presence of a witness who must also sign. An adhesive coloured seal must be affixed beside each signature.

c) Sole Proprietorship : The business name and the name of the sole proprietor must be printed in the space provided. The sole proprietor must sign in the presence of a witness who must also sign. An adhesive coloured seal must be affixed beside each signature.

2) Any alterations in the printed part of the Construction Tender Form or failure to provide the information requested therein, may render the tender invalid.

3) All space in the Construction Tender Form must be completed and any handwritten or typewritten corrections to the parts so completed must be initialed immediately to the side of the corrections by the person or persons executing the tender on behalf of the the tenderer.

4) Tenders must be based on the plans, specifications and tender documents provided.

Article 3 - Contract

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

Article 4 – Tender Destination

1a) Tenders are to be submitted in sealed envelopes to:
National Research Council Canada
Administrative Services and Property Management Branch
1200 Montreal Road
Building M-22
Ottawa, ON
K1A 0R6

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

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

Article 5 - Security

1a) Bid Security is required and must be submitted in one of the following forms:

i) a certified cheque payable to the Receiver General for Canada and drawn on a member of the Canadian Payments Association or a local cooperative credit society that is a member of a central cooperative credit society having membership in the Canadian Payments Association; **OR**

ii) bonds of the Government of Canada, or bonds unconditionally guaranteed as to principal and interest by the Government of Canada; **OR**

iii) a bid bond.

1b) Regardless of the Bid Security submitted, it should never be more than $250,000 maximum, calculated at 10% of the first $250,000 of the tendered price, plus 5% of any amount in excess of $250,000.

2a) Bid Security shall accompany each tender or, if forwarded separately from the tender, shall be provided not later than the specified tender closing time. Bid Security must be in the ORIGINAL form. Fax or photocopies and NOT acceptable. FAILURE TO PROVIDE THE REQUIRED BID SECURITY SHALL INVALIDATE THE TENDER.

2b) If the tender is not accepted, the Bid Security submitted pursuant to Article 8 shall be returned to the tenderer.

3a) The successful tenderer is required to provide security within 14 days of receiving notice of tender acceptance. The tenderer must furnish EITHER:

i) a Security Deposit as described in 1(b) above together with a Labour and Material Payment Bond in the amount of at least 50% of the amout payable under the contract, OR

ii) a Performance Bond and a Labour and Material Payment Bond – each in the amount of 50% of the amount payable under the contract.

3b) Should it not be possible to obtain a Labour Material Payment Bond as required under 3(a) above, on making application thereof to at least two acceptable Bonding Companies, an additional Security Deposit of a straight 10% of the amount payable under the contract must be furnished.

3c) Where a tender has been accompanied by a Security Deposit, as described in 1(b) above, the amount of the Security Deposit required under 3(a) above may be reduced by the amount of the Security Deposit which accompanied the tender.

3d) Bonds must be in an approved form and from the companies whose

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

Article 6 – Interest On Security Deposits

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

Article 7 – Sales Tax

1) The amount of the tender shall include all taxes as levied under the Excise Act, the Excise Tax Act, the Old Age Security Act, the Customs Act or the Customs Tariff, in force or applicable at the time.

2) In Quebec, the Provincial Sales Tax should not be included in the Tender Price as the Federal Government is exempt. Tenderers should contact the Provincial Revenue Minister to recover all taxes paid for goods and services rendered under this contract.

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

Article 8 – Examination of Site

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

Article 9 – Discrepancies, Omissions, Etc.

1a) Bidders finding discrepancies in, or omissions from, drawings, specifications or other documents, or having any doubt as to the meaning or intent of any part thereof, should at once notify the Engineer who will send written instructions or explanation to all bidders.

1b) Neither the Engineer nor the Council will be responsible for oral instructions.

1c) Addenda or corrections issued during the time of the bidding shall be covered in the proposal. However, the contract supersedes all communications, negotiations and agreements, either written or oral, relating to the work and made prior to the date of the contract.

Article 10 – No additional Payments for Increased Costs

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

Article 11 – Awards

1a) The Council reserves the power and right to reject tenders received from parties who cannot show a reasonable acquaintance with and preparation for the proper performance of the class of work herein specified and shown on plans. Evidence of such competence must be furnished by the tenderers if required to do so.

1b) A tenderer may be required to furnish to the Contracting Office, National Research Council of Canada, Building M-22, 1200 Montreal Road, Ottawa, Ontario, K1A 0R6, Canada, unsigned copies of the insurance requirements as covered by the Insurance Conditions of the General Specification.

1c) The Council does not bind itself to accept the lowest or any tender.

Article 12 – Harmonized Sales Tax

1) The Harmonized Sales Tax (HST) which in 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 × net book value at date of import × number of months in Ontario × 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)

Manufacturing for Own Use

Contractors may need to manufacture items, such as doors and windows, for their construction contracts. Manufacturing is work done in a factory away from a construction site, or in a mobile unit or workshop that is on or near the construction site. Manufacturing occurs when raw materials are changed into manufactured goods for use in real property contracts.

Contractors are considered to be manufacturing contractors if they produce goods:
1. for their own use in real property contracts, and
2. the manufactured cost of the goods is more than $50,000 a year.

(See RST Guide 401 - Manufacturing Contractors)

Contracts with the Federal Government

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

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

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

Exemptions

Contractors may supply and install equipment or materials for certain customers that may be entitled to an exemption from RST (e.g., manufacturers, Indian band councils, farmers and diplomatic organizations). The equipment or materials, when installed, becomes real property if it is permanently attached to land, or a fixture if it is permanently attached to a building or real property structure. Since

contractors are liable for RST, they should contact the ministry to find out if the customer qualifies for exemption before tendering the contract on a tax-excluded basis.

Status Indians, Indian Bands and Band Councils

Non-resident contractors may purchase building materials exempt from Retail Sales Tax (RST) for certain buildings and structures situated on reserves. The cost of such projects must be paid by the band council, and the buildings must provide a community service for the reserve. Contracts for the construction of an exempt community building project should be made on an RST-excluded basis. Non-resident contractors may purchase the materials exempt from RST by providing suppliers with a valid Purchase Exemption Certificate (PEC). As noted previously, only non-resident contractors who have registered with the ministry and posted a guarantee may issue a PEC. (See RST Guide 204 - Purchase Exemption Certificates).

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

Completion of Contract

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

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

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

All returns are subject to audit.

Legislative References

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

For More Information

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

Acceptable Bonding Companies

Published September 2010

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

1. Canadian Companies

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

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

2. Provincial Companies

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

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

3. Foreign Companies

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

Articles of Agreement

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

A1 Contract Documents

A2 Date of Completion of Work and Description of Work

A3 Contract Amount

A4 Contractor's Address

A5 Unit Price Table

A r t i c l e s o f A g r e e m e n t

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

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.

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:

A5 Unit Price Table

(23/01/2002)

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

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

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

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

Articles of Agreement

Signed on behalf of Her Majesty by

_____

as Senior Contracting Officer

and_____

as_____

of the **National Research Council Canada**

on the_____

day of _____

Signed, sealed and delivered by

_____

as_____and
Position

by_____

as_____
Position

Seal

of

on the_____

day of_____

NUMBER OF PAGES

DIVISION 00 – PROCUREMENT AND CONTRACTING REQUIREMENTS

DIVISION 02 – EXISTING CONDITIONS

DIVISION 04 – MASONRY

DIVISION 05 - METALS

DIVISION 06 – WOOD, PLASTICS, AND COMPOSITES

DIVISION 07 – THERMAL AND MOISTURE PROTECTION

DIVISION 08 - OPENINGS

DIVISION 09 - FINISHES

DIVISION 10 – SPECIALTIES

DIVISION 20 - COMMON MECHANICAL REQUIREMENTS

DIVISION 22 - PLUMBING

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

DIVISION 26 - ELECTRICAL

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

DESIGNATED SUBSTANCES SURVEY

END OF SECTION

1. SCOPE OF WORK

.1 Work under this contract covers the washroom renovations in the Council's Buildings M-2 (room 124) and M-59 (rooms 104, 105, 106, 107, 115, 128 and 129) of the National Research Council.

2. DRAWINGS

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

- 5378-5379-A000
- 5378-5379-A010
- 5378-5379-A011
- 5378-5379-A012
- M2-5378-A050
- M2-5378-A052
- M2-5378-A100
- M2-5378-A102
- M59-5379-A054
- M59-5379-A055
- M59-5379-A104
- M59-5379-A105
- 5378 & 5379 M0.1
- 5378 & 5379 M1.1
- 5378 & 5379 M2.1
- 5378 & 5379 M2.2
- 5378 & 5379 E0.1
- 5378 & 5379 E1.1
- 5378 & 5379 E2.1
- 5378 & 5379 E2.2

3. COMPLETION

.1 Complete all work within 12 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 Refer to the Designated Substances Report which is included in the contractual documents for more information in this regard.

.1 It is the responsibility of the general contractor to ensure that each prospective subcontractor for this project has received a copy of the above list.

.2 The general contractor is advised to take the following precautions when dealing with the above substances:

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 7 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 one (1) week basis and any changes to the list shall be immediately notified in writing to the Departmental Representative.

.3 Review shop drawings, data sheets and samples prior to submission.

.4 Submit 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.

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.~~ in the Appendix 2 included in the attached contractual documents.

.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 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 Obtain permission from the Departmental Representative to use the existing washroom facilities in the building.

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 ^{o}C (50 ^{o}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 three (3) bilingual copies of maintenance manuals or two English and two French maintenance manuals immediately upon completion of the work and prior to release of holdbacks.

.2 Manuals to be neatly bound in hard cover loose leaf binders.

.3 Manuals to include operating and maintenance instructions, all guarantees and warranties, shop drawings, technical data, etc., for the material and apparatus supplied under this contract.

END OF SECTION

1. GENERAL CONSTRUCTION SAFETY REQUIREMENTS

.1 The Contractor shall take all necessary steps to protect personnel (workers, visitors, general public, etc.) and property from any harm during the course of the contract.

.2 The Contractor shall be solely responsible for the construction safety of both its employees and those of its sub-contractors at the work site, and for initiating, maintaining and supervising safety precautions, programs and procedures in connection with the performance of the work.

.3 The Contractor shall comply with all Federal, Provincial and Municipal safety codes and regulations and 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:

FROM AN NRC PHONE	**333**
FROM ANY OTHER PHONE	**(613) 993-2411**

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 (C02) 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^{o}C (450 ^{o}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 ^{o}C (100 ^{o}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 56 00 Temporary Barriers and Enclosures.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)
.1 CSA S350-M1980 – 2003, Code of Practice for Safety in Demolition of Structures.

.2 National Building Code (NBC), 2010.

PART 2 - PRODUCTS

2.1 NOT USED

.1 Not used.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Inspect building with Departmental Representative and verify extent and location of items designated for removal, disposal, alternative disposal, recycling, salvage and items to remain.

.2 Locate and protect utilities. Preserve active utilities traversing site in operating condition.

.3 Notify and obtain approval of utility companies before starting demolition.

3.2 PROTECTION

.1 Prevent movement, damage to adjacent structures, building systems and parts of building to remain in place. Provide bracing and shoring required.

.2 Keep noise, dust, and inconvenience to occupants to minimum.

.3 Protect building systems, services and equipment.

.4 Provide temporary dust screens, covers, railings, supports and other protection as required.

3.3 REMOVALS

.1 Remove items as indicated.

3.4 DEMOLITION

.1 Remove parts of existing building to permit new construction.

.2 Trim edges of partially demolished building elements to tolerances as defined by Departmental Representative to suit future use.

3.5 DISPOSAL

.1 Dispose of removed materials, to appropriate recycling facilities except where specified otherwise, in accordance with authority having jurisdiction.

END OF SECTION

SCHEDULE A: DESIGNATED SUBSTANCES/ HAZARDOUS MATERIALS [Note 1]

Environmental Issue[i]	Area of Concern	Required Action
Asbestos-Containing Materials	Friable and non-friable asbestos-containing materials (ACMs) have been identified and are present throughout the project areas located in Building M-2 and Building M-59. These materials are outlined within the Designated Substances and Hazardous Materials Report for this abatement project, referenced in this section. Any disturbance and/or removal of these materials shall be performed by a qualified contractor.	Appropriate asbestos abatement practices must be utilized during the removal of asbestos-containing materials, including the use of proper personal protective equipment, as per Ontario Occupational Health and Safety Act, R.S.O., 1990, O. Reg. 278/05, Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations. Asbestos waste is to be disposed of in accordance with O. Reg. 347/90, as amended, General Waste Management. Remove asbestos containing materials in accordance with the requirements of Sections 02 82 00.02 and 02 82 00.03.
Lead	Lead is present in paint and ceramic tile glazing applications throughout the project areas located in Building M-2 and Building M-59 in concentrations that may result in a health risk during work activities. All paints, glazing, and all other surface coatings including structural steel coatings, are considered to be lead-containing in the project areas. Lead is also assumed to be present in the following materials: • Solder on the joints of copper piping; • Lead spacers associated with Terrazzo; and • Caulking in cast iron drainpipe joints.	Remove or disturb lead-containing materials in accordance with O. Reg. 490/09, Designated Substances, as amended and Ontario Ministry of Labour (MoL) - *Guideline: Lead on Construction Projects*. Lead is to be disposed of in accordance with O. Reg. 347/90, as amended, General Waste Management. No lead-containing material sampling was performed for lead leachate analysis. The disposal of construction waste containing lead is dependent on leachate testing, as governed by O. Reg. 347/90. Contractor is to retain a competent person prior to disposal to classify lead-containing waste streams as hazardous or non-hazardous for disposal purposes, using the Toxicity Characteristic Leachate Procedure (TCLP) at a certified analytical laboratory. All sampling procedures and submissions shall be approved by the NRC Departmental Representative.

Environmental Issue[i]	Area of Concern	Required Action
Mercury	Mercury vapour is present in fluorescent light tubes throughout the project areas located in Building M-2 and Building M-59.	Remove equipment containing mercury for recycling or disposal, as applicable, in accordance with O. Reg. 490/09, as amended, Designated Substances; Ontario MoL document *The Safe Handling of Mercury: A Guide for the Construction Industry,* and O. Reg. 347/90, as amended, General Waste Management.
Silica	Silica is assumed to be present within the following materials throughout the project areas located in Building M-2 and Building M-59: • Lay-in ceiling tiles; • Drywall; • Terracotta brick and mortar; • Plaster; • Ceramic tiles, mortars, and grout; • Brick and mortar; and, • Concrete materials.	Appropriate work practices must be utilized during the disturbance of these structures in accordance with O. Reg. 490/09, as amended, Designated Substances; and Ontario MoL - *Guideline: Silica on Construction Projects*.
Polychlorinated Biphenyls (PCBs)	PCBs are assumed present in select fluorescent light fixtures that contain T12 lamps noted in the project areas located in Building M-2 and Building M-59, which are suspected to contain PCB-containing ballasts.	Remove any PCB-containing equipment in accordance with O. Reg. 362/90, as amended; O. Reg. 347/90, and *PCB Regulations* 2008, as amended; and Transportation of Dangerous Goods Act. All ballasts are to be delivered to Building M-18 at the NRC Complex in Ottawa, Ontario, for disposal by the NRC Departmental Representative.

Note 1: This schedule only summarizes confirmed asbestos-containing materials and other designated substances and hazardous materials. Please refer to the below referenced documents for additional information. All contractors are to verify site conditions, quantities, and hazardous material locations themselves and base their bids upon their own observations and quantity take-offs for visible materials. Contractors are responsible for understanding and confirming scope of work for project prior to removal or disturbance.

References:

1. Project-Specific Designated Substances and Hazardous Materials Survey, Buildings M-2 and M-59-Washrooms Renovation Project. Prepared by DST Consulting Engineers, Inc. Dated June 2016.

Part 1 General

1.1 RELATED SECTIONS

.1 Section 02 62 00.01 – Schedule A – Hazardous Material Table

.2 Section 02 82 00.02 – Asbestos Abatement: Intermediate Precautions.

.3 Section 02 82 00.03 – Asbestos Abatement: Maximum Precautions.

1.2 REFERENCES

.1 The presence of Designated Substances and Hazardous Materials are outlined within the following documents:

.1 Project-Specific Designated Substances and Hazardous Materials Survey, Buildings M-2 and M-59-Washrooms Renovation Project**.** Prepared by DST Consulting Engineers, Inc. Dated June 2016.

.2 Work site may involve contact with the following:

.1 Asbestos.

.2 Lead.

.3 Mercury.

.4 Silica.

.5 PCBs.

.3 Canadian Environmental Protection Act, 1999 (CEPA 1999).

.1 Export and Import of Hazardous Waste Regulations (SOR/2002-300).

.2 Ozone-depleting Substances Regulations, 1998.

.3 Federal Halocarbon Regulations, 2003.

.4 Ontario Environmental Protection Act, R.R.O 1990.

.1 General – Waste Management, O. Reg. 347/90, as amended.

.5 Occupational Health and Safety Act

.1 Designated Substances, O.Reg 490/09, as amended

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

.1 Material Safety Data Sheets (MSDS).

.7 National Fire Code of Canada 2010.

.8 Transportation of Dangerous Goods Act (TDG Act) 1992, (c. 34).

.9 Transportation of Dangerous Goods Regulations (T-19.01-SOR/2003-400).

1.3 DEFINITIONS

.1 Dangerous Goods: product, substance, or organism that is specifically listed or meets hazard criteria established in Transportation of Dangerous Goods Regulations.

.2 Hazardous Material: product, substance, or organism that is used for its original purpose; and that is either dangerous goods or a material that may cause adverse impact to environment or adversely affect health of persons, animals, or plant life when released into the environment.

.3 Hazardous Material Waste: any hazardous material that is no longer used for its original purpose and that is intended for recycling, treatment or disposal.

.4 Workplace Hazardous Materials Information System (WHMIS): Canada-wide system designed to give employers and workers information about hazardous materials used in workplace. Under WHMIS, information on hazardous materials is provided on container labels, material safety data sheets (MSDS), and worker education programs. WHMIS is put into effect by combination of federal and provincial laws.

1.4 ACTION AND INFORMATIONAL SUBMITTALS

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for hazardous materials and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit to NRC Departmental Representative current Material Safety Data Sheet (MSDS) for each hazardous material required prior to bringing hazardous material on site.

.3 Submit hazardous materials management plan to NRC Departmental Representative that identifies hazardous materials, their use, their location, personal protective equipment requirements, and disposal arrangements.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Co-ordinate storage of hazardous materials with NRC Departmental Representative and abide by internal requirements for labelling and storage of materials and wastes.

.2 Store and handle hazardous materials and wastes in accordance with applicable federal and provincial laws, regulations, codes, and guidelines.

.3 Store and handle flammable and combustible materials in accordance with current National Fire Code of Canada requirements.

.4 Keep no more than 45 litres of flammable and combustible liquids such as gasoline, kerosene and naphtha for ready use.

.1 Store flammable and combustible liquids in approved safety cans bearing the Underwriters' Laboratory of Canada or Factory Mutual seal of approval.

.2 Storage of quantities of flammable and combustible liquids exceeding 45 litres for work purposes requires the written approval of the NRC Departmental Representative.

.5 Transfer of flammable and combustible liquids is prohibited within buildings.

.6 Do not transfer flammable and combustible liquids in vicinity of open flames or heat-producing devices.

.7 Do not use flammable liquids having flash point below 38 degrees Celsius, such as naphtha or gasoline as solvents or cleaning agents.

.8 Store flammable and combustible waste liquids for disposal in approved containers located in safe, ventilated area. Keep quantities to minimum.

.9 Observe smoking regulations, smoking is prohibited in areas where hazardous materials are stored, used, or handled.

.10 Storage requirements for quantities of hazardous materials and wastes in excess of 5 kg for solids, and 5 litres for liquids:

.1 Store hazardous materials and wastes in closed and sealed containers.

.2 Label containers of hazardous materials and wastes in accordance with WHMIS.

.3 Store hazardous materials and wastes in containers compatible with that material or waste.

.4 Segregate incompatible materials and wastes.

.5 Ensure that different hazardous materials or hazardous wastes are not mixed.

.6 Store hazardous materials and wastes in secure storage area with controlled access.

.7 Maintain clear egress from storage area.

.8 Store hazardous materials and wastes in location that will prevent them from spilling into environment.

.9 Have appropriate emergency spill response equipment available near storage area, including personal protective equipment.

.10 Maintain inventory of hazardous materials and wastes, including product name, quantity, and date when storage began.

.11 Ensure personnel have been trained in accordance with Workplace Hazardous Materials Information System (WHMIS) requirements.

.12 Report spills or accidents immediately to NRC Departmental Representative. Submit a written spill report to NRC Departmental Representative within 24 hours of incident.

1.6 TRANSPORTATION

.1 Transport hazardous materials and wastes in accordance with federal Transportation of Dangerous Goods Act, Transportation of Dangerous Goods Regulations, and applicable provincial regulations.

.2 If exporting hazardous waste to another country, ensure compliance with federal Export and Import of Hazardous Waste Regulations.

.3 If hazardous waste is generated on site:

.1 Co-ordinate transportation and disposal with NRC Departmental Representative.

.2 Ensure compliance with applicable federal, provincial and municipal laws and regulations for generators of hazardous waste.

.3 Use licensed carrier authorized by provincial authorities to accept subject material.

.4 Prior to shipping material obtain written notice from intended hazardous waste treatment or disposal facility that it will accept material and that it is licensed to accept this material.

.5 Label container[s] with legible, visible safety marks as prescribed by federal and provincial regulations.

.6 Ensure that trained personnel handle, offer for transport, or transport dangerous goods.

.7 Provide photocopy of shipping documents and waste manifests to NRC Departmental Representative.

.8 Track receipt of completed manifest from consignee after shipping dangerous goods. Provide a photocopy of completed manifest to Departmental Representative.

.9 Report discharge, emission, or escape of hazardous materials immediately to NRC Departmental Representative and appropriate provincial authority. Take reasonable measures to control release.

Part 2 Products

2.1 MATERIALS

.1 Only bring on site quantity of hazardous materials required to perform work.

.2 Maintain MSDS in proximity to where materials are being used. Communicate this location to personnel who may have contact with hazardous materials.

Part 3 Execution

3.1 DISPOSAL

.1 Dispose of hazardous waste materials in accordance with applicable federal and provincial acts, regulations, and guidelines.

.2 Recycle hazardous wastes for which there is approved, cost effective recycling process available.

.3 Send hazardous wastes to authorized hazardous waste disposal or treatment facilities.

.4 Burning, diluting, or mixing hazardous wastes for purpose of disposal is prohibited.

.5 Disposal of hazardous materials in waterways, storm or sanitary sewers, or in municipal non-hazardous solid waste landfills is prohibited.

.6 Dispose of hazardous wastes in timely fashion in accordance with applicable provincial regulations.

.7 Minimize generation of hazardous waste to maximum extent practicable. Take necessary precautions to avoid mixing clean and contaminated wastes.

.8 Identify and evaluate recycling and reclamation options as alternatives to land disposal, such as:

.1 Hazardous wastes recycled in manner constituting disposal.

.2 Hazardous waste burned for energy recovery.

.3 Lead-acid battery recycling.

.4 Hazardous wastes with economically recoverable precious metals.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 All removal or disturbance of asbestos-containing materials within Rooms 105 and 106 at the M-59 Building, and Rooms 147 and 148 at the M-2 Building shall comply with requirements of this Section when performing following Work:

.1 Removal or disturbance of all materials referred to in Item 1.8 - Existing Conditions to accommodate required work within the above noted rooms.

.1 All asbestos-containing pipe insulation above the drop-ceiling within the work area in Rooms 147/148 at the M-2 Building is to be removed.

.2 The removal or disturbance of one square metre or less of friable asbestos-containing material, including wall plaster or ceiling plaster (considered friable when disturbed).

.3 Removing non-friable asbestos containing materials by breaking, cutting, drilling, abrading, grinding, sanding or vibrating if the material is not wetted to control the spread of dust or fibres, and the work is done only by means of non-powered hand-held tools.

.4 Removing non-friable asbestos containing materials by breaking, cutting, drilling, abrading, grounding, sanding or vibrating if the work is done by means of power tools that are attached to dust-collecting devices equipped with HEPA filters.

.5 Glove bag and removal of good condition, friable, asbestos-containing material.

.2 Refer to the following document for details on asbestos containing materials:

.1 Project-Specific Designated Substances and Hazardous Materials Survey, Buildings M-2 and M-59-Washrooms Renovation Project**.** Prepared by DST Consulting Engineers, Inc. Dated June 2016.

1.2 RELATED SECTIONS

.1 Section 02 62 00.01 – Schedule A – Hazardous Material Table

.2 Section 02 81 01 – Hazardous Materials

.3 Section 02 82 00.03 – Asbestos Abatement: Maximum Precautions.

1.3 REFERENCES

.1 Canadian General Standards Board (CGSB).

.1 CAN/CGSB-1.205-03, Sealer for Application of Asbestos-Fibre Releasing Materials.

.2 Department of Justice Canada (Jus).

.1 Canadian Environmental Protection Act, 1999 (CEPA).

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

.1 Material Safety Data Sheets (MSDS).

.4 Transport Canada (TC).

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

.5 Ontario Environmental Protection Act, R.R.O 1990,

.1 General – Waste Management, O. Reg. 347/90, as amended.

.6 Underwriters' Laboratories of Canada (ULC).

.7 National Joint Council (NJC).

.1 Part XI – Hazardous Substances.

.8 Ontario Ministry of Labour (MoL).

.1 Occupational Health and Safety Act, R.S.O 1990, c. O1 (OSHA)

.1 O.Reg. 278/05 – Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations, as amended

.2 Ontario Occupational Health and Safety Act, R.S.O. 1990, Regulation 490/09 “Designated Substances”, as amended.

.3 O.Reg 213/91 - “Construction Projects”, as amended.

1.4 DEFINITIONS

.1 Amended Water: water with non-ionic surfactant wetting agent added to reduce surface tension of water to allow wetting of fibres.

.2 Asbestos-Containing Materials (ACMs): materials that contain 0.5 percent or more asbestos by dry weight, identified under Existing Conditions Article, including fallen materials and settled dust.

.3 Asbestos Work Area: area where work takes place which will, or may disturb ACMs.

.4 Authorized Visitors: NRC Departmental Representative, DST Representative, and representative(s) of regulatory agencies.

.5 Competent worker: in relation to specific work, means a worker who:

.1 Is qualified because of knowledge, training and experience to perform the work.

.2 Is familiar with the provincial laws and with the provisions of the regulations that apply to the work.

.3 Has knowledge of all potential or actual danger to health or safety in the work.

.6 Curtained doorway: arrangement of closures to allow ingress or egress from one room to another while permitting minimal air movement between rooms, typically constructed as follows:

.1 Place two overlapping sheets of polyethylene over existing or temporarily framed doorway, secure each along top of doorway, secure vertical edge of one sheet along one vertical side of doorway, and secure vertical edge of other sheet along opposite vertical side of doorway.

.2 Reinforce free edges of polyethylene with duct tape and weight bottom edge to ensure proper closing.

.3 Overlap each polyethylene sheet at openings not less than 1.5 metres on each side.

.7 DOP Test: testing method used to determine integrity of Negative Pressure unit using Dispersed Oil Particulate (DOP) HEPA-filter leak test.

.8 Friable Material: material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.

.9 Glove Bag: prefabricated glove bag as follows:

.1 Minimum thickness 0.25 mm (10 mil) polyvinyl-chloride bag.

.2 Integral 0.25 mm (10 mil) thick polyvinyl-chloride gloves and elastic ports.

.3 Equipped with reversible, double-pull, double throw zipper on top and at approximately mid-section of the bag.

.4 Straps for sealing ends around pipe.

.5 Must incorporate internal closure strip if it is to be moved or used in more than one specific location.

.10 Hazardous Material Workplan: A brief report identifying the location and quantities of hazardous materials and the methods that will be used to remove, store, transport and dispose of them.

.11 HEPA vacuum: DOP tested, High Efficiency Particulate Air filtered vacuum equipment with filter system capable of collecting and retaining fibres greater than 0.3 microns in any dimension at 99.97% efficiency.

.12 Non-Friable Material: material that when dry cannot be crumbled, pulverized or powdered by hand pressure.

.13 Polyethylene: polyethylene sheeting or rip proof polyethylene sheeting with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide protection and isolation.

.14 Occupied Area: any area of building or work site that is outside Asbestos Work Area.

.15 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must have appropriate capacity for scope of work.

1.5 ACTION AND INFORMATION SUBMITTALS

.1 Submit proof satisfactory to the NRC Departmental Representative that suitable arrangements have been made to dispose of asbestos-containing waste in accordance with requirements of authority having jurisdiction.

.2 Submit Provincial/Territorial and/or local requirements for Notice of Project Form.

.3 Submit proof of Contractor's Asbestos Liability Insurance.

.4 Submit to the NRC Departmental Representative necessary permits for transportation and disposal of asbestos-containing waste and proof that asbestos-containing waste has been received and properly disposed.

.5 Submit proof that all asbestos workers and/or supervisor have received appropriate training and education by a competent person in the hazards of asbestos exposure, good personal hygiene and work practices while working in Asbestos Work Areas, and the use, cleaning and disposal of respirators and protective clothing.

.6 Submit proof that supervisory personnel have attended asbestos abatement course, of not less than two days duration, approved by NRC Departmental Representative. Minimum of one supervisor for every ten workers.

.7 Submit Worker's Compensation Board status and transcription of insurance.

.8 Submit documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) for chemicals or materials including:

.1 encapsulants;

.2 amended water;

.3 slow-drying sealer.

.9 Submit proof satisfactory to NRC Departmental Representative that employees have appropriate respirator fitting and testing (fit test certificates). Workers must be fit tested (qualitative as a minimum for Half-face respirator, quantitative for Full-face respirator) with respirator that is personally issued.

.10 Asbestos abatement section within Hazardous Material Work Plan.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to asbestos, provided that in case of conflict among these requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at the time work is performed.

.2 Health and Safety:

.1 Safety Requirements: worker and visitor protection.

.1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area include:

.1 As a minimum, air purifying respirator with N-100, R-100 or P-100 particulate filter(s), personally issued to worker and marked as to efficiency and purpose, suitable for protection against asbestos and acceptable to Provincial Authority having jurisdiction. The respirator to be fitted so that there is an effective seal between the respirator and the worker's face, unless the respirator is equipped with a hood or helmet. The respirator to be cleaned, disinfected and inspected after use on each shift, or more often if necessary, when issued for the exclusive use of one worker, or after each use when used by more than one worker. The respirator to have damaged or deteriorated parts replaced prior to being used by a worker; and, when not in use, to be stored in a convenient, clean and sanitary location. The employer to establish written procedures regarding the selection, use and care of respirators, and a copy of the procedures to be provided to and reviewed with each worker who is required to wear a respirator. A worker not to be assigned to an operation requiring the use of a respirator unless he or she is physically able to perform the operation while using the respirator.

.2 Disposable-type protective clothing (high-density polyethylene protective clothing (Tyvek or similar, as approved by Client/Client Representative) that does not readily retain or permit penetration of asbestos fibres. Protective clothing to be provided by the employer and worn by every worker who enters the work area, and the protective clothing shall consist of a head covering and full body covering that fits snugly at the ankles, wrists and neck, in order to prevent asbestos fibres from reaching the garments and skin under the protective clothing to include suitable footwear, and to be repaired or replaced if torn.

.3 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.

.4 Before leaving Asbestos Work Area, the worker can decontaminate his or her protective clothing by using a vacuum equipped with a HEPA filter, or by damp wiping, before removing the protective clothing, or, if the protective clothing will not be reused, place it in a container for dust and waste. The container to be dust tight, suitable for asbestos waste, impervious to asbestos, identified as asbestos waste, cleaned with a damp cloth or a vacuum equipped with a HEPA filter immediately before removal from the work area, and removed from the work area frequently and at regular intervals.

.5 Ensure workers wash hands and face when leaving Asbestos Work Area. Facilities for washing hands and face shall be provided within or close to the Asbestos Work Area.

.6 Ensure that no person required to enter an Asbestos Work Area has facial hair that affects seal between respirator and face.

.7 Visitor Protection:

.1 Provide protective clothing and approved respirators to Authorized Visitors to work areas.

.2 Instruct Authorized Visitors in the use of protective clothing, respirators and procedures.

.3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Asbestos Work Area.

1.7 WASTE MANAGEMENT AND DISPOSAL

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

.2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.3 Separate for reuse, and recycling and place in designated containers steel, metal, plastic waste 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 Fold up metal banding, flatten and place in designated area for recycling.

.7 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 0.15 mm thick bags or leak proof drums. Label containers with appropriate warning labels.

.8 Provide waste manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial. All waste landfill manifests are to be provided to the NRC Departmental Representative at the end of the project.

1.8 EXISTING CONDITIONS

.1 Refer to the following document which is bound to this Specification and forms part of the tender documents package, for details on materials containing asbestos to be handled, removed, or otherwise disturbed and disposed of during this Project:

.1 Project-Specific Designated Substances and Hazardous Materials Survey, Buildings M-2 and M-59-Washrooms Renovation Project. Prepared by DST Consulting Engineers, Inc. Dated June 2016.

.2 Verification of visible quantities of asbestos-containing materials and site conditions are the responsibility of the bidding contractor. Contractors are to verify all site conditions themselves and base their abatement bids upon their own observations and quantity take-offs. Bidding contractors are to draw their own conclusions with respect to site conditions and/or factors that may affect their work.

.3 Notify NRC Departmental Representative of asbestos-containing material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material pending instructions from NRC Departmental Representative.

.4 Wall and ceiling plaster within Room 105 of the M-29 Building is assumed to be asbestos-containing.

.5 Wall parging above drop ceiling height in Room 106 is assumed to be asbestos-containing.

1.9 SCHEDULING

.1 Hours of Work: perform work involving asbestos abatement located at the Building during hours specified by NRC Departmental Representative.

1.10 PERSONNEL TRAINING

.1 Before beginning Work, provide NRC Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene and work practices, and in use, cleaning, and disposal of respirators and protective clothing.

.2 Instruction and training related to respirators includes, at minimum:

.1 Fitting of equipment.

.2 Inspection and maintenance of equipment.

.3 Disinfecting of equipment.

.4 Limitations of equipment.

.3 Instruction and training must be provided by competent, qualified person.

Part 2 Products

2.1 MATERIALS

.1 Drop and Enclosure Sheets.

.1 Polyethylene: 0.15 mm thick.

.2 FR polyethylene: 0.15 mm thick woven fibre reinforced fabric bonded both sides with polyethylene.

.2 Wetting Agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether mixed with water in concentration to provide thorough wetting of asbestos-containing material.

.3 Waste Containers: contain waste in two separate containers.

.1 Inner container: 0.15 mm thick sealable polyethylene bag

.2 Outer container: sealable metal or fibre type where there are sharp objects included in waste material; otherwise outer container may be sealable metal or fibre type or second 0.15 mm thick sealable polyethylene bag.

.3 Labelling requirements: affix preprinted cautionary asbestos warning, in both official languages, that is visible when ready for removal to disposal site.

.4 Glove Bag: prefabricated glove bag as follows:

.1 Minimum thickness 0.25 mm (10 mil) polyvinyl-chloride bag.

.2 Integral 0.25 mm (10 mil) thick polyvinyl-chloride gloves and elastic ports.

.3 Equipped with reversible, double-pull, double throw zipper on top and at approximately mid-section of the bag.

.4 Straps for sealing ends around pipe.

.5 Must incorporate internal closure strip if it is to be moved or used in more than one specific location.

.5 Tape: tape suitable for sealing polyethylene to surfaces under both dry and wet conditions using amended water.

.6 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.

.1 Sealer: flame spread and smoke developed rating less than 50.

.7 Encapsulant: penetrating type conforming to CAN/CGSB-1.205.

Part 3 Execution

3.1 SUPERVISION

.1 Minimum of one Supervisor for every ten workers is required.

.2 Approved Supervisor must remain within Asbestos Work Area during disturbance, removal, or other handling of asbestos-containing materials.

3.2 PROCEDURES

.1 All exterior asbestos-abatement work that requires workers to wear disposable type protective clothing and respirators shall be obstructed from public view through the use of visual barriers.

.2 Before beginning Work, at each access to Asbestos Work Area, install warning signs in both official languages in upper case 'Helvetica Medium' letters reading as follows, where number in parentheses indicates font size to be used: 'CAUTION ASBESTOS HAZARD AREA (25 mm) / NO UNAUTHORIZED ENTRY (19 mm) / WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) / BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)'.

.3 Before beginning Work remove visible dust from surfaces in work area where dust is likely to be disturbed during course of work.

.1 Use HEPA vacuum, or damp cloths where damp cleaning does not create hazard and is otherwise appropriate.

.2 Do not use compressed air to clean up or remove dust from any surface.

.4 Prevent spread of dust from Asbestos Work Area using measures appropriate to work to be done.

.1 Use FR polyethylene drop sheets over flooring such as carpeting that absorbs dust and over flooring in work areas where dust or contamination cannot otherwise be safely contained.

.2 Erect enclosure of polyethylene sheeting around indoor Type 2 work areas, shut off mechanical ventilation system serving work area, and seal ventilation ducts to and from work area. Exterior abatement work areas shall be separated from other areas using visual barriers that prevent members of the public from viewing abatement work operations.

.5 Remove loose material by HEPA vacuum; thoroughly wet friable material containing asbestos to be removed or disturbed before and during Work unless wetting creates hazard or causes damage.

.1 Use garden reservoir type low - velocity sprayer or airless spray equipment capable of producing mist or fine spray.

.2 Perform Work in a manner to reduce dust creation to lowest levels practicable.

.6 Pipe Insulation Removal Using Glove Bag:

.1 A glove bag not to be used to remove insulation from a pipe, duct or similar structure if:

.1 It may not be possible to maintain a proper seal for any reason including, without limitation:

.2 The condition of the insulation.

.3 The temperature of the pipe, duct or similar structure.

.4 The bag could become damaged for any reason including,
Including, without limitation:

.1 The type of jacketing.
.2 The temperature of the pipe, duct or similar Structure.

.2 Upon installation of the glove bag, inspect bag for any damage or defects. If any damage or defects are found, the glove bag is to be repaired or replaced. The glove bag to be inspected at regular intervals for damage and defects, and repair or replaced, as appropriately. The asbestos containing contents of the damaged or defective glove bag found during removal are to be wetted and the glove bag and its contents are to be removed and disposed of in an appropriate waste disposal container. Any damaged or defective glove bags are not be reused.

.3 Place tools necessary to remove insulation in tool pouch. Wrap bag around pipe and close zippers. Seal bag to pipe with cloth straps.

.4 Place hands in gloves and use necessary tools to remove insulation. Arrange insulation in bag to obtain full capacity of bag.

.5 Insert nozzle of garden reservoir type sprayer into bag through valve and wash down pipe and interior of bag thoroughly. Wet surface of insulation in lower section of bag.

.6 To remove bag after completion of stripping, wash top section and tools thoroughly. Remove air from top section through elasticized valve using a HEPA vacuum. Pull polyethylene waste container over glove bag before removing from pipe. Release one strap and remove freshly washed tools. Place tools in water. Remove second strap and zipper. Fold over into waste container and seal.

.7 After removal of bag ensure that pipe is free of residue. Remove residue using HEPA vacuum or wet cloths. Ensure that surfaces are free of sludge which after drying could release asbestos dust into atmosphere. Seal exposed surfaces of pipe and ends of insulation with slow drying sealer to seal in any residual fibres.

.8 Upon completion of Work shift, cover exposed ends of remaining pipe insulation with polyethylene taped in place.

.7 Work is subject to visual inspection and air monitoring. Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas at no additional costs to owners.

.8 Clean-up:

.1 Frequently during Work and immediately after completion of work, clean up dust and asbestos-containing waste using HEPA vacuum or by damp mopping.

.2 Place dust and asbestos-containing waste in sealed dust-tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste and wet and fold to contain dust and then place in waste bags.

.3 Immediately before their removal from Asbestos Work Area and disposal, clean each filled waste bag using damp cloths or HEPA vacuum and place in second clean waste bag.

.4 Seal and remove double-bagged waste from site. Dispose of in accordance with requirements of Provincial/Territorial and Federal

authority having jurisdiction. Supervise dumping and ensure that dump operator is fully aware of hazardous nature of material to be dumped and that guidelines and regulations for asbestos disposal are followed.

.5 Perform final thorough clean-up of Asbestos Work Areas and adjacent areas affected by Work using HEPA vacuum.

3.3 AIR MONITORING

.1 From beginning of Work until completion of cleaning operations, the NRC Departmental Representative may collect air samples on a daily basis outside of Asbestos Work Area enclosures.

.2 If air monitoring shows that areas outside work area enclosures are contaminated, enclose, maintain, and clean these areas in same manner as that applicable to Asbestos Work Areas

.1 Stop work and clean areas outside of Asbestos Work Areas when Phased Contrast Microscopy measurements exceed 0.05 fibres per cubic centimetre (f/cc) and correct procedures.

.2 All required cleaning, re-cleaning, additional air testing and/or inspections will be performed at no extra charge to the Client.

.3 Ensure that respiratory safety factors for Workers are not exceeded.

.4 The NRC Departmental Representative may collect clearance/post-abatement air samples following a final visual inspection of the Asbestos Work Area by the NRC Departmental Representative. Samples will be analyzed and compared to applicable regulations.

.1 Final air monitoring results must show fibre levels of less than 0.05 fibres per cubic centimetre (f/cc).

.2 If air monitoring shows that areas inside the Asbestos Work Area enclosures are contaminated; enclose, maintain and clean these areas in same manner as that applicable to Asbestos Work Area at no additional cost to the client.

.3 Repeat as necessary until fibre levels are less than 0.05 f/cc

.4 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

.1 All removal or disturbance of asbestos-containing materials within Rooms 104, 115, 128 and 129 at the M-59 Building, and Rooms 124, 133, and 271 at the M-2 Building, shall comply with requirements of this Section when performing following work:

.1 Removal or disturbance of all materials referred to in Item 1.8 - Existing Conditions to accommodate required work within the above noted rooms.

.2 All asbestos-containing piping insulation within the above noted rooms shall be removed including concealed insulation on domestic hot and cold water piping within wall cavities.

.3 Breaking, cutting, drilling, abrading, grinding, sanding or vibrating of asbestos containing materials, if the work is done by means of power tools that are not attached to dust-collecting devices equipped with HEPA filters.

.4 Asbestos containing mastic and levelling compound in Room 133 shall be removed however necessary (including grinding if required) to meet manufacturer requirements for new flooring adhesive.

.5 All asbestos-containing friable grey cement compound (GCC) on ductwork within Room 104 at the M-59 Building is to be removed.

.2 Refer to the following document for details on asbestos containing materials:

.1 Project-Specific Designated Substances and Hazardous Materials Survey, Buildings M-2 and M-59-Washrooms Renovation Project**.** Prepared by DST Consulting Engineers, Inc. Dated June 2016.

1.2 RELATED SECTIONS

.1 Section 02 62 00.01 – Schedule A – Hazardous Material Table.

.2 Section 02 81 01 – Hazardous Materials.

.3 Section 02 82 00.02 – Asbestos Abatement: Intermediate Precautions.

1.3 REFERENCES

.1 Canadian General Standards Board (CGSB)

.1 CAN/CGSB-1.205-03, Sealer for Application to Asbestos-Fibre-Releasing Materials.

.2 Canadian Standards Association (CSA International).

.3 Department of Justice Canada.

.1 Canadian Environmental Protection Act (CEPA), 1999.

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

.1 Material Safety Data Sheets (MSDS).

.5 Transport Canada (TC).

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

.6 Ontario Environmental Protection Act, R.R.O 1990,

.1 General – Waste Management, O. Reg. 347/90, as amended.

.7 Underwriters' Laboratories of Canada (ULC).

.8 Ontario Ministry of Labour (MoL).

.1 Occupational Health and Safety Act, R.S.O 1990, c. O1 (OSHA)

.1 O.Reg. 278/05 – Designated Substance – Asbestos on Construction Projects and in Buildings and Repair Operations, as amended.

.2 O.Reg. 490/09 – Designated Substances

.3 O.Reg. 213/91 - “Construction Projects”, as amended

1.4 DEFINITIONS

.1 Airlock: system for permitting ingress or egress without permitting air movement between contaminated area and uncontaminated area, typically consisting of two curtained doorways at least 2 m apart.

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

.3 Asbestos-Containing Materials (ACMs): materials that contain 0.5 percent or more asbestos by dry weight, identified under Existing Conditions Article, including fallen materials and settled dust.

.4 Asbestos Work Area: Area where actual removal and sealing and enclosure of spray or trowel-applied asbestos-containing materials takes place.

.5 Authorized Visitors: NRC Departmental Representative, DST Representative, and representative(s) of regulatory agencies.

.6 Competent worker: in relation to specific work, means a worker who:

.1 Is qualified because of knowledge, training and experience to perform the work.

.2 Is familiar with the provincial laws and with the provisions of the regulations that apply to the work.

.3 Has knowledge of all potential or actual danger to health or safety in the work.

.7 Curtained doorway: arrangement of closures to allow ingress and egress from one room to another while permitting minimal air movement between rooms, typically constructed as follows:

.1 Place two overlapping sheets of polyethylene over existing or temporarily framed doorway, secure each along top of doorway, secure vertical edge of one sheet along one vertical side of doorway, and secure vertical edge of other sheet along opposite vertical side of doorway.

.2 Reinforce free edges of polyethylene with duct tape and weight bottom edge to ensure proper closing.

.3 Overlap each polyethylene sheet at openings not less than 1.5 m on each side.

.8 DOP Test: testing method used to determine integrity of Negative Pressure unit using dispersed oil particulate (DOP) HEPA filter leak test.

.9 Friable Material: material that when dry can be crumbled, pulverized or powdered by hand pressure and includes such material that is crumbled, pulverized or powdered.

.10 Glove Bag: prefabricated glove bag as follows:

.1 Minimum thickness 0.25 mm (10 mil) polyvinyl-chloride bag.

.2 Integral 0.25 mm (10 mil) thick polyvinyl-chloride gloves and elastic ports.

.3 Equipped with reversible, double-pull, double throw zipper on top and at approximately mid-section of the bag.

.4 Straps for sealing ends around pipe.

.11 Hazardous Material Work Plan: A brief report identifying the location and quantities of hazardous materials and the methods that will be used to remove, store, transport and dispose of them.

.12 HEPA vacuum: DOP tested, High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.

.13 Negative pressure: DOP tested system that extracts air directly from work area, filters such extracted air through High Efficiency Particulate Air filtering system, and discharges this air directly outside work area to exterior of building.

.1 System to maintain minimum pressure differential of 5 Pa relative to adjacent areas outside of work areas, be equipped with alarm to warn of system breakdown, and be equipped with instrument to continuously monitor and automatically record pressure differences.

.14 Non-Friable Materials: material that when dry cannot be crumbled, pulverized or powdered by hand pressure.

.15 Occupied Area: any area of building or work site that is outside Asbestos Work Area.

.16 Polyethylene sheeting sealed with tape: Polyethylene sheeting of type and thickness specified sealed with tape along edges, around penetrating objects, over cuts and tears, and elsewhere as required to provide continuous polyethylene membrane to protect underlying surfaces from water damage or damage by sealants, and to prevent escape of asbestos fibres through sheeting into clean area.

.17 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of work.

1.5 ACTION AND INFORMATIONAL SUBMITTALS

.1 Before beginning work:

.1 Obtain from appropriate agency and submit to NRC Departmental Representative necessary permits for transportation and disposal of asbestos waste. Ensure that dump operator is fully aware of hazardous nature of material being dumped, and proper methods of disposal. Submit proof satisfactory to NRC Departmental Representative that suitable arrangements have been made to receive and properly dispose of asbestos waste.

.2 Submit proof satisfactory to NRC Departmental Representative that every worker involved in a Type 3 operation has successfully completed the

Asbestos Abatement Worker Training Program approved by the Ministry of Training, Colleges and Universities and every supervisor of a worker involved in a Type 3 operation has successfully completed the Asbestos Abatement Supervisor Training Program approved by the Ministry of Training, Colleges and Universities as outlined in O. Reg. 278/05, s. 20 (1). Submit proof of attendance in form of certificate.

.3 Ensure supervisory personnel have attended asbestos abatement course, of not less than two days duration, approved by NRC Departmental Representative. Submit proof of attendance in form of certificate. Minimum of one Supervisor for every ten workers.

.4 Submit documentation including test results for sealer proposed for use.

.5 Submit Provincial/Territorial and/or local requirements for Notice of Project Form.

.6 Submit proof of Contractor's Asbestos Liability Insurance.

.7 Submit proof satisfactory to NRC Departmental Representative that employees have appropriate respirator fitting and testing. Workers must be fit-tested **(quantitative)** with respirator that is personally issued.

.8 Submit documentation including air test results for compressor to be used for supplied air respirators.

.9 Submit Worker's Compensation Board status and transcription of insurance.

.10 Submit documentation including test results, fire and flammability data, and Material Safety Data Sheets (MSDS) for chemicals or materials including but not limited to following:

.1 amended water;

.2 slow-drying sealer.

.11 Submit Asbestos Abatement section within Hazardous Material Work Plan.

1.6 QUALITY ASSURANCE

.1 Regulatory Requirements: comply with Federal, Provincial/Territorial and local requirements pertaining to asbestos, provided that in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time work is performed.

.2 Health and Safety:

.1 Safety Requirements: worker and visitor protection.

.1 Protective equipment and clothing to be worn by workers while in Asbestos Work Area includes:

.1 As a minimum, full-face respirator equipped with HEPA P-100 filter cartridges. Respirators shall be personally issued to worker and marked as to efficiency and purpose, suitable for protection against asbestos and acceptable to Provincial Authority having jurisdiction.

.2 All respirators to be fitted so that there is an effective seal between the respirator and the worker's face, unless the respirator is equipped with a hood or helmet. The respirators are to be cleaned, disinfected and inspected after use on each shift, or more often if necessary, when

issued for the exclusive use of one worker, or after each use when used by more than one worker. The respirators to have damaged or deteriorated parts replaced prior to being used by a worker; and, when not in use, to be stored in a convenient, clean and sanitary location. The employer to establish written procedures regarding the selection, use and care of respirators, and a copy of the procedures to be provided to and reviewed with each worker who is required to wear a respirator. A worker not to be assigned to an operation requiring the use of a respirator unless he or she is physically able to perform the operation while using the respirator.

.3 Disposable-type protective clothing (high-density polyethylene protective clothing (Tyvek or similar, as approved by NRC Representative) that does not readily retain or permit penetration of asbestos fibres. Protective clothing to be provided by the employer and worn by every worker who enters the work area, and the protective clothing shall consist of a head covering and full body covering that fits snugly at the ankles, wrists and neck, in order to prevent asbestos fibres from reaching the garments and skin under the protective clothing to include suitable footwear, and to be repaired or replaced if torn

.2 Requirements for each worker:

.1 Remove street clothes in clean change room and put on respirator with new filters or reusable filters that have been tested as satisfactory, clean coveralls and head covers before entering Equipment and Access Rooms or Asbestos Work Area. Store street clothes, uncontaminated footwear, towels, and similar uncontaminated articles in clean change room.

.2 Remove gross contamination from clothing before leaving work area then proceed to Equipment and Access Room and remove clothing except respirators. Place contaminated worksuits in receptacles for disposal with other asbestos - contaminated materials. Leave reusable items except respirator in Equipment and Access Room. Still wearing the respirator proceed naked to showers. Using soap and water wash body and hair thoroughly. Clean outside of respirator with soap and water while showering; remove respirator; remove filters and wet them and dispose of filters in container provided for purpose; and wash and rinse inside of respirator. When not in use in work area, store work footwear in Equipment and Access Room. Upon completion of asbestos abatement, dispose of footwear as contaminated waste or clean thoroughly inside and out using soap and water before removing from work area or from Equipment and Access Room.

.3 After showering and drying off, proceed to clean change room and dress in street clothes at end of each day's work, or in clean coveralls before eating, smoking, or drinking. If

re-entering work area, follow procedures outlined in paragraphs above.

.4 Enter unloading room from outside dressed in clean coveralls to remove waste containers and equipment from Holding Room of Container and Equipment Decontamination Enclosure system. Workers must not use this system as means to leave or enter work area.

.3 Eating, drinking, chewing, and smoking are not permitted in Asbestos Work Area.

.4 Ensure workers are fully protected with respirators and protective clothing during preparation of system of enclosures prior to commencing actual asbestos abatement.

.5 Provide and post in Clean Change Room and in Equipment and Access Room the procedures described in this Section, in both official languages.

.6 Ensure that no person required to enter an Asbestos Work Area has facial hair or other facial condition that affects seal between respirator and face.

.7 Visitor Protection:

.1 Provide protective clothing and approved respirators to Authorized Visitors to work areas.

.2 Instruct Authorized Visitors in the use of protective clothing, respirators and procedures.

.3 Instruct Authorized Visitors in proper procedures to be followed in entering into and exiting from Asbestos Work Area.

1.7 WASTE MANAGEMENT AND DISPOSAL

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

.2 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.3 Separate for reuse, and recycling and place in designated containers steel, metal, plastic waste in accordance with Waste Management Plan.

.4 Place materials defined as hazardous or toxic in designated containers. Exterior on-site waste containers must be closable and lockable.

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

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

.7 Disposal of asbestos waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of asbestos waste in sealed double thickness 6 ml bags or leak proof drums. Label containers with appropriate warning labels.

.8 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial. All waste landfill manifests are to be provided to the NRC Departmental Representative at the end of the project.

1.8 EXISTING CONDITIONS

.1 Refer to the following document that is bound to this Specification and forms part of the tender documents package, for details on materials containing asbestos to be handled, removed, or otherwise disturbed and disposed of during this Project:

.1 Project-Specific Designated Substances and Hazardous Materials Survey, Buildings M-2 and M-59-Washrooms Renovation Project. Prepared by DST Consulting Engineers, Inc. Dated June 2016.

.2 Domestic hot and cold water piping concealed within wall cavities within Rooms 104, 115, 128 and 129 at the M-59 Building, and Rooms 124, and 271 at the M-2 Building is insulated with asbestos-containing insulation.

.3 Verification of visible quantities of asbestos-containing materials and site conditions are the responsibility of the bidding contractor. Contractors are to verify all site conditions themselves and base their abatement bids upon their own observations and quantity take-offs. Bidding contractors are to draw their own conclusions with respect to site conditions and/or factors that may affect their work.

.4 Notify NRC Departmental Representative of any suspect asbestos-containing material discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by NRC Departmental Representative.

.5 A total of 5 square metres of friable grey cement compound on ductwork within Room 104 at the M-59 Building is present.

1.9 SCHEDULING

.1 Not later than ten (10) days before beginning Work on this Project notify following in writing:

.1 Provincial/Territorial, Department of Labour.

.2 Disposal Authority.

.2 Inform sub-trades of presence of asbestos-containing materials identified in the documents listed in Item 1.8.

.3 Submit to NRC Departmental Representative copy of notifications prior to start of Work.

.4 Hours of Work: perform work involving asbestos abatement located at the Building during hours specified by NRC Departmental Representative. The work schedule must be in accordance with the specific phasing for this abatement project, as indicated on the drawings referenced in Section 1.8.4, and be approved in writing by the NRC Departmental Representative in advance of work. Contractor shall be available to work continuously from beginning to end of project.

.5 Any waste loading shall only be performed after regular business hours (18:00), ensuring this does not contradict with working hours. Waste loading shall not occur through occupied areas of the building. Waste storage containers to be closed and locked overnight.

1.10 PERSONNEL TRAINING

.1 Before beginning Work, provide to NRC Departmental Representative satisfactory proof that every worker has had instruction and training in hazards of asbestos exposure, in personal hygiene including dress and showers, in entry and exit from Asbestos Work Area, in aspects of work procedures, and in use, cleaning, and disposal of respirators and protective clothing.

.2 Instruction and training related to respirators includes, at minimum:

.1 Proper fitting of equipment.

.2 Inspection and maintenance of equipment.

.3 Cleaning and Disinfecting of equipment.

.4 Limitations of equipment.

.3 Instruction and training must be provided by competent, qualified person.

.4 Every worker involved in a Type 3 operation must have successfully completed the Asbestos Abatement Worker Training Program approved by the Ministry of Training, Colleges and Universities.

.5 Every supervisor of a worker involved in a Type 3 operation must have successfully completed the Asbestos Abatement Supervisor Training Program approved by the Ministry of Training, Colleges and Universities.

Part 2 Products

2.1 MATERIALS

.1 Polyethylene: minimum 0.15 mm thick unless otherwise specified; in sheet size to minimize joints.

.2 FR polyethylene: minimum 0.15 mm thick, woven fibre reinforced fabric bonded both sides with polyethylene.

.3 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under both dry conditions and wet conditions using amended water.

.4 Wetting agent: 50% polyoxyethylene ester and 50% polyoxyethylene ether, or other material approved by NRC Departmental Representative mixed with water in concentration to provide adequate penetration and wetting of asbestos-containing material.

.5 Asbestos waste containers: Metal or fibre - type acceptable to dump operator with tightly fitting covers and 0.15 mm minimum thickness sealable polyethylene liners.

.1 Inner container: 0.15 mm thick sealable polyethylene waste bag.

.2 Outer container: sealable metal or fibre type where there are sharp objects included in waste material; otherwise outer container may be sealable metal or fibre type or second 0.15 mm thick sealable polyethylene bag.

.3 Label containers in accordance with applicable Regulations. Label in both official languages.

.6 Tape: tape suitable for sealing polyethylene to surfaces under both dry and wet conditions using amended water.

.7 Scaffolding: Of appropriate size and strength to accommodate project in accordance with O.Reg 213/91, with specifications and set-up to be approved and stamped by professional engineer. Include in contract sum costs due to this requirement.

.8 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual asbestos fibres.

.9 Sealer: flame spread and smoke developed rating less than 50 and be compatible with new fireproofing.

.10 Encapsulant: penetrating type conforming to CAN/CGSB-1.205.

Part 3 Execution

3.1 PREPARATION

.1 Work Areas:

.1 Shut off and isolate air handling and ventilation systems for work areas to prevent fibre dispersal to other building areas during work phase. Location and procedure of shut off shall be approved by the NRC Departmental Representative. Conduct smoke tests to ensure that duct work isolation measures are airtight. Location and procedure for smoke tests shall be approved by the NRC Departmental Representative. Due to the presence of asbestos-containing spray-applied insulation within the work area, physical disturbance of any ductwork shall be performed under Type 3 asbestos precautionary measures.

.2 Utilities within the project area, including thermostats, heat detectors, smoke detectors and other wall or ceiling mounted utility devices shall remain functioning throughout the duration of the project, and shall be protected from debris during demolition. Where walls or ceilings are to be removed that utility devices are attached to, the utility devices can be detached and supported in such a way they can remain functioning and supported throughout the duration of the project, and be available for future use.

.3 Pre-clean moveable furniture and carpeting within proposed work area using HEPA vacuum and remove from work area to an appropriate temporary location.

.4 Pre-clean fixed casework, plant, and equipment within proposed work area(s), using HEPA vacuum and cover with polyethylene sheeting sealed with tape.

.5 Clean proposed work area(s) using, where practicable, HEPA vacuum cleaning equipment. If not practicable, use wet cleaning method. Do not use methods that raise dust, such as dry sweeping, or vacuuming using other than HEPA vacuum equipment.

.6 The spread of dust from the work area to be prevented by:

.1 Using enclosures of polyethylene or other suitable material that is impervious to asbestos (including, if the enclosure material is opaque, one or more transparent window areas to allow observation of the entire work area from outside the enclosure), if the work area is not enclosed by walls.

.2 Using curtains of polyethylene sheeting or other suitable material that is impervious to asbestos, fitted on each side of each entrance or exit from the work area.

.7 DOP test negative pressure units within one (1) month prior to work operations. Provide documentation to Client Representative. Put negative pressure system in operation and operate continuously from time first polyethylene is installed to seal openings until final completion of work including final cleanup. Provide continuous monitoring of pressure difference using automatic recording instrument. The system to maintain a negative air pressure of 0.02 inches [5 Pa] of water, relative to the area outside the enclosed area. The system to be inspected and maintained by a competent person prior each use to ensure that there is no air leakage, and if the filter is found to be damaged or defective, it to be replaced before the ventilation system is used. Vent negative air units to the outdoors.

.8 Seal off openings such as corridors, doorways, windows, skylights, ducts, grilles, and diffusers, with polyethylene sheeting sealed with tape.

.9 Cover floor and wall surfaces with polyethylene sheeting sealed with tape. Use one layer of FR polyethylene on floors. Cover floors first so that polyethylene extends at least 300 mm up walls then cover walls to overlap floor sheeting.

.10 Build airlocks at entrances to and exits from work area(s) so that work area(s) are always closed off by one curtained doorway when workers enter or exit.

.11 At each access to work areas install warning signs in both official languages in upper case "Helvetica Medium" letters reading as follows where number in parentheses indicates font size to be used: "CAUTION ASBESTOS HAZARD AREA (25 mm) NO UNAUTHORIZED ENTRY (19 mm) WEAR ASSIGNED PROTECTIVE EQUIPMENT (19 mm) BREATHING ASBESTOS DUST MAY CAUSE SERIOUS BODILY HARM (7 mm)".

.12 After work area isolation, remove heating, ventilating, and air conditioning filters, pack in sealed plastic bags 0.15 mm minimum thick and treat as contaminated asbestos waste. Remove ceiling - mounted objects such as lights, partitions, other fixtures not previously sealed off, and other objects that interfere with asbestos removal, as directed by NRC Departmental Representative. Use localized water spraying during fixture removal to reduce fibre dispersal.

.13 Maintain emergency and fire exits from work area(s), or establish alternative exits satisfactory to Fire Commissioner of Canada.

.14 Where application of water is required for wetting asbestos-containing materials, shut off electrical power, provide 24 volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical lines and equipment.

.2 Worker Decontamination Enclosure System:

.1 Worker Decontamination Enclosure System includes Equipment and Access Room, Shower Room, and Clean Room, as follows:

.1 Equipment and Access Room: build Equipment and Access Room between Shower Room and work area(s), with two curtained doorways, one to Shower Room and one to work area(s). Install portable toilet, waste receptor, and storage facilities for workers' shoes and protective clothing to be reworn in work area(s). Build Equipment and Access Room large enough to accommodate specified facilities, other equipment needed, and at least one worker allowing him /her sufficient space to undress comfortably.

.2 Shower Room: build Shower Room between Clean Room and Equipment and Access Room, with two curtained doorways, one to Clean Room and one to Equipment and Access Room. Provide one shower for every five workers. Provide hot and cold water or water of a constant temperature that is not less than 40°C or more than 50°C. Provide individual controls inside the room to regulate water flow, and individual controls inside room to regulate temperature. Provide piping and connect to water sources and drains. Pump waste water through 5 micrometre filter system acceptable to Client Representative before directing into drains. Provide soap, clean towels, and appropriate containers for disposal of used respirator filters.

.3 Clean Room: build Clean Room between Shower Room and clean areas outside of enclosures, with two curtained doorways, one to outside of enclosures and one to Shower Room. Provide lockers or hangers and hooks for workers' street clothes and personal belongings. Provide storage for clean protective clothing and respiratory equipment. Install mirror to permit workers to fit respiratory equipment properly.

.3 Container and Equipment Decontamination Enclosure System:

.1 Container and Equipment Decontamination Enclosure System consists of Staging Area within work area, Washroom, Holding Room, and Unloading Room. Purpose of system is to provide means to decontaminate waste containers, scaffolding, waste and material containers, vacuum and spray equipment, and other tools and equipment for which Worker Decontamination Enclosure System is not suitable.

.1 Staging Area: designate Staging Area in work area for gross removal of dust and debris from waste containers and equipment, labelling and sealing of waste containers, and temporary storage pending removal to Washroom. Equip Staging Area with curtained doorway to Washroom.

.2 Washroom: build Washroom between Staging Area and Holding Room with two curtained doorways, one to Staging Area and one to Holding Room. Provide high - pressure low - volume sprays for washing of waste containers and equipment. Pump waste water through 5 micrometre filter system before directing into drains. Provide piping and connect to water sources and drains.

.3 Holding Room: build Holding Room between Washroom and Unloading Room, with two curtained doorways, one to Washroom and one to Unloading Room. Build Holding

Room sized to accommodate at least two waste containers and largest item of equipment used.

.4 Unloading Room: build Unloading Room between Holding Room and outside, with two curtained doorways, one to Holding Room and one to outside.

.4 Construction of Decontamination Enclosures:

.1 Build suitable framing for enclosures or use existing rooms where convenient, and line with polyethylene sheeting sealed with tape. Use one layer of FR polyethylene on floors, as applicable.

.2 Build curtained doorways between enclosures so that when people move through or when waste containers and equipment are moved through doorway, one of two closures comprising doorway always remains closed.

.5 Separation of Work Areas from Occupied Areas:

.1 Separate parts of building required to remain in use from parts of building or exterior used for asbestos abatement by means of airtight barrier system constructed as follows:

.1 Build suitable floor to ceiling lumber or metal stud framing, cover with polyethylene sheeting sealed with tape, and apply 9 mm minimum thick plywood. Seal joints between plywood sheets and between plywood and adjacent materials with surface film forming type sealer, to create airtight barrier.

.2 Cover plywood barrier with polyethylene sealed with tape, as specified for work areas.

.6 Maintenance of Enclosures:

.1 Maintain enclosures in tidy condition.

.2 Ensure that barriers and polyethylene linings are effectively sealed and taped. Repair damaged barriers and remedy defects immediately upon discovery.

.3 Visually inspect enclosures at beginning of each working period.

.4 Use smoke methods to test effectiveness of barriers when directed by NRC Departmental Representative.

.7 Do not begin Asbestos Abatement work until:

.1 Arrangements have been made for disposal of waste.

.2 For wet stripping techniques, arrangements have been made for containing, filtering, and disposal of waste water.

.3 Work area(s) and decontamination enclosures and parts of building required to remain in use are effectively segregated.

.4 Tools, equipment, and materials waste containers are on hand.

.5 Arrangements have been made for building security.

.6 Warning signs are displayed where access to contaminated areas is possible.

.7 Notifications have been completed and other preparatory steps have been taken.

.8 Work area enclosure has been inspected and approved by the NRC Departmental Representative.

.9 Locations for waste bins as designated by the NRC Departmental Representative have been established. Keep bins covered and enclosed while at the site. Bin loading area shall be kept clean at all times.

3.2 SUPERVISION

.1 Minimum of one Supervisor for every ten workers is required.

.2 Approved Supervisor must remain within Asbestos Work Area during disturbance, removal, or other handling of asbestos-containing materials.

3.3 ASBESTOS REMOVAL

.1 Before removing asbestos:

.1 Prepare site.

.2 Spray asbestos-containing material with water containing specified wetting agent, using airless spray equipment capable of providing "mist" application to prevent release of fibres. Saturate asbestos material sufficiently to wet it to substrate without causing excess dripping. Spray asbestos material repeatedly during work process to maintain saturation and to minimize asbestos fibre dispersion.

.2 Remove saturated asbestos material in small sections. Do not allow saturated asbestos to dry out. As it is being removed pack material in sealable plastic bags 0.15 mm minimum thick and place in labelled containers for transport.

.3 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove from immediate working area to Staging Area. Clean external surfaces thoroughly again by wet sponging before moving containers to decontamination Washroom. Wash containers thoroughly in decontamination Washroom, and store in Holding Room pending removal to Unloading Room and outside. Ensure that containers are removed from Holding Room by workers who have entered from uncontaminated areas dressed in clean coveralls.

.4 After completion of stripping work, wire brushed and wet-sponge surfaces from which asbestos has been removed to remove visible material. During this work keep surfaces wet.

.5 Where NRC Departmental Representative decides complete removal of asbestos containing material is impossible due to obstructions such as structural members or major service elements, or because asbestos containing material was originally applied to asphaltic coating, and provides written direction, encapsulate material as follows:

.1 Apply surface film forming type sealer to provide 0.635 mm minimum dry film thickness over asbestos surfaces. Apply using airless spray equipment to avoid blowing off fibres. Apply penetrating type sealer to penetrate existing sprayed asbestos surfaces to uniform depth of 25 mm minimum. Apply penetrating type sealer to penetrate existing asbestos surfaces uniformly to substrate.

.6 After wire brushing and wet sponging to remove visible asbestos and after encapsulating asbestos containing material impossible to remove, wet clean entire work area including Equipment and Access Room, and equipment used in

process. After 24 hour period to allow for dust settling, wet clean these areas and objects again. During this settling period no entry, activity, or ventilation will be permitted. After second 24 hour period under same conditions, clean these areas and objects again using HEPA vacuum followed by wet cleaning. After inspection by NRC Departmental Representative or designate, apply continuous coat of slow drying sealer to surfaces of work area. Allow at least 16 hours with no entry, activity, ventilation, or disturbance other than operation of negative pressure units during this period.

.7 Work is subject to visual inspection and air monitoring by NRC Departmental Representative. Contamination of surrounding areas indicated by visual inspection or air monitoring will require complete enclosure and clean-up of affected areas.

.8 Cleanup:

.1 Frequently during Work and immediately after completion of work, clean up dust and asbestos containing waste using HEPA vacuum or by damp mopping.

.2 Place dust and asbestos containing waste in sealed dust tight waste bags. Treat drop sheets and disposable protective clothing as asbestos waste and wet and fold to contain dust and then place in waste bags.

.3 Immediately before their removal from Asbestos Work Area and disposal, clean each filled waste bag using damp cloths or HEPA vacuum and place in second clean waste bag.

.4 Seal and remove double bagged waste from site. Dispose of in accordance with requirements of Provincial/Territorial and Federal authority having jurisdiction. Supervise dumping and ensure that dump operator is fully aware of hazardous nature of material to be dumped and that guidelines and regulations for asbestos disposal are followed.

.5 Perform final thorough clean-up of Asbestos Work Areas and adjacent areas affected by Work using HEPA vacuum.

3.4 INSPECTION

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

.2 NRC Departmental Representative will inspect Work for:

.1 Adherence to specific procedures and materials.

.2 Final cleanliness and completion.

.3 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

.3 When asbestos leakage from Asbestos Work Area has occurred or is likely to occur, NRC Departmental Representative may order Work shutdown.

.4 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

3.5 AIR MONITORING

.1 From beginning of Work until completion of cleaning operations, NRC Departmental Representative will collect air samples on daily basis outside of work area enclosure(s) in accordance with industry standard practice.

.1 Contractor shall be responsible for monitoring inside in accordance with applicable Provincial/Territorial Occupational Health and Safety Regulations.

.2 Contractor shall ensure that respiratory safety factors for Workers are not exceeded.

.2 If air monitoring shows that areas outside work area are contaminated, enclose, maintain and clean these areas in same manner as that applicable to Asbestos Work Areas.

.1 Stop work and clean areas outside of Asbestos Work Areas when Phase Contrast Microscopy measurements exceed 0.05 fibres per cubic centimetre (f/cc) and correct procedures.

.2 All required cleaning, re-cleaning, additional air testing and/or inspections will be at no extra charge to NRC Departmental Representative.

.3 Final air monitoring to be conducted as follows: After Asbestos Work Area has passed visual inspection by NRC Departmental Representative, and acceptable coat of lock-down agent has been applied to surfaces within enclosure, and appropriate setting period has passed, NRC Departmental Representative will perform aggressive air monitoring within Asbestos Work Area.

.1 Final air monitoring results must show fibre levels of less than 0.01 f/cc.

.2 If air monitoring results show fibre levels in excess of 0.01 f/cc, re-clean work area and apply another acceptable coat of lock-down agent to surfaces.

.3 Repeat as necessary until fibre levels are less than 0.01 f/cc.

.4 No additional costs will be allowed by Contractor for additional labour or materials required to provide specified performance level.

3.6 FINAL CLEANUP

.1 Following cleaning and air sampling by NRC Departmental Representative shows that asbestos levels inside work area enclosure(s) do not exceed 0.01 fibres/cc, proceed with final cleanup.

.2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible asbestos-containing particles observed during cleanup, immediately, using HEPA vacuum equipment.

.3 Place polyethylene seals, tape, cleaning material, clothing, and other contaminated waste in plastic bags and sealed labelled waste containers for transport.

.4 Include in clean-up Work areas, Equipment and Access Room, Washroom, Shower Room, and other contaminated enclosures.

.5 Include in clean-up sealed waste containers and equipment used in Work and remove from work areas, via Container and Equipment Decontamination Enclosure System, at appropriate time in cleaning sequence.

.6 Conduct final check to ensure that no dust or debris remains on surfaces as result of dismantling operations.

.7 As work progresses, and to prevent exceeding available storage capacity on site, remove sealed and labelled containers containing asbestos waste and dispose of at authorized disposal area in accordance with requirements of disposal authority. Ensure that each shipment of containers transported to dump is accompanied by Contractor's representative to ensure that dumping is done in accordance with governing regulations.

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Canadian Standards Association (CSA International)
- .1 CAN3 A165 SERIES-94 (R2000), CSA Standards on Concrete Masonry Units.
- .2 CSA A179-04(R2014), Mortar and Grout for Unit Masonry.
- .3 CSA-A370-94(C1999), Connectors for Masonry.
- .4 CSA-A371-04(R2014), Masonry Construction for Buildings.
- .5 CSA G30.14-M1983(R1998), Deformed Steel Wire For Concrete Reinforcement.
- .6 CAN/CSA G30.18-09(R2014), Billet-Steel Bars for Concrete Reinforcement.
- .7 CSA-S304.1-94(R2001), Masonry Design for Buildings.

1.2 SUBMITTALS

.1 Product Data:
- .1 Submit manufacturer's printed product literature, specifications and data sheet in accordance with Section 00 10 00.

.2 Shop Drawings :
- .1 Submit shop drawings in accordance with Section 00 10 00.
- .2 Shop drawings consist of bar bending details, lists and placing drawings.
- .3 On placing drawings, indicate sizes, spacing, location and quantities of reinforcement and connectors.

1.3 STORAGE AND HANDLING

.1 Protect on site stored or installed material from moisture damage in accordance with manufacturer's printed instructions.

PART 2 - PRODUCTS

2.1 MASONRY UNITS

.1 Standard concrete block units: to CAN3-A165 Series (CAN3-A165.1).
- .1 Classification: H / 15 / A / M.
- .2 Size: modular.

2.2 REINFORCEMENT AND CONNECTORS

.1 Bar reinforcement: to CSA-A371 and CAN/CSA G30.18, Grade 400.

.2 Wire reinforcement: to CSA-A371 and CSA G30.14, truss type.

.3 Connectors shall be corrosion resistant: to CSA-A370 and CSA-S304.

2.3 MORTAR AND GROUT

.1 Mortar: to CSA A179.

.1 Use aggregate passing 1.18 mm sieve where 6 mm thick joints are indicated.
.2 Colour: ground coloured natural aggregates or metallic oxide pigments.

.2 Mortar Type: S based on specifications,

.3 Following applies regardless of mortar types and uses specified above:
.1 Mortar for grouted reinforced masonry: type S based on specifications.

2.4 ACCESSORIES

.1 Nailing Inserts: 0.5 mm minimum thickness, galvanized.

.2 Bolts: 12 mm diameter x 150 mm long with ends bent 50 mm at 90 degrees.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Do masonry work in accordance with CSA-A371 except where specified otherwise.
.1 Bond: running stretcher bond with vertical joints in perpendicular alignment and centred on adjacent stretchers above and below.
.2 Coursing height: 200 mm for one block and one joint.
.3 Jointing: tool where exposed or where paint or other finish coating is specified to provide smooth compressed concave surface.

.2 Build masonry plumb, level, and true to line, with vertical joints in alignment.

.3 Layout coursing and bond to achieve correct coursing heights, and continuity of bond above and below openings, with minimum of cutting.

3.2 CONSTRUCTION

.1 Exposed masonry:
.1 Remove chipped, cracked, and otherwise damaged units, in exposed masonry and replace with undamaged units.
.2 Cut out for electrical switches, outlet boxes, and other recessed or built-in objects. Make cuts straight, clean, and free from uneven edges.

.2 Building-In:
.1 Install masonry connectors and reinforcement where indicated on drawings.
.2 Build in items required to be built into masonry.
.3 Prevent displacement of built-in items during construction. Check plumb, location and alignment frequently, as work progresses.

.3 Interface with other work:
.1 Cut openings in existing work as indicated.
.2 Openings in walls: approved Departmental Representative.
.3 Make good existing work. Use materials to match existing.

3.3 REINFORCING AND CONNECTING

.1 Install masonry connectors and reinforcement in accordance with CSA-A370, CSA-A371 and CSA-S304.1 unless indicated otherwise.

3.4 TYING

.1 Tie new masonry to existing in accordance with NBC, CSA-S304.1, CSA-A371.

3.5 GROUTING

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

3.6 ANCHORS

.1 Supply and install metal anchors as indicated.

3.7 SITE TOLERANCES

.1 Tolerances in notes to Clause 5.3 of CSA-A371 apply.

3.8 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

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

3.9 PROTECTION

.1 Protect masonry and other work from marking and other damage. Protect completed work from mortar droppings. Use non-staining coverings.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 07 92 10 – Joint Sealants

.2 Section 09 91 23 - Interior Painting

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM)
.1 ASTM A 53/A53M-02, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Steamless.
.2 ASTM A 269-02, Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
.3 ASTM A 307-02, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-1.40-97, Anti-corrosive Structural Steel Alkyd Primer.
.2 CAN/CGSB-1.181-92, Ready-Mixed, Organic Zinc-Rich Coating.

.3 Canadian Standards Association (CSA International)
.1 CAN/CSA-G40.20/G40.21-98, General Requirements for Rolled or Welded Structural Quality Steel.
.2 CAN/CSA-G164-M92 (R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.
.3 CAN/CSA-S16.1-01, Limit States Design of Steel Structures.
.4 CSA W48-01, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).
.5 CSA W59-1989 (R2001),Welded Steel Construction (Metal Arc Welding) (Imperial Version).
.6 CSA W59.2-M1991 (R2009), Welded Aluminum Construction.

.4 Aluminum Association Designation System for Aluminum Finishes-(AA) – 2003 (R2009).

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 Shop Drawings
.1 Submit shop drawings in accordance with Section 00 10 00.
.2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

.3 Shop Drawings submitted shall bear the stamp and signature of a qualified Professional Engineer registered and licensed to practice in the Province of Ontario.

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.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Packing, Shipping, Handling and Unloading:

.2 Deliver, store, handle and protect materials in accordance with Section 00 10 00.

.3 Storage and Protection:
.1 Cover exposed stainless steel surfaces with pressure sensitive heavy protection paper or apply strippable plastic coating, before shipping to job site.
.2 Leave protective covering in place until final cleaning of building. Provide instructions for removal of protective covering.

1.6 WASTE MANAGEMENT AND DISPOSAL

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

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Steel sections and plates: to CAN/CSA-G40.20/G40.21, Grade 300W.

.2 Steel pipe: to ASTM A 53/A53M.

.3 Welding materials: to CSA W59-13.

.4 Welding electrodes: to CSA W48 Series.

.5 Bolts and anchor bolts: to ASTM A 307.

.6 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

.7 Aluminum extrusions: Aluminum Association Alloy AA6063-T6.

.8 Sheet aluminum: Aluminum Association Alloy AA1100.

.9 Fasteners: stainless steel.

2.2 FABRICATION

.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Use self-tapping shake-proof flat headed screws on items requiring assembly by screws or as indicated.

.3 Where possible, fit and shop assemble work, ready for erection.

.4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

2.3 PIPE RAILINGS

.1 Fabricate to shapes and sizes indicated.

2.4 FINISHES

.1 Shop coat primer: to CAN/CGSB-1.40.

2.5 SHOP PAINTING

.1 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

.2 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, grease. Do not paint when temperature is lower than 7 degrees C.

.3 Clean surfaces to be field welded; do not paint.

PART 3 - EXECUTION

3.1 ERECTION

.1 Do welding work in accordance with CSA W59 unless specified otherwise.

.2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.3 Provide suitable means of anchorage acceptable to Consultant such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.4 Exposed fastening devices to match finish and be compatible with material through which they pass.

.5 Provide components for building by other sections in accordance with shop drawings and schedule.

.6 Make field connections with bolts to CAN/CSA-S16.1, or weld.

.7 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.

.8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces after completion of erection with primer.

.9 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

3.2 PIPE RAILINGS

.1 Fabricate of steel, steel plate formed to shape and sizes indicated.

.2 Prime paint after fabrication.

.3 Set railing standards in concrete. Grout to fill hole. Trowel surface smooth and flush with adjacent surfaces.

3.3 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

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

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 09 22 16 – Non-Structural Metal Framing.

.2 Section 10 28 10 – Toilet and Bath Accessories.

1.2 REFERENCES

.1 Canadian Standards Association (CSA International)
- .1 CSA B111-1974 (R1998), Wire Nails, Spikes and Staples.
- .2 CAN/CSA-G164-M92 (R1998), Hot Dip Galvanizing of Irregularly Shaped Articles.
- .3 CSA O121-M1978 (R1998), Douglas Fir Plywood.
- .4 CAN/CSA-O141-91 (R1999), Softwood Lumber.
- .5 CSA O151-M1978 (R1998), Canadian Softwood Plywood.
- .6 CAN/CSA-O325.0-92 (R1998), Construction Sheathing.

.2 National Lumber Grades Authority (NLGA)
- .1 Standard Grading Rules for Canadian Lumber, 2014.

1.3 QUALITY ASSURANCE

.1 Lumber identification: by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood identification: by grade mark in accordance with applicable CSA standards.

.3 Plywood, OSB and wood based composite panel construction sheathing identification: by grademark in accordance with applicable CSA standards.

1.4 WASTE MANAGEMENT AND DISPOSAL

.1 Do not dispose of preservative treated wood through incineration.

.2 Do not dispose of preservative treated wood with materials destined for recycling or reuse.

.3 Dispose of treated wood, end pieces, wood scraps and sawdust at sanitary landfill.

.4 Dispose of unused wood preservative material at official hazardous material collections site.

.5 Do not dispose of unused preservative material into sewer system, into streams, lakes, onto ground or in other locations where they will pose health or environmental hazard.

PART 2 - PRODUCTS

2.1 LUMBER MATERIAL

.1 Lumber: unless specified otherwise, softwood, S4S, moisture content 19% or less in accordance with following standards:
- .1 CAN/CSA-O141.
- .2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Furring, blocking, nailing strips, grounds, rough bucks:
- .1 Board sizes: "Standard" or better grade.
- .2 Dimension sizes: "Standard" light framing or better grade.
- .3 Post and timbers sizes: "Standard" or better grade.

2.2 PANEL MATERIALS

.1 Douglas fir plywood (DFP): to CSA O121, exterior quality with pressure treated preservative.

2.3 ACCESSORIES

.1 Nails, spikes and staples: to CSA B111.

.2 Nails, spikes and staples:
- .1 Use common spiral nails and spiral spikes except where indicated otherwise.
- .2 Use hot galvanized finish steel for exterior work, interior high humidity areas and for pressure treated lumber except where indicated otherwise.
- .3 Bolt, nut, washer, screw and pin type fasteners: with hot-dip galvanized finish to CSA G164-M92 for exterior work, interior high humidity areas and for pressure treated lumber.
- .4 Use surface fastenings of following types, except where specific type is indicated.
  - .1 To hollow masonry, plaster and panel surfaces use toggle bolt.
  - .2 To solid masonry and concrete use expansion shield with lag screw.
  - .3 To structural steel use bolts through drilled hole, or welded stud-bolts or power driven self-drilling screws.
- .5 Submit alternate fasteners for Departmental Representative's approval.

2.4 FINISHES

.1 Galvanizing: to CAN/CSA-G164, use galvanized fasteners for exterior work, pressure- preservative, fire-retardant treated lumber.

2.5 WOOD PRESERVATIVE

.1 Surface-applied wood preservative: clear or copper napthenate or 5% pentachlorophenol solution, water repellent preservative.

.2 Pentachlorophenol use is restricted to building components that are in ground contact and subject to decay or insect attack only. Where

used, pentachlorophenol-treated wood must be covered with two coats of an appropriate sealer.

.3 Structures built with wood treated with pentachlorophenol and inorganic arsenicals must not be used for storing food nor should the wood come in contact with drinking water.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Treat surfaces of material with wood preservative, before installation.

.2 Apply preservative by dipping, or by brush to completely saturate and maintain wet film on surface for minimum 3 minute soak on lumber and one minute soak on plywood.

.3 Re-treat surfaces exposed by cutting, trimming or boring with liberal brush application of preservative before installation.

.4 Treat material as follows:
.1 Wood furring for exterior applications.

3.2 INSTALLATION

.1 Comply with requirements of NBC, supplemented by the following paragraphs.

.2 Install furring and blocking as required to space-out and support surface applied materials or other work as indicated.

.3 Align and plumb faces of furring and blocking to tolerance of 1:600.

.4 Install rough bucks, nailers and linings to rough openings as required to provide backing for frames and other work.

.5 Install wood cants, nailers, curbs and other wood supports as required and secure using steel fasteners.

3.3 NAILERS

.1 Install wood nailers as indicated.

.2 Except where indicated otherwise, use material at least 40 mm (1 ½”) thick secured with 10 mm (3/8”) bolts located within 300 mm (12”) from ends of members and uniformly spaced at 1200 mm (4’-0”) between.

.3 Countersink bolts where necessary to provide clearance for other work.

3.4 ERECTION .1 Frame, anchor, fasten, tie and brace members to provide necessary strength and rigidity.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 09 22 16 – Non-Structural Metal Framing.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
.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 00 01 00 - Submittal Procedures.

.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

2.2 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.

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 insulation 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, and minimum.

.6 Do not enclose insulation until it has been inspected and approved by Departmental Representative.

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

END OF SECTION

PART 1 - GENERAL

1.1 RELATED WORK

.1 Fire stopping and smoke seals within mechanical assemblies (i.e inside ducts, dampers) and electrical assemblies (i.e. inside cable trays) are specified in Divisions 21, 22, 23, 25, 26 and 28 respectively.

1.2 REFERENCES

.1 Underwriter's Laboratories of Canada (ULC)

.1 ULC-S115-Latest Edition, Fire Tests of Firestop Systems.

1.3 DEFINITIONS

.1 Fire Stop Material: device intended to close off opening or penetration during fire or materials that fill openings in wall or floor assembly where penetration is by cables, cable trays, conduits, ducts and pipes and poke-through termination devices, including electrical outlet boxes along with their means of support through wall or floor openings.

.2 Single Component Fire Stop System: fire stop material that has Listed Systems Design and is used individually without use of high temperature insulation or other materials to create fire stop system.

.3 Multiple Component Fire Stop System: exact group of fire stop materials that are Identified within Listed Systems Design to create on site fire stop system.

.4 Tightly Fitted; (ref: NBC Part 3.1.9.1.1): penetrating items that are cast in place in buildings of noncombustible construction or have "0" annular space in buildings of combustible construction.

.1 Words "tightly fitted" should ensure that integrity of fire separation is such that it prevents passage of smoke and hot gases to unexposed side of fire separation.

1.4 SUBMITTALS

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheet and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Submit WHMIS MSDS - Material Safety Data Sheets in accordance with Section 02 61 33 - Hazardous Materials.

.3 Shop Drawings:

.1 Submit shop drawings to show location, proposed material, reinforcement, anchorage, fastenings and method of installation.
.2 Construction details should accurately reflect actual job conditions.

.4 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control.

.1 Test reports: in accordance with CAN-ULC-S101 for fire endurance and CANULC-S102 for surface burning characteristics.
.1 Submit certified test reports from approved independent testing laboratories, indicating compliance of applied fire stopping with specifications for specified performance characteristics and physical properties.
.2 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
.3 Manufacturer's Instructions: submit manufacturer's installation instructions and special handling criteria, installation sequence, cleaning procedures.
.4 Manufacturer's Field Reports: submit to manufacturer's written reports within 3 days of review, verifying compliance of Work, as described in PART 3 – FIELD QUALITY CONTROL.

1.5 SAMPLES

.1 Submit samples in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit duplicate 300 x 300 mm samples showing actual firestop material proposed for project.

1.6 DELIVERY, STORAGE AND HANDLING

.1 Packing, shipping, handling and unloading:

.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 Deliver materials to the site in undamaged condition and in original unopened containers, marked to indicate brand name, manufacturer, and ULC markings.

.2 Storage and Protection:

.1 Store materials indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

1.7 WASTE MANAGEMENT AND DISPOSAL

.1 Separate and recycle waste materials in accordance with Section 01 74 19 - Construction/Demolition Waste Management And Disposal.

.2 Collect and separate plastic, paper packaging and corrugated cardboard in accordance with Waste Management Plan.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Fire stopping and smoke seal systems: in accordance with ULC-S115.

.1 Asbestos-free materials and systems capable of maintaining an effective barrier against flame, smoke and gases in compliance with requirements of ULC-S115 and not to exceed opening sizes for which they are intended [and conforming to special requirements specified in Part 3.
.2 Firestop system rating: In accordance with National Building Code (NBC).

.2 Service penetration assemblies: certified by ULC in accordance with ULC-S115 and listed in ULC Guide No.40 U19.

.3 Service penetration firestop components: certified by ULC in accordance with ULC-S115 and listed in ULC Guide No.40 U19.13 and ULC Guide No.40 U19.15 under the Label Service of ULC.

.4 Fire-resistance rating of installed fire stopping assembly in accordance with NBC.

.5 Fire stopping and smoke seals at openings intended for ease of re-entry such as cables: elastomeric seal.

.6 Fire stopping and smoke seals at openings around penetrations for pipes, ductwork and other mechanical items requiring sound and vibration control: elastomeric seal.

.7 Primers: to manufacturer's recommendation for specific material, substrate, and end use.

.8 Water: potable, clean and free from injurious amounts of deleterious substances.

.9 Damming and backup materials, supports and anchoring devices: to manufacturer's recommendations, and in accordance with tested assembly being installed as acceptable to authorities having jurisdiction.

.10 Sealants for vertical joints: non-sagging.

PART 3 - EXECUTION

3.1 PREPARATION

.1 Examine sizes and conditions of voids to be filled to establish correct thicknesses and installation of materials. Ensure that substrates and surfaces are clean, dry and frost free.

.2 Prepare surfaces in contact with fire stopping materials and smoke seals to manufacturer's instructions.

.3 Maintain insulation around pipes and ducts penetrating fire separation without interuption to vapour barrier.

.4 Mask where necessary to avoid spillage and over coating onto adjoining surfaces; remove stains on adjacent surfaces.

.5 Comply with manufacturer’s written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 INSTALLATION

.1 Install fire stopping and smoke seal material and components in accordance with ULC certification and manufacturer's instructions.

.2 Seal holes or voids made by through penetrations, poke-through termination devices, and unpenetrated openings or joints to ensure continuity and integrity of fire separation are maintained.

.3 Provide temporary forming as required and remove forming only after materials have gained sufficient strength and after initial curing.

.4 Tool or trowel exposed surfaces to a neat finish.

.5 Remove excess compound promptly as work progresses and upon completion.

3.3 INSPECTION

.1 Notify Consultant when ready for inspection and prior to concealing or enclosing firestopping materials and service penetration assemblies.

3.4 SCHEDULE

.1 Firestop and smoke seal at:

.1 Penetrations through fire-resistance rated masonry, concrete, and gypsum board partitions and walls.
.2 Edge of floor slabs at curtain wall and precast concrete panels.

.3 Top of fire-resistance rated masonry and gypsum board partitions.
.4 Intersection of fire-resistance rated masonry and gypsum board partitions.
.5 Control and sway joints in fire-resistance rated masonry and gypsum board partitions and walls.
.6 Penetrations through fire-resistance rated floor slabs, ceilings and roofs.
.7 Openings and sleeves installed for future use through fire separations.
.8 Around mechanical and electrical assemblies penetrating fire separations.
.9 Rigid ducts: greater than 129 cm^2: fire stopping to consist of bead of fire stopping material between retaining angle and fire separation and between retaining angle and duct, on each side of fire separation.

3.5 MANUFACTURER'S FIELD SERVICES

.1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 - SUBMITTALS.

.2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

.3 Schedule site visits, to review Work, as directed in PART 1 - QUALITY ASSURANCE.

3.6 CLEAN UP

.1 Remove excess materials and debris and clean adjacent surfaces immediately after application.

.2 Remove temporary dams after initial set of fire stopping and smoke seal materials.

67END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 08 11 16 – Aluminum Windows, Operable Sash

.2 Section 08 44 13 – Glazed Aluminum Curtain Walls

.3 Section 08 80 50 – Glazing

.4 Section 09 21 16 – Gypsum Board Assemblies

.5 Section 09 23 20 – Cement Plaster

1.3 REFERENCES

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

- .1 ASTM C 919-12, 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 00 10 00.

.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 00 10 00.

.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 00 10 00.
.1 Instructions to include installation instructions for each product used.

1.5 QUALITY ASSURANCE/MOCK-UP

.1 Construct mock-up in accordance with Section 00 10 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 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 in accordance with Section 01 15 45.

.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.

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 SEALANT 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 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.

2.3 SEALANT SELECTION

.1 Perimeters of exterior openings where aluminum frames meet exterior facade of building (i.e. brick, block, precast masonry): Sealant Type 2 or Type 4.

.2 Coping joints and coping-to facade joints: Sealant Type 2.

.3 Cornice and wash or horizontal surface joints: Sealant Type 2.

.4 Exterior joints in horizontal wearing surfaces (as itemized): Sealant Type 1.

.5 Seal interior perimeters of exterior openings as detailed on drawings: Sealant Type 1 or Type 4.

.6 Perimeters of interior frames, as detailed and itemized: Sealant Type 4.

.7 Joints at tops of non-load bearing masonry walls at the underside of poured concrete: Sealant Type 1.

.8 Exterior door thresholds bead of sealant over entire length of threshold: Sealant Type 2.

.9 Glazing butt sealant: Type 7 for clear interior or Type 4 for exterior.

.10 Air Barrier membranes to facades or window frames: Sealant Type 6.

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 RELATED SECTIONS

.1 Section 07 92 00 - Joint Sealing.

.2 Section 08 71 10 - Door Hardware.

.3 Section 09 22 16 – Non-Structural Metal Framing.

.4 Section 09 91 23 - Interior Painting.

.5 Division 26 – Wiring for Electronic Hardware.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM International)
.1 ASTM A 653/A653M-05a, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-1.181-99, Ready-Mixed Organic Zinc-Rich Coating.
.2 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.

.3 Canadian Standards Association (CSA International)
.1 G40.20/G40.21-98, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
.2 CSA W59-M1989 (R2001), Welded Steel Construction (Metal Arc Welding) (Metric Version).

.4 Canadian Steel Door Manufacturers' Association, (CSDMA).
.1 CSDMA, Specifications for Commercial Steel Doors and Frames, 2009.
.2 CSDMA, Recommended Selection and Usage Guide for Commercial Steel Doors, 2009.

.5 National Fire Protection Association (NFPA)
.1 NFPA 80-2016, Standard for Fire Doors and Fire Windows.
.2 NFPA 252-2012, Standard Methods of Fire Tests of Door Assemblies.

.6 Underwriters' Laboratories of Canada (ULC)
.1 CAN4-S104-80 2010, Fire Tests of Door Assemblies.
.2 CAN4-S105-85 R1992, Fire Door Frames Meeting the Performance Required by CAN4-S104.

.7 CAN/ULC-S701-01, Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.8 CAN/ULC-S702, Thermal Insulation, Mineral Fibre, for Buildings.

.9 CAN/ULC-S704, Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

.10 National Building Code of Canada, 2010.

1.3 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 00 10 00 - Submittal Procedures.

.2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, glazed arrangement of hardware, fire rating and finishes.

.3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings, reinforcing fire rating and finishes.

.4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

.5 Submit test and engineering data, and installation instructions.

1.4 REQUIREMENTS

.1 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN4-S104M for ratings specified or indicated.

.2 Provide fire labelled frame products for those openings requiring fire protection ratings, as scheduled. Test products in strict conformance with CAN4-S104, and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

1.5 WARRANTY

.1 Doors and frames shall be guaranteed against manufacturing defects for a period of three (3) years from the date of Certificate of Substantial Performance. Where defects occur, the Contractor shall be responsible for all costs, including painting, hanging and installing hardware, associated with replacing the defective doors.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Hot dipped galvanized steel sheet: to ASTM A 653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.

.2 Reinforcement channel: to CSA G40.20/G40.21, Type 44W, coating designation to ASTM A 653M, ZF75.

2.2 DOOR CORE MATERIALS

.1 Stiffened construction: face sheets welded, insulated core.
.1 Fibreglass: to CAN/ULC-S702, semi-rigid density 24 kg/m^3.

.2 Temperature rise rated (TRR): core composition to limit temperature rise on unexposed side of door to 250° C at 60 minutes. Core to be tested as part of a complete door assembly, in accordance with CAN4-S104, ASTM E 152 or NFPA 252, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency having factory inspection service.

2.3 PRIMER

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

2.4 PAINT

.1 Field paint steel doors and frames in accordance with Section 09 91 23 - Interior Painting. Protect weatherstrips from paint. Provide final finish shall be free of scratches or other blemishes.

2.5 ACCESSORIES

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

.2 Door bottom drop seal: refer to Section 08 71 10 – Door Hardware.

.3 Metallic paste filler: to manufacturer's standard.

.4 Fire labels: metal rivited.

.5 Sealant: In accordance with Section 07 92 00 – Joint Sealing.

2.6 FRAMES FABRICATION GENERAL

.1 Fabricate frames in accordance with CSDMA specifications.

.2 Fabricate frames to profiles and maximum face sizes as indicated.

.3 Interior frames: 1.6 mm welded type construction.

.4 Blank, reinforce, drill and tap frames for mortised, templated hardware, and electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.

.5 Protect mortised cutouts with steel guard boxes.

.6 Prepare frame for door silencers, 3 for single door.

.7 Manufacturer's nameplates on frames and screens are not permitted.

.8 Conceal fastenings except where exposed fastenings are indicated.

.9 Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.

.10 Insulate frame components with fibreglass insulation.

2.7 FRAME ANCHORAGE

.1 Provide appropriate anchorage to floor and wall construction.

.2 Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.

.3 Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.

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

2.8 FRAMES: WELDED TYPE

.1 Welding in accordance with CSA W59.

.2 Accurately mitre or mechanically joint frame product and securely weld on inside of profile.

.3 Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.

.4 Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.

.5 Securely attach floor anchors to inside of each jamb profile.

.6 Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.

2.9 DOOR FABRICATION GENERAL

.1 Doors: swing type, flush, with provision for louvre openings as indicated.

.2 Fire Rated Doors: Insulated hollow steel construction.

.3 Fabricate doors with longitudinal edges welded. Seams: grind welded joints to a flat plane, fill with metallic paste filler and sand to a uniform smooth finish

.4 Doors: manufacturers' proprietary construction, tested and/or engineered as part of a fully operable assembly, including door, frame, gasketing and hardware.

.5 Blank, reinforce, drill doors and tap for mortised and templated hardware.

.6 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.

.7 Reinforce doors where required, for surface mounted hardware. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.

.8 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.9 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in strict conformance with CAN4-S104 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

2.10 HOLLOW STEEL CONSTRUCTION

.1 Form each face sheet from 1.6 mm sheet steel.

.2 Reinforce doors with vertical stiffeners, securely welded to each face sheet at 150 mm on centre maximum.

.3 Fill voids between stiffeners of interior doors with fiberglass temperature rise rated core.

PART 3 - EXECUTION

3.1 INSTALLATION GENERAL

.1 Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.

.2 Install doors and frames to CSDMA Installation Guide.

3.2 FRAME INSTALLATION

.1 Set frames plumb, square, level and at correct elevation.

.2 Secure anchorages and connections to adjacent construction.

.3 Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.

.4 Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.5 Caulk perimeter of frames between frame and adjacent material.

3.3 DOOR INSTALLATION

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions and Section 08 71 10 - Door Hardware - General.

.2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.
.1 Hinge side: 1.0 mm.
.2 Latchside and head: 1.5 mm.
.3 Finished floor, top of carpet, noncombustible sill, and thresholds: 13 mm.

.3 Adjust operable parts for correct function.

.4 Install louvres.

3.4 FINISH REPAIRS

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

3.5 GLAZING

.1 Install glazing for doors and frames in accordance with Section 08 80 50 - Glazing.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 08 11 00 – Metal Doors and Frames.

.2 Division 26 Electrical: Electrical wiring for door operators, electric strikes.

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.

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.

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.

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.

PART 2 - PRODUCTS

2.1 HARDWARE ITEMS

.1 Use one manufacturer's products only for similar items.

2.2 DOOR HARDWARE

.1 Locks and latches:
.1 Bored and preassembled locks and latches: to CAN/CGSB-69.17, series 2000 preassembled lock, grade 1, designed for function and keyed As stated in Hardware Schedule.
.2 Mortise locks and latches: to CAN/CGSB-69.29, series 1000 mortise lock, grade 1, designed for function and keyed as stated in Hardware Schedule.
.3 Lever handles: plain design.
.4 Roses: round.
.5 Normal strikes: box type, lip projection not beyond jamb.
.6 Cylinders: key into keying system as noted.
.8 Finished to BHMA 626.

.2 Butts and hinges:
.1 Butts and hinges: to CAN/CGSB-69.18, designated by letter A and numeral identifiers, followed by size and finish, listed in Hardware Schedule.
.2 Acceptable Manufacturer:
.1 Hager ECBB1100NRP finished to BHMA C26D.

.3 Door Closers and Accessories:
.1 Door Controls (Closers): to CAN/CGSB-69.20, Designated Letter C.
.1 Acceptable Manufacturer:
.1 Corbin Russwin DC 3210 Parallel Arm Mounting, finished to BHMA 689.
.2 Door controls - overhead holders: to CAN/CGSB-69.24, designated by letter C, finished to C32D.

.4 Architectural door trim: to CAN/CGSB-69.22, designated by letter J and numeral identifiers as listed below, finished to BHMA C26D.
.1 Door protection plates: kick plate type, 1.27 mm thick stainless steel finished to BHMA 630.
.1 Acceptable Manufacturer:
.1 Don-Jo, Commercial Kickplate 90.
.2 Push plates: type 1.27 mm thick size 4” x 16”, stainless steel finished to BHMA 630.
.1 Acceptable Manufacturer:
.1 Don-Jo, Push Plate CFK71 and 71.
.3 Pull units: stainless steel, size 4” x 16”, finished to BHMA 630.
.1 Acceptable Manufacturer:
.1 Don-Jo, Pull Plate 7137 and CFC7115.

.5 Door bottom seal: heavy duty door seal of extruded aluminum frame and solid closed cell neoprene seal, surface mounted, closed ends, adjustable automatic retract mechanism when door is open, clear anodized finish.

.6 Thresholds: 150 mm wide x full width of door opening, extruded aluminum, serrated surface.

.7 Door Stops: Floor Mounted Door Stops
.1 Acceptable Manufacturer:
.1 Gallery Special Hardware GSH-209, finish to BHMA 626.

.8 Weatherstripping:
.1 Head and jamb seal:
.1 Extruded aluminum frame and hollow closed cell neoprene insert, clear anodized finish.
.2 Adhesive backed neoprene material.

.9 Barrier Free Pneumatic Door Operator:
.1 Heavy duty pneumatically assisted door closer, capable of multi-door operation, complete with actuators, control boxes, pneumatic tubing and compressed air source.
.2 Self contained control box/compressor combination for independent operation of two door leaves.
.3 Control boxes: complete with electric strike relay.
.4 Mount operators on either push or pull sides of doors as required to place them inside rooms.
.5 Actuation of operators by push plate.
.6 Electrical box and actuator/push plate: Hardwired low voltage actuator with heavy extruded aluminum push plate 150mm wide and 914mm high with “PUSH TO OPEN” and wheelchair symbol engraved blue. Box 51 mm wide x 102 mm high x 50 mm deep single gang electrical box, flush mounted in wall, locations indicated.
.7 Provide switched line voltage to control box. Locate switch adjacent to box.
.8 Provide low voltage wiring to each actuator and 6 mm diameter air tubing to each operator.
.9 Mount control box in location as directed by Departmental Representative.

2.3 FASTENINGS

.1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.

.2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

.3 Exposed fastening devices to match finish of hardware.

.4 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.

.5 Use fasteners compatible with material through which they pass.

2.4 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 masterkeys 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.

3.3 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.

3.4 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Clean hardware with damp rag and approved non-abrasive cleaner, and polish hardware in accordance with manufacture's instructions.

.3 Remove protective material from hardware items where present.

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

3.5 DEMONSTRATION

.1 Keying System Setup and Cabinet:
.1 Set up key control system with file key tags, duplicate key tags, numerical index, alphabetical index and key change index, label shields, control book and key receipt cards.
.2 Place file keys and duplicate keys in key cabinet on their respective hooks.
.3 Lock key cabinet and turn over key to Departmental Representative.

.2 Maintenance Staff Briefing:
.1 Brief maintenance staff regarding:
.1 Proper care, cleaning, and general maintenance of projects complete hardware.
.2 Description, use, handling, and storage of keys.
.3 Use, application and storage of wrenches for door closers, locksets.

.3 Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.6 SCHEDULE

.1 Building M-2:
.1 Single Door 124:
.1 3 pairs hinges
.2 1 pull unit
.3 1 push plate
.4 1 kickplate
.5 1 closer device
.6 1 floor stop
.7 1 classroom deadlock with thumbturn inside
.2 Single Door 124A:
.1 3 pairs hinges
.2 1 kickplate
.3 1 floor stop
.4 1 lockset – function: closet

.3 Single Door 133:
- .1 3 pairs hinges
- .2 1 kickplate
- .3 1 closer device
- .4 1 barrier-free door operator with two buttons
- .5 1 floor stop
- .6 1 lockset – function: passage

.4 Single Door 133A:
- .1 3 pairs hinges
- .2 1 kickplate
- .3 1 closer device
- .4 1 barrier-free door operator with two buttons
- .5 1 lockset – function: Privacy with “Occupied” indicator
- .6 1 floor stop

.5 Single Door 133B:
- .1 3 pairs hinges
- .2 1 kickplate
- .3 1 pull unit
- .4 1 push plate
- .5 1 closer device
- .6 1 barrier-free door operator with two push buttons
- .7 1 floor stop
- .8 1 classroom deadlock with thumbturn inside

.6 Single Door 271A:
- .1 3 pairs hinges
- .2 1 kickplate
- .3 1 closer device
- .4 1 lockset – function: Privacy with “Occupied” indicator
- .5 Floor stop

.7 Single Door 271B:
- .1 3 pairs hinges
- .2 1 kickplate
- .3 1 closer device
- .4 1 pull unit
- .5 1 push plate
- .6 1 classroom deadlock with thumbturn inside

.2 Building M-59:

.1 Single Door 129A:
- .1 3 pairs hinges
- .2 1 pull unit
- .3 1 push plate
- .4 1 kickplate
- .5 1 closer device
- .6 1 barrier-free door operator with two buttons
- .7 1 classroom deadlock with 1 thumbturn inside
- .8 1 overhead stop
- .9 1 weatherstripping
- .10 1 bottom seal
- .11 1 aluminum threshold

.2 Single Door 129B:
- .1 3 pairs hinges
- .2 1 pull unit
- .3 1 push plate
- .4 1 kickplate
- .5 1 closer device
- .6 1 floor stop
- .7 1 weatherstripping
- .8 1 bottom seal
- .9 1 aluminum threshold

.3 Single Door 104:
- .1 3 pairs hinges
- .2 1 kickplate
- .3 1 closer device
- .4 1 lockset – function: Privacy with “Occupied” indicator
- .5 1 overhead stop

.4 Single Door 115:
- .1 3 pairs hinges
- .2 1 kickplate
- .3 1 closer device
- .4 1 barrier-free door operator with two push buttons
- .5 1 pull unit
- .6 1 push plate
- .7 1 classroom deadlock with thumbturn inside
- .8 1 overhead stop

END OF SECTION

PART 1 - GENERAL

1.1 REFERENCES

.1 Government of Canada
.1 Canada Labour Code, WHMIS datasheets.

1.2 SUBMITTALS

.1 Submittals in accordance with Section 00 10 00.

.2 Product Data: submit WHMIS MSDS - Material Data Sheets in accordance with Section 02 61 33 - Hazardous Materials.

.3 Submit shop drawings and product data in accordance with Section 00 10 00.

.4 Submit samples in accordance with Section 00 10 00.
.1 Submit one 500 x 500 mm sample of film installed on 6 mm thick clear plate glass.

.5 Submit Closeout Submittals in accordance with Section 00 10 00.
.1 Provide operation and maintenance data for window film for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
.2 Follow manufacturers written instructions for care and maintenance of blockout film.
.3 Use only cleaning solution recommended by manufacturer for regularly scheduled cleaning of security film.

1.3 QUALITY ASSURANCE

.1 Health and Safety:
.1 Comply with requirements of WHMIS regarding use, handling, storage, and disposal of hazardous materials; and regarding labelling and provision of material safety data sheets acceptable to Canada Labour Code.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Deliver, store and handle materials in accordance with Section 00 10 00.

.2 Provide and maintain dry, off-ground weatherproof storage.

.3 Store rolls of film flat on cross supports. Do not stand rolls of film on end.

.4 Remove from storage, in quantities required for same day use.

.5 Store materials in accordance with manufacturers written instructions.

.6 Waste Management and Disposal:
.1 Separate and recycle waste materials.
.2 Place materials defined as hazardous or toxic waste in designated containers.
.3 Ensure emptied containers are sealed and stored safely.

1.6 WARRANTY

.1 Work of this Section 08 87 53 - Applied Films 5 years warranty period.

.2 Contractor hereby warrants that Blockout and Safety Strip Film will stay in place without delaminating, peeling or blistering.

.3 Ensure warranty includes items as follows:
.1 Maintaining adhesion properties without blistering, bubbling or delaminating from glass surface.
.2 Maintaining appearance without discolouration.
.3 Removing, replace and reapply defective materials.

1.7 MAINTENANCE DATA

.1 Provide operation and maintenance data for window film for incorporation into manual specified in Section 00 10 00.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Basis of Design Product – Blockout Film:
.1 3M Blockout Film 3635-226b.
.2 Light transmission: less than 1%, typical.
.3 Thickness: without adhesive 0.10 mm (4 ml).
.4 Adhesive Type: clear.
.5 Adhesive Colour: clear.
.6 Tensile Strength: 0.9 kg/CM at 23^0C.
.7 Chemical Resistance: resistance to mild alkaids, mild acids and salt.
.8 Resistance to water.

.2 Basis of Design Product – Translucent Film:
.1 3M Fasara Interior design privacy film.
.2 Thickness: without adhesive 0.10 mm (4 ml).
.3 Adhesive Type: clear.
.4 Adhesive Colour: clear.
.5 Tensile Strength: 0.9 kg/CM at 23^0C.
.6 Chemical Resistance: resistance to mild alkaids, mild acids

PART 3 - EXECUTION

3.1 PREPARATION

.1 Clean glass before beginning installation using neutral cleaning solution.

.2 Ensure no deleterious material adheres to glass by scraping surface of glass using industrial razors.

.3 Ensure dust, grease, and chemical residue are removed from surface of glass before installation of film.

.4 Examine glass under natural daylight and identify cracks, blisters, bubbles, discolouration, edge defects or other anomalies that may cause film to delaminate or cause vision transparency or distortion problems. Report findings to Departmental Representative.

3.2 INSTALLATION

.1 Field Installation of Blockout and Translucent Film to Glass:
.1 Install film in accordance with manufacturer's written instructions.
.2 Ensure dust, grease, and chemical residue are removed from surface of glass before installation of film.
.3 Examine glass under natural daylight and identify cracks, blisters, bubbles, discolouration, edge defects or other anomalies that may cause film to delaminate, or cause vision transparency or distortion problems. Report findings to Departmental Representative before starting Work.
.4 Install security film to glass windows ensuring no blisters, bubbles, scratches or distortions.

.2 Cut film edges straight and square.

.3 Cut edges tight to edge of glass sealing device and in accordance with manufacturers written instructions.

.4 Apply and attach film to glass in accordance with manufacturer's written instructions.

.5 Splicing:
.1 Splice film only when glass is greater in width than film.
.2 Splice film only after receipt of written approval from Departmental Representative.
.3 Use butt factory edges only.

3.3 FINAL CLEANING

.1 Wash interior and exterior of each glass panel and film using cleaning solution recommended by film manufacturer.

END OF SECTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

.1 Portland Cement plaster repair work.

1.2 RELATED SECTIONS

.1 Section 06 10 11 – Rough Carpentry.

.2 Section 09 91 23 – Interior Painting.

1.3 REFERENCES

.1 American Society for Testing and Materials (ASTM International)
- .1 ASTM C206-14, Specification for Finishing Hydrated Lime.
- .2 ASTM C150-15, Standard Specification for Portland Cement.
- .3 ASTM C207-06(2011), Standard Specification for Hydrated Lime for Masonry Purposes.
- .4 ASTM C897-15, Standard Specification for Aggregate for Job-Mixed Portland Cement-Based Plasters.
- .5 ASTM C926-16, Standard Specification for Application of Portland Cement-Based Plaster.
- .6 ASTM C1059-13, Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.
- .7 ASTM C1583-13, Standard Test Method for Tensile Strength of Concrete Surfaces and the Bond Strength or Tensile Strength of Concrete Repair and Overlay Materials by Direct Tension (Pull-off Method).

.2 Canadian Standards Association (CSA International)
- .1 CAN/CSA-A3000-98, Cementitious Materials Compendium.

.3 CAN/CSA-A5-98, Portland Cement. CAN/CSA-A82.57-M1977 Inorganic aggregates for use in interior plaster.

.4 Association of Wall and Ceiling Contractors (AWCC):
- .1 Association of Wall and Ceiling Contractors Specification Standards Manual", 2003 Edition, Section 9.3 – Stucco (AWCC Manual).

1.4 QUALITY ASSURANCE

.1 Qualifications: Work to be undertaken by skilled personal with a minimum 5 years' experience, references to be made available upon request.

.2 Mock-up: construct mock-up in accordance with Section 00 10 00.

.3 Before application of plaster, at location designated by Departmental Representative, prepare 1 m^2 representative sample plastering coat.

.4 Allow 24 hours for inspection of mock-up by Departmental Representative before proceeding with plaster work.

.5 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

1.5 DELIVERY, STORAGE, AND HANDLING

.1 Deliver, store and handle in accordance with the provision of Section 00 10 00.

.2 Ensure bagged materials are delivered to site and stored in original containers.

.3 Ensure loose material is delivered, clean, and stored to prevent contamination by foreign material.

.4 Protect material from damage by moisture and freezing.

1.6 ENVIRONMENTAL REQUIREMENTS

.1 Do plaster work when ambient temperature is between 13° C and 21° C under conditions specified in ASTM C 842.

.2 Ventilate to facilitate proper application and curing of plaster.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Metal Lath: Use galvanized, metal lath to ASTM C 841 of type and weight to suit plaster system and support spacing.

.2 Hydrated Lime: to ASTM C 206.

.3 Cement: to CAN/CSA-A3000.

.4 Portland Cement: to CAN/CSA-A3000.

.5 Bonding Adhesive: to ASTM C1059.

.6 Sand: to ASTM C 35. Clean, sharp, free from deleterious matter.

.7 Water: potable, free of substances that would affect set of plaster.

2.2 MIXES

.1 Mix plaster in accordance with CAN/CSA-A82.57-M1977.

.2 Accurately maintain measuring proportions from batch to batch.

.3 Have materials batch mixed.

.4 Keep mixing tools and bins free of hardened residue.

PART 3 - EXECUTION

3.1 EXAMINATION

.1 Examine existing plaster surfaces and methods of reproducing finish.

3.2 PROTECTION

.1 Protect any fittings and surfaces adjacent to work by covering or masking.

3.3 PREPARATION

1 Ensure that all existing wall surfaces are sound and solid before beginning repairs. Remove loose, unsound or flaking plaster on walls at windows which has been damaged by water or as a result of construction.

.2 Install wire lath in large holes as required.

.3 Before repairing, coat all existing plaster surfaces with "Plaster-Weld" by Larsen Products Corp or "Plaster Bonder" by United States Gypsum Co to prevent re-hydration of plaster.

.4 Fill all depressions and cracks as noted above to obtain a suitable base for new finishes. Completed installation to be smooth, level or plumb, free from waves and other defects.

.5 Do not repair plaster until adjacent finished work has been masked or protected from damage in a suitable manner.

.6 Ensure ground, screeds, beads and accessories are in place and conduits, pipes, cables and outlets are properly plugged, capped or covered before commencing work.

.7 Where plaster butts exposed masonry walls, insert 1 m (3’-3”) wide strip of polyethylene before applying plaster to protect masonry. Cut polyethylene neatly at junction with plaster when plastering completed.

.8 Apply adhesives to bond new plaster with existing.

3.4 INSTALLATION

.1 Repair of metal lath.
.1 Remove and replace lath, as required, with new metal lath.

.2 Use bonding agents on masonry.

3.5 APPLICATION

.1 Ensure that plaster finish follows surface irregularities to maintain authenticity of original work.

.2 Do plaster work to ASTM C 842, unless otherwise specified.

.3 Base Coat:
.1 Apply first coat, with trowel, using sufficient pressure to force it between gaps of lath. Ensure even surface.
.2 Scratch surface with broom when initial set is obtained (2-4 days).
.3 Keep base coat damp for 3 days.
.4 Cure base coat 10 days in ventilated surroundings.

.4 Intermediate scratch coat:
.1 Wet base coat 2 hours before application of scratch coat.
.2 Apply scratch coat.
.3 Keep scratch coat damp for 2 days.
.4 Cure 6 days.

.5 Finish coat:
.1 Wet intermediate coat thoroughly.
.2 Apply finish coat to 3 mm thickness minimum.
.3 Smooth finish coat with wood trowel to achieve desired texture and appearance.
.4 Trowel patch work to smooth surface, even with adjacent work.

3.6 CLEANING

.1 Remove droppings and splashings, immediately, using clean sponge and water.

3.7 PROTECTION

.1 Protect finished adjoining work, during execution of plaster work, with polyethelene sheets or building paper.

.2 Remove surplus material, tools, equipment and debris from work area on completion of work.

END OF SECTION

PART 1 - GENERAL

1,1 RELATED SECTIONS

.1 Section 06 10 00 – Rough Carpentry.

.2 Section 08 11 00 – Metal Doors and Frames

.3 Section 09 03 51 – Historic – Plaster

.4 Section 09 22 16 – Non-Structural Metal Framing

.5 Section 09 30 13 – Ceramic Tiling

1.2 REFERENCES

.1 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 630/C630M-01, Specification for Water-Resistant Gypsum Backing Board.
.7 ASTM C 840-01, Specification for Application and Finishing of Gypsum Board.
.9 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.
.10 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.
.11 ASTM C 1047-99, Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
.12 ASTM C 1280-99, Specification for Application of Gypsum Sheathing Board.
.13 ASTM C 1177-01, Specification for Glass Mat Gypsum Substrate for Use as Sheathing.
.14 ASTM C 1178/C1178M-01, Specification for Glass Mat Water-Resistant Gypsum Backing Board.

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

.3 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-51.34-M86 R1988, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.4 Underwriters' Laboratories of Canada (ULC)
.1 CAN/ULC-S102-1988 R2000, 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 samples in accordance with Section 00 10 00.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Standard board: to ASTM C 36/C36M regular, Type X, 16 mm thick, 1200 mm wide x maximum practical length, ends square cut, edges squared.

.2 Glass-mat Moisture Resistant Board:
To ASTM D3273, ASTM C1658, and ASTM C1177, 16 mm thick, 1200 mm wide x maximum practical length, ends square cut, edges squared.

.3 Cement Backer Board:
To ASTM C473, ASTM D3273 and ASTM C627, 16 mm thick, 1200 mm wide x maximum practical length, edges squared.

.4 Insulating strip: rubberized, moisture resistant, closed cell neoprene strip, 50 mm wide.

.5 Casing beads, corner beads, control joints and “J-Trim” edge trim: to ASTM C 1047, zinc-coated zinc-coated by electrolytic process, 0.5 mm base thickness, perforated flanges, one piece length per location.

.6 Joint compound: to ASTM C 475, asbestos-free and as recommended by manufacturer.

.7 Tape: as recommended by manufacturer.

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 840 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 19 x 64 mm 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 Install 150 mm continuous strip of 12.7 mm gypsum board along base of partitions where resilient furring installed.

3.2 APPLICATION

.1 Do not apply gypsum board until bucks, anchors, blocking, sound attenuation, electrical and mechanical work are approved.

.2 Apply single layer gypsum board to metal furring or framing using screw fasteners. Maximum spacing of screws 300 mm on centre.

.3 Apply single layer gypsum board to concrete or terracotta block surfaces, where indicated, using screw fasteners.

.4 Install gypsum board with face side out.

.5 Do not install damaged or damp boards.

3.3 INSTALLATION

.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 access doors to electrical and mechanical fixtures specified in respective sections.
.1 Rigidly secure frames to furring or framing systems.

.6 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.

.7 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 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.

.8 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.

.9 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.

.10 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.11 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

.12 Apply one coat of white primer sealer over surface to be textured. When dry apply textured finish in accordance with manufacturer's instructions.

.13 Mix joint compound slightly thinner than for joint taping.

.14 Apply thin coat to entire surface using trowel or drywall broadknife to fill surface texture differences, variations or tool marks.

.15 Allow skim coat to dry completely.

.16 Remove ridges by light sanding or wiping with damp cloth.

.17 Provide protection that ensures gypsum drywall work will remain without damage or deterioration at time of substantial completion.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 06 10 100 – Rough Carpentry.

.2 Section 09 21 16 - Gypsum Board Assemblies.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).
.1 ASTM C 645-07, Specification for Nonstructural Steel Framing Members.
.2 ASTM C 754-15, Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.

.2 Canadian General Standards Board (CGSB).
.1 CAN/CGSB-1.40-97, Primer, Structural Steel, Oil Alkyd Type.

1.3 QUALITY ASSURANCE

.1 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Non-load bearing channel stud framing: to ASTM C 645, 64 mm, 92 mm, 152 mm stud size, roll formed from 0.91 mm (20 gauge) thickness hot dipped galvanized steel sheet, for screw attachment of gypsum board. Knock-out service holes at 460 mm centres.

.2 Floor and ceiling tracks: to ASTM C 645, in widths to suit stud sizes, 32 mm flange height.

.3 Metal channel stiffener: 1.4 mm thick cold rolled steel, coated with rust inhibitive coating.

.4 Insulating strip: rubberized, moisture resistant 3 mm thick lengths as required.

PART 3 - EXECUTION

3.1 ERECTION

.1 Align partition tracks at floor and ceiling and secure at 300 mm on centre maximum.

.2 Install damp proof course under stud shoe tracks of partitions on slabs on grade.

.3 Place studs vertically at 355 mm (14”) on centre 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 ceiling track using screws.

.6 Co-ordinate simultaneous erection of studs with installation of service lines. When erecting studs ensure web openings are aligned.

.7 Co-ordinate erection of studs with installation of door/window frames and special supports or anchorage for work specified in other Sections.

.8 Provide two studs extending from floor to ceiling at each side of openings wider than stud centres specified. Secure studs together, 50 mm apart using column clips or other approved means of fastening placed alongside frame anchor clips.

.9 Install heavy gauge single jamb studs at openings.

.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 instructions. Install intermediate studs above and below openings in same manner and spacing as wall studs.

.11 Frame openings and around built-in equipment, cabinets, access panels, on four sides. Extend framing into reveals. Check clearances with equipment suppliers.

.12 Provide 40 mm stud or furring channel secured between studs for attachment of fixtures behind lavatory basins, toilet and bathroom accessories, and other fixtures including grab bars and towel rails, attached to steel stud partitions.

.13 Install steel studs or furring channel between studs for attaching electrical and other boxes.

.14 Extend partitions to ceiling height except where noted otherwise on drawings.

.15 Maintain clearance under beams and structural slabs to avoid transmission of structural loads to studs. Use 50 mm leg ceiling tracks.

.16 Install continuous insulating strips to isolate studs from uninsulated surfaces.

3.2 CLEANING

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

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 00 10 00 - Submittal Procedures.

.2 Section 07 92 10 - Joint Sealing.

.3 Section 09 21 16 – Gypsum Board Assemblies

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 Grounts (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 - Submittal Procedures.

.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 - Submittal Procedures.

.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 2% 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 Ceramic mosaic tile: to CAN/CGSB-75.1, Type 2, Class MR 1, 50 x 50 mm size, slip resistant surface, Matching coved base, 150 mm high.

.2 Acceptable Material:
.1 CMT-1: Olympia Quebec Series / “Anthracite” Unglazed.

2.2 WALL TILE

.1 Ceramic tile: to CAN/CGSB-75.1, Type 5, Class MR 1, matt glazed surface.

.2 Acceptable Material:
.1 CT-1: By Olympia Ontario Series “Snow White Matte” Size: 50 x 50 mm.
.2 CT-2: By Olympia Yura New Series – Lead Grey, Size: 300 x 600 mm.

2.3 THIN SET MORTAR AND ADDITIVES

.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.

2.4 BOND COAT

.1 Latex Portland Cement mortar: to ANSI A108.1, two-component universal dry-set mortar.

2.5 WATERPROOFING SYSTEM

.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.

2.6 GROUT

.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.

2.7 ACCESSORIES

.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.

.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.

.6 Top of ceramic tile base: Schluter – Jolly.

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

.3 Thresholds: marble, 16 mm thick, bevelled one side, honed finish to exposed surfaces, 100 mm wide as indicated.

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, fitments, 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.

3.2 WALL TILE

.1 In shower stalls and as indicated install CT-1 tiles in full height of all shower walls and to underside of ceiling.

.2 In washrooms as indicated, install CT-2 tiles Wainscot up to 1100 mm above finish floor and full height of walls and to underside of ceiling at urinals and where indicated.

3.3 FLOOR TILES

.1 Install mosaic floor tiles type CMT-1 in all shower rooms.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Related Sections:
.1 Section 09 53 00.01 - Acoustical Suspension.

1.2 REFERENCES

.1 American Society for Testing and Materials International (ASTM)
.1 ASTM C 423-09a, Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
.2 ASTM E 1264-14, Standard Classification for Acoustical Ceiling Products.
.3 ASTM E 1477-98a(2013), Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers.

.2 Canadian General Standards Board (CGSB)
.1 CAN/CGSB-51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction and Amendment No. 1 1988.
.2 CAN/CGSB-92.1-M89, Sound Absorptive Prefabricated Acoustical Units.

.3 Canadian Standards Association (CSA International)
.1 CSA B111-1974(R2003), Wire Nails, Spikes and Staples.

.4 Department of Justice Canada (Jus)
.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.
.2 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

.5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).

.6 Underwriter's Laboratories of Canada (ULC)
.1 CAN/ULC-S102-10, Surface Burning Characteristics of Building Materials and Assemblies.

1.3 SUBMITTALS

.1 Submit samples in accordance with Section 00 10 00.

.2 Submit duplicate 6” x 6” samples of each type acoustical units.

1.4 DELIVERY, STORAGE AND HANDLING

.1 Protect on site stored or installed absorptive material from moisture damage.

.2 Store extra materials required for maintenance, where directed by Departmental Representative.

1.5 ENVIRONMENTAL REQUIREMENTS

.1 Permit wet work to dry before beginning to install.

.2 Maintain uniform minimum temperature of 15 degrees C and humidity of 20 - 40 % before and during installation.

.3 Store materials in work area 48 hours prior to installation.

1.6 EXTRA MATERIALS

.1 Provide extra materials of acoustic units in accordance with Section 00 10 00.

.2 Provide acoustical units amounting to 4% of gross ceiling area for each pattern and type required for project.

.3 Ensure extra materials are from same production run as installed materials.

.4 Clearly identify each type of acoustic unit, including colour and texture.

.5 Deliver to Departmental Representative, upon completion of the work of this section.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Acoustic units for suspended ceiling system]: to CAN/CGSB-92.1, ASTM E 1264.
- .1 Type XX.
- .2 Class A.
- .3 Wet formed ceramic and mineral fiber composite.
- .4 Pattern CE, Class A.
- .5 Textures: fine fissured.
- .6 Flame spread rating of 25 or less in accordance with CAN/ULC-S102.
- .7 Smoke developed 50 or less in accordance with CAN/ULC-S102.
- .8 Noise Reduction Coefficient (NRC) designation of 0.55.
- .9 Ceiling Attenuation Class (CAC) rating 40, in accordance with ASTM E 1264
- .10 Light Reflectance (LR) range of 0.82 to ASTM E 1477.
- .11 Edge type square edge.
- .13 Colour white.
- .14 Size 610 mm x 1220 mm x 16 mm thick.
- .15 Shape flat.
- .16 Sag resistant.
- .17 Anti-mold and mildew.
- .18 Acceptable Material:
  - .1 Ceramaguard – Fine Fissured by Armstrong.

PART 3 - EXECUTION

3.1 EXAMINATION	.1	Do not install acoustical panels and tiles until work above ceiling has been inspected by Departmental Representative.
3.2 INSTALLATION	.1	Install acoustical panels and tiles in ceiling suspension system.
3.3 INTERFACE WITH OTHER WORK	.1	Co-ordinate ceiling work to accommodate components of other sections, such as light fixtures, diffusers, speakers, sprinkler heads, to be built into acoustical ceiling components.
3.4 EXISTING CEILINGS	.1	Where existing ceilings are affected by new work, remove ceilings as required and reinstall using undamaged existing components. Replace damaged components with new matching components.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 09 51 13 - Acoustical Ceilings: Acoustical units.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM International)
.1 ASTM C 635-07, Specifications for the Manufacture, Performance and Testing of Metal Suspension Systems for Acoustical Tile and Lay-In Panel Ceilings.
.2 ASTM C 636-13, Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels.

1.3 DESIGN REQUIREMENTS

.1 Maximum deflection: 1/360th of span to ASTM C 635 deflection test.

1.4 SHOP DRAWINGS

.1 Submit shop drawings in accordance with Section 00 10 00.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Intermediate duty system to ASTM C 635.

.2 Basic materials for suspension system: commercial quality cold rolled steel zinc coated.

.3 Suspension system: non fire rated, made up as follows:
.1 two directional exposed tee bar grid.
.1 Acceptable material:
.1 Bailey Metal Products Ltd.: Exposed two directional Tee Grid System.
.2 Donn DX, Suspension System by CGC Inc.
.3 Prelude XL, Exposed Tee System by Armstrong.

.4 Exposed tee bar grid components: shop painted satin sheen white. Components die cut. Main tee with double web, rectangular bulb and 25 mm rolled cap on exposed face. Cross tee with rectangular bulb; web extended to form positive interlock with main tee webs; lower flange extended and offset to provide flush intersection.

.5 Hanger wire: galvanized soft annealed steel wire.
.1 3.6 mm diameter for access tile ceilings.
.2 to ULC design requirements for fire rated assemblies.
.3 2.6 mm diameter for [other] ceilings.

.6 Hanger inserts: purpose made.

.7 Accessories: splices, clips, wire ties, retainers and wall moulding flush, to complement suspension system components, as recommended by system manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Installation: in accordance with ASTM C 636 except where specified otherwise.

.2 Install suspension system to manufacturer's instructions and Certification Organizations tested design requirements.

.3 Do not erect ceiling suspension system until work above ceiling has been inspected by Departmental Representative.

.4 Install hangers spaced at maximum 1200 mm centres and within 150 mm from ends of main tees.

.5 Lay out system according to reflected ceiling plan.

.6 Ensure suspension system is co-ordinated with location of related components.

.7 Install wall moulding to provide correct ceiling height.

.8 Completed suspension system to support super-imposed loads, such as lighting fixtures, diffusers,]grilles, and speakers.

.9 Support at light fixtures, diffusers with additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.10 Interlock cross member to main runner to provide rigid assembly.

.11 Frame at openings for light fixtures, air diffusers, speakers and at changes in ceiling heights.

.12 Finished ceiling system to be square with adjoining walls and level within 1:1000.

3.2 CLEANING

.1 Touch up scratches, abrasions, voids and other defects in painted surfaces.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 00 10 00 - Submittal Procedures.

.2 Section 05 50 00 – Metal Fabrication.

.3 Section 09 65 19 – Resilient Tile Flooring.

1.2 REFERENCES

.1 American Society for Testing and Materials (ASTM International)
.1 ASTM F 1913 Standard Specification for Vinyl Sheet Floor Covering Without Backing.
.2 ASTM D 2047, Standard Test Method for State Coefficient of Friction of Polish-Coated Flooring of 0.6 or greater.
.3 ASTM F 970, Standard Test Method for Static Load Limit – 250 PSI.
.4 ASTM E 648, Standard Test Method for Critical Radiant Flux of 0.45 watts/cm^2 or greater, Class I.

.2 Canadian Standards Association (CSA International)
.1 CAN/CSA-ISO 14040-06(r2011), Environmental Management - Life Cycle Assessment - Principles and Framework.

1.3 SAMPLES

.1 Submit samples in accordance with Section 00 10 00 - Submittal Procedures.

.2 Submit duplicate 300 x 300 mm sample pieces of sheet material, 300 mm long base, edge strips.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for resilient flooring for incorporation into manual specified in Section 00 10 00.

1.5 EXTRA MATERIALS

.1 Provide extra materials of resilient sheet flooring and adhesives in accordance with Section 00 10 00 Closeout Submittals.

.2 Provide 1 m^2 of each colour, pattern and type flooring material required for project for maintenance use.

.3 Extra materials to be in one piece and from same production run as installed materials.

.4 Clearly identify each roll of sheet flooring and each container of adhesive.

.5 Deliver to Departmental Representative, upon completion of the work of this section.

.6 Store where directed by Departmental Representative.

1.6 ENVIRONMENTAL REQUIREMENTS

.1 Maintain air temperature and structural base temperature at flooring installation area above 20° for 48 hours before, during and 48 hours after installation.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Resilient Homogeneous Vinyl Sheet Flooring: to ASTM F 1913, without backing.
- .1 Colour: #864 – Concrete Slab.
- .2 Thickness: 2 mm.
- .3 Acceptable material: Optima as manufactured by Johnsonite Inc.

.2 Resilient stair tread and one piece stair tread/riser: rubber, 30 mm vertical face, round nose, full tread deep, full tread width, 3 mm thick, raised round pattern, surface with carborundum strips, colour selected by Departmental Representative.

.3 Primers and adhesives: of types recommended by resilient flooring manufacturer for specific material on applicable substrate.
- .1 Adhesive
  - .1 Acceptable Material: Johnsonite #975 Two-Part Urethane Adhesive.

.4 Sub-floor filler and leveller: Latex modified Portland Cement based.

.5 Metal edge strips:
- .1 Aluminum extruded, smooth, mill finish with lip to extend under floor finish.

.6 External corner protectors: type recommended by flooring manufacturer.

.7 Edging to floor penetrations: aluminum, type recommended by flooring manufacturer.

.8 Cove Base Filler Strip:
- .1 Acceptable Material: CFS-00-A Cove Filler Strip as manufactured by Johnsonite Inc.

.9 Transition and reducer trims, vinyl, colour to match sheet flooring, size and shape purpose-made. Acceptable Manufacturer: Bengard.

.10 Sealer and wax: type recommended by resilient flooring material manufacturer for material type and location.

PART 3 - EXECUTION

3.1 SITE VERIFICATION OF CONDITIONS

.1 Ensure concrete floors are clean and dry by using test methods recommended by flooring manufacturer.

3.2 PREPARATION

.1 Remove sub-floor ridges and bumps. Fill low spots, cracks, joints, holes and other defects with sub-floor filler.

.2 Clean floor and apply filler; trowel and float to leave smooth, flat hard surface. Prohibit traffic until filler cured and dry.

.3 Prime sub-floor to resilient flooring manufacturer's printed instructions.

.4 Prepare Substrates according to ASTM F 710 including the following:
.1 Moisture Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
.1 Perform anhydrous calcium chloride test, ASTM F 1869. Results must not exceed 5 lbs. Moisture Vapour Emission Rate per 1,000 sq. ft. in 24 hours.
-or-
.2 Perform relative humidity test using in situ probes, ASTM F 2170. Must not exceed 80%.
.2 A pH test for alkalinity must be conducted. Results should range between 7 and 9. If the test results are not within the acceptable range of 7 to 9, the installation must not proceed until the problem has been corrected.
.3 Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer.

3.3 APPLICATION: FLOORING

.1 Provide a high ventilation rate, with maximum outside air, during installation, and for 48 to 72 hours after installation. If possible, vent directly to the outside. Do not let contaminated air recirculate through a district or whole building air distribution system.

.2 Apply adhesive uniformly using recommended trowel. Do not spread more adhesive than can be covered by flooring before initial set takes place.

.3 Lay flooring with seams parallel to building lines to produce a minimum number of seams. Border widths minimum 1/3 width of full material.

.4 Run sheets in direction of traffic. Double cut sheet joints and continuously heat weld according to manufacturer's printed instructions.

.5 As installation progresses, and after installation roll flooring with 45 kg minimum roller to ensure full adhesion.

.6 Cut flooring neatly around fixed objects.

.7 Terminate flooring at centreline of door in openings where adjacent floor finish.

.8 Install metal edge strips at top of cove base and vinyl transition or reducer trim at exposed edges where flooring terminates.

3.4 APPLICATION: STAIRS

.1 Install stair treads and risers one piece for full width of stair. Adhere over entire surface and fit accurately.

3.5 APPLICATION: BASE

.1 Cove Base: 200 mm high.

.2 Lay out base to keep number of joints at minimum.

.3 Clean substrate and prime with one coat of adhesive.

.4 Apply adhesive to back of base.

.5 Set base against wall and floor surfaces tightly by using 3 kg hand roller.

.6 Install straight and level to variation of 1:1000.

.7 Scribe and fit to door frames and other obstructions. Use premoulded end pieces at flush door frames.

.8 Cope internal corners. Use premoulded corner units for right angle external corners. Use formed straight base material for external corners of other angles.

.9 Use cove type base.

.10 Heat weld base in accordance with manufacturer's printed instructions.

3.6 CLEANING

.1 Remove excess adhesive from floor, base and wall surfaces without damage.

.2 Clean, seal and wax floor and base surface to flooring manufacturer's printed instructions.

3.7 PROTECTION

.1 Protect new floors from time of final set of adhesive.

.2 Prohibit traffic on floor for 48 hours after installation.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 00 10 00 - Submittal Procedures.

.2 Section 05 50 00 – Metal Fabrication.

.3 Section 09 65 19 – Resilient Tile Flooring.

1.2 EXAMINATION

. .1 Examine surfaces on which rubber flooring and base are to be installed and ensure that they are flush, level, dry, and free from deleterious substances. Commencement of work implies full acceptance of responsibility for the appearance and function of floor and base finishes. Report to the Architect any defects which may affect the work.

.2 Immediately prior to installation of flooring, test concrete slab for excessive moisture content by a method acceptable to the flooring manufacturer.

1.3 SAMPLES

.1 Submit samples in accordance with Section 00 10 00 - Submittal Procedures.

.2 Submit duplicate 300 x 300 mm sample pieces of sheet material, 300 mm long base, edge strips.

1.4 CLOSEOUT SUBMITTALS

.1 Provide maintenance data for resilient tile flooring for incorporation into manual specified in Section 00 10 00.

1.5 ENVIRONMENTAL REQUIREMENTS

. 1 Maintain air temperature and structural base temperature at flooring installation area above 20°C for 72 hours before, during and for 48 hours after installation.

1.6 MAINTENANCE

.1 Deposit with the Architect all instructions for maintenance.

1.7 WARRANTY

.1 Installation and material shall be warranted for a period of five (5) years from the date of Substantial Performance.

.2 The warranty shall be supplied in writing and shall be made jointly and severally with the flooring installer and the manufacturer.

.3 Repair and/or replace whenever directed by the Architect, within the guarantee period indicated above, any and all defects occurring in the work.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Surface Applied Tactile Walking Surface Indicators

.1 Quality Assurance

.1 Provide Surface Applied TWSI tiles and accessories as produced by a single manufacturer with a minimum of three (3) years' experience in the manufacturing of Surface Applied TWSI tiles.

.2 Installer's Qualifications: Engage an experienced installer certified in writing by Surface Applied TWSI tile manufacturer as qualified for installation, who has successfully completed installations similar in material, design, and extent to that indicated for the project.

.3 Provide Surface Applied TWSI tiles which are in compliance with the following standards (or most recent):
.1 ISO 23599:2012(E): Assistive Products for Blind and Vision Impaired Persons – Tactile Walking Surface Indicators.

.2 CSA B651-12: Accessible Design for the Built Environment Standard

.3 Integrated Accessibility Standards Regulation 191/11 – Sections 80.25 to 80.29

.4 Vitrified Polymer Composite (VPC) Surface Applied TWSI tiles shall be an epoxy polymer composition with a ultra-violet coating employing aluminum oxide particles in the truncated domes; "Armor Tile" as distributed under license by Kinesik Engineered Products (855-364-7763), or approved equal.

.5 Dimensions: The tile shall incorporate an in-line pattern of truncated domes measuring nominal 5mm height, 23mm base diameter, 12mm top diameter spaced center-to-center 61mm as measured on a diagonal and 42mm as measured side by side. For wheelchair safety the field area shall consist of a non-slip surface with a minimum of 40 - 90° raised points 1.2mm high, per square inch. Surface Applied TWSI tiles shall be held within the following dimensions and tolerances:

.6 Product Data: Vitrified Polymer Composite (VPC) Surface Applied TWSI tiles shall meet or exceed the following test criteria:

ASTM Reference	Test Description	Value
ASTM D 695	Compressive Strength	≥ 193 MPa
ASTM D 790	Flexural Strength	≥ 172 MPa
ASTM D 638	Tensile Strength	≥ 131 MPa
ASTM D 5420	Impact Resistance	≥ 2,300 J/m
ASTM D 696	Coefficient of Thermal Expansion	5.0 x 10-6/°C
ASTM C 1028	Static Coefficient of Friction	≥ 0.80
ASTM E 84	Flame Spread Index	≤ 25
ASTM D 570	Water Absorption	0.05%
ASTM C 501	Abrasive Wear Index Iw	≥ 50
ASTM D 2486	Abrasive Scrub Test	≤ 1.5 mm
ASTM B 117	Salt Spray (300 hrs)	No effect
ASTM D 1037	Accelerated Aging Cycle Testing	No effect
ASTM D 543	Chemical Resistance	No effect
ASTM G 155	Accelerated Weathering	ΔE ≤ 4.5

Part No.	Size (mm x mm)
ADA-S-2448	648 x 1220

.2 Manufacturer's Warranty

.1 Surface Applied TWSI tiles shall be warranted in writing for a period of five (5) years from date of substantial completion. The guarantee includes factory defects, breakage, and deformation.

.3 Installation Warranty

.1 Surface Applied TWSI tile installation shall be warranted in writing for a period of two (2) years. Alternate products approved during the tendering process must be guaranteed for an additional three (3) years. Product must be guaranteed from defective work.

.4 Manufacturers

.1 The Vitrified Polymer Composite (VPC) Surface Applied Tactile Walking Surface Indicator Tile specified is based on Armor Tile as distributed under license by Kinesik Engineered Products (855-364-7763). Existing engineered and field tested products, which have been in successful service for a period of three (3) years are subject to compliance with requirements, may be incorporated in the work and shall meet or exceed the specified test criteria and characteristics.

.2 Colour: Colour shall be homogeneous throughout the tile.

Colour	Federal Colour No.
Federal Yellow	33538

.5 Materials

.1 Fasteners: Colour matched (where appropriate), corrosion resistant, flat head drive anchor: ¼" diameter x 1 ½" long as supplied by Kinesik Engineered Products.

.2 Adhesive: Tactile Bond and Seal (TBS) as supplied by Kinesik Engineered Products.

.3 Sealant: Tactile Bond and Seal (TBS) as supplied by Kinesik Engineered Products.

.6 Cleaning, Protecting and Maintenance

.1 Protect tiles against damage during construction period to comply with TWSI tile manufacturer's specification.

.2 Protect tiles against damage from rolling loads following installation by covering with plywood or hardwood.

.3 Clean tiles not more than four days prior to date scheduled for inspection intended to establish date of substantial completion in each area of project. Clean tile by method specified by tile manufacturer.

.4 Comply with manufacturer's maintenance manual for cleaning and maintaining tile surface and it is recommended to perform annual inspections for safety and integrity.

PART 3 - EXECUTION

3.1 DELIVERY AND .1 Deliver and store materials in original packages with the

STORAGE

manufacturer's labels and seals intact.

3.2 PREPARATION

.1 The recommendations of the manufacturer of the floor covering will be considered as minimal. Remove foreign matter, grease, oil, paint, and anything that may prevent good adhesion.

.2 Where the surface is concrete, remove loose material, grind out protrusions, patch depressions, and fill cracks and holes with latex cement.

.3 Do not use gypsum products.

3.3 APPLICATION: FLOORING

.1 During all surface preparation and installation procedures, ensure adequate safety guidelines are in place and that they are in accordance with the applicable industry and government standards.

.2 The application of all tiles, adhesives, mechanical fasteners, and caulking shall be in strict accordance with the guidelines set by their respective manufacturers. Not recommended for asphalt applications.

.3 Coordinate with the Contractor or Engineer to ensure that the surfaces being prepared and fabricated to receive the tiles are constructed correctly and adequately for tile installation. Review manufacturer and contract drawings with the Contractor prior to the construction and refer any and all discrepancies to the Engineer.

.4 Set the tile true and square to the curb ramp area as detailed in the design drawings, so that its location can be marked on the concrete surface. A thin permanent marker works well. Remove tile when done marking its location.

.5 The surface to receive the Surface Applied TWSI tile is to be mechanically cleaned with a diamond cup grinder or shot blaster to remove any dirt or foreign material. This cleaning and roughening of the concrete surface should include at least 4 inches around the perimeter of the area to receive the tile, and also along the cross pattern established by the corresponding areas on the backside of the tile. Those same areas should then be cleaned with a clean rag soaked in Acetone.

.6 Immediately prior to installing the Surface Applied TWSI tile, the concrete surfaces must be inspected to ensure that they are clean, dry, free of voids, curing compounds, projections, loose material, dust, oil, grease, sealers and determined to be

structurally sound and cured for a minimum of 30 days.

.7 Using Acetone, wipe the backside of the tile around the perimeter and along the internal cross pattern, to remove any dirt or dust particles from the area to receive the adhesive.

.8 Apply TBS to the backside of the tile, following the perimeter and internal cross pattern established by the tile manufacturer. Sufficient adhesive must be placed on the prescribed areas to have full coverage across the 2" width of the adhesive locator and shall be applied to within 1/4" continuously around the perimeter edge of the tile. The entire tube of adhesive shall be applied to the back of each tile, sizes 610mm x 1220mm and greater.

.9 Set the tile true and square to the curb ramp area as detailed in the design drawings.

.10 Working from the center of the tile outwards, proceed to drill and install all fasteners in the tile's molded recesses.

.11 Standing with both feet applying pressure around the molded recess provided in the tile, drill a hole true and straight to a depth of 3½" using a 1/4" masonry drill bit. Drill through the tile without hammer option (on the drill) until the tile has been successfully penetrated, then with hammer option (on the drill) to drill into the concrete. Maintaining foot pressure on both sides of the hole while drilling prevents concrete dust from accumulating between the tile and concrete which can affect the tile being installed flush and may compromise installation integrity.

.12 Immediately after drilling each hole, before moving on to the next, and while still applying foot pressure, mechanically fasten tiles to the concrete substrate using a leather bound or hard plastic mallet to set the fasteners. Ensure the fastener has been placed to full depth in the dome, straight, and flush to the top of dome. Drive the pin of the fastener with the mallet, taking care to avoid any inadvertent blows to the truncated dome or tile surface.

.13 Following the installation of the fasteners, the concrete dust should be vacuumed, brushed or blown away from the tile's surface and adjacent concrete. Using Acetone on a rag, wipe the concrete around the tile's perimeter to ensure a clean, dry surface to receive perimeter sealant.

.14 TBS perimeter caulking sealant should be applied following the sealant manufacturer's recommendations. Tape all perimeter edges of the tile back 1/16" from the tile's perimeter edge and tape the adjacent concrete back 1/2" from the tile's perimeter edge to maintain a straight and even caulking line. Apply sealant around tile perimeter using care to work sealant into any void between the tile and concrete interface. Tool the perimeter caulking with a rounded plastic applicator or spatula to create a cove profile between the tile and adjacent concrete. Remove tape immediately after tooling perimeter

caulking sealant.

.15 Do not allow foot traffic on installed tiles until the perimeter caulking sealant has cured sufficiently to avoid tracking. Curing time is weather dependent (average cure time at 75° F is 30 minutes). Adhesive or caulking on the surface of the Armor-Tile can be removed with Acetone.

.16 If installing adjacent tiles, note the orientation of each tile. Careful attention will reveal that one of the long edges of the tile is different than the other in regard to the tiny dotted texture. You may also note a larger perimeter margin before the tiny dotted texture pattern begins. Consistent orientation of each Armor-Tile is required in order that the truncated domes on adjacent tiles line up with each other.

.17 In order to maintain proper spacing between truncated domes on adjacent tiles, the tapered edge should be trimmed off using a continuous rim diamond blade in a circular saw or mini-grinder. The use of a straightedge to guide the cut is required. All cuts should be made prior to installation of the tiles. If installing adjacent tiles, care should be taken to leave a 1/8 inch gap between each tile to allow for expansion and contraction.

.18 If tiles are custom cut to size, if pre-molded recesses (to receive fasteners) are removed by the cut, or to maintain a tight installation to the substrate then any truncated dome can be center-drilled with a 1/4 inch masonry drill bit to create a through hole, and the through hole must be countersunk with a suitable carbide countersink bit to receive mechanical fasteners. Care should be taken to not countersink too widely or deeply. Fasteners should be flush with the top of the truncated dome when countersunk properly.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 05 50 00 – Metal Fabrications

.2 Section 06 10 00 – Rough Carpentry.

.3 Section 07 92 00 – Joint Sealants.

.4 Section 09 03 51 – Historic – Plaster

.5 Section 09 21 16 – Gypsum Board Assemblies

1.2 REFERENCES

.1 Department of Justice Canada (Jus)
.1 Canadian Environmental Protection Act (CEPA), 1999, c. 33.

.2 Environmental Protection Agency (EPA)
.1 EPA Test Method for Measuring Total Volatile Organic Compound Content of Consumer Products, Method 24 – 1993, (for Surface Coatings).

.3 Health Canada / Workplace Hazardous Materials Information System (WHMIS)
.1 Material Safety Data Sheets (MSDS).

.4 Master Painters Institute (MPI)
.1 MPI Architectural Painting Specifications Manual, 2012.

.5 National Fire Code of Canada – 2010.

.6 Society for Protective Coatings (SSPC)
.1 SSPC Painting Manual, Volume Two, 8th Edition, Systems and Specifications Manual.

.7 Transport Canada (TC)
.1 Transportation of Dangerous Goods Act (TDGA), 1992, c. 34.

1.3 QUALITY ASSURANCE

.1 Qualifications:
.1 Contractor: minimum of five years proven satisfactory experience. Provide list of last three comparable jobs including, job name and location, specifying authority, and project manager.
.2 Journeymen: qualified journeymen who have "Tradesman Qualification Certificate of Proficiency" engaged in painting work.
.3 Apprentices: working under direct supervision of qualified trades person in accordance with trade regulations.

.2 Mock-Ups:
.1 Construct mock-ups in accordance with Section 00 10 00.
.1 Provide 1000 mm x 1000 mm mock-up. Prepare and

paint designated surface, area, room or item (in each colour scheme) to specified requirements, with specified paint or coating showing selected colours, gloss/sheen, textures.

.2 Mock-up will be used:

.1 To judge workmanship, substrate preparation, operation of equipment and material application and workmanship to MPI Architectural Painting Specification Manual standards.

.3 Locate where directed.

.4 Allow 24 hours for inspection of mock-up before proceeding with work.

.5 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may not remain as part of finished work.

.3 Health and Safety:

.1 Do construction occupational health and safety in accordance with Section 01 15 45.

1.4 SCHEDULING

.1 Submit work schedule for various stages of painting to Departmental Representative for review. Submit schedule minimum of 48 hours in advance of proposed operations.

.2 Paint occupied facilities in accordance with approved schedule. Schedule operations to approval of Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

.3 Obtain written authorization from Departmental Representative for changes in work schedule.

.4 Schedule painting operations to prevent disruption of occupants.

.5 Painting should occur before absorptive materials/furnishings have been installed in the space.

1.5 WARNING

.1 **DO NOT USE SPRAY PAINT EQUIPMENT:** Only paint brush and roller will be accepted on this project.

1.6 SUBMITTALS

.1 Submittals in accordance with Section 00 10 00.

.2 Product Data:

.1 Submit product data and instructions for each paint and coating product to be used.

.2 Submit product data for the use and application of paint thinner.

.3 Submit two copies of Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS) in accordance with Section 00 10 00.

.3 Samples:

.1 Submit full range colour sample chips to indicate where colour availability is restricted.

.2 Submit duplicate 200 x 300 mm sample panels of each paint, stain, clear coating, special finish with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards submitted on following substrate materials:

.1 3 mm plate steel for finishes over metal surfaces.

.2 13 mm birch plywood for finishes over wood surfaces.

.3 50 mm concrete block for finishes over concrete or concrete masonry surfaces.

.4 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.

.3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.

.4 Test reports: submit certified test reports for paint from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

.1 Lead, cadmium and chromium: presence of and amounts.

.2 Mercury: presence of and amounts.

.3 Organochlorines and PCBs: presence of and amounts.

.5 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Manufacturer's Instructions:

.1 Submit manufacturer's installation and application instructions.

.7 Closeout Submittals: submit maintenance data for incorporation into manual specified in Section 00 10 00, include following:

.1 Product name, type and use.

.2 Manufacturer's product number.

.3 Colour number[s].

.4 MPI Environmentally Friendly classification system rating.

1.7 MAINTENANCE

.1 Extra Materials:

.1 Deliver to extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels. Comply with Section 00 10 00.

.2 Quantity: provide one litre can of each type and colour of primer, stain, finish coating. Identify colour and paint type in relation to established colour schedule and finish system.

.3 Delivery, storage and protection: comply with Departmental Representative requirements for delivery and storage of extra materials.

1.8 DELIVERY, STORAGE AND HANDLING

.1 Packing, Shipping, Handling and Unloading:
.1 Pack, ship, handle and unload materials in accordance with Section 00 10 00.

.2 Acceptance at Site:
.1 Identify products and materials with labels indicating:
.1 Manufacturer's name and address.
.2 Type of paint or coating.
.3 Compliance with applicable standard.
.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Storage and Protection:
.1 Provide and maintain dry, temperature controlled, secure storage.
.2 Store materials and supplies away from heat generating devices.
.3 Store materials and equipment in well ventilated area with temperature range 7 degrees C to 30 degrees C.

.5 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.6 Keep areas used for storage, cleaning and preparation clean and orderly. After completion of operations, return areas to clean condition.

.7 Remove paint materials from storage only in quantities required for same day use.

.8 Fire Safety Requirements:
.1 Provide one 9 kg Type ABC fire extinguisher adjacent to storage area.
.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.
.3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.

.9 Waste Management and Disposal:
.1 Separate waste materials for recycling in accordance with Section 01 74 19 - Construction/Demolition Waste Management and Disposal.
.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.
.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard, packaging material for recycling in accordance with Waste Management Plan (WMP).
.4 Separate for recycling and place in designated containers waste in accordance with Waste Management Plan (WMP).

.5 Place materials defined as hazardous or toxic in designated containers.
.6 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal Regulations.
.7 Ensure emptied containers are sealed and stored safely.
.8 Unused paint materials must be disposed of at official hazardous material collections site.
.9 Paint, stain and wood preservative finishes and related materials (thinners, and solvents) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.
.10 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.
.11 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.
.12 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground follow these procedures:
.1 Retain cleaning water for water-based materials to allow sediments to be filtered out.
.2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.
.3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.
.4 Dispose of contaminants in approved legal manner in accordance with hazardous waste regulations.
.5 Empty paint cans are to be dry prior to disposal or recycling (where available).
.13 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

.14 Set aside and protect surplus and uncontaminated finish materials. Deliver to or arrange collection by employees, or organizations for verifiable re-use or re-manufacturing.

1.9 SITE CONDITIONS

.1 Surface and Environmental Conditions:
.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.
.2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.
.3 Apply paint when previous coat of paint is dry or adequately cured.

.2 Additional interior application requirements:
.1 Apply paint finishes when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.
.2 Apply paint in occupied facilities during silent hours only.

Schedule operations to approval of Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.

.2 Provide paint materials for paint systems from single manufacturer.

.3 Only qualified products with E2 "Environmentally Friendly" rating are acceptable for use on this project.

.4 Conform to latest MPI requirements for interior painting work including preparation and priming.

.5 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.

.6 Linseed oil, shellac, and turpentine: highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.

.7 Provide paint products meeting MPI "Environmentally Friendly" E2 ratings based on VOC (EPA Method 24) content levels.

.8 Use MPI listed materials having minimum E2 rating where indoor air quality (odour) requirements exist.

.9 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids:

.1 Water-based.
.2 Non-flammable.
.3 Manufactured without compounds which contribute to ozone depletion in the upper atmosphere.
.4 Manufactured without compounds which contribute to smog in the lower atmosphere.
.5 Do not contain methylene chloride, chlorinated hydrocarbons, toxic metal pigments.

.10 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.

.11 Flash point: 61.0 degrees C or greater for water-borne surface coatings and recycled water-borne surface coatings.

.12 Ensure manufacture and process of both water-borne surface coatings and recycled water-borne surface coatings does not release:
.1 Matter in undiluted production plant effluent generating 'Biochemical Oxygen Demand' (BOD) in excess of 15mg/L to natural watercourse or sewage treatment facility lacking secondary treatment.
.2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15mg/L to natural watercourse or a sewage treatment facility lacking secondary treatment.

.13 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes to meet minimum "Environmentally Friendly" E2 rating.

.14 Recycled water-borne surface coatings must not contain:
.1 Lead in excess of 600.0 ppm weight/weight total solids.
.2 Mercury in excess of 50.0 ppm weight/weight total product.
.3 Cadmium in excess of 1.0 ppm weight/weight total product.
.4 Hexavelant chromium in excess of 3.0 ppm weight/weight total product.
.5 Organochlorines or polychlorinated biphenyls (PCBS) in excess of 1.0 ppm weight/weight total product.

2.2 MIXING AND TINTING

.1 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.

.2 Use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.

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

2.3 GLOSS/SHEEN RATINGS

.1 Paint gloss is defined as sheen rating of applied paint, in accordance with following 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 as noted on Finish Schedule.

2.4 INTERIOR PAINTING SYSTEMS

.1 Concrete vertical and horizontal (soffits) surfaces:
.1 INT 3. 1A – Two coats Latex over one coat of Latex primer.
.1 Satin Finish: Horizontal (soffits)
.2 Semi-Gloss Finish: Vertical

.2 Concrete masonry units:
.1 INT 4.2A – Two coats Latex finish over one coat of Latex primer.
.1 Semi-Gloss Finish

.3 Ferrous Metal Surfaces:
.1 INT 5.1B – Two coats Waterborne light industrial coating over one coat of Alkyd primer.
.1 Semi-Gloss Finish.

.4 Galvanized metal:
.1 INT 5.3C – Two coats Alkyd over one coat of galvanized primer.
.1 Semi-Gloss Finish.

.5 Plaster and gypsum board:
.1 INT 9.2A – Two coats Latex over one coat of Latex primer.
.1 Semi-Gloss finish

.6 Interior Unpainted Wood:
.1 INT 6.3B – Two coats alkyd over one coat of alkyd primer.
.1 Semi-Gloss finish

2.5 SOURCE QUALITY CONTROL

.1 Perform following tests on each batch of consolidated post-consumer material before surface coating is reformulated and canned. Testing by laboratory or facility which has been accredited by Standards Council of Canada.
.1 Lead, cadmium and chromium are to be determined using ICP-AES (Inductively Coupled Plasma - Atomic Emission Spectroscopy) technique no. 6010 as defined in EPA SW-846.
.2 Mercury is to be determined by Cold Vapour Atomic Absorption Spectroscopy using Technique no. 7471 as defined in EPA SW-846.
.3 Organochlorines and PCBs are to be determined by Gas Chromatography using Technique no. 8081 as defined in EPA SW-846.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 GENERAL

.1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.3 EXAMINATION

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Departmental Representative, damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

.2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

.3 Maximum moisture content as follows:
.1 Stucco, plaster and gypsum board: 12%
.2 Concrete: 12%
.3 Clay and Concrete Block/Brick: 12%
.4 Wood: 15%

3.4 PREPARATION

.1 Protection:
.1 Protect existing building surfaces and adjacent structures from paint spatters, markings and other damage by suitable non-staining covers or masking. If damaged, clean and restore surfaces as directed by Departmental Representative.
.2 Protect items that are permanently attached such as Fire Labels on doors and frames.
.3 Protect factory finished products and equipment.
.4 Protect building occupants and general public in and about the building.

.2 Surface Preparation:
.1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.
.2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.
.3 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval of Departmental Representative.

.3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in

regard to specific requirements and as follows:
.1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths.
.2 Wash surfaces with a biodegradable detergent and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.
.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.
.4 Allow surfaces to drain completely and allow to dry thoroughly.
.5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.
.6 Use trigger operated spray nozzles for water hoses.
.7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.

.4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pretreatment as soon as possible after cleaning and before deterioration occurs.

.5 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.
.1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.
.2 Apply wood filler to nail holes and cracks.
.3 Tint filler to match stains for stained woodwork.

.6 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

.7 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted by brushing with clean brushes or vacuum cleaning.

.8 Touch up of shop primers with primer as specified.

3.5 APPLICATION

.1 Apply paint by brush, roller. Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:
.1 Apply paint in uniform layer using brush and/or roller type suitable for application.
.2 Work paint into cracks, crevices and corners.
.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.

.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.
.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.

.4 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.5 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.6 Sand and dust between coats to remove visible defects.

.7 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.

3.6 MECHANICAL/ ELECTRICAL EQUIPMENT

.1 Paint finished area exposed conduits, piping, hangers, ductwork and other mechanical and electrical equipment with colour and finish to match adjacent surfaces, except as indicated.

.2 Touch up scratches and marks on factory painted finishes and equipment with paint as supplied by manufacturer of equipment.

.3 Do not paint over nameplates.

.4 Keep sprinkler heads free of paint.

.5 Paint inside of ductwork where visible behind grilles, registers and diffusers with primer and one coat of matt black paint.

3.7 SITE TOLERANCES

.1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.
.2 Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.8 CLEAN-UP

.1 Remove paint where spilled, splashed, splattered or sprayed as work progresses using means and materials that are not detrimental to affected surfaces.

.2 Keep work area free from an unnecessary accumulation of tools, equipment, surplus materials and debris.

.3 Remove combustible rubbish materials and empty paint cans each day and safely dispose of same in accordance with requirements of authorities having jurisdiction.

.4 Clean equipment and dispose of wash water used for water borne materials, solvents used for oil based materials as well as other cleaning and protective materials (e.g. rags, drop cloths, masking papers, etc.), paints, thinner, paint removers/strippers in accordance with the safety requirements of authorities having jurisdiction and as noted herein.

.5 Painting equipment shall be cleaned in leak-proof containers that will permit particulate matter to settle out and be collected. Sediment remaining from cleaning operations shall be recycled or disposed of in a manner acceptable to authorities having jurisdiction.

.6 Paint and coatings in excess of repainting requirements shall be recycled as noted herein.

3.9 RESTORATION

.1 Clean and re-install hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition.

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 10 21 16 - Shower and Dressing Compartments.

.2 Section 10 28 10 - Toilet And Bath Accessories.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).
.1 ASTM A 167-R2009, Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
.2 ASTM A 240/A240M-R15B, Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
.3 ASTM A 480/A480M-12, Specification for General Requirements for Flat-Rolled Stainless and Heat Resisting Steel Plate, Sheet, and Strip.
.4 ASTM A 653/A653M-2015, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) 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-1.104M-91, Semigloss Alkyd, Air Drying and Baking Enamel.

.3 Canadian Standards Association (CSA International).
.1 CAN/CSA-B651-12, Barrier-Free Design.

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 Shop Drawings:
.1 Submit shop drawings in accordance with Section 00 10 00 - Submittal Procedures.
.2 Indicate fabrication details, plans, elevations, hardware, and installation details.

.3 Samples:
.1 Submit samples in accordance with Section 00 10 00 - Submittal Procedures.

.4 Manufacturer's Instructions:
.1 Submit manufacturer's installation instructions.

.5 Manufacturers' Field Reports: submit copies of manufacturers' field reports.

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.

.3 Mock-ups:
.1 Construct mock-ups in accordance with Section 00 10 00.
.1 Mock-up will be used:
.1 To judge workmanship, substrate preparation, and material application.
.2 Allow 24 hours for inspection of mock-up before proceeding with work.
.3 When accepted, mock-up will demonstrate minimum standard of quality required for this work. Approved mock-up may remain as part of finished work.

PART 2 - PRODUCTS

2.1 MATERIALS

.1 Metal toilet partitions and urinal screens.

.2 Sheet steel: commercial quality to ASTM A653 GR33 designation zinc coating.

.3 Minimum base steel thickness:
.1 Panels and doors: 0.8 mm.
.2 Pilasters: 0.9 mm.
.3 Reinforcement: 3.0 mm.

.4 Toilet Partitions:
.1 Doors 1460 mm high.
.2 Stiles 2083 mm high.

.5 Urinal Screens:
.1 457 mm x 1067 mm high.

.6 Headrails: 25 mm x 41 mm x 1.5 mm thick, clear anodized, extruded aluminum, anti grip design.

.7 Pilaster shoe: 0.8 mm stainless steel 100 mm high.

.8 Attachment: stainless steel tamperproof type screws and bolts.

.9 Acceptable Manufacturer:
.1 Hadrian Manufacturing Inc.

2.2 COMPONENTS

.1 Hinges:
.1 Heavy duty,self-lubricating sleeve, fully concealed, mounted on upper and lower pilaster hinge brackets.
.2 Material/finish: stainless steel.
.3 Swing: as indicated.
.4 Return movement: gravity.
.5 Emergency access feature.

.2 Latch set: surface mounted, combination latch, combination door-stop, keeper and bumper, chrome plated non-ferrous, emergency access feature.

.3 Wall and connecting brackets: chrome plated non-ferrous extrusion or casting.

.4 Coat hook: combination hook and rubber door bumper, chrome plated non-ferrous.

.5 Door pull: Barrier-free type, stainless steel.

2.3 FABRICATION

.1 Doors and screens: 25 mm thick, two steel sheets faces pressure bonded to honeycomb core, 1460 mm high.

.2 Pilasters: 32 mm thick, constructed same as door, 2083 mm high.

.3 Provide formed and closed edges for doors, panels and pilasters. Miter and weld corners and grind smooth.

.4 Provide internal reinforcement at areas of attached hardware and fittings. Temporarily mark location of reinforcement for tissue holders and grab bars.

.5 Provide 0.8 mm thick type 316 stainless steel protective shields on urinal side of toilet partition panels next to urinals and on urinal screens. Make protective shields 1000 mm high with top of shield 1200 mm above finished floor. Make shields to full width of partition or screen panel. Fasten with stainless steel screws.

2.4 FINISHES

.1 Clean, degrease and neutralize steel components with phosphate or chromate treatment.

.2 Spray apply primer to CAN/CGSB-1.81, 1 coat.

.3 Spray apply finish enamel to CAN/CGSB-1.88, type 2 gloss, 2 coats and bake to smooth, hard finish 0.025 mm thick.

.4 Finish: doors and pilaster/panels same colour as selected from manufacturer's standard colours: 535 Light Grey.

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 INSTALLATION

.1 Ensure supplementary anchorage, if required, is in place.

.2 Do work in accordance with CAN/CSA-B651.

3.3 ERECTION

.1 Partition erection.

.1 Install partitions secure, plumb and square.

.2 Leave 12 mm space between wall and panel or end pilaster.

.3 Anchor mounting brackets to masonry/concrete surfaces using screws and shields: blocking/backing must be provided, to hollow masonry walls using bolts and toggle type anchors.

.4 Attach panel and pilaster to brackets with through type sleeve bolt and nut.

.5 Provide for adjustment of floor-braced pilasters variations with screw jack through steel saddles made integral with pilaster. Conceal floor fixings with stainless steel shoes.

.6 Equip doors with hinges, latch set, and each stall with coat hook mounted on partition wall, mounting heights 1200 mm. Adjust and align hardware for easy, proper function. Set door open position at 30 degrees to front. Install door bumper door mounting.

.7 Equip outswinging doors with door pulls on inside and outside of door in accordance with CAN/CSA-B651.

.8 Install hardware grab bars in barrier-free stalls..

.2 Floor supported and overhead braced partition erection.

.1 Attach pilasters to floor with pilaster supports and level, plumb, and tighten installation with levelling device.

.1 Secure pilaster shoes in position.

.2 Secure headrail to pilaster face with not less than two fasteners per face.

.3 Set tops of doors parallel with overhead brace when doors are in closed position.

.2 Floor supported partition erection.

.1 Secure pilasters to floor with pilaster supports anchored with minimum 50 mm penetration in structural floor.

.2 Level, plumb and tighten installation with levelling

device.
.3 Secure pilaster shoes in position.
.4 Set tops of doors level with tops of pilasters when doors are in closed position.

.3 Screens erection:
.1 Provide urinal stall screens consisting of panel and post.
.2 Anchor wall-hung screen panels to walls with 3 panel brackets and wing brackets and vertical upright consisting of tubular headrail stock and end sockets anchored to floor.

3.4 FIELD QUALITY CONTROL

.1 Have manufacturer of products supplied under this Section review Work involved in handling, installation/application, protection and cleaning of its product, and submit written reports in acceptable format to verify compliance of Work with Contract.

.2 Manufacturer's field services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.5 ADJUSTING

.1 Adjust doors and locks for optimum, smooth operating condition.

.2 Lubricate hardware and other moving parts.

3.6 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Clean surfaces after installation using manufacturer's recommended cleaning procedures.

.3 Clean aluminum with damp rag and approved non-abrasive cleaner.

.4 Clean and polish hardware and stainless components.

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

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 00 10 00 - Submittal Procedures.

.2 Section 05 50 00 - Metal Fabrications.

.3 Section 09 21 16 - Gypsum Board Assemblies.

.4 Section 09 30 13 - Ceramic Tiling.

.5 Section 10 21 13.13 – Metal Toilet Compartments.

1.2 REFERENCES

.1 American Society for Testing and Materials International, (ASTM).
.1 ASTM A 167-(R2009), Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
.2 ASTM A 653/A653M-2015, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
.3 ASTM A 924/A924M-14e1, Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

.2 Canadian General Standards Board (CGSB).
.1 CAN/CGSB-1.36-[97], General Purpose Interior Alkyd Varnish.
.2 CAN/CGSB-71.20-[M88], Adhesive Contact Brushable.
.3 CAN/CGSB-1.81-[M90], Air Drying and Baking Alkyd Primer for Vehicles and Equipment.
.4 CAN/CGSB-1.88-[92], Gloss Alkyd Enamel Air Drying and Baking.
.5 CAN/CGSB-1.104-[91], Semigloss Alkyd Air Drying and Baking Enamel.

.3 Canadian Standards Association (CSA International).
.1 CAN/CSA-B651, Barrier-Free Design.

.4 National Electrical Manufacturers' Association (NEMA).
.1 NEMA LD-3.

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 Shop Drawings:
.1 Submit shop drawings in accordance with Section 00 10 00 - Submittal Procedures.
.2 Indicate fabrication details, plans, elevations, hardware, and

installation details.

.3 Samples:
.1 Submit samples in accordance with Section 00 10 00 - Submittal Procedures.
.2 Submit duplicate 300 x 300 mm samples of panel showing finishes, edge and corner construction and core construction.

.4 Manufacturer's Instructions:
.1 Submit manufacturer's installation instructions.

.5 Manufacturers' Field Reports: submit copies of manufacturers field reports.

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 MATERIALS

.1 Shower and dressing compartments.

.2 Acceptable Manufacturer: Bobrick Duraline Series.

.3 Compact Laminate (Solid Phenolic) Dressing Compartments and Shower Dividers:
.1 Doors:
.1 Height
.1 Door/Panel Height: 1830 mm
.2 Floor Clearance: 110 mm
.2 Gap-Free interlocking design.
.3 Stiles Mounting Configuration:
.1 Floor-mounted, overhead-braced with satin finish, extruded anodized aluminum headrails, 1.65 mm thick with anti-grip profile.
.1 Stile Height: 2110 mm

.4 Materials: Solidly fused plastic laminate with matte-finish melamine surfaces; integrally bonded coloured face sheets and black phenolic-resin core.

.5 Edges: Black; brown edges not acceptable.

.6 Colour: 949-58 White

.7 Fire Resistance:
.1 Natoinal Fire Protection Association/International Building Code Interior Wall and Ceiling Finish: Class B / Uniform Building Code: Class II.

.8 Finished Thickness:
.1 Stiles and Doors: ¾ inch (19 mm).
.2 Panels 13 mm.

.9 Stiles: Floor-anchored stiles furnished with expansion shields and threaded rods.
.1 Levelling Devices: 7 gauge, 5 mm thick, corrosion-resistant, chromate-treated, double zinc-plated steel angle leveling bar bolted to stile; furnished with 10 mm diameter threaded rods, hex nuts, lock washers, flat washers, spacer sleeves, expansion anchors, and shoe retainers.
.2 Stile Shoes: One-piece, 22 gauge (0.8 mm), 18-8, Type 304 stainless steel, 102 mm height; tops with 90 degrees return to stile. One-piece shoe capable of adapting to 19 mm or 1 inch (25 mm) stile thickness and capable of being fastened (by clip) to stiles starting at wall line.

.10 Wall Posts: Pre-drilled for door hardware, 18-8, Type 304, 16 gauge (1.6 mm) stainless steel with satin finish; 25 mm x 38 mm.

.11 Anchors: Expansion shields and threaded rods at floor connections as applicable.

.12 Hardware:
.1 Compliance: Operating force of less than 2.25 kg.
.2 Emergency Access: Hinges, latch allow door to be lifted over keeper from outside compartment on inswing doors.
.3 Materials: 18-8, Type 304, heavy-gauge stainless steel with satin finish.
.4 Doorstops: Prevents inswinging doors from swinging in beyond stile.
.5 Fastening: Hardware secured to door and stile by through-bolted, theft-resistant, pin-in-head Torx stainless steel machine screws into factory installed, threaded brass inserts. Fasteners secured directly into core not acceptable.
.1 Threaded Brass Inserts: Factory-installed; withstand direct pull force exceeding 680 kg per insert.
.6 Clothes Hooks: Projecting no more than 29 mm from face of door.
.7 Door Hardware Type:
.1 Institutional Hardware
.1 Latching: 14 gauge (2 mm) sliding door latch, 11 gauge (3.2 mm) keeper; latch slides on a shock-resistant nylon track.
.2 Hinges: 16 gauge (1.6 mm) stainless steel, self-closing, 3 section hinges.

.8 Fittings:
- .1 Standard, commercial hardware.
  - .1 Mounting Brackets: Mounted inside compartment; exposed brackets on exterior of compartment not acceptable with the exception of outswing doors.
- .2 Institutional Hardware
  - .1 Mounting Brackets: 16 gauge (1.2 mm) stainless steel and extend full height of panel.
  - .2 U-Channels: Secure panels to stiles.
  - .3 Angle Brackets: Secure stiles-to-walls and panels to walls.

2.2 COMPONENTS

.1 Door pull Barrier-free: type suited for sttainless steel.

2.3 FINISHES

.1 Clean, degrease and neutralize steel components with phosphate or chromate treatment.

.2 Finish: doors and pilaster/panels same colour.

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 INSTALLATION

.1 Ensure supplementary anchorage, is in place.

.2 Do work in accordance with Manufacturer's written instructions.

3.3 ERECTION

.1 Partition erection.
- .1 Install partitions secure, plumb and square.
- .2 Gap-free Installation between wall and panel or end pilaster.
- .3 Anchor mounting brackets to masonry-concrete surfaces using screws and shields, to blocking/backing must be provided hollow walls using bolts and toggle type anchors.
- .4 Attach panel and pilaster to mounting brackets.
- .5 Provide templates, drilling dimensions for locating threaded studs through finished ceilings.
- .6 Equip doors with hinges, latch set, and each stall with coat hook mounted on partition wall mounting heights 1200 mm. Adjust and align hardware for easy, proper function. Set door open position at 30 degrees to front. Install door bumper door mounted.

.7 Equip doors with door pulls on inside and outside of door in accordance with CAN/CSA-B651.
.8 Install hardware, grab bars.

.2 Floor supported and overhead braced partition erection.
.1 Attach pilasters to floor with floor channel and level, plumb, and tighten installation with secure to floor channel.
.2 Secure pilaster shoes in position.
.3 Secure headrail to pilaster face with not less than two fasteners per face.
.4 Set tops of doors parallel with overhead brace when doors are in closed position.

.3 Floor supported partition erection:
.1 Secure pilasters to floor with pilaster supports anchored with minimum 50 mm penetration in structural floor.
.2 Level, plumb and tighten installation with levelling device.
.3 Secure pilaster shoes in position.
.4 Set tops of doors level with tops of pilasters when doors are in closed position.

3.4 FIELD QUALITY CONTROL

.1 Have manufacturer of products supplied under this Section review Work involved in handling, installation/application, protection and cleaning of its product, and submit written reports in acceptable format to verify compliance of Work with Contract.

.2 Manufacturer's field services: provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

3.5 ADJUSTING

.1 Adjust doors and locks for optimum, smooth operating condition.

.2 Lubricate hardware and other moving parts.

3.6 CLEANING

.1 Perform cleaning after installation to remove construction and accumulated environmental dirt.

.2 Clean surfaces after installation using manufacturer's recommended cleaning procedures.

.3 Clean aluminum with damp rag and approved non-abrasive cleaner.

.4 Clean and polish hardware and stainless components.

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

END OF SECTION

PART 1 - GENERAL

1.1 RELATED SECTIONS

.1 Section 00 10 00 - Submittal Procedures.

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)
.1 CAN/CSA-B651, Barrier-Free Design.
.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 - Submittal Procedures.

.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: 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: 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.

.3 Shower seat: wall mounted folding, hinged, phenolic top with stainless steel assembly.
- .1 Acceptable material:
  - .1 Frost Code 972.

.4 Grab bars: 38 mm dia tubing of stainless steel with peened finish, 76 mm diameter wall flanges, concealed screw attachment, flanges provided with steel back plates and all accessories. Grab bar material and anchorage to withstand downward pull of 2.2 kN.
- .1 Acceptable material:
  - .1 Frost Code 1001NP2 24”.
  - .2 Frost Code 1001NP 36”.
  - .3 Frost Code 1001NP 48”

.5 Soap holder: surface mounted, stainless steel dished tray, self draining, concealed fasteners.
- .1 Acceptable material:
  - .1 Frost Code 1136S.

.6 Robe hook: stainless steel with concealed fasteners.
.1 Acceptable material:
.1 Frost Code 1138S.

.7 Waste receptacle: Type surface mounted, size 384 mm x 216 mm x 584 mm high, stainless steel.
.1 Acceptable Manufacturer: American Specialties Model No. 20826.

.8 Tilt mirror: 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 Tilt: Frost Code 941-1630 FT.
.2 Heavy Duty Shelf 18” long x 4” deep: Frost Code 950-4.

.9 Corner Shelf surface mounted, 204 x 204 triangle, stainless steel.
.1 Acceptable material:
.1 Frost Code 950-8 x 8.

.10 Utility hook rack, white finish, five (5) double hooks”
.1 Acceptable Manufacturer: Nystrom, Product Number NH02021030

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 Install grab bars on built-in anchors provided by bar manufacturer.

.3 Use tamper proof screws/bolts for fasteners.

.4 Fill units with necessary supplies shortly before final acceptance of building.

.5 Install accessories supplied by Owner.

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 - Double tier locker, freestanding.

.1 Size: 305 mm wide x 305 mm deep x 1829 mm high, 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 Gladiator (Athletic) as manufactured by Hadrian Manufacturing Inc.

2.2 ACCESSORIES

.1 Latching/Locking Device – Single Point
.1 An 11 gauge 51 mm x 9 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 chiplocked 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 The door shall be ventilated at upper and lower sections with staggered 13 mm wide by 25 mm high oval perforations.

.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. Double tier lockers shall have three single prong coat hooks per compartment. Two side hooks shall be provided. All hooks zinc plated steel with ball point heads and are attached with two fasteners.

2.3 BENCHES

.1 Seats: Hardwood laminate 32 mm thick x 241 mm wide x 1829 mm long.

.2 Bench Pedestals: 6 mm x 64 mm aluminum with high grade hybrid epoxy polyester powder finish. Colour to be selected by Departmental Representative.

.3 Acceptable Manufacturer: Hadrian

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 wall trim around recessed locker banks.

.4 Install filler panels (false fronts) where required and where obstructions occur.

.5 Install finished end panels to exposed ends of locker banks.

.6 Install locker numbers.

END OF SECTION

PART 1 - GENERAL

1.1 References

.1 American Society of Heating, Refrigerating and Air Conditioning Engineers (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 General

.1 This section covers items common to all sections of Divisions 20, 21, 22, 23 & 25.

.2 Coordinate location & installation of all equipment with all trades to ensure the equipment is serviceable.

.3 Contractor shall be responsible to ensure that all requirements of Divisions 20, 21, 22, 23 & 25 are met and comply with all other divisions and contract documents.

.4 The word "provide" shall mean "supply and install".

1.3 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 ANSI/ASHRAE/IESNA 90.1.
- .2 The minimum equipment efficiency, standard rating and operating conditions shall be as per ANSI/ASHRAE/IESNA 90.1, superceded 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.

1.3 Equipment (Cont'd)

.2 (Cont'd)

.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.

1.4 Anchor Bolts and Templates

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

1.5 Trial Usage

.1 Engineer 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.

1.6 Protection of Openings

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

1.7 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. Refer to Division 26 for quality of materials and workmanship.

.2 Any costs associated with deviation of mechanical equipment rating affecting electrical Division 26 shall be carried by the mechanical contractor.

.3 All control wiring & conduit associated with Building Automation System & HVAC controls shall be provided by Divisions 20, 21, 22, 23 & 25 including power wiring to all control panels & other field mounted control devices. Emergency power circuits are provided by Division 26 in the vicinity of the power source.

1.8 Painting

.1 To Section 09 91 23 - Interior Painting.

.2 Apply at least one coat of corrosion resistant primer paint to ferrous supports and site fabricated work.

.3 Prime and touch up marred finished paintwork to match original. Use primer or enamel to match original. Do not paint over nameplates.

.4 Restore to new condition, finishes which have been damaged too extensively to be merely primed and touched up.

1.8 Painting (Cont'd)

.5 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.

.6 Touch-up damaged surfaces of all mechanical equipment and materials, to the satisfaction of Engineer. Use primer or enamel to match original. Do not paint over nameplates.

1.9 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 it's 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 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.

1.10 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.

.5 Where deemed necessary, Owner may record these demonstrations on video tape for future reference.

.6 Furnish trained instructors to instruct Owner'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.

1.10 Demonstration and Operating and Maintenance Instructions (Cont'd)

.7 The instructions shall take place during regular working hours before systems are accepted and turned over to Owner's staff.

.8 Ensure that the Owner'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 Owner's personnel and for their instruction in operation and maintenance of all mechanical equipment.

1.11 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, Engineer 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.
- .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing.

.7 Approvals:
- .1 Submit electronic format (pdf) copy of draft Operation and Maintenance Manual to Engineer for approval. Submission of individual data will not be accepted unless so directed by Engineer. 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 Engineer.
- .3 Upon acceptance by Engineer submit one (1) electronic format (pdf) and three (3) hardcopies of O&M manuals to Owner.

.8 Additional data:

1.11 Closeout Submittals (Cont'd)

.8 (Cont'd)

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

1.12 Acceptable Products

.1 Design is based on first manufacturer's name under acceptable products. Subsequent manufacturer's names indicate that those named are acceptable providing they meet specifications and space limitations and are subject to acceptance by Shop Drawing Review.

1.13 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. eg. 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 Engineer's review is for assistance only.

1.13 Shop Drawings and Product Data (Cont'd)

.6 No equipment will be accepted on the job site without shop drawings having been reviewed by the Engineer.

1.14 Cleaning

.1 Prior to turnover to client, clean interior and exterior of all new systems. Replace all air & hydronic filters on new & modified systems. Vacuum interior of new and modified ductwork and air handling units.

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 Prior to start of Testing, Adjusting and Balancing (TAB), finalize production of as-built drawings.

.2 Identify each drawing in lower right hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW MECHANICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).

.3 Submit hard copy to Engineer for approval and make corrections as directed.

.4 TAB to be performed using as-built drawings.

.5 Following approval, submit completed hard copy as-built drawings scanned soft copy with Operating and Maintenance Manuals.

.3 Submit copies of as-built drawings for inclusion in final TAB report.

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 Engineer 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.

1.16 Conflict/ Co-ordination Drawings (Cont'd)

.6 Within six (6) weeks of Letter of Intent, mechanical & electrical trades to verify that proposed rooms, shafts, chases, reflected ceiling elevations, etc. provide adequate space for the installation of mechanical & electrical 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.

.8 When requested by the City, contractor shall provide a single line isometric drawing of the proposed plumbing vent system.

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 Goodkey, Weedmark & Associates Limited 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 it's work. The User shall sign a License Agreement before drawings will be released.

1.21 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 Owner or Building Management 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 architect & structural engineer.
- .3 Structural engineer to provide written report outlining acceptance of the openings, as well as specific requirements for reinforcing at each location.

1.21 Cutting, Patching & Coring (Cont'd)

.2 (Cont'd)

.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 engineer 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 Engineer'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.

1.22 Mechanical Cost Breakdown

.1 Upon award of contract, provide mechanical cost breakdown as per attached schedules for engineer'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 Engineer. 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 Engineer.

.7 Equipment costs are to be broken down into specific equipment grouping and submitted with proposed billing submittal.

1.23 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 Owner's operating personnel have been instructed in the operation of all systems and equipment.

.5 The complete operation and maintenance data books have been delivered to the Engineer.

1.23 Final Inspection (Cont'd)

.1 (Cont'd)

.6 All inspection certificates have been furnished including but not limited to seismic certification, NFPA (Fire) 13 certification, City's final plumbing inspection.

.7 All record drawings have been completed and approved.

.8 All fire extinguishers have been installed.

.9 The cleaning up is finished in all respects.

.10 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 Engineer.

Project: Date:

HVAC		Total Contract Amount $	% to Date	Total to Date $	Previous Amount Invoiced $	Amount this Claim $	Balance Remaining $
Mobilization – Admin., Site Set-up							
Drafting & Coordinating							
Sleeving	Material						
	Labour						
Sheet Metal	Material						
	Labour						
Grilles, Diffusers	Material						
	Labour						
Silencers	Equipment						
	Labour						
Fans, VAV & FP Boxes	Equipment						
	Labour						
R.T.U.'s, Curbs, A.H.U.'s & Filters	Equipment						
	Labour						
	Start-up						
A/C Units	Equipment						
	Labour						
	Start-up						
Smoke/Fire Dampers	Equipment						
	Labour						
VFD's	Equipment						
	Labour						
	Start-up						

Project: Date:

HVAC		Total Contract Amount $	% to Date	Total to Date $	Previous Amount Invoiced $	Amount this Claim $	Balance Remaining $
Insulation	Material						
	Labour						
Close-out Documentation (5%)							
TOTAL ORIGINAL CONTRACT AMOUNT							
Change Orders							
Architect's CO #	GWA CCO or SI #						
#	#						
#	#						
Total Change Order Amount							
TOTAL CONTRACT AMOUNT							

NOTE: Change Orders that do not reference the Architect's Change Order number and Goodkey, Weedmark's Contemplated Change Order (CCO) or Site Instruction (SI) number will not be reviewed.

Project: Date:

Controls		Total Contract Amount $	% to Date	Total to Date $	Previous Amount Invoiced $	Amount this Claim $	Balance Remaining $
Mobilization – Admin., Site Set-up							
Hardware	Equipment						
	Labour						
Wiring	Material						
	Labour						
Close-out Documentation (5%)							
TOTAL ORIGINAL CONTRACT AMOUNT							
Change Orders							
Architect's CO #	GWA CCO or SI #						
#	#						
#	#						
Total Change Order Amount							
TOTAL CONTRACT AMOUNT							

NOTE: Change Orders that do not reference the Architect's Change Order number and Goodkey, Weedmark's Contemplated Change Order (CCO) or Site Instruction (SI) number will not be reviewed.

Project: Date:

Plumbing		Total Contract Amount $	% to Date	Total to Date $	Previous Amount Invoiced $	Amount this Claim $	Balance Remaining $
Mobilization – Admin., Site Set-up							
San. Storm Underground Piping & Floor Drains	Material						
	Labour						
Sleeving	Material						
	Labour						
San. Storm Above Ground Piping & Roof Drains	Material						
	Labour						
Domestic Water Piping	Material						
	Labour						
Chilled/Condensing Water Piping	Material						
	Labour						
Heating Water Piping	Material						
	Labour						
Gas Piping	Material						
	Labour						
Fuel Oil Piping	Material						
	Labour						
Medical Piping	Material						
	Labour						
Plumbing Equipment							
Boilers	Equipment						
	Labour						
	Start-up						

Project: Date:

Plumbing		Total Contract Amount $	% to Date	Total to Date $	Previous Amount Invoiced $	Amount this Claim $	Balance Remaining $
Hot Water Tanks	Equipment						
	Labour						
	Start-up						
Pumps, VFD's	Equipment						
	Labour						
	Start-up						
Expansion Tanks, Coils, Heat Exchangers	Equipment						
	Labour						
Chillers	Equipment						
	Labour						
	Start-up						
Unit/Force Flow Heaters	Equipment						
	Labour						
	Start-up						
Plumbing Fixtures	Equipment						
	Labour						
Insulation							
Domestic	Material						
	Labour						
Chilled/Condenser	Material						
	Labour						
Heating	Material						
	Labour						

Project: Date:

Plumbing		Total Contract Amount $	% to Date	Total to Date $	Previous Amount Invoiced $	Amount this Claim $	Balance Remaining $
Close-out Documentation (5%)							
TOTAL ORIGINAL CONTRACT AMOUNT							
Change Orders							
Architect's CO #	GWA CCO or SI #						
#	#						
#	#						
Total Change Order Amount							
TOTAL CONTRACT AMOUNT							

NOTE: Change Orders that do not reference the Architect's Change Order number and Goodkey, Weedmark's Contemplated Change Order (CCO) or Site Instruction (SI) number will not be reviewed.

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, "Standard Method of Fire Tests of Through Penetration Fire Stops".

.2 International Firestop Council Guidelines for Evaluating Firestop Systems Engineering Judgements.

.3 Inspection Requirements: ASTM E2174-14b, "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.

1.6 References (Cont'd)

.5 All major building codes: NBC, OBC.

.6 NFPA (Fire) 101 - Life Safety Code, 2015 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 smokeseal schedule. Schedule is to include complete details, cut sheets, system descriptions and location of each proposed firestopping & smokeseal 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.

1.10 Delivery, Storage, and Handling (Cont'd)

.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.

2.1 Firestopping, General (Cont'd)

.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.

2.3 Materials (Cont'd)

.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 of Separation	Required ULC or cUL "F" Rating of Firestopping Assembly
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:

3.5 Identification & Documentation (Cont'd)

.4 (Cont'd)

.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, 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 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 B16.18-2012, 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, Class 150 and 300.

.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-16, 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.

.4 Canadian Standards Association (CSA)
- .1 CSA B242-05 (R2016), Groove- and Shoulder-Type Mechanical Pipe Couplings.

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.

2.2 Fittings (Cont'd)

.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.

3.7 Performance Verification (Cont'd)

.2 (Cont'd)

.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 C1540-15, 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 Buried sanitary and vent minimum NPS 3, 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.
- .2 Provide proper transition fittings to tie into existing hub and spigot type pipe when found on site.

2.2 Cast Iron Piping and Fittings (Cont'd)

.2 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 or galvanized steel above ground only.)

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, Specification for Solvent Cements for Poly (Vinyl-Chloride) (PVC) Plastic Piping Systems.

.2 Canadian Standards Association (CSA)
- .1 CSA B1800-15, 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.

2.1 Piping and Fittings (Cont'd)

.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.

3.1 Installation (Cont'd)

.4 Plastic pipe shall not be used on pumped sanitary & storm discharge.

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) 1017-2009, Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems.
- .2 ASSE (Plumbing) 1018-2001, Performance Requirements for Trap Seal Primer Valves-Potable Water Supplied.

.2 Canadian Standards Association (CSA)
- .1 CSA B64 Series-11 (R2016), Backflow preventers and vacuum breakers (Consists of B64.0, B64.1.1, B64.1.2, B64.1.3,B64.1.4 B64.2, B64.2.1, B64.2.1.1, B64.2.2, B64.3,B64.3.1, B64.4, B64.4.1, B64.5, B64.5.1, B64.6, B64.6.1, B64.7, B64.8 and B64.9).
- .2 CSA B79-08 (R2013), Floor, Area and Shower Drains, and Cleanouts for Residential Construction.

.3 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 specialities 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

.1 Floor drains: to CSA B79. Refer to schedule on drawings.

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 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 Floor access: round cast iron body and frame with adjustable secured nickel bronze top, and.
.1 Plugs: bolted bronze with neoprene gasket.
.2 Cover for unfinished concrete floors: nickel bronze round, gasket, vandal-proof screws. Acceptable material: Watts, Zurn ZX-1612-BP.
.3 Cover for terrazzo finish: polished nickel bronze with recessed cover for filling with terrazzo, vandal-proof locking screws. Acceptable material: Watts, Zurn ZX-1400-BP-Z.
.4 Cover for tile and linoleum floors: polished nickel bronze with recessed cover for linoleum or tile infill, complete with vandal-proof locking screws. Acceptable material: Watts, Zurn ZN-1602-BP-VP light traffic.

2.3 Trap Seal Primers

.1 Type 1: for use on urinal or water closet cold water line.
.1 Pressure drop activated type, all brass construction with "O" ring seals, 12 mm (NPT ½) male inlet & 12 mm (NPT ½) female outlet drip line connection with viewing holes, and removable fitter screen. Trap primer shall have no adjustment. Operating range shall be 138 kPa (20 psi) to 861 kPa (125 psi). Operates on pressure drop of Minimum 20 kPA (3 psi). One (1) to six (6) 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 urinal or water closet cold water line. Trap line shall be from top of cold water line and include a service valve. All to be serviceable from access doors.
.4 Acceptable materials: Mifab M-500, Watts, Zurn Z-1022.

.2 Type 2: for use on lavatory cold water line.
.1 Brass trap seal primer with removable poppet, integral vacuum breaker, gasketted access cover 13 NPT (½") threaded inlet and outlet connections, complete with 13 NPT (½") sweat connection adapters and 13 NPT (½") 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.

2.4 Water Hammer Arrestors

.1 Copper construction, bellows or piston type: to PDI-WH201.

2.4 Water Hammer Arrestors (Cont'd)

.2 Acceptable material: Watts, J.R. Smith & Zurn Z-1700.

2.5 Vacuum Breakers

.1 To CSA B64.

.2 Atmospheric vacuum breaker:
.1 Acceptable material: Zurn Model 35 (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.

2.6 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.

2.7 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.

2.8 Under Sink Thermostatic Mixing Valve

.1 Thermostatic Mixing Valve:
.1 The valve shall be ASSE standard 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.
.2 Acceptable material: Watts series LFUSG-B or as scheduled.

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

.1 In addition to those required by code, and as indicated, install at base of soil and waste stacks, and rainwater leaders.

.2 Bring cleanouts to wall or finished floor unless serviceable from below floor.

.3 Building drain cleanout and stack base cleanouts: line size to maximum NPS4.

3.4 Water Hammer Arrestors

.1 Install on branch supplies to fixtures or group of fixtures.

3.5 Hose Bibbs and Sediment Faucets

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

3.6 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 Engineer.

.3 Install soft copper 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.

3.7 Strainers

.1 Install with sufficient room to remove basket.

3.8 Start-up

.1 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.

3.8 Start-up (Cont'd)

.2 Provide continuous supervision during start-up.

3.9 Testing and Adjusting

.1 Timing:
- .1 After start-up deficiencies rectified.
- .2 After certificate of completion has been issued by authority having jurisdiction.

.2 Application tolerances:
- .1 Pressure at fixtures: +/- 70 kPa.
- .2 Flow rate at fixtures: +/- 20%.

.3 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.

.4 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, removeability of strainer.
- .5 Clean out baskets.

.5 Access doors:
- .1 Verify size and location relative to items to be accessed.

.6 Cleanouts:
- .1 Verify covers are gas-tight, secure, yet readily removable.

.7 Water hammer arrestors:
- .1 Verify proper installation of correct type of water hammer arrester.

.8 Strainers:
- .1 Clean out repeatedly until clear.
- .2 Verify accessibility of cleanout plug and basket.
- .3 Verify that cleanout plug does not leak.

- 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 (Consists of B45.0-02, B45.1-02, B45.2-02, B45.3-02, B45.4-02, B45.5-02, B45.6-02, B45.7-02, B45.8-02 and B45.9-02), Includes Updates No. 1, No. 2, No. 3, and No. 4 (2007).
- .2 CSA B125-01, Plumbing Fittings.
- .3 CSA B651-12 (R2017), Accessible Design for the Built Environment.

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.

2.1 Manufactured Units (Cont'd)

.1 (Cont'd)

.2 (Cont'd)

.3 Sink and lavatory heavy gauge P-traps shall be cast brass style adjustable 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, OBC or CAN/CSA B651.

3.2 Urinals

.1 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.

3.3 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 -

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, 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.

3.3 Drains (Cont'd)

.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 (½").

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, 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.

3.6 Pipework Installation (Cont'd)

.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 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.

3.8 Flushing out of Piping Systems

.1 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

.2 Provide test results upon completion and retain written report on status after complete.

3.9 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.

3.10 Existing Systems

.1 Connect into existing piping systems at times approved by Engineer.

.2 Request written approval 10 days minimum, prior to commencement of work.

.3 Be responsible for damage to existing plant by this work.

3.10 Existing Systems (Cont'd)

.4 Ensure daily clean-up of existing areas.

.5 Cleaning & flushing of new piping to be done prior to making final connection to existing system.

.6 Provide full size bypass as required to ensure cleaning of piping.

- 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.

2.2 Motors (Cont'd)

.2 Motors efficiency must exceed the following:

Open Drip-Prrof (ODP) Type

Motor Size	Speed (RPM) 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	Speed (RPM) 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%

2.2 Motors (Cont'd)

.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 Two speed motors shall be double winding type.

.6 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.

.7 Motors coupled with VFD's shall include a shaft grounding ring.

.8 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.

2.4 Belt Drives

.1 Fit reinforced belts in sheave matched to drive. Multiple belts to be matched sets.

.2 Use cast iron or steel sheaves secured to shafts with removable keys unless otherwise specified.

.3 For motor under 7.5 kW (10 HP): standard adjustable pitch drive sheaves, having plus or minus 10% range. Use mid-position of range for specified r/min.

.4 For motors 7.5 kW (10 HP) and over: sheave with split tapered bushing and keyway having fixed pitch unless specifically required for item concerned. Provide sheave of correct size to suit balancing.

.5 Correct size of sheave to be determined during start-up and commissioning.

.6 Minimum drive rating: 1½ times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.

.7 Motor slide rail adjustment plates to allow for centre line adjustment.

2.5 Drive Guards

.1 Provide guards for unprotected drives.

.2 Guards for belt drives;
- .1 Expanded metal screen welded to steel frame.
- .2 Minimum 1.6 mm (16 ga). sheet metal tops and bottoms.

2.5 Drive Guards (Cont'd)

.2 (Cont'd)
- .3 38 mm (1½") dia holes on both shaft centres for insertion of tachometer.
- .4 Removable for servicing.
- .5 OSHA approved.
- .6 Sized to allow either sheave to be increased by two sizes.

.3 Provide means to permit lubrication and use of test instruments with guards in place.

.4 Install belt guards to allow movement of motors for adjusting belt tension.

.5 Plenum fan assembly must have an enclosed safety screen as per OSHA standards.

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 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 B16.34-2013, 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-16, 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-17, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
- .4 ASTM A216/A216M-16, 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 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.

2.3 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.

2.4 Control Valves

.1 Body: globe style or characterized ball.
- .1 Flow characteristic equal percentage.
- .2 Flow factor (KV) to suit application: CV in imperial units.
- .3 Normally open or normally closed, as indicated.
- .4 Two or three port, as indicated.
- .5 Leakage rate ANSI class IV, 0.01% of full open valve capacity.
- .6 Packing easily replaceable.
- .7 Stem, stainless steel.
- .8 Plug and seat, stainless steel.
- .9 Disc, replaceable, material to suit application.
- .10 NPS 2 and under:
  - .1 Screwed National Pipe Thread (NPT) tapered female connections.
  - .2 Valves to ANSI Class 250, valves to bear ANSI mark.
  - .3 Rangeability 50:1 minimum.

.2 Electronic/Electric Valve Actuators:
- .1 Construction: steel, cast iron, aluminum.
- .2 Control signal: 0-10V DC or 4-20 mA DC.
- .3 Positioning time: to suit application. 90 sec maximum.
- .4 Fail to normal position as indicated.
- .5 Scale or dial indication of actual control valve position.
- .6 Size actuator to meet requirements and performance of control valve specifications.

2.4 Control Valves (Cont'd)

.2 (Cont'd)

.7 For interior and perimeter terminal heating and cooling applications floating control actuators are acceptable.

.8 Minimum shut-off pressure: to suit application.

.3 Room temperature sensors and display wall modules.

.1 Temperature sensing and display wall module to base building standard.

.1 LCD display to show space temperature and temperature setpoint.

.2 Buttons for occupant selection of temperature setpoint with lockout capability.

.3 Jack connection for plugging in laptop personal computer for access to zone bus.

.4 Integral thermistor sensing element 10,000 ohm at 24 degrees.

.5 Accuracy 0.2 degrees C over range of 0 to 70 degrees C.

.6 Stability 0.02 degrees C drift per year.

.7 Separate mounting base for ease of installation.

.8 Low voltage transformer wired from nearest available circuit c/w associated wiring. Coordinate with Division 26.

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
Check	NPS 2 & Under	Solder	1342	4093J	237	-	23
		Threaded	37	4037	236	-	22
	NPS 2½ & Over	Flanged	373	587J	435	-	78
		Grooved	-	-		716	-
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	
Natural Gas							
Valve Type			**Crane**	**Jenkins**	**Toyo**	**Kitz**	
Ball	2" & Under	Threaded	9201	201J	5044A	58	

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 A125-96(2013)e1, Specification for Steel Springs, Helical, Heat-Treated.
- .2 ASTM A307-14e1, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .3 ASTM A563-15, Specification for Carbon and Alloy Steel Nuts (Metric).

.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 23 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.

1.5 Shop Drawings and Product Data (Cont'd)

.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 - PRODUCTS

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 23 05 49.01 - Seismic Restraint Systems (SRS).

2.2 Pipe Hangers (Cont'd)

.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^3 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.

2.5 Constant Support Spring Hangers (Cont'd)

.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 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.

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.

3.1 Installation (Cont'd)

.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 23 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.

3.2 Hanger Spacing (Cont'd)

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 ASHRAE HVAC Application-2015, Chapter 54 Seismic & Wind Restraint Design. In addition reference ASHRAE "A Practical Guide to Seismic Restraint".

.2 Ontario Regulation
- .1 ONTARIO OBC-2012, 2012 Ontario Building Code Compendium.

.3 National Fire Protection Association (NFPA)
- .1 NFPA (Fire) 13, Installation of Sprinkler Systems, 2016 edition.
- .2 NFPA (Fire) 14, Installation of Standpipe and Hose Systems, 2016 edition.
- .3 NFPA (Fire) 20, Installation of Stationary Pumps for Fire Protection, 2016 edition.

.4 SMACNA Seismic Restraint Manual 3rd Edition, 2008.

1.3 Definitions

.1 SRS: acronym for Seismic Restraint System.

1.4 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.

.4 Specified critical systems as noted below must remain operational during and after an earthquake:
- .1 All systems for buildings as listed in OBC Table 4.1.8.17.
- .2 Life safety systems for P2 buildings.
- .3 Natural gas & fuel oil systems for P2 buildings.

.5 Design to be by 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 calculations.
- .2 SRS shop drawings.
- .3 SRS installation inspections.
- .4 SRS final certification letter for the project.

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

1.5 Submittals

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

.2 Submittals to include:
- .1 Full details of design criteria, calculations for all equipment & associated systems.
- .2 Seismic Design Engineer shall provide a spreadsheet identifying all equipment requiring or not requiring seismic restraints and include all calculations.
- .3 A copy of the seismic design engineer professional liability insurance coverage.

.3 Submit additional copy of shop drawings and product data to Structural Engineer for review of connection points to building structure.

1.6 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
- .4 Seismic Engineer: a Professional Engineer holding a Certificate of Authorization in the Province of Ontario with a minimum of 5 years experience in seismic design, and with a minimum of $1 million Professional Liability Insurance.

.2 Each contactor 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 Ontario Building Code, ASHRAE Standard "A Practical Guide to Seismic Restraint", NFPA (Fire) 13, 14 & 20, SMACNA "Seismic Restraint Manual" and good engineering practice.

2.1 General (Cont'd)

.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 shall include calculations certified by the Seismic Engineer.

.1 Acceptable Suppliers: HTS Engineering, Master Group, Walmar, E.H. Price.

.2 Acceptable Manufacturers: Kinetics / Vibron, Tecoustics, Mason, Gripple Seismic.

.3 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.

.7 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.

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 OBC.

.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 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 Z7396.1-12. 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 no existing building identification system obvious than the following applies.

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.

2.5 Identification of Piping Systems (Cont'd)

.6 (Cont'd)

.2 Colours for legends, arrows: To following table:

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

.3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
Hot water heating supply	Yellow	HEATING SUPPLY
Hot water heating return	Yellow	HEATING RETURN
Domestic hot water supply	Green	DOM. HW SUPPLY
Dom. HWS recirculation	Green	DOM. HW CIRC
Domestic cold water supply	Green	DOM. CWS source)
Storm water	Green	STORM
Sanitary	Green	SAN.
Plumbing vent	Green	SAN. VENT

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, ...

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 floor. operating

.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.

3.4 Location of Identification on Piping and Ductwork Systems (Cont'd)

.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 ANSI/ASHRAE 110-2016, Method of Testing Performance of Laboratory Fume Hoods.

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 14 days of award of contract.

.2 Provide documentation confirming qualifications, successful experience.

.3 The following are acceptable TAB contractors:
- .1 Aerodynamics & Associates Testing Services Ltd. (N.B.C.T.A., ASHRAE)
- .2 Maxima Technical Services Inc.
- .3 Kanata Air Balancing & Engineering (C.A.A.B.C.)
- .4 Capital Airflow Ltd.
- .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.

1.11 Start of TAB (Cont'd)

.3 (Cont'd)
- .2 (Cont'd)
  - .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.

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).

1.17 TAB Report (Cont'd)

.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 Fan rotational speed.
  - .5 Fan Power, calculate fan efficiency.
  - .6 Equipment static pressure profile.
  - .7 Noise.
- .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.

1.21 Systems (Cont'd)

.2 (Cont'd)
- .3 Air Outlets/Inlets
  - .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.
- .4 Laboratory fume hoods:
  - .1 TAB procedures: as described in standard.

.3 Hydronic Systems: Include both specified and measured data.
- .1 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.

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.

3.1 Balancing and Adjusting Preparation (Cont'd)

.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 C335/C335M-10e1, Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
- .2 ASTM C449-07(2013), Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
- .3 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 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 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.

1.6 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.

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/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^3.

2.3 Jackets

.1 Canvas: 220 gm/m^2 cotton, plain weave, treated with dilute fire retardant lagging adhesive to ASTM C921.

2.3 Jackets (Cont'd)

.2 Lagging adhesive: Compatible with insulation.

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^2.

.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.

3.2 Installation (Cont'd)

.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:

	TIAC Code	Vapour Retarder	Thickness mm (in.)
Exhaust ducts within 3 m from roof/exterior wall	C-1	yes	50 (2")

.2 Finishes: Conform to following table:

	TIAC Code	
	Rectangular	Round
Indoor, concealed	none	none

- 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-10e1, 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-51.11-92, Mineral Fibre Thermal Insulation Blanket.
- .4 CAN/CGSB-51.12-95, Cement, Thermal Insulating and Finishing.
- .5 CAN/CGSB-51.40-95, Thermal Insulation, Flexible, Elastomeric, Unicellular, Sheet and Pipe Covering.
- .6 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.

2.2 Insulation (Cont'd)

.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^3.

.6 TIAC Code A-6: Flexible unicellular tubular elastomer.
- .1 Insulation: to CAN/CGSB-51.40 with vapour retarder jacket.

.7 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 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^2 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.

.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.

3.2 Installation (Cont'd)

.5 (Cont'd)
.2 Saddles to have ridges to limit movement while in hanger.
.3 To be edge flared to prevent cutting/damage to insulation coverage.

.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, Insulation and Enclosures

.1 Application: At expansion joints, valves, primary flow measuring elements flanges and unions 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 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: A-6.
.1 Insulation securements: Bands.
.2 Seals: lap seal adhesive, lagging adhesive.

.5 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.

3.5 Piping Insulation Schedules (Cont'd)

.6 TIAC Code: A-2.
- .1 Insulation securements: stainless steel bands.
- .2 Seals: lap seal adhesive, lagging adhesive.
- .3 Installation: TIAC Code: 1501-H.

.7 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
Domestic Hot Water		A-1	25	38	38	38
Heating/Cooling with Vapour Barrier		A-3	25	38	38	38
Domestic Cold Water		A-3	25	25	25	25
On top of Radiant Panels		C-2	----------50----------			

.8 Finishes:
- .1 Exposed indoors: Canvas, except generator exhaust shall be aluminum.
- .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.

.9 Storm piping & fittings to be insulated from all roof drain bodies to storm piping at grade level.

.10 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 Control Air Tubing

.1 Plastic: flame retardant PVC tubing with minimum burst gauge pressure of 1.4 MPa at 80 degrees C.

.2 Copper: type L complete with flared fittings.

2.2 Thermostats

.1 Wall mounted, direct or reverse acting, to match existing. Existing pneumatic thermostats to be reused.

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 Identify and code pneumatic tubing at every branch and at each piece of equipment and components.

.2 Use copper tubing with flared fittings in following locations:

.1 Inaccessible areas.
.2 Where single lines travel from tube tray to instruments.
.3 Areas of heat above 80 degrees C.
.4 Mechanical rooms.
.5 Rooms where piping subject to damage.
.6 Adjacent to heating pipes passing through common sleeve.
.7 Where air pressures above 200 kPa.
.8 Where codes will not permit use of PVC.
.9 In fire rated walls and ceilings.

.3 Follow building lines. Do not cover with insulation. Install drip legs and drains at low points.

3.3 Field Quality Control .1 Start-Up and Adjustment:

.1 Upon completion of installation, test, adjust and regulate controls or safety equipment provided under this Section.

.2 Adjust and place in operating condition.

- 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 B16.18-2012, 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-13, Specification for Seamless Copper Water Tube Metric.
- .3 ASTM E202-12, 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.

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.

2.3 Di-Electric Couplings

.1 Provide wherever pipes of dissimilar metals are jointed.

2.3 Di-Electric Couplings (Cont'd)

.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].

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 Section 25 01 11.

3.2 Flushing and Cleaning

.1 As new pipework to be flushed, cleand and refilled to approval of Engineer.

3.3 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.

3.4 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.

- 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 and Hex Bolts and Screws.
- .6 ASME B18.2.2-2015, Square and Hex Nuts.

.2 American Society for Testing and Materials (ASTM).
- .1 ASTM A47/A47M-99(2014), Specification for Ferritic Malleable Iron Castings.
- .2 ASTM A53/A53M-12, 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. Steam & Condensate systems refer to Section 23 22 13 - Steel Piping Valves Fittings Steam and Condensate up to 860 kPa,
- .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.
- .9 Grooved mechanical couplings c/w stainless steel hardware as manufactured by Victaulic are acceptable as listed. Style 07; ZeroFlex for rigid connections. Style 77 for flexible connections.

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, perform welding in accordance with ASME.

3.2 Piping Installation

.1 In accordance with Section 23 05 05 - Installation of Pipework.

3.3 Flushing, Cleaning and Filling System .1 All new pipework to be flushed, cleaned and refilled to approval of Engineer.

3.4 Testing .1 Test system in accordance with Section 23 05 05 - Installation of Pipework.

3.5 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 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 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.

2.2 Pipe Line Strainer
.1 NPS 1/2 to 2: bronze body to ASTM B62, Class 250 screwed connections.

.2 NPS 2-1/2 to 12: cast steel body to ASTM A278M, Class 250, flanged connections.

2.2 Pipe Line Strainer (Cont'd)

.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 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").

- 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 A924/A924M-16ae1, 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.

.3 National Fire Protection Association (NFPA)
- .1 NFPA (Fire) 90A, Installation of Air Conditioning and Ventilating Systems, 2015 Edition.
- .2 NFPA (Fire) 90B, Installation of Warm Air Heating and Air Conditioning Systems, 2015 Edition.

.4 Sheet Metal and Air Conditioning Contractors' National Association (SMACA)
- .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.

2.4 Fittings (Cont'd)

.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 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	¼
31 to 42	1½ x 1½ x 1/8	¼
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 ¼	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 Sealing

.1 Apply sealant to outside of joint to manufacturer's recommendations.

3.4 Leakage Tests

.1 In accordance with SMACNA 016.

.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 then 3 branch takeoffs and two 90° elbows.

.6 Complete test before insulation or concealment.

3.5 Kitchen Exhaust Systems

.1 Provide gasketted access doors in suitable locations for inspections & cleaning.

.2 Duct branches to suit openings in kitchen hoods as per supplier recommendation.

.3 All exposed duct connections to hood to be claded with stainless steel.

- 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^2.

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.

2.3 Access Doors in Ducts (Cont'd)

.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 As indicated.
- .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.

3.1 Installation (Cont'd)

.2 (Cont'd)

.2 (Cont'd)

.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 -

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.

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.

3.1 Installation (Cont'd)

.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 References

.1 National Fire Protection Association (NFPA)
- .1 NFPA (Fire) 90A, Installation of Air Conditioning and Ventilating Systems, 2015 Edition.

.2 Underwriters Laboratories of Canada (ULC)
- .1 CAN/ULC S112-10, Fire Test of Fire Damper Assemblies.

1.3 Product Data

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

.2 Indicate the following:
- .1 Fire dampers.
- .2 Fusible links.

1.4 Maintenance Materials

.1 Provide maintenance materials in accordance with Section 20 05 01 - Mechanical General Requirements.

1.5 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 signifying adherence to codes and standards.

PART 2 - PRODUCTS

2.1 Fire Dampers

.1 Fire dampers: arrangement Type B or C, listed and bear label of ULC, meet requirements of NFPA (Fire) 90A authorities having jurisdiction. Fire damper assemblies to be fire tested in accordance with CAN/ULC S112.

.2 Mild steel, factory fabricated for fire rating requirement to maintain integrity of fire wall and/or fire separation.

.3 Top hinged: offset single damper, round or square; interlocking type; sized to maintain full duct cross section as indicated.

.4 Fusible link actuated having negator-spring- closing operator. Dynamic type.

2.1 Fire Dampers (Cont'd)

.5 40 x 40 x 3 mm retaining angle iron frame, on full perimeter of fire damper, on both sides of fire separation being pierced.

.6 Rating: 1½ hr.

.7 Acceptable material: AMI, NCA, Nailor, Ruskin, Ventex/Alumavent, Greenheck, E.H. Price.

PART 3 - EXECUTION

3.1 Installation

.1 Install in accordance with NFPA (Fire) 90A and in accordance with conditions of ULC listing.

.2 Maintain integrity of fire separation.

.3 After completion and prior to concealment obtain approvals of complete installation from authority having jurisdiction.

.4 Install access door adjacent to each damper. See Section 23 33 00 - Duct Accessories.

.5 Coordinate with installer of firestopping.

.6 Ensure access door/panels, fusible links, and/or damper operators are easily observed 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 National Fire Protection Association (NFPA)
- .1 NFPA (Fire) 90A, Installation of Air Conditioning and Ventilating Systems, 2015 Edition.
- .2 NFPA (Fire) 90B, Installation of Warm Air Heating and Air Conditioning Systems, 2015 Edition.

.2 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA).

.3 Underwriters Laboratories (UL)
- .1 UL 181, Factory Made Air Ducts and Connectors.

.4 Underwriters' Laboratories of Canada (ULC)
- .1 CAN/ULC S110-13, Fire Tests for Air Ducts.

1.3 Product Data

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

.2 Indicate the following:
- .1 Thermal properties.
- .2 Friction loss.
- .3 Acoustical loss.
- .4 Leakage.
- .5 Fire rating.

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 Factory fabricated to CAN/ULC S110.

.2 Pressure drop coefficients listed below are based on relative sheet metal duct pressure drop coefficient of 1.00.

.3 Flame spread rating not to exceed 25. Smoke developed rating not to exceed 50.

2.2 Metallic - Uninsulated

.1 Type 2: spiral wound flexible aluminum with triple lock mechanical joints.

.2 Performance:
- .1 Factory tested to 2.5 kPa without leakage.
- .2 Maximum relative pressure drop coefficient: 3.

.3 Acceptable material: Flexmaster Type T/L.

PART 3 - EXECUTION

3.1 Duct Installation

.1 Install in accordance with: CAN/ULC S110, UL 181 Amendment 1, NFPA (Fire) 90A, NFPA (Fire) 90B & SMACNA.

.2 Maximum length of flexible duct: 1500 mm (5 feet).

3.2 Application

.1 Branch ductwork to diffuser where concealed.

- 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 Measurements and Thermal 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, 2015 Edition.
- .2 NFPA (Fire) 90B, Installation of Warm Air Heating and Air Conditioning Systems, 2015 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^3 minimum.
- .4 Thermal resistance to be minimum 0.76 m^2.°C/W for 25 mm thickness when tested in accordance with ASTM C177, at 24°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°C to plus 93°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 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 210-07, 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/AMCA 51-2016, Laboratory Methods of Testing Fans for Rating.

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.

1.6 Certification of Ratings (Cont'd)

.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 as specified supplemented 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 Vibration isolation: as per manufacturer's recommendations.

.13 Flexible connections: to Section 23 33 00 - Duct Accessories.

2.2 Roof Exhauster

.1 Spun aluminum, downblast exhaust fans shall be direct type as per equipment schedule. The fan wheel shall be centrifugal backward inclined, constructed of aluminum and shall include a wheel cone carefully matched to the inlet cone for precise running tolerances. Vibration isolated. Wheels shall be statically and dynamically balanced. The fan housing shall be constructed of heavy gauge aluminum with a rigid internal support structure and a birdscreen.

.2 Motors shall be heavy duty ECM type c/w speed controller, carefully matched to the fan load, and furnished at the specified voltage, phase and enclosure. Drive frame assembly shall be constructed of heavy gauge steel. Motors and drives shall be mounted on vibration isolators, out of the airstream. Fresh air for motor cooling shall be drawn into the motor compartment through a large space between the fan shroud and the motor cover. Motors and drives shall be readily accessible for maintenance.

.3 Precision ground a polished fan shafts shall be mounted in permanently sealed, lubricated pillow block ball bearings. Drives shall be sized for a minimum of 150% of driven horsepower. Pulleys shall be of the cast type, keyed and securely attached to the wheel and motor shafts.

.4 Motor pulleys shall be adjustable for final system balancing. A conduit chase shall be provided through the base to the motor compartment for ease of electrical wiring.

.5 All fans shall come with prefabricated insulated roof curb and backdraft damper.

.6 All fans shall bear the AMCA Certified Ratings Seal for sound and air performance.

.7 Each fan shall bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number for future identification.

.8 Performance: as indicated on drawing schedule.

.9 Acceptable material: Greenheck, PennBarry, Loren Cook or equal.

PART 3 - EXECUTION

3.1 Installation

.1 Install in accordance with manufacturer's instructions.

3.2 Anchor Bolts and Templates

.1 Size anchor bolts to withstand seismic acceleration and velocity forces as specified in Section 23 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 References

.1 Air Movement and Control Association (AMCA)
- .1 AMCA 201-02 (R2011), Fans and Systems.
- .2 AMCA 210-07, 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.
- .5 AMCA 302-73 (R2012), Application of Sone Ratings for Non-Ducted Air Moving Devices.
- .6 AMCA 303-79 (R2012), Application of Sound Power Level Ratings for Fans.

.2 ASHRAE/Air Movement and Control Association
- .1 ASHRAE/AMCA 51-2007, Laboratory Methods of Testing Fans for Rating.

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 Closeout Submittals

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

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 Fans General

.1 Standard of rating:
- .1 AMCA 201 for fan application.
- .2 AMCA 302 for application of sone loudness ratings for non-ducted air moving devices.
- .3 AMCA 303 for application of sound power ratings for ducted air moving devices.
- .4 Performance: to AMCA 210 and ASHRAE 51. Unit to bear AMCA certified seal.

.2 Pwl sound ratings to comply with AMCA 303, tested to AMCA 300 Unit to bear AMCA certified sound rating seal.

2.1 Fans General (Cont'd)

.3 Maximum loudness: 3.5 sones.

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. ECM motor with controller.

.7 Angle mounting brackets can be adjusted to any typical ceiling material thickness.

.8 Acceptable material: Greenheck, PennBarry, Loren Cook, Twin City.

PART 3 - EXECUTION

3.1 Installation

.1 Install in accordance with manufacturer's recommendations.

3.2 Anchor Bolts and Templates

.1 Supply for installation by other Divisions.

.2 Size anchor bolts to withstand seismic 4 acceleration and 2 velocity forces.

- 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.

2.1 General (Cont'd)

.4 Acceptable material: E.H Price Ltd., Nailor, Titus, Krueger, Metal-aire.

2.2 Return and Exhaust Grilles and Register

.1 Type TG1: aluminum, 13 mm x 13 mm egg crate type face bars, baked white enamel finish, ducted where indicated, drywall mounted. Size 600 mm x 150 mm unless otherwise indicated. Equivalent to E.H. Price Model 80.

.2 Type EG1: steel construction, 35° deflection, fixed louvres, 20 mm (¾") spacing, off-white baked enamel finish. Size as indicated. Drywall mounted. Equivalent to E.H. Price Model 535.

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 Shop Drawings

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

.2 Manufacturer of Radiant Panel shall submit AutoCAD drawings and full scale plans showing panel layout dimensions, connection points, performance data and assembly details.

.3 Indicate:

.1 Equipment, capacity, piping, and connections.

.2 Dimensions, internal and external construction details, recommended method of installation with proposed structural steel support, sizes and location of mounting bolt holes.

.3 Special enclosures.

.4 Shop drawings will not be reviewed unless all the above submissions are provided. Any costs associated with the failure to provide the above noted submittals shall be borne solely by the contractor.

1.3 Samples

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

.2 Submit 600 mm length sample panel showing method of securing to structure and connecting to adjacent length of enclosure.

1.4 Warranty

.1 Manufacturer to provide a 10 year radiant panel replacement warranty including parts and labour for panel finish against discolouring and paint separation when operating with 85°C heating water.

PART 2 - PRODUCTS

2.1 Capacity

.1 As indicated, based on 82.2°C (180°F) entering water temperature, 11°C (20°F) temperature drop and 21°C (70°F) room temperature.

.2 Maximum pressure drop per zone: 12.9 kPa (4 ft.)

2.2 Linear Radiant Panels (RP)

.1 Contractor shall refer to mechanical drawings to determine location, quantity and sizing of radiant panels.

.2 Panels shall be sized according to the required heat output as indicated on drawings.

.3 The radiant ceiling extrusions shall consist of extruded aluminum with copper tubing of 12.8 mm I.D. mechanically attached to the aluminum face plate. The copper tube shall be held in place by an aluminum saddle which extends more than half way around the diameter of the tube. A non-hardening heat conductive paste shall be placed between the copper tubing and the aluminum face plate. Panels shall weigh no more than 10.5 kg/m^2 when operating. The use of adhesive and/or clips to attach the copper tube to the extrusion will not be acceptable. Panels shall be fitted with drywall frame and access sections as noted; confirm dimension from site prior to fabrication. All curved sections shall be shop mitred. All panels shall be independently supported from structure.

.4 Factory assembled panels only.

.5 Provide boarder frame or vertical extrusion as indicated.

.6 Panels shall be finished in a powder coat to the manufacturer's standard white colour.

.7 Reference drawing for performance.

.8 Acceptable materials: TWA panels, Airtex (Engineered Air), Rittling, Sigma panels.

PART 3 - EXECUTION

3.1 Installation

.1 Install in accordance with manufacturer's instructions.

.2 Install in accordance with piping layout and reviewed shop drawings.

.3 Provide for pipe movement during normal operation.

.4 Maintain sufficient clearance to permit performance of service maintenance.

.5 Check final location with Engineer if different from that indicated prior to installation. Should deviations beyond allowable clearances arise, request and follow Engineer's directive.

.6 All panels to be covered by 50 mm (2") thick fibreglass insulation c/w foil back after connection and testing of panels is complete.

- END OF SECTION -

1.1 General

.1 Inspection authorities shall mean Electrical Safety Authority.

.2 Supply authority shall mean Hydro Ottawa.

.3 Provide shall mean supply, install, test and commission.

.4 Refer to General Instructions, Contract Requirements, Amendments and Divisions 00 & 01 and be governed by same.

1.2 Codes and Standards

.1 Provide complete installation in accordance with the latest edition of the Ontario Electrical Safety Code and Electrical Bulletins.

.2 Provide overhead and underground systems in accordance with CAN/CSA C22.3 No. 1 except where specified otherwise.

.3 Comply with the following additional codes as a minimum:

.1 CSA Standards.
.2 ULC Standards.
.3 Ontario Building Code - Latest Edition.
.4 Fire Code.
.5 Elevator Code.
.6 NFPA.

1.3 Care, Operation and equipment. Start-up

.1 Instruct operating personnel in the operation, care and maintenance of

.2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components.

.3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.4 Time of Completion

.1 Commence work upon notification of acceptance of offer, or as outlined in the approved construction schedule.

.2 Verify equipment delivery times immediately and notify engineer within two (2) weeks of contract award of any deliveries which would affect schedule.

1.5 Shop Drawings

.1 Submit single electronic format (pdf) of shop drawings and product data along with transmittal. Hard copy shop drawings shall not be accepted.

1.5 Shop Drawings (Cont'd)

.2 The review is for the sole purpose of ascertaining conformance with the general design concept, and does not mean approval of the design details inherent in the shop drawings, responsibility for which shall remain with the Contractor. Such review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of his responsibility for meeting all requirements of the Contract Documents.

.3 Do not commence manufacture or order materials before shop drawings are reviewed.

.4 Shop drawings shall clearly indicate:
- .1 Name of Contractor.
- .2 Name of component.
- .3 Name of service or system.
- .4 Contractors signed review stamp.

.5 Shop drawings shall include, but is not limited to, the following information:
- .1 Arrangement of specific system.
- .2 Electrical characteristics, volts, phase, amps, etc.
- .3 Dimensions of equipment and required clearances.
- .4 Performance data.
- .5 Finish.
- .6 Gauge of materials.
- .7 Wiring diagrams (where applicable).
- .8 Product data (where applicable).

.6 Review relevant shop drawings of other Divisions to ensure interface of systems with respect to wiring, voltages, ampacities, phases, size, controls, etc. Notify Engineer of any discrepancies immediately.

.7 Provide shop drawings for the equipment listed below and/or as indicated in this specification:
- .1 Distribution equipment.
- .2 Light fixtures.
- .3 Emergency lighting.
- .4 Motor control equipment.
- .5 Emergency - power generation.
- .6 Fire alarm.

1.6 Fire & Safety at Requirements

.1 Comply with National Building Code (Part 8, Health and Safety Measures Construction and Demolition Sites) and Provincial Regulations for Construction Projects.

1.7 Existing Services

.1 Existing services required for work may be used by the Contractor with the Owners written consent. Ensure capacity is adequate prior to imposing additional loads. Connect and disconnect at own expense and responsibility.

.2 Notify the Owner a minimum of 72 hours in advance of intended interruption of services; obtain requisite permissions.

1.7 Existing Services (Cont'd)

.3 Keep duration of these interruptions to a minimum. Carry out all interruptions after normal working hours of the occupants, preferably on weekends or as approved by the Owner in writing.

.4 Any unscheduled disruption to services to be immediately reinstated.

.5 Existing fire alarm and security systems are to remain fully functional, throughout, provide conduit and wire as required to maintain services during construction.

1.8 Demolition

.1 Unless otherwise specified, materials for removal become the Contractor's property and shall be taken from site, and disposed of in accordance with all applicable codes, standards and regulations.

.2 Existing lighting ballasts may contain P.C.B.'s. Contact the local Ministry of Environment (M.O.E.) office for confirmation of ballasts containing P.C.B. material. Submit written confirmation from M.O.E. verifying the presence or non-presence of P.C.B.'s. If P.C.B.'s are found to be present, provide removal of ballasts from light fixtures and place in approved 45 gallon drums for storage on site. Handle P.C.B. contaminated equipment in accordance with codes, standards and guidelines.

.3 Disconnect and make safe all systems to be demolished by other Divisions. Refer to other Divisions for extent.

.4 Maintain existing remaining circuits, systems, etc., which pass through construction/demolition areas. Provide additional wire and conduit as required to maintain systems. Additional wire and conduit to be concealed when construction is complete.

.5 Reinstate immediately, any existing remaining systems, inadvertently interrupted during construction or demolition.

.6 Remove all redundant wiring and conduit in ceiling spaces, (power, communications, systems, etc.).

1.9 Protection

.1 Protect access areas through existing building (lobby, elevator, corridor stairwell, etc.) from damage. Clean area daily or more frequently if directed by Engineer.

.2 Protect exterior areas (roof, walls, etc.) against damage during handling of new and removed materials.

.3 Repair and make good all damaged equipment, etc. to satisfaction of the Engineer.

.4 Protect stored materials, work in process and finished work against damage until take-over.

.5 Protect adjacent areas against spread of dust and dirt beyond work areas.

.6 Protect operatives and other users of site from all hazards.

1.10 Anchoring Methods

.1 Electrical equipment, fixtures, cable tray, conduit and cabling is to be securely anchored or fastened to the building structure using drilled hole wedge anchors for concrete structures or steel clamps for steel structures.

.2 Air, fuel or powder actuated devices or any other equivalent type of fastening devices are not to be used.

.3 Where anchoring method forms part of seismic restraint requirements, anchoring methods to comply with Section 26 05 05 - Seismic Restraint Systems (SRS).

1.11 Use of Site and of Facilities

.1 Execute work with least possible interference or disturbance to normal use premises. Make arrangements with Building Owner to facilitate work as stated.

.2 Particular attention shall be given to minimizing dust, noise and other forms of contamination from occupied areas.

.3 Maintain existing services to building and provide for personnel and vehicle access.

.4 Where security is reduced by work, provide temporary means to maintain security.

1.12 Cutting, Patching & work. Making Good

.1 Provide cutting & patching of existing surfaces as required to accommodate new

.2 Remove all items so shown or specified.

.3 Patch and make good surfaces cut, damaged or disturbed, to Engineer'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.

.5 Scan slabs before coring or drilling deeper than 1" (25 mm). Provide all required notification, clearance & protection for scanning process. Adjust coring & drilling locations as necessary to avoid rebar & conduits.

1.13 Examination

.1 Examine site and conditions which will affect the work. Submission of tender shall be deemed as confirmation that tenderer has inspected site and is conversant with conditions, and shall not constitute additional costs as a result of site conditions.

.2 Verify existing conditions including but not limited to, structural elements, sprinkler piping and heads, roof drains and storm sewer piping, electrical conduit and wiring, process utility piping, ductwork and other building services.

.3 The fact that not all existing conditions discussed in Item .2 above are shown on the drawings does not relieve the responsibility of coordinating the work with the existing construction.

1.14 Co-ordination

.1 Co-ordinate the work with all other Divisions, especially Divisions 21, 22 & 23, to ensure systems compatibility, and to ensure schedules and requirements are maintained.

.2 Where perceived interferences occur, prepare detailed sketches indicating proposed solution for review and acceptance by Engineer.

1.15 Operating and Maintenance Instructions Manual

.1 Submit electronic format (pdf) copy of draft Operation and Maintenance Manual to Engineer for approval, compiled as follows:

.1 Enclose title sheet labelled "Operating and Maintenance Instructions", project name, date and list of contents. Project name must appear on binder face and spine.

.2 Organize contents into applicable sections of work to parallel project specifications breakdown. Mark each section by labelled tabs protected with celluloid covers fastened to hard paper dividing sheets.

.2 Include following information plus data specified.

.1 Installation and maintenance instructions for equipment and materials.

.2 Description: Operation of the equipment and systems defining start-up, shut-down and emergency procedures, and any fixed or adjustable set points that affects the equipment operation. Include nameplate information such as make, size, capacity and serial number.

.3 Maintenance: Use clear drawings, diagrams or manufacturers' literature which specifically apply and detail the following:

.1 Lubrication products and schedules.

.2 Trouble-shooting procedures.

.3 Adjustment techniques.

.4 Operational checks. Suppliers names, addresses and telephone numbers and components supplied by them must be included in this section. Components must be identified by a description and manufacturer's part

.3 Spare Parts: List all recommended spares to be maintained on site to ensure optimum efficiency. List all special tools appropriate unique application. All parts/tools detailed must be identified as to manufacturer, manufacturer part number and supplier (including address).

.4 Include shop drawings, operation and maintenance instructions (bound as one) in accordance with the above for all equipment specified.

.5 Include one complete set of final shop drawings (bound separately) indicating corrections and changes made during fabrication and installation.

.6 Within four (4) weeks of acceptance of draft manuals, submit four (4) copies.

.7 Failure to submit manuals as specified, will incur additional 10% holdback against progress payments.

.8 Include appropriate wiring diagrams, schematics, elevations, mounting requirements, options included, etc. as it pertains to each system and/or device.

1.15 Operating and Maintenance Instructions Manual (Cont'd)

.9 Information in manuals is to be specific to this project. Generic information is unacceptable.

1.16 As-built Drawings

.1 Site records:

.1 Electrical 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 ELECTRICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (date).

.2 Submit hard copy to Engineer for approval and make corrections as directed.

.3 Following approval, submit completed hard copy as-built drawings with Operating and Maintenance Manuals.

1.17 Guarantees and and Warranties

.1 Before completion of work, collect all manufacturer's guarantees and warranties submit to the Engineer.

.2 Identify, bind and index material in maintenance manuals.

.3 Division 26's Contractor to submit a written, signed guarantee stating that all systems and components have been installed to manufacturers recommendations and that systems are operating satisfactorily and meet the design requirements, and all material and labour deficiencies will be corrected, at no cost, for a period of one year after substantial completion.

1.18 Final Inspection

.1 Do not request final inspection until:

.1 Deficiencies are less than 25 items.

.2 All systems have been tested and are ready for operation.

.3 All balancing of loads has been completed.

.4 The Owner's operating personnel have been instructed in the operation of all systems and equipment.

.5 The complete operation and maintenance data books have been delivered to the Engineer.

.6 All inspection certificates have been furnished.

.7 All record drawings have been completed and approved.

.8 All spare parts and replacement parts have been provided and receipt of same acknowledged.

.9 The cleaning up is finished in all respects.

.10 Fire alarm verification certificates submitted.

1.18 Final Inspection (Cont'd)

.2 Final inspection shall be subjected to the approval of the Engineer.

1.19 Clean Up

.1 Clean up work area as work progresses.

.2 At the end of each work period, and more often if ordered by the Engineer, remove debris from site.

.3 Clean areas under contract to a condition at least equal to that previously existing and to approval of Engineer.

.4 Provide cleaning of light fixture reflectors, lamps and lenses, vacuum panelboards, cabinets switchgear, etc., upon completion of contract, to Engineers satisfaction.

1.20 Approval of be Alternative Material

.1 During the tendering period, alternative materials to those specified may considered if full descriptive data are submitted five (5) days prior to tender closing to:

GOODKEY, WEEDMARK & ASSOCIATES LIMITED
1688 Woodward Drive
Ottawa, Ontario
K2C 3R8

.2 Approval of alternatives will be signified by issue of an Addendum to the Contract Documents.

.3 Include cost of any and all additional work and modifications to the engineering design, and costs incurred by other Divisions as a result of using materials.

1.21 Contract Documents

.1 Drawings and specifications are complementary, items shown or mentioned in one and not in the other are deemed to be included in the contract work.

.2 The contract documents are intended to describe complete fully functional systems although not all components are indicated. Division 26 shall provide all required conduits, wiring, equipment, etc. to provide fully functional systems which meet the design intent.

.3 Discrepancies in the design documents, or doubt as to the full intent of the design shall be brought to the Engineer's attention prior to tender close. Failure to do this means that the Contractor is fully aware and shall be responsible of design intent and requirements and shall provide fully functional and coordinated systems.

1.22 Project Schedule

.1 On award of contract and upon Engineer's request, submit bar chart construction schedule for work, indicating anticipated progress stages within time of completion.

.2 All building operations must be maintained during all phases of construction.

1.22 Project Schedule (Cont'd)

.3 All plant shutdowns causing interruption of services to the building occupants will be scheduled for unoccupied hours (nights or weekends) as approved by the Owner and Engineer. Provide minimum of 72 hours notice.

.4 When schedule has been reviewed by the Owner and Engineer, take necessary measures to complete work within scheduled time. Any change of schedule must be authorized by Owner and the Engineer.

1.23 Cost Breakdown

.1 Within one (1) week of award of contract, submit breakdown of costs as separate amounts of labour, materials, etc. of each system. Break down electrical systems generally as follows:

.1 Start-up.
.2 Permits and inspections.
.3 Site work.
.4 Distribution.
.5 Coordination study.
.6 Branch circuit roughing.
.7 Wiring devices.
.8 Lighting:
  .1 Exterior.
  .2 Interior.
  .3 Exit Lights.
.9 Fire alarm.
.10 C.A.T.V.
.11 Telephone.
.12 PA/intercom.
.13 Security.
.14 Generator & associated equipment.
.15 Clocks.
.16 Motor control.
.17 Data system.
.18 Testing, commissioning and job cleanup. (Generally 1.5 to 3% of total cost). Indicate material & labour costs separately for each item.

.2 After acceptance by Engineer, cost breakdown will be used as the basis of progress payments.

1.24 Permits, Fees and of Inspection

.1 Submit to Electrical Inspection Department and Supply Authority necessary number drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Notify Engineer of changes required by Electrical Inspection Department prior to making changes.

.4 Furnish Certificates of Acceptance from Electrical Inspection Department and authorities having jurisdiction on completion of work to Engineer and include in manuals. Final payment will not be made until certificates have been submitted.

1.25 Materials and to Equipment

.1 Equipment and material to be new CSA certified. Where there is no alternative supplying equipment which is not CSA certified, obtain special approval from Electrical Inspection Department.

.2 Factory assemble control panels and component assemblies.

1.26 Trade Qualifications

.1 The work shall be carried out by licensed electricians with minimum five years experience who hold Ontario Certificates of Qualifications, and current contractors license.

.2 Installation methods and materials to be of strictest quality, and conform to Canadian General Standards Board, Canadian Standards Association, Ontario Building Code and all Local and Provincial Codes and Standards. Discrepancy in Codes to mean strictest rule applies.

.3 The ratio of Journeymen to Apprentices shall not exceed the ratio in the Trade Qualifications and Apprenticeship Act of Ontario.

1.27 Finishes

.1 Shop finish metal enclosure surfaces by application of rust resistant primer inside and outside, and at least two coats of finish enamel.
- .1 Paint outdoor electrical equipment "equipment green" finish to EEMAC Y1-1.
- .2 Paint indoor switchgear and distribution enclosures light grey to EEMAC 2Y-1.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original paint.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

1.28 Equipment Identification

.1 Identify electrical equipment with nameplates as follows:
- .1 Nameplates:
  - .1 Lamicoid 3 mm thick plastic engraving sheet, black face, white core, mechanically attached with self tapping screws.

NAMEPLATE SIZES

Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters

- .2 Labels:
  - .1 Electronically printed, self-adhesive plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates to be as indicated c/w volts, phase, amps, HP, etc.
- .4 Allow for average of twenty-five (25) letters per nameplate.
- .5 Identification to be English and French.
- .6 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .7 Disconnects, starters and contactors: indicate equipment being controlled and voltage, Size 7.
- .8 Terminal cabinets and pull boxes: indicate system and voltage, Size 7.

1.28 Equipment Identification (Cont'd)

.1 (Cont'd)

.9 Transformers: indicate capacity, primary and secondary voltages, Size 7.

.10 Panelboards nameplate, Size 7.

.11 Provide typed circuit directory for each panelboard.

.12 Identify all receptacle outlets by panel, circuit number and voltage, with Brother P-Touch labeller.

.13 Provide identification on service poles and prewired partitions at 300 mm A.F.F.

.14 Provide system, circuit, voltage, phase, etc., on all ceiling space junction box covers, red for fire alarm & emergency circuits, black for others.

.15 All circuit protective devices to be c/w a lamacoid label mounted inside door of device listing all fuse type and ratings, circuit breaker settings and minimum interrupting ratings.

.16 All switchboards and panelboards to have a permanent lamicoid label mounted on inside of door with minimum circuit breaker interrupting rating.

1.29 Wiring Identification

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

1.30 Conduit and Cable cables. Identification

.1 Colour code conduits, boxes and metallic sheathed

.2 Code with plastic tape or paint at points where conduit or cable enters wall, ceiling, or floor, and at 15 m intervals.

.3 Colours: 25 mm wide prime colour and 20 mm wide auxiliary colour.

	Prime	Auxiliary
up to 250 V	blue	
up to 600 V	yellow	
up to 5 kV	yellow	blue
up to 15 kV	yellow	yellow
Voice/data	green	
Security	green	blue
Fire alarm	red	
Emergency power (250V)	red	blue
Emergency power (600V)	red	yellow

1.31 Wiring Terminations

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

1.32 Manufacturers and installed. CSA Labels

.1 Visible and legible after equipment is

1.33 Location of Outlets

.1 Locate outlets as indicated.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors. Locate disconnect devices in mechanical and elevator machine rooms on latch side of door.

1.34 Mounting Heights

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.

- .1 Local switches: 1100 mm.
- .2 Wall receptacles:
  - .1 General: 400 mm.
  - .2 Above top of continuous baseboard heater: minimum 200 mm.
  - .3 Above top of counters or counter back splashes: 175 mm.
  - .4 In mechanical rooms: 1200 mm.
- .3 Panelboards: as required by Code or as indicated.
- .4 Telephone and interphone outlets: 400 mm.
- .5 'F' indicates floor mounting.
- .6 'C' indicates ceiling mounted.
- .7 Wall mounted telephone and interphone outlets: 1100 mm.
- .8 Fire alarm pull stations: 1200 mm.
- .9 Fire alarm bells: 2100 mm.
- .10 Television outlets: 400 mm.
- .11 Wall mounted speakers: 2100 mm.
- .12 Clocks: 2100 mm.
- .13 Door bell pushbuttons: 1100 mm.
- .14 Thermostats: 1200 mm.

1.35 Load Balance

.1 Measure phase current to panelboards with normal loads operating. Do tests after space is fully occupied and operational. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

.2 Measure phase voltages at loads and adjust transformer taps to within 2% of rated voltage of equipment, after space is fully occupied and operational.

1.35 Load Balance (Cont'd)

.3 Submit, at completion of work, report listing phase and neutral currents on panelboards, dry-core transformers and motor control centres, operating under normal load. State hour and date on which each load was measured, and voltage at time of test.

1.36 Field Quality Control

.1 Conduct and pay for following tests:
- .1 Power distribution system including phasing, voltage, grounding and load balancing.
- .2 Circuits originating from branch distribution panels.
- .3 Lighting and its control.
- .4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
- .5 Systems: fire alarm system.

.2 Furnish manufacturer's certificate or letter confirming that entire installation as it pertains to each system has been installed to manufacturer's instructions.

.3 Carry out tests in presence of Engineer.

.4 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.

.5 Submit test results for Engineer's review.

.6 Hot spot testing:
- .1 After 24 hours of operation under full load, perform infrared tests on all cable terminations and connections and all transformer, panel and breaker connections, to ensure the integrity of the system.
- .2 Tests to be carried out by using an infrared camera.
- .3 Terminations and/or connections failing tests shall be replaced immediately as part of the contract.

1.37 Co-ordination of Protective Devices

.1 Ensure circuit protective devices such as overcurrent trips, relays and fuses installed to values and settings, as per approved coordination study.

1.38 Fire and Smoke Stopping

.1 Provide fire and smoke stopping where conduits, cables, trays, etc., penetrate floor slabs or fire rated walls with an approved ULC listed putty, equal to 3M caulk CP25 and putty 303.

.2 Installation of fire stops by trained manufacturers representative.

1.39 Sprinkler- proof Equipment

.1 Provide sprinklerproof equipment in all sprinklered areas to the local authorities requirements.

1.40 Access Doors

.1 Provide access doors as required by inspection authorities and Engineer to ensure access to concealed electrical work.

.2 Access doors shall be as specified in Division 09 with fire resistance rating equal to wall or ceiling in which door to be installed. Minimize access door requirements and obtain approval of locations prior to electrical systems installation. Prepare a sketch drawing indicating locations for review by Owner/Architect/Engineer.

.3 Submit access door shop drawings.

Project: Date:

Item		Total Contract Amount $	% to Date	Total to Date $	Previous Amount Invoiced $	Amount this Claim $	Balance Remaining $
Job Set-up (Mobilization)							
Permits & Inspections							
Site Work							
Distribution	Material						
	Labour						
Branch Circ. Roughing	Material						
	Labour						
Wiring Devices	Material						
	Labour						
Lighting (Interior & Exterior)	Material						
	Labour						
Emergency & Exit Lighting	Material						
	Labour						
Fire Alarm	Material						
	Labour						
Data/Communications	Material						
	Labour						
Generator & Transfer Switches (if applicable)	Material						
	Labour						
	Start-up						
Systems (job specific)	Material						
	Labour						
	Start-up						

Project: Date:

Item		Total Contract Amount $	% to Date	Total to Date $	Previous Amount Invoiced $	Amount this Claim $	Balance Remaining $
Motor Control (if applicable)	Material						
	Labour						
Testing & Job Clean-up (Demobilization)							
Commissioning							
As-builts and O&M Manuals							
TOTAL ORIGINAL CONTRACT AMOUNT							
Change Orders							
Architect's CO #	GWA CCO or SI #						
#	#						
#	#						
Total Change Order Amount							
TOTAL CONTRACT AMOUNT							

NOTE: Change Orders that do not reference the Architect's Change Order number and Goodkey, Weedmark's Contemplated Change Order (CCO) or Site Instruction (SI) number will not be reviewed.

PART 1 - GENERAL

1.1 Related Sections

.1 This section shall be read in conjunction with specification Section 26 05 00 - Electrical General Requirements, all electrical sections, and all other disciplines related to the project.

1.2 Definitions

.1 SRS: acronym for Seismic Restraint System.

1.3 General Description

.1 This section covers design, supply and installation of complete SRS for all systems, equipment specified for installation on this project by Division 26. This includes, but is not limited to, electrical light fixtures, transformers, MCC's, UPS, diesel generators, fire protection, conduit, communications, electrical equipment and systems, both vibration isolated and statically supported.

.2 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.

1.4 References

.1 Canadian Standards Association (CSA)
- .1 CSA S832-14, Seismic Risk Reduction of Operational and Functional Components (OFCs) of Buildings.

.2 Ontario Regulation
- .1 ONTARIO OBC-2012, 2012 Ontario Building Code.

1.5 Submittals

.1 Submit shop drawings and product data in accordance with Section 26 05 00 - Electrical General Requirements.

.2 Submit seismic restraint shop drawings, c/w seal of Professional Engineer registered in Province of Ontario, clearly identifying equipment/systems reviewed and the equipment/systems requiring restraint. Shop drawings must clearly show all forces transferred to structure.

.3 Seismic Design Engineer shall provide a spreadsheet identifying all equipment and systems requiring or not requiring seismic restraints and include all circulations.

.4 Submit additional copy of shop drawings and product data to project Structural Engineer for review of connection points to building structure.

1.6 Maintenance Data

.1 Provide maintenance data including monitoring requirements for incorporation into manuals specified in Section 26 05 00 - Electrical General Requirements.

1.7 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 OBC.

PART 2 - PRODUCTS

2.1 SRS Manufacturer

.1 SRS to be from one manufacturer regularly engaged in production of same, 5 years experience.

.2 Acceptable materials: Korfund-Sampson, Mason Industries, Tecoustics, Vibra-Sonic Control, Vibron.

2.2 General

.1 Design to be by Professional Engineer specializing in design of SRS and registered in Province of Ontario. Division 26 to include all costs associated with this work as it relates to Division 26 installations.

.2 SRS to be fully integrated into, compatible with:
.1 Noise and vibration controls specified elsewhere in this project specification, telecommunications.
.2 Structural, mechanical, electrical design of project.

.3 During seismic event, SRS to prevent systems and equipment from causing personal injury, interfering with other systems, and from moving from normal position.

.4 Design and installation in accordance with OBC, CSA S832.

.5 SRS to provide gentle and steady cushioning action and avoid high impact loads

.6 SRS to restrain seismic forces in all directions.

.7 Fasteners and attachment points to resist same load as seismic restraints.

.8 SRS of conduit systems to be compatible with:
.1 Expansion, anchoring and guiding requirements.
.2 Equipment vibration isolation and equipment SRS.

.9 SRS utilizing cast iron, threaded pipe, other brittle materials not permitted.

.10 Attachments to RC structure:
.1 Use high strength mechanical expansion anchors.
.2 Drilled or power driven anchors not permitted.

.11 Seismic control measures not to interfere with integrity of firestopping.

2.3 SRS for Static Equipment, Systems

.1 Floor-mounted equipment, systems:
- .1 Anchor equipment to equipment supports.
- .2 Anchor equipment supports to structure.
- .3 Use size of bolts scheduled in approved shop drawings.

.2 Suspended equipment, systems:
- .1 Use one or combination of following methods:
  - .1 Install tight to structure.
  - .2 Cross-brace in all directions.
  - .3 Brace back to structure.
  - .4 Slack cable restraint system.
- .2 SRS to prevent sway in horizontal plane, "rocking" in vertical plane, sliding and buckling in axial direction.
- .3 Hanger rods to withstand compressive loading and buckling.

2.4 SRS for Vibration Isolated Equipment

.1 Floor mounted equipment, systems:
- .1 Use one or combination of following methods:
  - .1 Vibration isolators with built-in snubbers.
  - .2 Vibration isolators and separate snubbers.
  - .3 Built-up snubber system approved by Engineer, consisting of structural elements and elastomeric layer.
- .2 SRS to resist complete isolator unloading.
- .3 SRS not to jeopardize noise and vibration isolation systems. Provide 4-8 mm clearance between seismic restraint snubbers and equipment during normal operation of equipment and systems.
- .4 Cushioning action to be gentle and steady by utilizing elastomeric material or other means in order to avoid high impact loads.

.2 Suspended equipment, systems:
- .1 Use one or combination of following methods:
  - .1 Slack cable restraint system.
  - .2 Brace back to structure via vibration isolators and snubbers.

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.

3.2 Inspection and Certification (Cont'd)	.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 set Documentation	.1	Upon completion and acceptance of certification, hand over to Engineer complete 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 26 05 00 - Electrical General Requirements, all electrical sections, and all other disciplines related to the project.

1.2 Location of Conduit
.1 Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only.

.2 Conduit to be concealed.

1.3 References
.1 Canadian Standards Association (CSA)
- .1 CSA C22.1HB-15, CE Code Handbook, an Explanation of Rules of the Canadian Electrical Code, Part 1.
- .2 CAN/CSA C22.2 No. 65-13, Wire Connectors.

PART 2 - PRODUCTS

2.1 Conduits
.1 Electrical metallic tubing EMT, with steel set screw couplings and connectors.

.2 Flexible steel conduit and liquid-tight flexible metal conduit.

2.2 Conduit Fastenings
.1 One hole steel straps to secure surface conduits 50 mm and smaller. Two hole steel straps for conduits larger than 50 mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 1.5 m oc.

.4 Six mm dia threaded rods to support suspended channels.

2.3 Conduit Fittings
.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90° bends are required for 25 mm and larger conduits.

2.4 Fish Cord
.1 Polypropylene.

2.5 Building Wires

.1 Conductors: stranded for 10 AWG and larger. Minimum size: 12 AWG (including ground wires).

.2 Copper conductors: size as indicated, with 1000 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90. RWU-90 for buried services.

2.6 Armoured Cables

.1 Conductors: insulated, copper, size as indicated.

.2 Type: AC90 XLPE insulation, 600 V rated.

.3 Armour: interlocking type fabricated from aluminum.

2.7 Outlet and Conduit Boxes General

.1 Size boxes in accordance with CSA C22.2.1HB.

.2 100 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 347 V outlet boxes for 347 V switching devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

2.8 Sheet Steel Outlet Boxes

.1 Electro-galvanized steel single and multi gang flush device boxes for flush installation, minimum size 76 x 50 x 38 mm or as indicated. 102 mm square outlet boxes when more than one conduit enters one side with extension and plaster rings as required.

.2 102 mm square or octagonal outlet boxes for lighting fixture outlets.

.3 102 mm square outlet boxes with extension and plaster rings for flush mounting devices in finished plaster or tile walls.

2.9 Conduit Boxes

.1 Cast FS boxes with factory-threaded hubs and mounting feet for surface wiring of all devices.

2.10 Box Fittings-throats. General

.1 Bushing and connectors with nylon insulated

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

2.10 Box Fittings-General (Cont'd)

.4 Double locknuts and insulated bushings on sheet metal boxes.

2.11 Wire and Box copper Connectors

.1 Pressure type wire connectors: with current carrying parts of copper sized to fit conductors as required. Equal to T&B-PT Series.

.2 Bushing stud connectors: to EEMAC 1Y-2 to consist of:
- .1 Connector body and stud clamp for stranded copper conductors.

.3 Clamps or connectors for armoured cable as required.

2.12 Support Channels

.1 U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended. Equal to Unistrut, Burndy or Cantruss.

PART 3 - EXECUTION

3.1 Installation

.1 Conduit Systems:
- .1 Install conduits to conserve headroom in exposed locations and cause i minimum interference in spaces through which they pass.
- .2 Conceal conduits except in mechanical and electrical service rooms.
- .3 Use electrical metallic tubing EMT except in where indicated or specified elsewhere.
- .4 Use liquid tight flexible metal conduit for connection to motors which may vibrate or must be moved for servicing.
- .5 Use liquid tight flexible metal conduit for connection to equipment in damp, wet or corrosive locations.
- .6 Minimum conduit size 21 mm.
- .7 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.
- .8 Mechanically bend steel conduit over 21 mm dia.
- .9 Install fish cord in empty conduits.
- .10 Where conduits become blocked, remove and replace blocked section. Do not use liquids to clean out conduits.
- .11 Dry conduits out before installing wire.
- .12 Run parallel or perpendicular to building lines.
- .13 Locate conduits behind infrared or gas fired heaters with 1.5 m clearance.
- .14 Run conduits in flanged portion of structural steel.
- .15 Group conduits wherever possible on channels.
- .16 Do not pass conduits through structural members except as indicated.
- .17 Do not locate conduits less than 75 mm parallel to steam or hot water lines with minimum of 25 mm at crossovers.
- .18 Slope conduits to provide drainage.
- .19 Ream raceways to remove burrs.
- .20 Provide nylon pull cord in all empty raceways.

3.1 Installation (Cont'd)

.2 Wiring:
- .1 Install RW-90 conductors in raceways except as otherwise indicated.
- .2 Installation of type AC-90 will be permitted from:
  - .1 Conduit system junction boxes to recessed lighting fixtures in suspended ceilings, maximum length 2.5 m each run.
  - .2 Conduit system junction boxes to hollow gypsum partitions, maximum length 2.5 m each run.
  - .3 AC-90 is permitted in hollow gypsum partitions.
  - .4 AC-90 is not permitted in insulated masonary walls or concrete walls.
- .3 Leave minimum 200 mm length of conductor at junction and outlet boxes.
- .4 Splices shall not be pulled into conduits.
- .5 Group AC-90 cables where possible. Do not bundle.
- .6 Provide approved wire pulling lubricants for cable installations in conduits.

.3 Outlet boxes:
- .1 Support boxes independently of connecting conduits.
- .2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.
- .3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.
- .4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.
- .5 Provide circuit number identification on all junction boxes with black marker.

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

.5 Fastenings and Supports:
- .1 Secure equipment to hollow masonry, tile and plaster surfaces with lead anchors or nylon shields.
- .2 Secure equipment to poured concrete with expandable inserts.
- .3 Secure surface mounted equipment with twist clip fasteners to inverted T-bar ceilings. Ensure that T-bars are adequately supported to carry weight of equipment specified before installation. Provide additional supports to T-bar ceiling as required.
- .4 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .5 Fasten exposed conduit or cables to building construction or support system using straps.
  - .1 One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
  - .2 Two-hole steel straps for conduits and cables larger than 50 mm.
  - .3 Beam clamps to secure conduit to exposed steel work.
- .6 Suspended support systems.
  - .1 Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.

3.1 Installation (Cont'd)

.5 (Cont'd)

.6 (Cont'd)

.2 Support 2 or more cables or conduits on channels supported by 6 mm dia. threaded rod hangers where direct fastening to building construction is impractical.

.7 For surface mounting of two or more conduits use channels at 1.5 m oc spacing.

.8 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.9 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.10 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.11 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Engineer.

.12 Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

- END OF SECTION -

PART 1 - GENERAL

1.1 Related Sections

.1 This section shall be read in conjunction with specification Section 26 05 00 - Electrical General Requirements, all electrical sections, and all other disciplines related to the project.

PART 2 - PRODUCTS

2.1 Equipment

.1 Clamps for grounding of conductor: size as indicated as required to electrically conductive underground water pipe.

.2 Grounding conductors: bare stranded copper, tinned, soft annealed.

.3 Insulated grounding conductors: green, type RW90.

.4 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

.1 Grounding and bonding bushings.
.2 Protective type clamps.
.3 Bolted type conductor connectors.
.4 Thermit welded type conductor connectors.
.5 Bonding jumpers, straps.
.6 Compression wire connectors.

PART 3 - EXECUTION

3.1 Installation General

.1 Install complete permanent, continuous grounding and bonding system including, conductors, connectors, accessories.

.2 Install connectors in accordance with manufacturer's instructions.

.3 Protect all exposed grounding conductors from mechanical injury.

.4 Use compression connectors for grounding connections to equipment provided with lugs.

.5 Soldered joints not permitted.

.6 Install bonding wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.7 Make grounding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

3.1 Installation General (Cont'd)

.8 Provide continuous ground conductor for raceways, outlets, and junction boxes for all systems.

.9 Provide a ground conductor in all EMT conduits.

.10 Provide ground conductor for all non conductive raceways.

.11 Ground all systems raceways, provide ground bushings.

3.2 Equipment necessarily Grounding

.1 Install grounding connections to typical equipment included in, but not limited to following list service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting, communications systems and conduits, raised floors, etc.

3.3 Field Quality Control

.1 Perform tests in accordance with Section 26 05 00 - Electrical General Requirements.

.2 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Engineer and local authority having jurisdiction over installation.

.3 Perform tests before energizing electrical system.

.4 Disconnect ground fault indicator during tests.

- END OF SECTION -

PART 1 - GENERAL

1.1 Related Sections

.1 This section shall be read in conjunction with specification Section 26 05 00 - Electrical General Requirements, all electrical sections, and all other disciplines related to the project.

1.2 References

.1 Canadian Standards Association (CSA International).

1.3 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with Section 26 05 00 - Electrical General Requirements.

.2 Coordination study, refer to Section 26 05 01 - System Coordination/Short Circuit/Device Evaluation Study & Arc Flash Hazard.

1.4 Acceptable Manufacturers

.1 Eaton Cutler/Hammer.

.2 Siemens.

.3 Schneider/Square D.

.4 G.E.

.5 Equipment supplied shall be of a single manufacturer.

1.5 Spare Parts

.1 Provide three spare fuses of each size and type installed in this project.

1.6 Ratings

.1 Equipment supplied shall have interrupting capacities in excess of currents calculated in the short circuit study.

1.7 Overcurrent Protection

.1 Confirm overcurrent protection requirements of equipment supplied by Divisions 20, 21, 22 & 23, Architectural Divisions and equipment supplied by Owner prior to installation.

PART 2 - PRODUCTS

2.1 Disconnect Switches

.1 Heavy duty fusible and non-fusible, disconnect switch in CSA Enclosure I, size as indicated. CSA 3 Enclosure in outdoor or damp locations. Arc quencher and visible blade copper terminals.

.2 Provision for padlocking in on-off switch position.

.3 Mechanically interlocked door to prevent opening when handle in ON position.

.4 Fuses: size as indicated.

.5 Quick make, quick break type.

2.2 Moulded Case Circuit and Breakers

.1 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual automatic operation with temperature compensation for 40°C ambient.

.2 Common-trip breakers: with single handle for multi-pole applications.

.3 Circuit breakers with interchangeable trips as indicated.

.4 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.

PART 3 - EXECUTION

3.1 Installation

.1 Confirm equipment locations and sizes in electrical and mechanical rooms to ensure equipment will fit.

.2 Secure floor and wall mounted equipment plumb and square.

.3 Connect supply and load feeders from all equipment.

.4 Check trip unit and fuse ratings to match those recommended in coordination study.

.5 Check factory made connections for secureness and electrical continuity.

.6 Install fuses as required.

.7 Ensure adequate clearances around equipment for ventilation requirements and code.

.8 Provide auxiliary equipment and connections as required.

.9 Provide typed, dated panel directory for each affected panelboard on this project.

- END OF SECTION -

PART 1 - GENERAL

1.1 Related Sections
.1 This section shall be read in conjunction with specification Section 26 05 00 - Electrical General Requirements, all electrical 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 26 05 00 - Electrical General Requirements.

1.3 Equipment
.1 Receptacle and switch devices shall be of a single manufacturer.

.2 Acceptable manufacturers: Hubbell, Arrow Hart, Pass and Seymour, Leviton, Bryant.

1.4 References
.1 Canadian Standards Association (CSA).

PART 2 - PRODUCTS

2.1 Switches
.1 15 or 20 A, 120 V, or 347 V single pole, double pole, three-way, four-way switches as required.

.2 Manually-operated general purpose ac switches with following features:
- .1 Silver alloy contacts.
- .2 Urea or melamine molding for parts subject to carbon tracking.
- .3 Suitable for back and side wiring.
- .4 White toggle.
- .5 Specification Grade.

.3 Switches equal to the following:
- .1 120 V, 15 A - Hubbell #1201.
- .2 120 V, 15 A , Keyed - Hubbell #1201-L.
- .3 120 V, 15 A, 3-way - Hubbell #1203.
- .4 120 V, 15 A, 4-way - Hubbell #1204.
- .5 347 V, 15 A - Hubbell #18201.
- .6 347 V, 20 A - Hubbell #18221.
- .7 347 V, 20 A, 3-way - Hubbell #18223.
- .8 Wall mounted occupancy switches, white, 1500 W rated equal to Hubbell #WSS-120 c/w relay pack.
- .9 Ceiling mounted occupancy switches:
  - .1 Hallway (narrow).
  - .2 Area (wide).

2.2 Receptacles

.1 Duplex receptacles, CSA type, voltage, ampacity, phase as indicated, with following features:
- .1 White urea molded housing.
- .2 Suitable for No. 10 AWG for back and side wiring.
- .3 Break-off links for use as split receptacles.
- .4 Eight back wired entrances, four side wiring screws.
- .5 Triple wipe contacts and riveted grounding contacts.
- .6 Ground fault interrupter 5 mA, Class 'A' type where indicated.
- .7 Surge suppressor type where indicated.
- .8 Child safety receptacles where indicated.
- .9 Provide receptacles equal to the following:
  - .1 15 A, 120 V, - Hubbell #5262.
  - .2 20 A, 120 V, - Hubbell #6331.
  - .3 20 A, 250 V, - Hubbell #6391.
  - .4 30 A, 125/250 V (Dryer) - Hubbell #9430-P.
  - .5 50 A, 125/250 V (Range) - Hubbell #9450-P.
  - .6 Isolated ground - Hubbell #IG-5262.
  - .7 Ground fault - Hubbell #GF5252-W.
  - .8 Safety receptacles - Hubbell #SG-62-HI.
  - .9 Surge suppressor - Hubbell #5252-S.
- .10 Specification grade.

2.3 Cover Plates

.1 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.2 Stainless steel, vertically brushed, 1 mm thick cover plates for wiring devices mounted in flush-mounted outlet box.

.3 Cast cover plates for wiring devices mounted in surface-mounted FS or FD type conduit boxes.

2.4 Telephone, Data & accessible Cable TV Outlet

.1 Provide 100 x 100 mm outlet box c/w plaster ring and 21 mm EMT to ceiling space at indicated locations.

.2 Coverplates to be provided by respective companies or as specified in other sections.

PART 3 - EXECUTION

3.1 Installation

.1 Switches:
- .1 Install single throw switches with handle in "UP" position when switch closed.
- .2 Install switches in gang type outlet box when more than one switch is required in one location.
- .3 Mount toggle switches at height specified in Section 26 05 00 - Electrical General Requirements or as indicated.

3.1 Installation (Cont'd)

.2 Receptacles:
- .1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.
- .2 Mount receptacles at height specified in Section 26 05 00 - Electrical General Requirements or as indicated.
- .3 Where split receptacle has one portion switched, mount vertically and switch upper portion.

.3 Coverplates:
- .1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.
- .2 Install suitable common cover plates where wiring devices are grouped.
- .3 Do not use coverplates meant for flush outlet boxes on surface-mounted boxes.

.4 Provide weatherproof devices as indicated.

- END OF SECTION -

PART 1 - GENERAL

1.1 Related Sections
.1 This section shall be read in conjunction with specification Section 26 05 00 - Electrical General Requirements, all electrical sections, and all other disciplines related to the project.

1.2 Shop Drawings and General Product Data
.1 Submit shop drawings in accordance with Section 26 05 00 - Electrical Requirements.

1.3 References
.1 American National Standards Institute (ANSI)
.1 ANSI C62.1, Gapped Silicon-Carbide Surge Arresters for AC Power Circuits.

.2 Canadian Standards Association (CSA).
.1 CSA C22.2 No. 141-15, Emergency Lighting Equipment.
.2 CSA C860-11(2016), Performance of Internally Lighted Exit Signs.

.3 Institute of Electrical and Electronics Engineers (IEEE)
.1 IEEE 587, Applicability to Adjustable Frequency Control (Surge Voltages).

PART 2 - PRODUCTS

2.1 Lamps
.1 Incandescent lamps as indicated on fixture list, 5000 hr. life minimum.

.2 Fluorescent lamps as indicated on fixture list, and as follows:
.1 32 Watt, T8, 3050 Lumens, 20,000 hr. life. Low mercury content (Philips Alto or equivalent).
.2 Compact fluorescent lamps, wattage as indicated, 10,000 hr. life low mercury content (Philips Alto or equivalent).
.3 Colour temperature 3500°K or as indicated on Lighting Fixture Schedule or to match existing. Use 3000°K or 4100°K only as indicated or to match existing lamps (3000°K to match warm white, 4100°K to match cool white).
.4 CRI minimum 85.

2.2 Ballasts
.1 Fluorescent ballast: CBM and CSA certified, energy efficient type, IC electronic, rapid start:
.1 Rating: voltage as indicated, for use with 2-32 W lamps, rapid start.
.2 RFI/EMI suppression circuit.
.3 Totally encased and designed for 40°C ambient temperature.
.4 Power factor: minimum 95% with 95% of rated lamp lumens.
.5 Crest factor: 1.7 maximum.
.6 Capacitor: thermally protected.
.7 Thermal protection: non-resettable on coil.
.8 Harmonics: 10% maximum THD.

2.2 Ballasts (Cont'd)

.1 (Cont'd)

.9 Operating frequency of electronic ballast: 20 kHz or greater without visible flicker.

.10 Sound rated: A.

.11 Mounting: integral with luminaire.

.12 Include line surge withstand to ANSI C62-1 and IEEE 587. Lamp start voltages not to exceed ANSI C78.1.

.13 Ballast factor: greater than 0.9.

2.3 Finishes

.1 Light fixtures to be factory primed and painted after fixture construction.

2.4 Fluorescent Fixture minimum. Light Control Device

.1 Lens thickness: 3.175 mm

.2 Material: injection moulded clear prismatic virgin acrylic.

.3 Frame: hinged,gasketted, latched, die cast, aluminum.

2.5 Luminaires

.1 Provide light fixtures as per fixture schedule, c/w ballasts, lamps and mounting accessories.

.2 Each 347V fluorescent luminaire shall have an integral disconnecting means as per the Canadian Electrical Code.

2.6 Exit Lights

.1 Exit lights: to CSA C22.2 No. 141 and CSA C860.

.2 Housing: extruded aluminum, white finish.

.3 Face and back plates: extruded aluminum.

.4 Lamps: LED with 25-year rated life.

.5 Pictogram: aluminum frame, opal diffuser panel, pictogram panel with multiple films for direction selection, and clear protective panel. Pictogram panel shall consist of green pictogram and white graphic symbol meeting the visibility specifications referred to in ISO 3864-1, and conform to the dimensions indicated in ISO 7010.

.6 Suitable for 347V or 120V normal supply and emergency supply.

.7 Die cast mounting bracket for wall, ceiling, or end mounting as indicated.

.8 Provide circuit labels at all exit signs.

PART 3 - EXECUTION

3.1 Installation

.1 Locate and install luminaires as indicated.

.2 Provide sufficient cable length and/or access panels, to provide access to wiring connections in hard ceiling areas, to the inspection authorities requirements.

.3 Install light fixtures to manufacturers recommendations.

.4 Connect fixtures to indicated circuits and connect exit lights to emergency battery units.

.5 Verify and coordinate location of light fixtures on site with other trades to verify clearances at indicated locations prior to installation.

3.2 Luminaire Supports

.1 For recessed or surface mounted lighting in suspended ceiling installations, support luminaires independently from ceiling, by means of a minimum of two chain hangers bolted to diagonal corners of the fixture body and secured to building structure in accordance with ESA, Section 26 05 00 - Electrical General Requirements and Section 26 05 05 - Seismic Restraint Systems (SRS).

3.3 Luminaire Alignment

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.4 Testing

.1 Verify operation of lighting systems, and controls.

3.5 Lamp Guarantee

.1 Replace all fluorescent lamps burnt out within 24 months of final acceptance.

- END OF SECTION -

PART 1 - GENERAL

1.1 Related Sections

.1 This section shall be read in conjunction with specification Section 26 05 00 - Electrical General Requirements, all electrical sections, and all other disciplines related to the project.

1.2 References

.1 Underwriters Laboratories of Canada (ULC)
- .1 CAN/ULC S524-14, Installation of Fire Alarm Systems.
- .2 CAN/ULC S525-16, Audible Signal Devices for Fire Alarm Systems, Including Accessories.
- .3 CAN/ULC S527-11-AMD-1 (2014), Control Units for Fire Alarm Systems.
- .4 CAN/ULC S536-13, Inspection and Testing of Fire Alarm Systems.
- .5 CAN/ULC S537-13, Verification of Fire Alarm Systems.

.2 National Research Council Canada
- .1 NRCC NBCC-2015, National Building Code of Canada 2015.

1.3 Description of EST. System

.1 Existing systems in both buildings M2 and M59 are Edwards

1.4 Shop Drawings

.1 Submit shop drawings in accordance with Section 26 05 00 - Electrical General Requirements.

.2 Include:
- .1 Layout of equipment.
- .2 System addresses.
- .3 Complete wiring diagram, including schematics of modules.
- .4 Graphic plot plan c/w addresses.

1.5 Operation and into Maintenance Data

.1 Provide operation and maintenance data for Fire Alarm System for incorporation manuals.

.2 Include:
- .1 Operation and maintenance instructions for complete fire alarm system to permit effective operation and maintenance.
- .2 Technical data - illustrated parts lists with parts catalogue numbers.
- .3 Copy of approved shop drawings.

1.6 Maintenance Electrical Materials

.1 Provide maintenance materials in accordance with Section 26 05 00 - General Requirements.

1.6 Maintenance Materials (Cont'd)

.2 Include:

.1 Provide a list of recommended spare parts. In the case of a standard spares kit, the content of the kit shall be listed.

1.7 As-Builts

.1 Provide 'as-builts' drawings upon completion showing all devices c/w addresses including line isolator locations and conduit runs.

PART 2 - PRODUCTS

2.1 Materials

.1 Equipment and devices: ULC listed and labelled and supplied by single manufacturer. Addressable type unless otherwise noted.

.2 Power supply: to CAN/ULC S524, and NBCC.

.3 Audible signal devices: to ULC S525.

.4 Control unit: to ULC S527.

2.2 Audible/Visual Signal tube Devices

.1 Horns/Strobe unit, 24 V dc, current limiting electronics, red flush mounted, Zenon 15-75cd.

.2 Bells: vibrating type, gongs of special alloy steel, 24 VDC, 150 mm, 90 dB.

PART 3 - EXECUTION

3.1 Installation

.1 Install systems in accordance with CAN/ULC S524.

.2 Locate and install bells and horns and connect to signalling circuits.

.3 Connect signalling circuits to main control panel. Alternate signal circuits within floor space, i.e., circuit 'A' device adjacent to circuit 'B' device.

.4 Install all wiring for fire alarm system monitoring, control and communication circuits in conduit. Minimum conduit size shall be 21 mm. All wiring must be clear of shorts, opens and grounds on completion of installation. All wires must be clearly identified at all termination points.

.5 Ensure wire and cable are copper conductors with insulation rated at 300 V minimum, as follows:

.1 Fire alarm addressable circuits shall be #18 AWG twisted shielded pair. Maximum allowable length of run (wire distance) must not exceed 762 m.

.2 Signal circuit: 300 V 105°C PVC insulated copper conductors. Minimum conductor size #12 AWG. Voltage drop must not exceed the maximum permissible value recommended by the manufacturer.

3.1 Installation (Cont'd)

.5 (Cont'd)
.3 All wiring to be in conduit.

.6 Ground panel and conduits.

.7 All Fire Alarm devices shall have both the device and it's base labelled with p-touch to indicate building (if in a campus), floor, column line, device type. i.e. device labelled as T2-5-G3-SD would indicate tower 2, floor 5, column G3, smoke detector. This description should also be indicated at the annunciator and control panel.

.8 All fire alarm work is to be logged in at the main security station by the contractor, and shall indicate the location of the work, a description of the work, and the name of the contractor performing the work.

.9 The installing contractor shall notify the building owner of verification times, so the owner can include their maintenance contractor in review.

3.2 Field Quality Control

.1 Perform tests in accordance with Section 26 05 00 - Electrical General Requirements. and CAN/ULC S536.

.2 Fire alarm system:
.1 Test each device and alarm circuit to ensure manual stations, thermal and smoke detectors transmit alarm to control panel and actuate general alarm ancillary devices.
.2 Test to demonstrate correct operation of each interlock device, auxiliary device, by-pass switches.
.3 Check annunciator panels to ensure zones are shown correctly.
.4 Simulate grounds and breaks on alarm and signalling circuits to ensure proper operation of trouble signals and the capability for providing a subsequent alarm during any imposed single circuit fault condition (open, ground).
.5 Perform the system verification and certification per Clause 3.3 "Verification and Certification".

3.3 Certification and Verification

.1 Verify system to "CAN/ULC S537".

.2 Verification is the responsibility of the manufacturer for testing the wiring in relation to field devices operation.

.3 To avoid unnecessary alarms during testing, the system's program shall be capable of being temporarily disabled to disconnect only the audible signals that are being tested. Reenable the zones after the testing is performed at the end of the day.

.4 Inspect and test wiring to every device to verify the removal of the device or breaking the wire will cause a trouble condition at the Control Panel.

.5 Inspect all equipment installed as part of the system for visible damage or tampering which may be a potential problem with its intended operation.

.6 Activate each manual initiating device to verify and ensure their proper operation.

3.3 Certification and Verification (Cont'd)

.7 Test each self-restoring heat detector utilizing a heat source to test the device operation.

.8 Test each ionization smoke detector. Detector operation shall be tested by introducing "smoke" into the detector head.

.9 Test all audible signals for proper operation. Tests shall be made to determine that the signal is audible throughout the area and above the normal ambient noise level.

.10 Verify all field wiring and terminate on a single conductor per terminals basis.

.11 Test system annunciators to ensure proper operation correct zoning and visibility of window inscriptions. All lamps and indicators shall be tested for proper operation.

.12 Test all control equipment for proper operation. Inspect and test all cable terminals, plug connectors, plug-in modules circuitry, lamp sockets and controls to confirm that their mechanical and electrical connections and mounting are acceptable to confirm their electrical supervision.

.13 Test ancillary equipment connections. Inspect such equipment to ensure that faults and malfunctions will not interfere with the alarm system.

.14 Test the following control functions for proper supervision, operation and annunciation.
- .1 The Central station connection.

.15 Only make changes to the system program or zone identifications as approved by authorized personnel.

.16 Notify and demonstrate the complete system to Owner's representative and Building Inspection's representatives only after testing and verification performances has been completed and all deficiencies rectified. In their presence, demonstrate the proper functioning of the system. Have system manufacturer's certified technician present.

.17 Upon completion of the inspection and when all of the above conditions have been performed and complied with, the manufacturer shall issue to the Owner's representative the following:
- .1 A copy of the inspection report identifying the location of each device and certifying the test results of each device.
- .2 A certificate of verification confirming that the inspection has been completed and outlining the conditions upon which such an inspection and certification have been rendered.
- .3 Proof of liability insurance for the inspection.

.18 All costs involved in this inspection for both the manufacturer's and the Contractor's work shall be included in the overall tender price.

3.4 Verification Records

.1 Complete accurate records of the verification shall be maintained with the following requirements but not limited to:
- .1 Show the date on which each device and equipment has been verified.
- .2 Show the date of all deficiencies encountered in the control system equipment, wiring and field devices.
- .3 Show the date when the deficiencies have been corrected and re-verified.

3.4 Verification Records (Cont'd)

.1 (Cont'd)

.4 Show dB levels measured during verification.

3.5 Integrated Systems Testing

.1 Fire Alarm System:

.1 Following are tests required to show system integration with other systems.

.2 Initiate a fire alarm via a manual pull station verify the following:

.1 Alarm initiated.

.2 Elevators return to ground level.

.3 Signal sent to central alarm facility.

.4 Signal sent to building automation system for fan shutdown.

.5 Signal sent to security system.

.6 Alarm annunciates at fire control panel.

.7 Magnetic hold open devices release & door close.

.8 Fire shutters release & close.

.9 Pressurization and/or smoke EVAC fans start.

.10 All magnetically locked doors release.

.11 Audible devices are operating.

.3 Verify connection to fire pump for power available monitoring by disconnecting normal & emergency source to fire pump.

.4 Verify generator set monitoring by initiating a trouble & alarm condition at generator.

.5 Throughout the tests utilize the emergency voice communications systems for instructions & verifications at various levels.

.6 Initiate a first stage alarm and allow verification timer to time out and start second stage alarm.

.7 Verify connections to elevators.

- END OF SECTION -

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April 24, 2017

Attention: Isabelle D'Amour-Tanguay, Project Manager

RE: Project-Specific Designated Substances and Hazardous Materials Survey
Buildings M-2 and M-59-Washrooms Renovation Project
NRC Project Numbers 5378 & 5379

DST File No.: GV-OT-026477

1.0 INTRODUCTION

DST Consulting Engineers Inc. (DST) was retained by the National Research Council (NRC) to conduct a Project-Specific Designated Substances and Hazardous Materials Survey (DSHMS) for the M-2 and M-59 Washrooms Renovation Project prior to planned renovation work.

The Designated Substances Report is required under the Ontario Occupational Health and Safety Act in order to identify designated substances that may be present within the project areas. The Canada Labour Code also stipulates under Part II, Section 124 that every employer shall ensure that the health and safety at work of every person employed by the employer is protected. By having a DSHMS conducted, NRC will be able to inform employees, contractors, and tenants of any designated substances that may be present and possibly disturbed throughout the planned renovation work.

DST staff completed a visual evaluation of building materials for the presence of suspected designated substances and select hazardous materials in the project areas on May 26, 2016 and June 1, 2016.

2.0 SCOPE OF WORK

The survey implemented by DST included the 11 designated substances listed in Section 30 of the Occupational Health and Safety Act, R.S.O. 1990, Chapter 0.1. Designated Substances, as identified under the Ontario Occupational Health and Safety Act, are as follows:

- Acrylonitrile;
- Arsenic;
- Asbestos-Containing Materials (ACMs) - both friable and non-friable;
- Benzene;
- Coke Oven Emissions;
- Ethylene Oxide;
- Isocyanates;
- Lead;
- Mercury;
- Silica; and
- Vinyl Chloride.

Other Hazardous Materials which are not classified as Designated Substances, but were included as part of the survey and considered pertinent due to applicable regulations, best practice guidelines and/or potential risks to human health and/or the environment, are:

- Polychlorinated Biphenyls (PCBs);
- Mould;
- Ozone-depleting substances; and
- Other hazardous materials, as deemed pertinent.

3.0 METHODOLOGY

The field program for this survey was completed by DST on May 26, 2016 and June 1, 2016. The survey was limited to the following project areas:

Building M-2

- Room 124 – Washroom, and Room 124A – Janitor's Closet
- Room 133 – Storage room, including the area directly below at basement level, the basement floor slab directly below, and adjacent dumbwaiter shaft
- Room 271
- Rooms 147 and 148 – Control Room and offices
- Roofing material above Rooms 238/253

Building M-59

- Room 104 - Washroom
- Room 115 - Washroom
- Room 128 - Washroom
- Room 129 - Washroom

No other areas of the building were included as part of this project-specific DSHMS.

At the request of NRC, DST performed all ceiling entries during the DSMS using Type 2 asbestos precautions.

Materials suspected of containing designated substances were visually identified, based on the surveyor's knowledge of the historical composition of building products. Equipment that may contain polychlorinated biphenyls (e.g. electrical transformers and fluorescent light ballasts) can often be identified by examining manufacturer's labels. For safety reasons, DST personnel do not remove the ballast shields from fluorescent light fixtures to examine the ballast codes unless the electrical circuit for the lighting has been tagged and locked out by a qualified electrician. Visual identification of materials suspected to contain asbestos or lead (in paint) was supported by the collection and analysis of a limited number of representative samples, where applicable. Materials suspected of containing designated substances other than asbestos or lead (in paint) were identified by appearance, age, and knowledge of historical applications.

In Ontario, a material is defined as an Asbestos-Containing Material (ACM) if the material has a minimum asbestos content of 0.5 per cent (%) by dry weight, as O. Reg. 278/05, as amended. ACMs can be divided into two categories: friable and non-friable material. A friable ACM is a material that can be crumbled, powdered, or pulverized by hand pressure and can readily release

fibres when disturbed. Common applications of friable ACMs are sprayed or trowelled surfacing materials (e.g. sprayed fireproofing and textured coatings) as well as mechanical and thermal insulation. Non-friable materials are materials that will generally release fibres only when cut or shaped. Common non-friable ACMs include vinyl floor products, caulking applications, asbestos textile products and asbestos cement products (transite). Some of these products may become friable with time or when disturbed.

Representative bulk samples of suspected ACMs were collected by DST during the site investigations. Bulk asbestos samples were collected in order to meet the bulk sampling requirements stipulated in *O.Reg. 278/05, as amended*. Bulk samples were submitted to and analyzed by Paracel Laboratories Ltd. (Paracel). The bulk samples were analyzed using polarised light microscopy (PLM). This analytical method complies with the United States Environmental Protection Agency (U.S. EPA) Method 600/R-93/116 dated July, 1993, which is the regulatory approved protocol for bulk asbestos analysis in Ontario.

All bulk samples were analyzed using a combination of dispersion staining and polarised light microscopy (PLM). This analytical method complies with the United States Environmental Protection Agency (U.S. EPA) Method 600/R-93/116 dated July 1993, which is the regulatory approved protocol for bulk asbestos analysis in Ontario.

With regards to lead in paint, although the Ontario Ministry of Labour (MoL) has published a guideline for control of lead exposures on construction projects in Ontario, it does not include criteria for the classification of lead-paint. Instead, it uses presumed airborne lead concentrations for specific tasks as criteria for classifying work. The Environmental Abatement Council of Ontario (EACO) has published the Lead Guideline for Construction, Renovation, Maintenance or Repair (October 2014). This document outlines that *Paints or surface coatings containing less than or equal to 0.1% lead by weight (1000 ug/g or 1000 mg/kg or 1000 ppm lead) are considered low-level lead paints or surface coatings. If these materials (and the surfaces to which they are applied) are disturbed in a non-aggressive manner, performed using normal dust control procedures and are completed so that the TWA [Time Weighted Average] for PNOS [Particles Not Otherwise Specified] is not exceeded, then worker protection from the inhalation of lead is not required.* For the purposes of this survey and as specifically instructed by CBRE, paint applications having a lead concentration above 0.1% (1,000 ppm) detectable concentrations of lead are considered to be lead-based.

Representative lead paint samples were collected and submitted by DST for lead content analysis. The samples were analyzed at Paracel using Inductively Coupled Plasma – Optical Emission Spectrometry (ICP-OES) in accordance with MOE E3470, ICP-OES.

DST also collected samples of ceramic tile for analysis of the tile glazing for lead analysis using an X-Ray Fluorescence (XRF) analyzer.

Selected photographs are included in Appendix A. Bulk asbestos and lead analytical results are included in Appendix B. Floor plans showing the sample locations are included in Appendix C.

4.0 BACKGROUND REPORT REVIEW

Prior to the DSHMS, the NRC provided DST with the following documents:

- Designated Substances Survey, Building M-02, March 2007, Oakhill Environmental Inc.
- Designated Substances Survey, Building M-59, March 2009, Oakhill Environmental Inc.

DST referenced any previously identified confirmed or assumed asbestos-containing materials or other designated substances as they pertained to the scope of work for this project.

5.0 FINDINGS

5.1. Asbestos – Building M-2

Based on a review of previous documentation as it pertains to the project areas, the following ACMs were historically identified by Oakhill Environmental:

- Aircell pipe insulation, containing 30% Chrysotile;
- Grey cement compound on pipe fittings, containing 20% Chrysotile;
- Sweatwrap pipe insulation, containing 15% Chrysotile asbestos; and
- Magblock pipe insulation, containing 27% Chrysotile.

Table 1 below presents the findings of bulk asbestos material samples collected by DST from the Building M-2 project areas, based on visual observations at the time of the site survey:

Table 1: Summary of Bulk Samples Analyzed for Asbestos Content by PLM, Building M-2

Sample I.D.	Sample Location	Sample Description	Asbestos Content and Type
26477-M2-01A	Room 133, upper ceiling	Ceiling Plaster	None Detected
26477-M2-01B	Room 124, ceiling		None Detected
26477-M2-01C	Room 147, bulkhead		None Detected
26477-M2-02A	**Room 133, floor**	**Vinyl Floor Tile Mastic**	**1.95% Chrysotile**
26477-M2-02B			**Not Analysed**
26477-M2-02C			**Not Analysed**
26477-M2-03A	**Room 133, floor**	**Leveling Compound**	**1% Chrysotile**
26477-M2-03B			**Not Analysed**
26477-M2-03C			**Not Analysed**
26477-M2-04A	Room 133, wall	Drywall Joint Compound	None Detected
26477-M2-04B			None Detected
26477-M2-04C			None Detected
26477-M2-05A	Area on Basement Level directly below Room 133	Cement Block & Mortar	None Detected
26477-M2-05B			None Detected
26477-M2-05C			None Detected
26477-M2-06A	**Room 133, wall**	**Wall plaster**	None Detected
26477-M2-06B			None Detected
26477-M2-06C			**1% Tremolite**
26477-M2-07A	**Room 148, ceiling beams above ceiling tiles**	**Trowel-applied fireproofing**	None Detected
26477-M2-07B			None Detected
26477-M2-07C			**1% Tremolite**
26477-M2-08A	Room 271, wall	Ceramic tile Adhesive	None Detected
26477-M2-08B			None Detected
26477-M2-08C			None Detected
26477-M2-09A	Room 271, wall	Wall plaster	None Detected
26477-M2-09B			None Detected
26477-M2-09C			None Detected

Table 1: Summary of Bulk Samples Analyzed for Asbestos Content by PLM, Building M-2			
Sample I.D.	**Sample Location**	**Sample Description**	**Asbestos Content and Type**
26477-M2-10A	Roof, directly above Rooms 238/253	Roofing materials - tar	None Detected
26477-M2-10B			None Detected
26477-M2-10C			None Detected
26477-M2-11A	Roof, directly above Rooms 238/253	Roofing materials - shingle	None Detected
26477-M2-11B			None Detected
26477-M2-11C			None Detected

Note: Bold items represent materials that contain regulated concentrations of asbestos (0.5% or more) as per *O.Reg 278/05*, as amended.

Based upon consultation with NRC, for the purposes of this project the ceiling/deck plasters within the M-2 project areas will be considered homogenous with wall plaster, and are assumed to contain 1% Tremolite asbestos.

Based on previous sampling results, visual observations and bulk sampling analytical results for samples collected by DST, the following materials are identified as containing regulated concentrations of asbestos. Findings have been split up according to each project area at Building M-2:

5.1.1. Identified ACMs – M-2 Washroom 124 and Room 124A

- Non-friable (**Friable** when disturbed) wall plaster, containing 1% Tremolite asbestos (DST sample 26477-M2-06C). There is approximately 60 square metres of wall plaster in Room 124, and approximately 15 square metres in Room 124A.
- Non-friable (**Friable** when disturbed) ceiling plaster is considered homogenous with wall plaster, and is assumed to contain 1% Tremolite asbestos. There is approximately 20 square metres of ceiling plaster in Room 124, and approximately 5 square metres in Room 124A.
- Friable asbestos-containing pipe insulation and pipe fitting insulation (Aircell, Mag-block, Sweatwrap, Grey Cement Compound), containing 15-30% Chrysotile asbestos (previous consultant samples). There is approximately 20 linear metres of pipe insulation and pipe fitting insulation in the ceiling cavity above the drop plaster ceiling, in fair/poor condition.
- Friable asbestos-containing pipe insulation and pipe fitting insulation (Aircell, Mag-block, Sweatwrap, Grey Cement Compound), containing 15-30% Chrysotile asbestos (previous consultant samples) is assumed to be present within wall cavities associated with domestic water piping systems (i.e. sinks and toilets).
- Cast iron drain pipe joint caulking (suspect ACM.)

5.1.2. Identified ACMs – M-2 Storage Room 133

- Non-friable remnant black floor tile mastic, containing 1.95% Chrysotile asbestos (DST sample 26477-M2-02A). There is approximately 30 square metres of mastic, applied to the floor in good condition.
- Non-friable floor levelling compound, containing 1% Chrysotile asbestos (DST sample 26477-M2-03A). There is approximately 20 square metres of compound, applied to the floor in good condition.

- Non-friable (**Friable** when disturbed) wall plaster, containing 1% Tremolite asbestos (DST sample 26477-M2-06C). There is approximately 100 square metres of wall plaster in Room 133 and the dumb waiter shaft.
- Non-friable (**Friable** when disturbed) upper ceiling/deck plaster is considered homogenous with wall plaster, and is assumed to contain 1% Tremolite asbestos. There is approximately 20 square metres of ceiling plaster in Room 133 and the dumb waiter shaft.
- Ceiling plaster debris, assumed to contain 1% Tremolite asbestos, is present on top of ceiling tiles and on top of the dumb waiter. There is less than one square metre of ceiling plaster debris on ceiling tiles in Room 133 and approximately 1 square metre of plaster debris in the dumb waiter shaft.
- Cast iron drain pipe joint caulking (suspect ACM.)

5.1.3. Identified ACMs, M-2 Washroom 271

- Non-friable (**Friable** when disturbed) wall plaster, containing 1% Tremolite asbestos (DST sample 26477-M2-06C). There is approximately 50 square metres of wall plaster in Room 271 in good condition.
- Non-friable (**Friable** when disturbed) upper ceiling/deck plaster is considered homogenous with wall plaster, and is assumed to contain 1% Tremolite asbestos. There is approximately 20 square metres of ceiling plaster in Room 271 in good condition.
- Friable asbestos-containing pipe insulation and pipe fitting insulation (Aircell, Mag-block, Sweatwrap, Grey Cement Compound), containing 15-30% Chrysotile asbestos (previous consultant samples) is assumed to be present within wall cavities associated with domestic water piping systems (i.e. sinks and toilets).
- Remnant mastic pucks on wall within ceiling cavity (suspect ACM – inaccessible)
- Cast iron drain pipe joint caulking (suspect ACM.)

5.1.4. Identified ACMs, M-2 Control Room and Offices, Rooms 147 and 148

- Non-friable (**Friable** when disturbed) wall plaster, containing 1% Tremolite asbestos (DST sample 26477-M2-06C). There is approximately 80 square metres of wall plaster in Room 147, and 80 square metres in Room 148.
- Friable trowel-applied fireproofing material, applied to ceiling beams above lay-in ceiling tiles, containing 1% Tremolite asbestos (DST sample 26477-M2-07C). There is approximately 30 square metres of fireproofing in the ceiling cavity of Room 148 in good condition.
- Friable asbestos-containing pipe insulation and pipe fitting insulation (Aircell, Mag-block, Sweatwrap, Grey Cement Compound), containing 15-30% Chrysotile asbestos (previous consultant samples). There is approximately 20 linear metres of pipe insulation and pipe fitting insulation and 4 pipe fittings on fiberglass insulation in good condition in the ceiling cavity above the suspended ceilings of Rooms 147 and 148.
- Friable asbestos-containing pipe insulation and pipe fitting insulation (Aircell, Mag-block, Sweatwrap, Grey Cement Compound), containing 15-30% Chrysotile asbestos (previous consultant samples) is assumed to be present within wall and bulkhead cavities associated with domestic water piping systems (i.e. sinks and toilets).
- Cast iron drain pipe joint caulking (suspect ACM.)

5.1.5. Non-Asbestos-Containing Materials – all M-2 Project Areas

Bulk sampling has confirmed that the following materials do not contain regulated concentrations of asbestos in the project areas of M-2:

- Drywall joint compound (DST Samples 26477-M2-04A-C);
- Cement and mortar (DST samples 26477-M2-05A-C) from the basement walls below Room 133;
- Ceramic tile adhesive (DST samples 26477-M2-08A-C);
- Roofing materials (DST samples 26477-M2-10A-C and 11A-C); and
- In-lay acoustic ceiling tiles (date codes post-date use of asbestos in these building materials.)

5.2. Asbestos – Building M-59

Based on a review of previous documentation as it pertains to the project areas, the following friable ACMs were historically identified by Oakhill Environmental:

- Aircell pipe insulation, containing 40% Chrysotile;
- Grey cement compound on pipe fittings, containing 60% Chrysotile;
- Magblock pipe insulation, containing 25% Chrysotile; and
- Exterior stucco finish, containing 2% Chrysotile.

Table 2 below presents the findings of bulk asbestos material samples collected by DST from Building M-59 project areas, based on visual observations at the time of the site survey:

Table 2: Summary of Bulk Samples Analyzed for Asbestos Content by PLM, Building M-59

Sample I.D.	Sample Location	Sample Description	Asbestos Content and Type
26477-M59-01A	**Washroom 115, ceiling**	**Ceiling Plaster**	**1% Chrysotile**
26477-M59-01B	**Washroom 104, ceiling**		**Not Analysed**
26477-M59-01C	**Washroom 271, ceiling**		**Not Analysed**
26477-M59-02A	Washroom 115, wall	Ceramic tile Adhesive	None Detected
26477-M59-02B			None Detected
26477-M59-02C			None Detected
26477-M59-03A	Washroom 104, wall	Wall plaster	None Detected
26477-M59-03B			None Detected
26477-M59-03C			None Detected
26477-M59-04A	Washroom 104, floor	Vinyl sheet flooring and backing	None Detected
26477-M59-04B			None Detected
26477-M59-04C			None Detected
26477-M59-05A	Washroom 104, wall	Drywall joint compound	None Detected
26477-M59-05B			None Detected
26477-M59-05C			None Detected
26477-M59-06A	**Washroom 104, ductwork**	**Grey cement compound**	**40% Chrysotile**
26477-M59-06B			**Not Analysed**
26477-M59-06C			**Not Analysed**

Table 2: Summary of Bulk Samples Analyzed for Asbestos Content by PLM, Building M-59			
Sample I.D.	**Sample Location**	**Sample Description**	**Asbestos Content and Type**
26477-M59-07A	**Washroom 104, floor**	**Vinyl sheet flooring mastic**	None Detected
26477-M59-07B			None Detected
26477-M59-07C			**1% Tremolite**
26477-M59-08A	Washroom 128, wall	Ceramic tile Adhesive	None Detected
26477-M59-08B			None Detected
26477-M59-08C			None Detected

Note: Bold items represent materials that contain regulated concentrations of asbestos (0.5% or more) as per *O.Reg 278/05*, as amended.

Based upon consultation with NRC, for the purposes of this project the wall plasters within the project areas of M-59 will be considered homogenous with ceiling plaster, and are assumed to contain 1% Chrysotile asbestos.

Based on previous sampling results, visual observations and bulk sampling analytical results for samples collected by DST, the following materials are identified as containing regulated concentrations of asbestos. Findings have been split up according to each project area at Building M-59:

5.2.1. Identified ACMs – M-59 Washroom 104

- Non-friable (**Friable** when disturbed) wall plaster, considered homogenous with ceiling plaster, containing 1% Chrysotile asbestos (DST sample 26477-M59-01A). There is approximately 20 square metres of good condition wall plaster in Room 104.
- Non-friable (**Friable** when disturbed) ceiling plaster, containing 1% Chrysotile asbestos (DST sample 26477-M59-01A). There is approximately 10 square metres of good condition ceiling plaster in Room 104 above suspended ceiling tiles.
- Friable asbestos-containing pipe insulation and pipe fitting insulation (Aircell, Mag-block, Sweatwrap, Grey Cement Compound), containing 20-60% Chrysotile asbestos (previous consultant samples) is assumed to be present within wall cavities associated with domestic water piping systems (i.e. sinks and toilets).
- Friable grey cement compound (GCC) on ductwork, containing 40% Chrysotile asbestos (DST sample 26477-M59-06A). A quantity of this ACM could not be documented as the majority is located above an inaccessible solid plaster ceiling.
- Cast iron drain pipe joint caulking (suspect ACM.)

5.2.2. Identified ACMs – M-59 Washroom 115

- Non-friable (**Friable** when disturbed) wall plaster, considered homogenous with ceiling plaster, containing 1% Chrysotile asbestos (DST sample 26477-M59-01A). There is approximately 45 square metres of wall plaster in Room 115.
- Non-friable (**Friable** when disturbed) ceiling plaster, containing 1% Chrysotile asbestos (DST sample 26477-M59-01A). There is approximately 12 square metres of ceiling plaster in Room 115.
- Friable asbestos-containing pipe insulation and pipe fitting insulation (Aircell, Mag-block, Sweatwrap, Grey Cement Compound), containing 20-60% Chrysotile asbestos (previous consultant samples). There is approximately 20 linear metres of pipe insulation and pipe

fitting insulation in the ceiling cavity above the drop plaster ceiling, in fair/poor condition. In addition there is approximately 1 square metres of poor condition debris (asbestos containing pipe insulation and pipe fitting insulation) scattered above the plaster drop ceiling.
- Friable asbestos-containing pipe insulation and pipe fitting insulation (Aircell, Mag-block, Sweatwrap, Grey Cement Compound), containing 20-60% Chrysotile asbestos (previous consultant samples) is assumed to be present within wall cavities associated with domestic water piping systems (i.e. sinks and toilets).
- Cast iron drain pipe joint caulking (suspect ACM.)

5.2.3. Identified ACMs, M-59 Washrooms 128 and 129

- Non-friable (**Friable** when disturbed) wall plaster, considered homogenous with ceiling plaster, containing 1% Chrysotile asbestos (DST sample 26477-M59-01A). There is approximately 45 square metres of wall plaster in Room 128, and approximately 20 square metres in Room 129.
- Non-friable (**Friable** when disturbed) ceiling plaster, containing 1% Chrysotile asbestos (DST sample 26477-M59-01A). There is approximately 15 square metres of ceiling plaster in Room 128, and approximately 10 square metres in Room 129.
- Friable asbestos-containing pipe insulation and pipe fitting insulation (Aircell, Mag-block, Sweatwrap, Grey Cement Compound), containing 20-60% Chrysotile asbestos (previous consultant samples). There is approximately 40 linear metres of pipe insulation and pipe fitting insulation in the ceiling cavity above the drop plaster ceiling, in fair/poor condition. In addition there is approximately 1 square metres of poor condition debris (asbestos containing pipe insulation and pipe fitting insulation) scattered above the plaster drop ceiling.
- Cast iron drain pipe joint caulking (suspect ACM.)
- Non-friable stucco on the exterior outer face of the perimeter walls of the washrooms containing 2% Chrysotile asbestos (previous consultant samples).

5.2.4. Non-Asbestos-Containing Materials – all M-59 Project Areas

Bulk sampling has confirmed that the following materials do not contain regulated concentrations of asbestos in the project area:

- Ceramic tile adhesive (DST Samples 26477-M59-02A-C);
- Vinyl sheet flooring (DST samples 26477-M59-04A-C);
- Drywall joint compound (DST samples 26477-M59-05A-C);
- Vinyl sheet flooring mastic (DST samples 26477-M59-07A-C);
- Ceramic tile adhesive (DST Samples 26477-M59-08A-C); and
- In-lay acoustic ceiling tiles (date codes post-date use of asbestos in these building materials.)

5.3. Lead

5.3.1. Building M-2

Table 3 summarises the analytical results of paint chip samples and ceramic tile glazing samples collected from the project areas:

Table 3: Lead Content Analysis by ICP-IES, Building M-2			
Sample ID	**Description**	**Sample Location**	**Lead Content**
26477-M2-LP01	**Off White**	**Room 133, walls and Ceilings**	**2,430 ppm**
26477-M2-LP02	**Off white/green**	**Room 124, radiator**	**11,500 ppm**
26477-M2-LP03	Beige	Room 271, Ceiling	351 ppm
26477-M2-LP04	**Grey**	**Basement (below Room 133) floor paint**	**1,970 ppm**
26477-M2-Pb03	**Glazing**	**Room 124, ceramic tile**	**7.1 mg/cm^2**

Note: Bold items represent paints or surface coatings that are considered to be lead-containing

Based on the analytical paint chip and glazing sampling results presented above, all of the paints sampled contain detectable amounts of lead. However, the beige paint similar to that present on the ceiling of Room 271 is not considered to be "lead containing".

No further paint samples were collected by DST for lead content analysis during the site investigation, as other paints encountered in the project area were in good condition and sampling without matrix interference (i.e. removing the paint without the substrate material) would have proved difficult. As such, all paint finishes that have not been sampled are assumed to be lead containing.

Lead is suspected to be present in the following materials:

- Solder on the joints of copper pipes;
- Ceramic tile glazing;
- Lead spacers associated with Terrazzo; and
- Cast iron drain pipe joint caulking

5.3.2. Building M-59

Table 4 summarises the analytical results of paint chip samples and ceramic tile glazing samples collected from the project areas:

Table 4: Lead Content Analysis by ICP-IES, Building M-59			
Sample ID	**Description**	**Sample Location**	**Lead Content**
26477-M59-LP01	**Off White**	**Room 115, walls and ceilings**	**1,660 ppm**
26477-M59-LP02	**Pink**	**Room 104, walls**	**1,340 ppm**
26477-M59-LP03	**Green/Brown**	**Room 128 Door frame**	**5,540 ppm**
26477-M59-LP04	Beige	Room 128 walls and ceilings	375 ppm
26477-M59-Pb01	**Glazing**	**Room 115, ceramic tile**	**5.3 mg/cm^2**

Table 4: Lead Content Analysis by ICP-IES, Building M-59			
Sample ID	**Description**	**Sample Location**	**Lead Content**
26477-M59-Pb02	**Glazing**	**Room 128, ceramic tile**	**5.3 mg/cm^2**

Note: Bold items represent paints or surface coatings that are considered to be lead-containing

Based on the analytical paint chip and glazing sampling results presented above, all of the paints sampled contain detectable amounts of lead. However, the beige paint similar to that present on the walls and ceiling of Room 128 is not considered to be "lead containing".

No further paint samples were collected by DST for lead content analysis during the site investigation, as other paints encountered in the project area were in good condition and sampling without matrix interference (i.e. removing the paint without the substrate material) would have proved difficult. As such, all older interior wall and ceiling paint finishes are suspected to contain lead.

Lead is suspected to be present in the following materials:

- Solder on the joints of copper piping;
- Ceramic tile glazing;
- Lead spacers associated with Terrazzo; and
- Cast iron drain pipe joint caulking

5.4. Mercury

Mercury is assumed to be present in the following equipment within the project areas of both M-2 and M-59:

- Fluorescent light fixtures containing fluorescent light tubes were observed. Fluorescent light tubes contain mercury in a vapour form and in the phosphor coating on the lamp tube;

5.5. Silica

Based on the historical composition of building materials, silica is expected to be present within the project areas of both M-2 and M-59 in:

- Lay-in ceiling tiles;
- Drywall;
- Terracotta brick and mortar;
- Plaster;
- Ceramic tiles, mortars, and grout;
- Brick and mortar; and
- Concrete materials.

5.6. Polychlorinated Biphenyls (PCBs)

Polychlorinated Biphenyls (PCBs) are hazardous chemicals which were used in the manufacturing of a variety of equipment, such as electrical equipment, heat exchangers, hydraulic systems, and for several other specialized applications. PCBs are commonly found within

electrical ballasts manufactured prior to 1981, found within fluorescent light fixtures and high intensity discharge lamps.

Light fixtures with T12 lamps are more likely to contain ballasts that were manufactured prior to 1981. T8 lamps are associated with light fixtures that were manufactured after the phase-out of PCB-containing ballasts. The letter "T" denotes the shape of the light fixture (e.g. tubular) and the number which follows indicates the diameter in eights of an inch.

DST did not disassemble light fixtures in the project areas of M-2 and M-59. Based on limited visual observations, select fluorescent light fixtures that contain T12 lamps were noted in several areas, which are suspected to contain PCB-containing ballasts.

5.7. Other Designated Substances and Hazardous Materials

The following Designated Substances and Hazardous Materials were neither observed, nor suspected of being present, in forms or quantities that would impact the renovation work:

- Acrylonitrile;
- Arsenic;
- Benzene;
- Coke Oven Emissions;
- Ethylene Oxide;
- Isocyanates;
- Ozone-depleting substances;
- Vinyl Chloride; and
- Mould

6.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the site investigation, sampling and analysis, the following Designated Substances are present in forms and quantities expected to have a measurable impact on the M-2 and M-59 Washrooms Renovation Project:

- Asbestos;
- Lead;
- Mercury;
- Silica; and
- PCBs.

DST's recommendations for each material, which are based upon both regulatory compliance and best practice guidelines, are included in the following sections below.

6.1. Asbestos

The disturbance of asbestos-containing materials on construction and demolition projects in the province of Ontario is governed by *O. Reg. 278/05, Asbestos on Construction Projects and in Buildings and Repair Operations* enabled under the *Occupational Health and Safety Act (R.S.O. 1990, Chapter 0.1),* as amended. This regulation classifies all asbestos disturbances as either Low Risk (Type 1), Moderate Risk (Type 2), or High Risk (Type 3), each of which has defined precautionary measures. All asbestos materials are subject to specific handling and disposal

precautions, and must be removed prior to demolition or renovation. The Ontario Ministry of Labour (MOL) must be notified of any project involving removal of more than a minor amount (e.g. typically one square metre) of friable asbestos material.

The removal or disturbance of 1 square metre or less of friable asbestos-containing material must be conducted using a minimum of Type 2 asbestos precautionary measures. The removal or disturbance of greater than 1 square metre of friable ACMs must be conducted using Type 3 asbestos precautionary measures. It should be noted that:

- Plaster materials are considered non-friable in their undisturbed state, but typically become friable when disturbed. As such, plaster materials should be treated as friable ACM;
- Friable asbestos-containing debris has been identified on select upper ceiling surfaces. Entry to these areas will require a minimum of Type 2 precautions.
- Pipe fitting insulation can be removed using Type 2 glove bag procedures, provided the pipe fittings are in good condition, and the work is performed in accordance with the requirements of O.Reg 278/05, as amended. Note that a proper seal must be maintained and that glove bag procedures cannot be used for conditions that prevent a seal from being maintained (e.g. hot pipes, physical geometry).

The removal or disturbance of non-friable asbestos-containing materials (mastics and floor levelling compounds) can be completed using Type 1 asbestos precautionary measures, provided the material is wetted and only non-powered hand-held tools are used. If these conditions cannot be met, than more stringent (Type 2 or Type 3) procedures are required.

The time weight average exposure limit (TWAEL) for airborne asbestos is prescribed by Ontario Regulation 490/09 *Designated Substances*, as amended. Work procedures and personal protective equipment must be used to ensure that workers are not exposed to airborne asbestos levels that exceed this TWAEL.

The following recommendations apply to ACMs:

1. In general, materials must be maintained in good condition;
2. The condition of material(s) identified in this report must be inspected at least annually, and this record must be updated accordingly;
3. Appropriate work procedures and precautionary measures must be used, as outlined in O. Reg. 278/05, as amended, when performing work that may disturb ACMs or suspected ACMs, including prior to building demolition;
4. If ACMs or suspected ACMs become damaged and worker exposure to the material is likely to occur, the damaged material must be repaired or removed following work procedures outlined in O. Reg. 278/05, as amended; and
5. Disposal of asbestos waste is controlled by the Ontario Environmental Protection Act, R.R.O., 1990, Regulation 347, *General – Waste Management,* as amended. This regulation requires that asbestos waste be sealed in double containers resistant to puncture and tears, and appropriately labelled. The waste must be disposed at a licensed waste disposal site. Proper notification must be issued to the site representative prior to transportation of waste. The transport of the waste to the disposal site is controlled by the federal *Transportation of Dangerous Goods Act*, 1992 (TDGA).

Although attempts were made to look above ceilings and into wall cavities, some ACMs may be concealed and thus not observed at the time of the survey. Should any previously unidentified suspect ACMs be encountered as part of future work, these materials are to be treated as ACMs and handled accordingly, unless sampling proves otherwise.

Materials that have not been analyzed, but are visibly similar to other materials identified as asbestos-containing, must be considered asbestos-containing unless proven otherwise by laboratory analysis.

6.2. Lead

The Occupational Health and Safety Branch of the Ontario MoL has published *Guideline: Lead on Construction Projects*. This document classifies all lead disturbances as Type 1, Type 2a, Type 2b, Type 3a or Type 3b work, and assigns different levels of respiratory protection and work procedures for each classification. In the absence of specific legislation for lead on construction projects, this guideline should be followed when disturbing lead-containing materials.

Paints containing elevated concentrations of lead can pose a health risk to humans if ingested or inhaled. Such lead paints are also a risk to the environment with the potential to contaminate soil and groundwater. Paints with elevated lead content can also pose a health risk to workers while completing renovations within the building.

Lead-containing materials including paints having lead concentrations greater than 1,000 ppm require lead abatement precautionary measures. Work procedures outlined in the MoL document entitled Guideline: Lead on Construction Projects should be followed to reduce the exposure to lead when disturbing materials coated with these paints.

Paints having lead concentrations less than 1,000 ppm are not considered to be lead-containing but require lead abatement precautionary measures if these paints are disturbed in an aggressive manner (e.g. torching/welding, grinding, power sanding, or abrasive blasting).

The TWAEL for airborne lead is prescribed by Ontario Regulation 490/09 *Designated Substances*, as amended. Work procedures and personal protective equipment must be used to ensure that workers are not exposed to airborne lead levels that exceed this TWAEL.

DST recommends that any future disturbance of lead-containing materials avoid operations that generate high levels of dust (e.g. sanding, grinding) and that should these operations be required, appropriate precautionary measures be implemented for worker exposure.

The disposal of construction waste containing lead is governed by O. Reg. 347/90 - General – Waste Management, as amended. The transport of the waste to the disposal site is controlled by the federal Transportation of Dangerous Goods Act (TDGA), 1992.

If required at some future date to accommodate work, the following procedures are appropriate for other materials containing lead:

- Copper piping and cast iron joint caulking can be cut a small distance (e.g. 50 mm) from the joints to avoid direct disturbance of suspected lead solder and caulking; and

- Ceramic tiles can be removed using Type 1 work procedures and respiratory protection provided that only non-powered hand tools are used.

6.3. Mercury

There are no regulations that specifically govern the disturbance of mercury on construction projects. However, the Occupational Health and Safety Division of the Ontario MoL has published *The Safe Handling of Mercury: A Guide for the Construction Industry*. This document provides advice on how to reduce the risk of mercury exposure, and outlines clean-up methods for spills. In the absence of specific legislation for mercury on construction projects, this guideline would serve as a reasonable, peer reviewed standard for work procedures.

When the removal of fluorescent light tubes is required, the tubes should be removed intact from the fixtures. This prevents worker exposure to mercury vapour, particularly if the tube was energized shortly before removal. Thermostats containing liquid mercury can be removed in the same fashion.

The TWAEL for mercury is prescribed by Ontario Regulation 490/09 *Designated Substances*, as amended. Work procedures and personal protective equipment must be used to ensure that workers are not exposed to airborne mercury levels that exceed this exposure limit.

Liquid mercury is classified as a hazardous waste under O. Reg. 347/90, as amended. The transport of the waste to a disposal site is controlled by O. Reg. 347/90 and by the federal TDGA. It is now common practice to recycle fluorescent light tubes and avoiding the generation of hazardous waste.

6.4. Silica

The Occupational Health and Safety Branch of the Ontario Ministry of Labour have published *Guideline: Silica on Construction Projects*. This document classifies all silica disturbances as Type 1, Type 2 or Type 3 work, and assigns different levels of respiratory protection and work procedures for each classification.

The TWAEL for airborne silica is prescribed by Ontario Regulation 490/09 *Designated Substances*, as amended. Work procedures and personal protective equipment must be used to ensure that workers are not exposed to airborne silica levels that exceed this exposure limit.

As a general rule, it is preferable to use more stringent dust suppression techniques and engineering controls as opposed to relying on respiratory protection to control worker exposure. Respiratory protection should only be relied on as a last resort when dust suppression techniques and engineering controls fail to control worker.

6.5. Polychlorinated Biphenyls (PCBs)

Fluorescent light ballasts that may be encountered in the M-2 and M-59 project areas are suspected to contain PCBs. Prior to removal or disposal, the PCB content of equipment must be confirmed to determine proper procedures to be followed. When the light fixtures are taken out of service, the ballasts should be examined to determine whether they contain PCBs. This can be done by comparing the manufacturer date codes stamped on the ballasts to information contained in the document titled Identification of Lamp Ballasts Containing PCBs, published by Environment

Canada. Ballasts that contain PCBs must be packaged, transported and disposed of in accordance with all appropriate provincial and federal regulations.

O. Reg. 347, General – Waste Management, as amended, is regulated under the Environmental Protection Act to regulate the handling, storage and transportation of hazardous substances and waste dangerous goods. The transport of PCB waste to the disposal site is controlled by the federal Transportation of Dangerous Goods Act, 1992. Proper notification must be issued to the site representative prior to transportation of waste. Use, storage, labelling, and reporting requirements are also outlined within the federal PCB Regulation under the Canadian Environmental Protection Act (CEPA).

7.0 CLOSURE

A Limitations of Report section, which forms an integral part of this report, is attached.

We trust that the information contained herein meets your needs. Should you have any questions or comments, please do not hesitate to contact us.

DST CONSULTING ENGINEERS INC.

for

Nicolas Strang, C.Tech.
Environmental Scientist
nstrang@dstgroup.com

Brendan Harrigan, P.Eng.
Director of Government Client Group
bharrigan@dstgroup.com

LIMITATIONS OF REPORT

This report is intended for client use only. Any use of this document by a third party, or any reliance on or decisions made based on the findings described in this report, are the sole responsibility of such third parties, and DST Consulting Engineers Inc. accepts no responsibility for damages, suffered by any third party as a result of decisions made or actions conducted based on this report. No other warranties are implied or expressed.

The data, conclusions and recommendations which are presented in this report, and the quality thereof, are based on a scope of work authorized by the client. The sampling program included asbestos bulk sampling and lead chip/bulk sampling in select representative areas for laboratory analysis. There is a practical limitation on the number of intrusive test cuts that can be made and the number of samples that can be collected in an occupied building. This requires the investigator to extrapolate observations and analytical results between test cut locations. The uncertainty, and inherent risk, associated with this necessity increases with the distance between sampling locations. Note, however, that no scope of work, no matter how exhaustive, can guarantee to identify all contaminants. This report therefore cannot warranty that all building conditions are represented by those identified at specific locations.

Recommendations, when included, are made in good faith and are based on several successful experiences.

Any recommendations and conclusions provided that are based on conditions or assumptions reported herein will inherently include any uncertainty associated with those conditions or assumptions.

Note also that standards, guidelines and practices related to environmental investigations may change with time. Those which were applied at the time of this investigation may be obsolete or unacceptable at a later date.

Any comments given in this report on potential remediation problems and possible methods are intended only for the guidance of the designer. The scope of work may not be sufficient to determine all of the factors that may affect construction, clean-up methods and/or costs. Contractors bidding on this project or undertaking clean-ups should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the conditions may affect their work.

Any results from an analytical laboratory or other subcontractor reported herein have been carried out by others, and DST Consulting Engineers Inc. cannot warranty their accuracy. Similarly, DST cannot warranty the accuracy of information supplied by the client.

APPENDIX A

Select Photographs

Photo 1: Asbestos-containing remnant mastic and floor levelling compound in Room 133 at the M-2 Building.

Photo 2: Suspected asbestos containing remnant mastic pucks above Room 271 solid ceiling at the M-2 Building

Photo 3: Asbestos containing pipe insulation debris above the solid ceiling in Room 115 at the M-59 Building

Photo 4: Loose terracotta bricks on top of duct work pose a risk to potential workers removing the duct work.

Photo 5: Asbestos containing pipe insulation debris above the solid ceiling in Room 128 at the M-59 Building

Photo 6: Good condition Mag-block pipe insulation feeding a radiant heater.

APPENDIX B

Laboratory Certificates of Analysis – Asbestos and Lead in Paint

PARACEL LABORATORIES LTD.

TRUSTED.
RESPONSIVE.
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300 - 2319 St. Laurent Blvd
Ottawa, ON, K1G 4J8
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www.paracellabs.com

Certificate of Analysis

DST Consulting Engineers Inc. (Ottawa)

203-2150 Thurston Dr.
Ottawa, ON K1G 5T9
Attn: Brendan Harrigan

Client PO:
Project: GV OT 026477
Custody:

Report Date: 3-Jun-2016
Order Date: 30-May-2016

Order #: 1623202

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1623202-01	26477-M2-01A (White)
1623202-02	26477-M2-01B (White)
1623202-03	26477-M2-01C (White)
1623202-04	26477-M2-01A (Grey)
1623202-05	26477-M2-01B (Grey)
1623202-06	26477-M2-01C (Grey)
1623202-07	26477-M2-02A
1623202-08	26477-M2-02B
1623202-09	26477-M2-02C
1623202-10	26477-M2-03A (Leveling Compound)
1623202-11	26477-M2-03B (Leveling Compound)
1623202-12	26477-M2-03C (Leveling Compound)
1623202-16	26477-M2-04A
1623202-17	26477-M2-04B
1623202-18	26477-M2-04C
1623202-19	26477-M2-05A (Light Grey Cement)
1623202-20	26477-M2-05B (Light Grey Cement)
1623202-21	26477-M2-05c (Light Grey Cement)
1623202-22	26477-M2-05A (Dark Grey Mortar)
1623202-23	26477-M2-05B (Dark Grey Mortar)
1623202-24	26477-M2-05C (Dark Grey Mortar)
1623202-25	26477-M2-06A (White)
1623202-26	26477-M2-06B (White)
1623202-27	26477-M2-06C (White)
1623202-28	26477-M2-06A (Grey)
1623202-29	26477-M2-06B (Grey)
1623202-30	26477-M2-06C (Grey)
1623202-31	26477-M2-07A
1623202-32	26477-M2-07B
1623202-33	26477-M2-07C
1623202-34	26477-M2-08A (Yellow Glue)
1623202-35	26477-M2-08B (Yellow Glue)
1623202-36	26477-M2-08C (Yellow Glue)
1623202-43	26477-M2-09A (DJC)
1623202-44	26477-M2-09B (DJC)
1623202-45	26477-M2-09C (DJC)
1623202-46	26477-M2-09A (White Plaster)
1623202-47	26477-M2-09B (White Plaster)
1623202-48	26477-M2-09C (White Plaster)
1623202-49	26477-M2-09A (Grey Plaster)
1623202-50	26477-M2-09B (Grey Plaster)
1623202-51	26477-M2-09C (Grey Plaster)
1623202-52	26477-M59-01A (White)
1623202-53	26477-M59-01B (White)
1623202-54	26477-M59-01C (White)
1623202-55	26477-M59-01A (Grey)
1623202-56	26477-M59-01B (Grey)
1623202-57	26477-M59-01C (Grey)
1623202-58	26477-M59-02A
1623202-59	26477-M59-02B
1623202-60	26477-M59-02C
1623202-61	26477-M59-03A (White)

Approved By:

Emma Diaz
Senior Analyst

1623202-62	26477-M59-03B (White)
1623202-63	26477-M59-03C (White)
1623202-64	26477-M59-03A (Grey)
1623202-65	26477-M59-03B (Grey)
1623202-66	26477-M59-03C (Grey)
1623202-67	26477-M59-04A (SVF)
1623202-68	26477-M59-04B (SVF)
1623202-69	26477-M59-04C (SVF)
1623202-70	26477-M59-04A (Mastic)
1623202-71	26477-M59-04B (Mastic)
1623202-72	26477-M59-04C (Mastic)
1623202-73	26477-M59-05A
1623202-74	26477-M59-05B
1623202-75	26477-M59-05C
1623202-76	26477-M59-06A
1623202-77	26477-M59-06B
1623202-78	26477-M59-06C
1623202-79	26477-M59-07A
1623202-80	26477-M59-07B
1623202-81	26477-M59-07C
1623202-82	26477-M59-08A (Grey Plaster)
1623202-83	26477-M59-08B (Grey Plaster)
1623202-84	26477-M59-08C (Grey Plaster)

Certificate of Analysis
Client: DST Consulting Engineers Inc. (Ottawa)
Client PO:

Report Date: 03-Jun-2016
Order Date: 30-May-2016
Project Description: GV OT 026477

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	*Sample Date*	*Layers Analyzed*	*Colour*	*Description*	*Asbestos Detected:*	*Material Identification*	*% Content*
1623202-01	26-May-16	sample homogenized	White	Plaster	No	**Client ID: 26477-M2-01A (White)**	
						Non-Fibers	100
1623202-02	26-May-16	sample homogenized	White	Plaster	No	**Client ID: 26477-M2-01B (White)**	
						Non-Fibers	100
1623202-03	26-May-16	sample homogenized	White	Plaster	No	**Client ID: 26477-M2-01C (White)**	
						Non-Fibers	100
1623202-04	26-May-16	sample homogenized	Grey	Plaster	No	**Client ID: 26477-M2-01A (Grey)**	
						Non-Fibers	100
1623202-05	26-May-16	sample homogenized	Grey	Plaster	No	**Client ID: 26477-M2-01B (Grey)**	
						Non-Fibers	99
						Other fibers	1
1623202-06	26-May-16	sample homogenized	Grey	Vermicrete	No	**Client ID: 26477-M2-01C (Grey)**	
						Non-Fibers	100
1623202-07	26-May-16	sample homogenized	Black	Mastic	**Yes**	**Client ID: 26477-M2-02A** [AS-PRE]	
						Chrysotile	1.95
						Non-Fibers	98.05
1623202-08	26-May-16					**Client ID: 26477-M2-02B**	
						not analyzed	
1623202-09	26-May-16					**Client ID: 26477-M2-02C**	
						not analyzed	
1623202-10	26-May-16	sample homogenized	Grey/Beige	Leveling Compound	**Yes**	**Client ID: 26477-M2-03A (Leveling Compound)**	
						Chrysotile	1
						Non-Fibers	99
1623202-11	26-May-16					**Client ID: 26477-M2-03B (Leveling Compound)**	
						not analyzed	
1623202-12	26-May-16					**Client ID: 26477-M2-03C (Leveling Compound)**	
						not analyzed	
1623202-16	26-May-16	sample homogenized	Grey	Drywall Joint Compound	No	**Client ID: 26477-M2-04A**	
						Non-Fibers	100
1623202-17	26-May-16	sample homogenized	Grey	Drywall Joint Compound	No	**Client ID: 26477-M2-04B**	
						Non-Fibers	100
1623202-18	26-May-16	sample homogenized	Grey	Drywall Joint Compound	No	**Client ID: 26477-M2-04C**	
						Non-Fibers	100
1623202-19	26-May-16	sample homogenized	Light Grey	Cement	No	**Client ID: 26477-M2-05A (Light Grey Cement)**	
						Non-Fibers	100

Certificate of Analysis
Client: DST Consulting Engineers Inc. (Ottawa)
Client PO:

Report Date: 03-Jun-2016
Order Date: 30-May-2016
Project Description: GV OT 026477

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	*Sample Date*	*Layers Analyzed*	*Colour*	*Description*	*Asbestos Detected:*	*Material Identification*	*% Content*
1623202-20	26-May-16	sample homogenized	Light Grey	Cement	No	**Client ID: 26477-M2-05B (Light Grey Cement)**	
						Non-Fibers	100
1623202-21	26-May-16	sample homogenized	Light Grey	Cement	No	**Client ID: 26477-M2-05c (Light Grey Cement)**	
						Non-Fibers	100
1623202-22	26-May-16	sample homogenized	Dark Grey	Mortar	No	**Client ID: 26477-M2-05A (Dark Grey Mortar)**	
						Non-Fibers	100
1623202-23	26-May-16	sample homogenized	Dark Grey	Mortar	No	**Client ID: 26477-M2-05B (Dark Grey Mortar)**	
						Non-Fibers	100
1623202-24	26-May-16	sample homogenized	Dark Grey	Mortar	No	**Client ID: 26477-M2-05C (Dark Grey Mortar)**	
						Non-Fibers	100
1623202-25	26-May-16	sample homogenized	White	Plaster	No	**Client ID: 26477-M2-06A (White)**	
						Non-Fibers	100
1623202-26	26-May-16	sample homogenized	White	Plaster	No	**Client ID: 26477-M2-06B (White)**	
						Non-Fibers	100
1623202-27	26-May-16	sample homogenized	White	Plaster	No	**Client ID: 26477-M2-06C (White)**	
						Non-Fibers	100
1623202-28	26-May-16	sample homogenized	Grey	Vermicrete	No	**Client ID: 26477-M2-06A (Grey)**	
						Non-Fibers	100
1623202-29	26-May-16	sample homogenized	Grey	Vermicrete	No	**Client ID: 26477-M2-06B (Grey)**	
						Non-Fibers	100
1623202-30	26-May-16	sample homogenized	Grey	Vermicrete	**Yes**	**Client ID: 26477-M2-06C (Grey)**	
						Tremolite	1
						Non-Fibers	99
1623202-31	26-May-16	sample homogenized	White/Grey	Plaster/Vermicrete	No	**Client ID: 26477-M2-07A** [ASLYR]	
						Non-Fibers	100
1623202-32	26-May-16	sample homogenized	White/Grey	Plaster/Vermicrete	No	**Client ID: 26477-M2-07B** [ASLYR]	
						Non-Fibers	100
1623202-33	26-May-16	sample homogenized	White/Grey	Plaster/Vermicrete	**Yes**	**Client ID: 26477-M2-07C** [ASLYR]	
						Tremolite	1
						Non-Fibers	99
1623202-34	26-May-16	sample homogenized	Yellow	Glue	No	**Client ID: 26477-M2-08A (Yellow Glue)** [AS-PRE]	
						Non-Fibers	100
1623202-35	26-May-16	sample homogenized	Yellow	Glue	No	**Client ID: 26477-M2-08B (Yellow Glue)** [AS-PRE]	
						Non-Fibers	100

Certificate of Analysis
Client: DST Consulting Engineers Inc. (Ottawa)
Client PO:

Report Date: 03-Jun-2016
Order Date: 30-May-2016
Project Description: GV OT 026477

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	Sample Date	Layers Analyzed	Colour	Description	Asbestos Detected:	Material Identification	% Content
1623202-36	26-May-16	sample homogenized	Yellow	Glue	No	**Client ID: 26477-M2-08C (Yellow Glue)**	[AS-PRE]
						Non-Fibers	100
1623202-43	26-May-16	sample homogenized	Grey	Drywall Joint Compound	No	**Client ID: 26477-M2-09A (DJC)**	
						Non-Fibers	100
1623202-44	26-May-16	sample homogenized	Grey	Drywall Joint Compound	No	**Client ID: 26477-M2-09B (DJC)**	
						Non-Fibers	100
1623202-45	26-May-16	sample homogenized	Grey	Drywall Joint Compound	No	**Client ID: 26477-M2-09C (DJC)**	
						Non-Fibers	100
1623202-46	26-May-16	sample homogenized	White	Plaster	No	**Client ID: 26477-M2-09A (White Plaster)**	
						Non-Fibers	100
1623202-47	26-May-16	sample homogenized	White	Plaster	No	**Client ID: 26477-M2-09B (White Plaster)**	
						Non-Fibers	100
1623202-48	26-May-16	sample homogenized	White	Plaster	No	**Client ID: 26477-M2-09C (White Plaster)**	
						Non-Fibers	100
1623202-49	26-May-16	sample homogenized	Grey	Vermicrete	No	**Client ID: 26477-M2-09A (Grey Plaster)**	
						Non-Fibers	100
1623202-50	26-May-16	sample homogenized	Grey	Vermicrete	No	**Client ID: 26477-M2-09B (Grey Plaster)**	
						Non-Fibers	100
1623202-51	26-May-16	sample homogenized	Grey	Vermicrete	No	**Client ID: 26477-M2-09C (Grey Plaster)**	
						Non-Fibers	100
1623202-52	26-May-16	sample homogenized	White	Plaster	No	**Client ID: 26477-M59-01A (White)**	
						Non-Fibers	100
1623202-53	26-May-16	sample homogenized	White	Plaster	No	**Client ID: 26477-M59-01B (White)**	
						Non-Fibers	100
1623202-54	26-May-16	sample homogenized	White	Plaster	No	**Client ID: 26477-M59-01C (White)**	
						Non-Fibers	100
1623202-55	26-May-16	sample homogenized	Grey	Plaster	**Yes**	**Client ID: 26477-M59-01A (Grey)**	
						Chrysotile	1
						Non-Fibers	99
1623202-56	26-May-16					**Client ID: 26477-M59-01B (Grey)**	
						not analyzed	
1623202-57	26-May-16					**Client ID: 26477-M59-01C (Grey)**	
						not analyzed	
1623202-58	26-May-16	sample homogenized	Grey	Adhesive	No	**Client ID: 26477-M59-02A**	
						Non-Fibers	100

Certificate of Analysis
Client: DST Consulting Engineers Inc. (Ottawa)
Client PO:

Report Date: 03-Jun-2016
Order Date: 30-May-2016
Project Description: GV OT 026477

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	Sample Date	Layers Analyzed	Colour	Description	Asbestos Detected:	Material Identification	% Content
1623202-59	26-May-16	sample homogenized	Grey	Adhesive	No	**Client ID: 26477-M59-02B**	
						Non-Fibers	100
1623202-60	26-May-16	sample homogenized	Grey	Adhesive	No	**Client ID: 26477-M59-02C**	
						Non-Fibers	100
1623202-61	26-May-16	sample homogenized	White	Plaster	No	**Client ID: 26477-M59-03A (White)**	
						Non-Fibers	100
1623202-62	26-May-16	sample homogenized	White	Plaster	No	**Client ID: 26477-M59-03B (White)**	
						Non-Fibers	100
1623202-63	26-May-16	sample homogenized	White	Plaster	No	**Client ID: 26477-M59-03C (White)**	
						Non-Fibers	100
1623202-64	26-May-16	sample homogenized	Grey	Plaster	No	**Client ID: 26477-M59-03A (Grey)**	
						Non-Fibers	100
1623202-65	26-May-16	sample homogenized	Grey	Plaster	No	**Client ID: 26477-M59-03B (Grey)**	
						Non-Fibers	100
1623202-66	26-May-16	sample homogenized	Grey	Plaster	No	**Client ID: 26477-M59-03C (Grey)**	
						Non-Fibers	100
1623202-67	26-May-16	sample homogenized	Grey	Sheet Vinyl Flooring	No	**Client ID: 26477-M59-04A (SVF)**	[AS-PRE]
						Cellulose	15
						MMVF	5
						Non-Fibers	80
1623202-68	26-May-16	sample homogenized	Grey	Sheet Vinyl Flooring	No	**Client ID: 26477-M59-04B (SVF)**	[AS-PRE]
						Cellulose	15
						MMVF	5
						Non-Fibers	80
1623202-69	26-May-16	sample homogenized	Grey	Sheet Vinyl Flooring	No	**Client ID: 26477-M59-04C (SVF)**	[AS-PRE]
						Cellulose	15
						MMVF	5
						Non-Fibers	80
1623202-70	26-May-16	sample homogenized	Beige	Mastic	No	**Client ID: 26477-M59-04A (Mastic)**	[AS-PRE]
						MMVF	1
						Non-Fibers	99
1623202-71	26-May-16	sample homogenized	Beige	Mastic	No	**Client ID: 26477-M59-04B (Mastic)**	[AS-PRE]
						MMVF	1
						Non-Fibers	99

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Order #: 1623202

Certificate of Analysis
Client: DST Consulting Engineers Inc. (Ottawa)
Client PO:

Report Date: 03-Jun-2016
Order Date: 30-May-2016
Project Description: GV OT 026477

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	*Sample Date*	*Layers Analyzed*	*Colour*	*Description*	*Asbestos Detected:*	*Material Identification*	*% Content*
1623202-72	26-May-16	sample homogenized	Beige	Mastic	No	**Client ID: 26477-M59-04C (Mastic)** [AS-PRE]	
						MMVF	1
						Non-Fibers	99
1623202-73	26-May-16	sample homogenized	Grey	Drywall Joint Compound	No	**Client ID: 26477-M59-05A**	
						Cellulose	1
						Non-Fibers	99
1623202-74	26-May-16	sample homogenized	Grey	Drywall Joint Compound	No	**Client ID: 26477-M59-05B**	
						Cellulose	1
						Non-Fibers	99
1623202-75	26-May-16	sample homogenized	Grey	Drywall Joint Compound	No	**Client ID: 26477-M59-05C**	
						Cellulose	1
						Non-Fibers	99
1623202-76	26-May-16	sample homogenized	Grey	Compound	**Yes**	**Client ID: 26477-M59-06A**	
						Chrysotile	40
						Non-Fibers	60
1623202-77	26-May-16					**Client ID: 26477-M59-06B**	
						not analyzed	
1623202-78	26-May-16					**Client ID: 26477-M59-06C**	
						not analyzed	
1623202-79	26-May-16	sample homogenized	Beige	Mastic	No	**Client ID: 26477-M59-07A** [AS-PRE]	
						Non-Fibers	100
1623202-80	26-May-16	sample homogenized	Beige	Mastic	No	**Client ID: 26477-M59-07B** [AS-PRE]	
						Non-Fibers	100
1623202-81	26-May-16	sample homogenized	Beige	Mastic	No	**Client ID: 26477-M59-07C** [AS-PRE]	
						Non-Fibers	100
1623202-82	26-May-16	sample homogenized	Grey	Plaster	No	**Client ID: 26477-M59-08A (Grey Plaster)**	
						Non-Fibers	100
1623202-83	26-May-16	sample homogenized	Grey	Plaster	No	**Client ID: 26477-M59-08B (Grey Plaster)**	
						Non-Fibers	100
1623202-84	26-May-16	sample homogenized	Grey	Plaster	No	**Client ID: 26477-M59-08C (Grey Plaster)**	
						Non-Fibers	100

** MMVF: Man Made Vitreous Fibers: Fiberglass, Mineral Wool, Rockwool, Glasswool*

**** Analytes in bold indicate asbestos mineral content.**

Certificate of Analysis
Client: DST Consulting Engineers Inc. (Ottawa)
Client PO:

Report Date: 03-Jun-2016
Order Date: 30-May-2016
Project Description: GV OT 026477

Analysis Summary Table

Analysis	Method Reference/Description	Lab Location	NVLAP Lab Code *	Analysis Date
Asbestos, PLM Visual Estimation	by EPA 600/R-93/116	Ottawa West Lab	200812-0	3-Jun-16

** Reference to the NVLAP term does not permit the user of this report to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.*

Qualifier Notes

Sample Qualifiers :

ASLYR: Layers were noted for this sample, however, the entire sample was homogenized per client request.

AS-PRE: Due to the difficult nature of the bulk sample (interfering fibers/binders), additional NOB preparation was required prior to analysis

Work Order Revisions / Comments

None

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Chain of Custody

(Lab Use Only)

№ 14459

Page 1 of 1

Client Name: PST Consulting Eng.	Project Reference: GVOT026477
Contact Name: Brendan Horgan	Quote #:
Address: 2150 Thurston Ottawa, ON	PO #:
Telephone: 613-748-1415	Email Address: Brendan

TAT: [X] Regular [ ] 3 Day [ ] 2 Day [ ] 1 Day [ ] Same Day

Date Required: June 3

ASBESTOS ANALYSIS

Matrix: [ ] Air [ ] Other Regulatory Guideline: _____

Required Analyses: [ ]PCM [X]PLM [ ]PLM 400PC [ ]PLM 1000PC [ ]Chatfield [ ]TEM

Paracel Order Number: 623202

	Sample ID	Matrix Description	Sampling Date	Air Volume (L)	Positive Stop? (Y/N)	Is the Sample Layered? (Y/N)	If layered, Describe Layer(s) to be Analyzed Separately* or Homogenize all **
1	See Attached	See Attached					See Attached
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

* Each layer is charged as a separate analysis ** Homogenize = Sample is combined to a uniform mixture

Comments:

Method of Delivery: Walkin

Relinquished By: Sampler	Received at Depot:	Received at Lab:	Verified By:
Relinquished By: Print: Brendan Horgan			
Date/Time: May 30 / 10:30	Date/Time: May 30/16 10:30a	Date/Time: May 30/16 1 00	Date/Time: Jun 1/16 9 cc

Chain of Custody - Summary of Samples

Project Number: GV-OT-0 26477

Sample ID	Matrix	Description	Layers Analysis	Sampling Date
26477-M2-01A	Solid	Ceiling Plaster	Analyze layers separately	26-May-16
26477-M2-01B	Solid	Ceiling Plaster	Analyze layers separately	26-May-16
26477-M2-01C	Solid	Ceiling Plaster	Analyze layers separately	26-May-16
26477-M2-02A	Solid	Viny Floor Tile Mastic	1 layer	26-May-16
26477-M2-02B	Solid	Viny Floor Tile Mastic	1 layer	26-May-16
26477-M2-02C	Solid	Viny Floor Tile Mastic	1 layer	26-May-16
26477-M2-03A	Solid	Leveling Compound	1 layer	26-May-16
26477-M2-03B	Solid	Leveling Compound	1 layer	26-May-16
26477-M2-03C	Solid	Leveling Compound	1 layer	26-May-16
26477-M2-04A	Solid	Drywall Joint Compound	1 layer	26-May-16
26477-M2-04B	Solid	Drywall Joint Compound	1 layer	26-May-16
26477-M2-04C	Solid	Drywall Joint Compound	1 layer	26-May-16
26477-M2-05A	Solid	Cement Block & Mortar	Analyze layers separately	26-May-16
26477-M2-05B	Solid	Cement Block & Mortar	Analyze layers separately	26-May-16
26477-M2-05C	Solid	Cement Block & Mortar	Analyze layers separately	26-May-16
26477-M2-06A	Solid	Wall plaster (white + yellow layers)	Analyze layers separately	26-May-16
26477-M2-06B	Solid	Wall plaster (white + yellow layers)	Analyze layers separately	26-May-16
26477-M2-06C	Solid	Wall plaster (white + yellow layers)	Analyze layers separately	26-May-16
26477-M2-07A	Solid	Fireproofing	Homogenize sample	26-May-16
26477-M2-07B	Solid	Fireproofing	Homogenize sample	26-May-16
26477-M2-07C	Solid	Fireproofing	Homogenize sample	26-May-16
26477-M2-08A	Solid	Ceramic tile Adhesive	1 layer	26-May-16
26477-M2-08B	Solid	Ceramic tile Adhesive	1 layer	26-May-16
26477-M2-08C	Solid	Ceramic tile Adhesive	1 layer	26-May-16
26477-M2-09A	Solid	Wall plaster (white + yellow layers)	Analyze layers separately	26-May-16
26477-M2-09B	Solid	Wall plaster (white + yellow layers)	Analyze layers separately	26-May-16
26477-M2-09C	Solid	Wall plaster (white + yellow layers)	Analyze layers separately	26-May-16
26477-M59-01A	Solid	Ceiling Plaster	Analyze layers separately	26-May-16
26477-M59-01B	Solid	Ceiling Plaster	Analyze layers separately	26-May-16
26477-M59-01C	Solid	Ceiling Plaster	Analyze layers separately	26-May-16
26477-M59-02A	Solid	Ceramic tile Adhesive	1 layer	26-May-16
26477-M59-02B	Solid	Ceramic tile Adhesive	1 layer	26-May-16
26477-M59-02C	Solid	Ceramic tile Adhesive	1 layer	26-May-16
26477-M59-03A	Solid	Wall plaster (Grey+ white)	Analyze layers separately	26-May-16
26477-M59-03B	Solid	Wall plaster (Grey+ white)	Analyze layers separately	26-May-16
26477-M59-03C	Solid	Wall plaster (Grey+ white)	Analyze layers separately	26-May-16
26477-M59-04A	Solid	Vinyl Sheet Flooring	Analyze layers separately	26-May-16
26477-M59-04B	Solid	Vinyl Sheet Flooring	Analyze layers separately	26-May-16
26477-M59-04C	Solid	Vinyl Sheet Flooring	Analyze layers separately	26-May-16
26477-M59-05A	Solid	Drywall Joint Compound	1 layer	26-May-16
26477-M59-05B	Solid	Drywall Joint Compound	1 layer	26-May-16
26477-M59-05C	Solid	Drywall Joint Compound	1 layer	26-May-16
26477-M59-06A	Solid	Grey Cement Compound	1 layer	26-May-16
26477-M59-06B	Solid	Grey Cement Compound	1 layer	26-May-16
26477-M59-06C	Solid	Grey Cement Compound	1 layer	26-May-16
26477-M59-07A	Solid	Vinyl Sheet Flooring Mastic	1 layer	26-May-16
26477-M59-07B	Solid	Vinyl Sheet Flooring Mastic	1 layer	26-May-16
26477-M59-07C	Solid	Vinyl Sheet Flooring Mastic	1 layer	26-May-16
26477-M59-08A	Solid	Ceramic tile Adhesive	1 layer	26-May-16
26477-M59-08B	Solid	Ceramic tile Adhesive	1 layer	26-May-16
26477-M59-08C	Solid	Ceramic tile Adhesive	1 layer	26-May-16

White & grey

LC + mastic

light grey cement + dark grey mortar

white + grey

yellow glue, Ceramic tile white plaster

DTC, white plaster, grey plaster

white + grey

white + grey

sheet vinyl Flooring + mastic

Grey plaster, Grey ceramic White ceramic

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Certificate of Analysis

DST Consulting Engineers Inc. (Ottawa)

203-2150 Thurston Dr.
Ottawa, ON K1G 5T9
Attn: Brendan Harrigan

Client PO:
Project: GV OT 026477
Custody: 15157

Report Date: 6-Jun-2016
Order Date: 1-Jun-2016

Order #: 1623366

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1623366-01	26477-M2-10-A
1623366-02	26477-M2-10-B
1623366-03	26477-M2-10-C
1623366-04	26477-M2-11-A
1623366-05	26477-M2-11-B
1623366-06	26477-M2-11-C

Approved By:

Emma Diaz
Senior Analyst

PARACEL LABORATORIES LTD.

Order #: 1623366

Certificate of Analysis
Client: DST Consulting Engineers Inc. (Ottawa)
Client PO:

Report Date: 06-Jun-2016
Order Date: 1-Jun-2016
Project Description: GV OT 026477

Asbestos, PLM Visual Estimation **MDL - 0.5%**

Paracel I.D.	*Sample Date*	*Layers Analyzed*	*Colour*	*Description*	*Asbestos Detected:*	*Material Identification*	*% Content*
1623366-01	01-Jun-16	sample homogenized	Black	Tar	No	**Client ID: 26477-M2-10-A**	[AS-PRE]
						Cellulose	10
						MMVF	1
						Non-Fibers	89
1623366-02	01-Jun-16	sample homogenized	Black	Tar	No	**Client ID: 26477-M2-10-B**	[AS-PRE]
						Cellulose	10
						MMVF	1
						Non-Fibers	89
1623366-03	01-Jun-16	sample homogenized	Black	Tar	No	**Client ID: 26477-M2-10-C**	[AS-PRE]
						Cellulose	10
						MMVF	1
						Non-Fibers	89
1623366-04	01-Jun-16	sample homogenized	Black	Shingle	No	**Client ID: 26477-M2-11-A**	[AS-PRE]
						MMVF	10
						Non-Fibers	90
1623366-05	01-Jun-16	sample homogenized	Black	Shingle	No	**Client ID: 26477-M2-11-B**	[AS-PRE]
						MMVF	10
						Non-Fibers	90
1623366-06	01-Jun-16	sample homogenized	Black	Shingle	No	**Client ID: 26477-M2-11-C**	[AS-PRE]
						MMVF	10
						Non-Fibers	90

** MMVF: Man Made Vitreous Fibers: Fiberglass, Mineral Wool, Rockwool, Glasswool*

Analysis Summary Table

Analysis	Method Reference/Description	Lab Location	NVLAP Lab Code *	Analysis Date
Asbestos, PLM Visual Estimation	by EPA 600/R-93/116	Ottawa West Lab	200812-0	6-Jun-16

** Reference to the NVLAP term does not permit the user of this report to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the Federal Government.*

Certificate of Analysis
Client: DST Consulting Engineers Inc. (Ottawa)
Client PO:

Report Date: 06-Jun-2016
Order Date: 1-Jun-2016
Project Description: GV OT 026477

Qualifier Notes

Sample Qualifiers :

AS-PRE: Due to the difficult nature of the bulk sample (interfering fibers/binders), additional NOB preparation was required prior to analysis

Work Order Revisions / Comments

None

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Page 1 of 1

Client Name: DST consulting Eng.	Project Reference: 6UOT-026477		TAT: [X] Regular [ ] 3 Day
Contact Name: Brendan Harrigan	Quote #:		[ ] 2 Day [ ] 1 Day
Address: 2150 Thurston Ottawa ON	PO #:		[ ] Same Day
	Email Address: bharrigan@dstgroup.com		
Telephone: 613-748-1415	Brendan		Date Required:

ASBESTOS ANALYSIS

Matrix: [ ] Air [ ] Other Regulatory Guideline: ________ Required Analyses: [ ] PCM [X] PLM [ ] PLM 400PC [ ] ~~[illegible]~~ [ ] Chatfield [ ] TEM

Paracel Order Number: ~~1623202~~ 1623366

	Sample ID	Matrix Description	Sampling Date	Air Volume (L)	Positive Stop? (Y/N)	Is the Sample Layered? (Y/N)	If layered, Describe Layer(s) to be Analyzed Separately* or Homogenize all **
1	SEE ATTACHED	SEE ATTACHED	01/06/16				Homogenize all
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

* Each layer is charged as a separate analysis ** Homogenize = Sample is combined to a uniform mixture

Comments:

Method of Delivery: walkin

Relinquished By (Sign): [signature]	Received at Depot: [signature]	Received at Lab: Karen Cull	Verified By: Karen Cull
Relinquished By (Print): Eve Saborin			
Date/Time: 01/06/2016	Date/Time: June 1, 16 4:52	Date/Time: Jun 2/16 11:10	Date/Time: Jun 2/16 11:32

Chain of Custody (Asbestos) - Rev 0.4 Jan. 2015.xlsx

Chain of Custody - Summary of Samples

Project Number: GV-OT-0 26477

Sample ID	Matrix	Description	Location	Sampling Date
26477-M2-01-A	Solid	CS	NRC BLDG M2 ROOF	1-Jun-16
26477-M2-01-B	Solid	CS	NRC BLDG M2 ROOF	1-Jun-16
26477-M2-01-C	Solid	CS	NRC BLDG M2 ROOF	1-Jun-16
26477-M2-02-A	Solid	MB	NRC BLDG M2 ROOF	1-Jun-16
26477-M2-02-B	Solid	MB	NRC BLDG M2 ROOF	1-Jun-16
26477-M2-02-C	Solid	MB	NRC BLDG M2 ROOF	1-Jun-16

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Certificate of Analysis

DST Consulting Engineers Inc. (Ottawa)

203-2150 Thurston Dr.
Ottawa, ON K1G 5T9
Attn: Brendan Harrigan

Client PO:
Project: GV OT 026477
Custody: 30285

Report Date: 1-Jun-2016
Order Date: 30-May-2016

Order #: 1623043

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1623043-01	26477-M2-LP01
1623043-02	26477-M2-LP02
1623043-03	26477-M2-LP03
1623043-04	26477-M59-LP01
1623043-05	26477-M59-LP02
1623043-06	26477-M59-LP03
1623043-07	26477-M59-LP04

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: DST Consulting Engineers Inc. (Ottawa)
Client PO:

Report Date: 01-Jun-2016
Order Date: 30-May-2016
Project Description: GV OT 026477

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Metals, ICP-OES	based on MOE E3470, ICP-OES	31-May-16	31-May-16

Sample Data Revisions

None

Work Order Revisions/Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

Certificate of Analysis
Client: DST Consulting Engineers Inc. (Ottawa)
Client PO:

Report Date: 01-Jun-2016
Order Date: 30-May-2016
Project Description: GV OT 026477

Sample Results

Lead

Matrix: Paint
Sample Date: 26-May-16

Paracel ID	Client ID	Units	MDL	Result
1623043-01	26477-M2-LP01	ug/g	20	2430
1623043-02	26477-M2-LP02	ug/g	20	11500
1623043-03	26477-M2-LP03	ug/g	20	351
1623043-04	26477-M59-LP01	ug/g	20	1660
1623043-05	26477-M59-LP02	ug/g	20	1340
1623043-06	26477-M59-LP03	ug/g	20	5540
1623043-07	26477-M59-LP04	ug/g	20	375

Laboratory Internal QA/QC

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Matrix Blank									
Lead	ND	20	ug/g						
Matrix Duplicate									
Lead	ND	20	ug/g	ND			0.0	30	
Matrix Spike									
Lead	224		ug/L	ND	94.1	70-130			

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Page 1 of 1

Client Name: DST Consulting Eng	Project Reference: GVOT 026477
Contact Name: Brandon Vanwyn	Quote #
Address: 2150 Thurston Ottawa, ON	PO #
Telephone: 748-1415	Email Address:

Turnaround Time:
☐ 1 Day ☐ 3 Day
☐ 2 Day ☒ Regular
Date Required: June 3/16

Criteria: ☐ O. Reg. 153/04 (As Amended) Table __ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: ______ ☐ Other: ______

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number: 1623043

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken Date	Sample Taken Time	Required Analyses: Pb										
1	See Attached	Paint			See attached		✓										
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

Comments:

Method of Delivery: Walk-in

Relinquished By (Sign): [signature]	Received by Driver/Depot: [signature]	Received at Lab:	Verified By: [signature]
Relinquished By (Print): Brandon Vanwyn	Date/Time: May 30/16 10:30	Date/Time:	Date/Time: May 30/16 11:40
Date/Time: May 30/16 / 10:30	Temperature: °C	Temperature: °C	pH Verified ☒ By: N/A

1623043

Chain of Custody - Summary of Samples

Project Number: GV-OT-0 26477

Sample ID	Matrix	Description	Location	Sampling Date
26477-M2-LP01	Solid	Off White	Walls and Ceilings	26-May-16
26477-M2-LP02	Solid	Off white/green	Radiator	26-May-16
26477-M2-LP03	Solid	Beige	Ceiling	26-May-16
26477-M59-LP01	Solid	Off White	Walls and Ceilings	26-May-16
26477-M59-LP02	Solid	Pink	Walls and Ceilings	26-May-16
26477-M59-LP03	Solid	Green/Brown	Door frame	26-May-16
26477-M59-LP04	Solid	Beige	Walls and Ceilings	26-May-16

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Certificate of Analysis

DST Consulting Engineers Inc. (Ottawa)

203-2150 Thurston Dr.
Ottawa, ON K1G 5T9
Attn: Brendan Harrigan

Client PO:
Project: GV OT 026477
Custody: 30326

Report Date: 8-Jun-2016
Order Date: 6-Jun-2016

Order #: 1624068

This Certificate of Analysis contains analytical data applicable to the following samples as submitted:

Paracel ID	Client ID
1624068-01	26477-M2-LP04

Approved By: Mark Foto

Mark Foto, M.Sc.
Lab Supervisor

Certificate of Analysis
Client: DST Consulting Engineers Inc. (Ottawa)
Client PO:

Report Date: 08-Jun-2016
Order Date: 6-Jun-2016
Project Description: GV OT 026477

Analysis Summary Table

Analysis	Method Reference/Description	Extraction Date	Analysis Date
Metals, ICP-OES	based on MOE E3470, ICP-OES	7-Jun-16	7-Jun-16

Sample Data Revisions

None

Work Order Revisions/Comments:

None

Other Report Notes:

n/a: not applicable
ND: Not Detected
MDL: Method Detection Limit
Source Result: Data used as source for matrix and duplicate samples
%REC: Percent recovery.
RPD: Relative percent difference.

Certificate of Analysis
Client: DST Consulting Engineers Inc. (Ottawa)
Client PO:

Report Date: 08-Jun-2016
Order Date: 6-Jun-2016
Project Description: GV OT 026477

Sample Results

Lead

Matrix: Paint
Sample Date: 31-May-16

Paracel ID	Client ID	Units	MDL	Result
1624068-01	26477-M2-LP04	ug/g	20	1970

Laboratory Internal QA/QC

Analyte	Result	Reporting Limit	Units	Source Result	%REC	%REC Limit	RPD	RPD Limit	Notes
Matrix Blank									
Lead	ND	20	ug/g						
Matrix Duplicate									
Lead	44.9	20	ug/g	40.1			11.4	30	
Matrix Spike									
Lead	506		ug/L	280	90.4	70-130			

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Chain of Custody
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№ 30326

Page 1 of 1

Client Name: DST Consulting	Project Reference: GVOT 025477
Contact Name: Brendan Harrison	Quote #:
Address: 1304 Algoma Ottawa	PO #:
Telephone:	Email Address:

Turnaround Time:
☐ 1 Day ☐ 3 Day
☒ 2 Day ☐ Regular
Date Required: _____

Criteria: ☐ O. Reg. 153/04 (As Amended) Table __ ☐ RSC Filing ☐ O. Reg. 558/00 ☐ PWQO ☐ CCME ☐ SUB (Storm) ☐ SUB (Sanitary) Municipality: _____ ☐ Other: _____

Matrix Type: S (Soil/Sed.) GW (Ground Water) SW (Surface Water) SS (Storm/Sanitary Sewer) P (Paint) A (Air) O (Other)

Paracel Order Number: 1624068

	Sample ID/Location Name	Matrix	Air Volume	# of Containers	Sample Taken: Date	Sample Taken: Time	Required Analyses: Pb
1	2477-MA-L104	Soil			May 31		X
2							
3							
4							
5							
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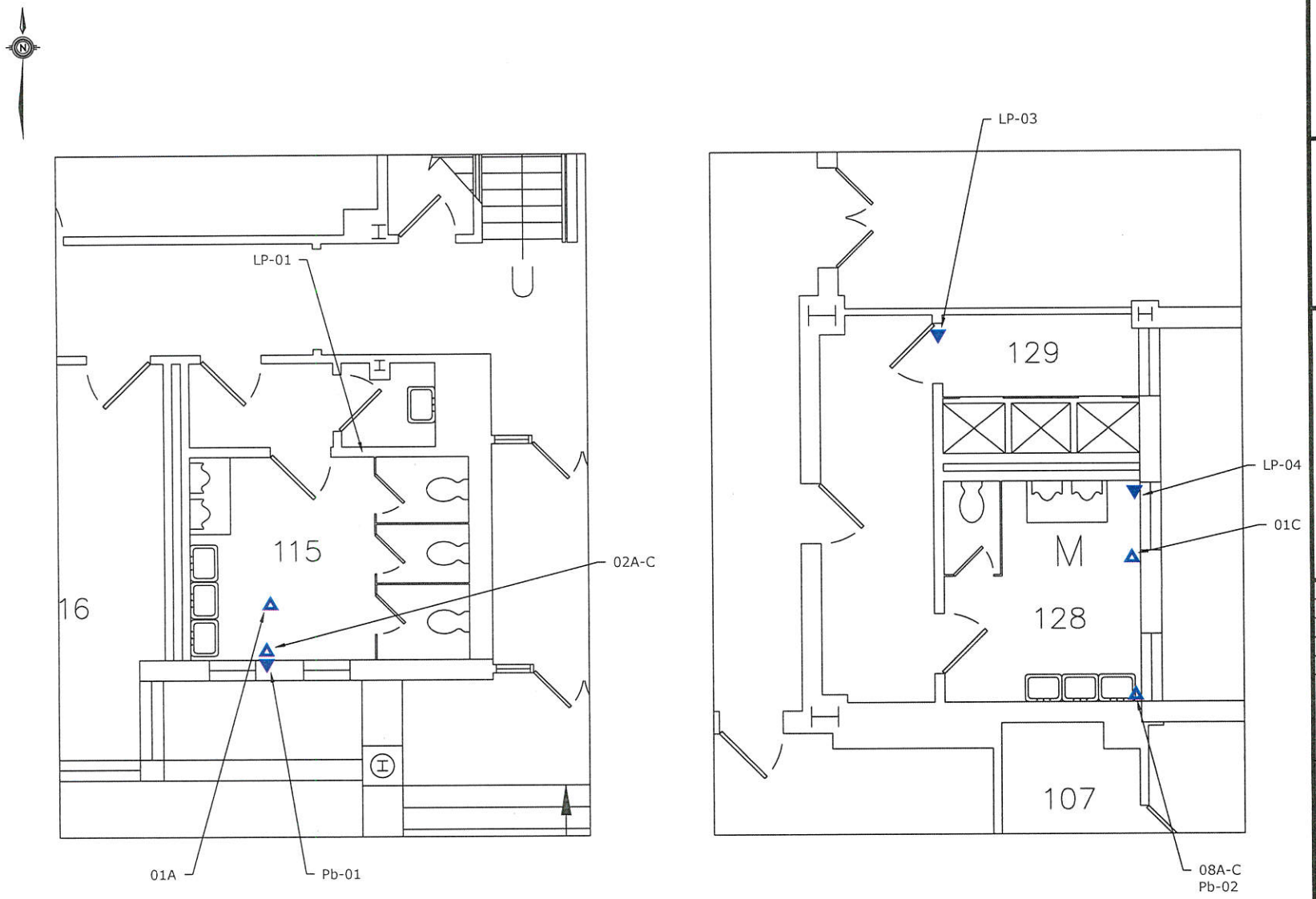
Comments:

Method of Delivery: Walk-in

Relinquished By (Sign):	Received by Driver/Depot:	Received at Lab:	Verified By:
Relinquished By (Print): Brendan Harrison	Date/Time:	Date/Time: June 6/16 4:40	Date/Time: JUNE 6/16 8:05
Date/Time: June 6/16 16:45	Temperature: °C	Temperature: °C	pH Verified ☐ By:

APPENDIX C

Sample Location Plans



DST
consulting engineers
2150 THURSTON DRIVE, SUITE 203
OTTAWA, ONTARIO, K1G 5T9
TEL (613) 748-1415 FAX (613) 748-1356
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NOTES:

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2. DO NOT SCALE DRAWING.
3. ALL SAMPLE IDENTIFIERS ARE PREFIXED WITH '24677-' WHICH WAS LEFT OUT FOR DRAWING CLARITY.
4. BASE DRAWINGS PROVIDED BY CLIENT.

LEGEND:

01A-C — APPROXIMATE ASBESTOS SAMPLE LOCATION, AS APPLICABLE

LP-01 — APPROXIMATE PAINT SAMPLE LOCATION, LEAD TESTING (LP-#), AS APPLICABLE

REV	DATE	ISSUE	APPROVAL
A	22/06/16	ORIGINAL	D.K.

PROJECT TITLE

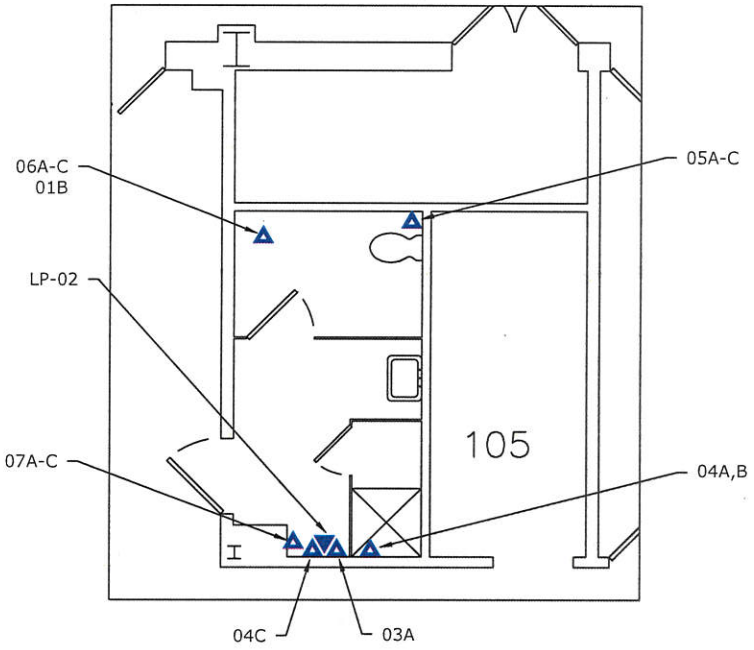
NRC M2 & M59 RENO DSR & ABATEMENT

DRAWING TITLE

BUILDING M59
WASHROOM 115 &
WASHROOM 128/129

DESIGNED BY: D.K.	SCALE: N.T.S.
DRAWN BY: R.W.	DATE: June 2016
APPROVED BY: B.H.	PROJECT NO.: GV-OT-026477

FIGURE



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LP-01 — APPROXIMATE PAINT SAMPLE LOCATION, LEAD TESTING (LP-#), AS APPLICABLE

REV	DATE	ISSUE	APPROVAL
A	22/06/16	ORIGINAL	D.K.

PROJECT TITLE

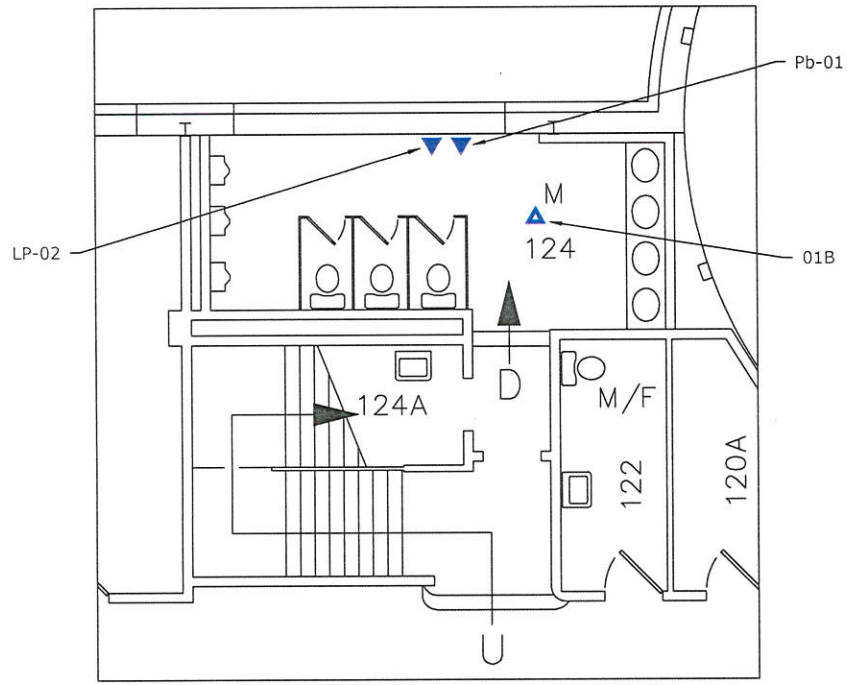
NRC M2 & M59 RENO DSR & ABATEMENT

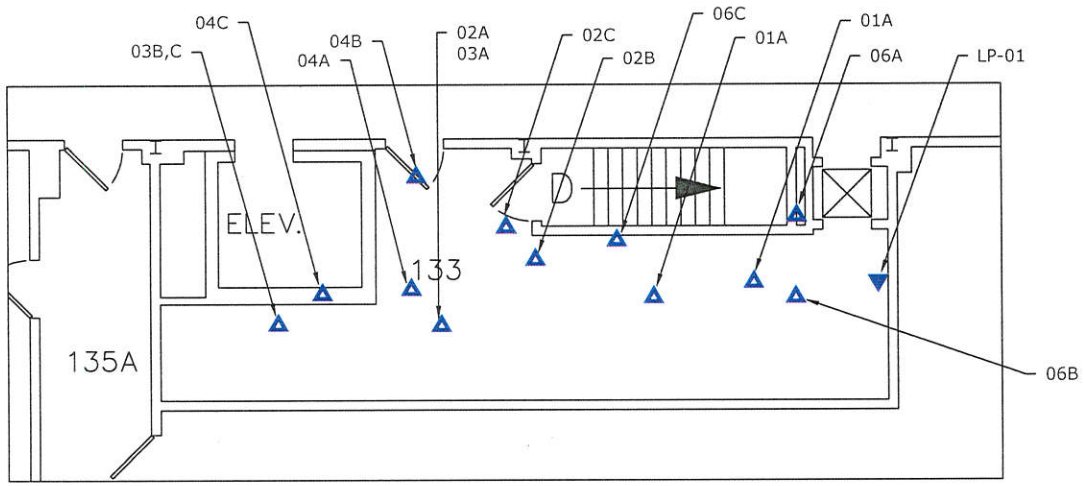
DRAWING TITLE

BUILDING M59
WASHROOM 105

DESIGNED BY: D.K.	SCALE: N.T.S.
DRAWN BY: R.W.	DATE: June 2016
APPROVED BY: B.H.	PROJECT NO.: GV-OT-026477

FIGURE





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LP-01	APPROXIMATE PAINT SAMPLE LOCATION, LEAD TESTING (LP-#), AS APPLICABLE

REV	DATE	ISSUE	APPROVAL
A	22/06/16	ORIGINAL	D.K.

PROJECT TITLE

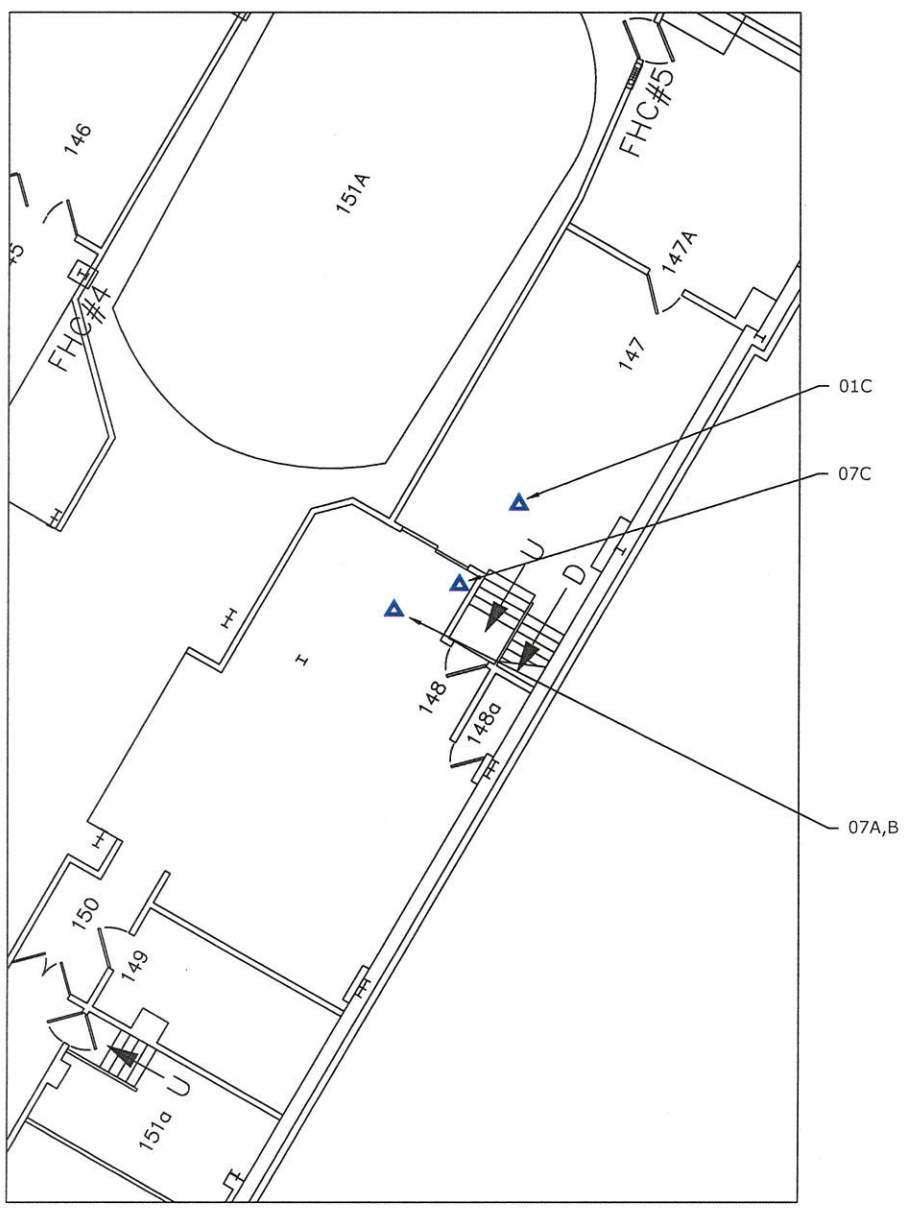
NRC M2 & M59 RENO DSR & ABATEMENT

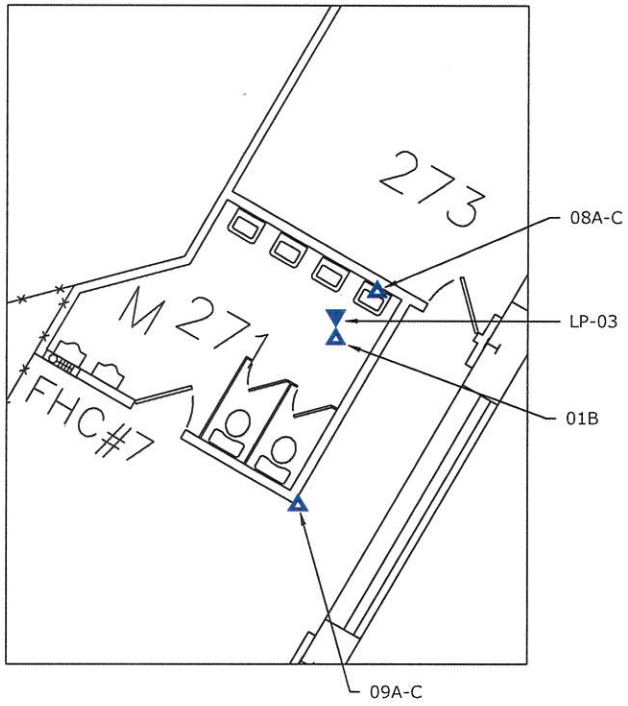
DRAWING TITLE

BUILDING M2
WASHROOM 124 &
WASHROOM 133

DESIGNED BY: D.K.	SCALE: N.T.S.
DRAWN BY: R.W.	DATE: June 2016
APPROVED BY: B.H.	PROJECT NO.: GV-OT-026477

FIGURE





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LP-01	APPROXIMATE PAINT SAMPLE LOCATION, LEAD TESTING (LP-#), AS APPLICABLE

REV	DATE	ISSUE	APPROVAL
A	22/06/16	ORIGINAL	D.K.

PROJECT TITLE

NRC M2 & M59 RENO DSR & ABATEMENT

DRAWING TITLE

BUILDING M2
WASHROOM 147/148 &
WASHROOM 271

DESIGNED BY: D.K.	SCALE: N.T.S.
DRAWN BY: R.W.	DATE: June 2016
APPROVED BY: B.H.	PROJECT NO.: GV-OT-026477

FIGURE

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 be 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 Nothwithstanding GC7 any delay by Her Majesty in making any payment when it is due pursuant to these Terms of Payment shall not be a breach of the contract by Her Majesty.

6.2 Her Majesty shall pay, without demand from the Contractor, simple interest at the Bank Rate plus 1 -1/4 per centum on any amount which is overdue pursuant to TP4.1.3, and the interest shall apply from and include the day such amount became overdue until the day prior to the date of payment except that

6.2.1 interest shall not be payable or paid unless the amount referred to in TP6.2 has been overdue for more that 15 days following

6.2.1.1 the date the said amount became due and payable, or

6.2.1.2 the receipt by the Departmental Representative of the Statutory Declaration referred to in TP4.5, TP4.8 or TP4.11,

whichever is the later, and

6.6.2 interest shall not be payable or paid on overdue advance payments if any.

TP7 Right of Set-off

7.1 Without limiting any right of set-off or deduction given or implied by law or elsewhere in the contract, Her Majesty may set off any amount payable to Her Majesty by the Contractor under this contract or under any current contract against any amount payable to the Contractor under this contract.

7.2 For the purposes of TP7.1, "current contract" means a contract between Her Majesty and the Contractor

7.2.1 under which the Contractor has an undischarged obligation to perform or supply work, labour or material, or

7.2.2 in respect of which Her Majesty has, since the date of which the Articles of Agreement were made, exercised any right to take the work that is the subject of the contract out of the Contractor's hands.

TP8 Payment in Event of Termination

8.1 If the contract is terminated pursuant to GC41, Her Majesty shall pay the Contractor any amount that is lawfully due and payable to the Contractor as soon as is practicable under the circumstances.

TP9 Interest on Settled Claims

9.1 Her Majesty shall pay to the Contractor simple interest on the amount of a settled claim at an average Bank Rate plus 1 ¼ per centum from the date the settled claim was outstanding until the day prior to the date of payment.

9.2 For the purposes of TP9.1,

9.2.1 a claim is deemed to have been settled when an agreement in writing is signed by the Departmental Representative and the Contractor setting out the amount of the claim to be paid by Her Majesty and the items or work for which the said amount is to be paid.

9.2.2 an "average Bank Rate" means the discount rate of interest set by the Bank of Canada in effect at the end of each calendar month averaged over the period the settled claim was outstanding.

9.2.3 a settled claim is deemed to be outstanding from the day immediately following the date the said claim would have been due and payable under the contract had it not been disputed.

9.3 For the purposes of TP9 a claim means a disputed amount subject to negotiation between Her Majesty and the Contractor under the contract.

GC1 Interpretation

1.1 In the contract

1.1.1 where reference is made to a part of the contract by means of numbers preceded by letters, the reference shall be construed to be a reference to the particular part of the contract that is identified by that combination of letters and numbers and to any other part of the contract referred to therein;

1.1.2 "contract" means the contract document referred to in the Articles of Agreement;

1.1.3 "contract security" means any security given by the Contractor to Her Majesty in accordance with the contract;

1.1.4 "Departmental Representative" means the officer or employee or Her Majesty who is designated pursuant to the Articles of Agreement and includes a person specially authorized by him to perform, on his behalf, any of his functions under the contract and is so designated in writing to the Contractor;

1.1.5 "material" includes all commodities, articles and things required to be furnished by or for the Contractor under the contract for incorporation into the work;

1.1.6 "Minister" includes a person acting for, or if the office is vacant, in place of the Minister and his successors in the office, and his or their lawful deputy and any of his or their representatives appointed for the purposes of the contract;

1.1.7 "person" includes, unless the context otherwise requires, a partnership, proprietorship, firm, joint venture, consortium and a corporation;

1.1.8 "plant" includes all animals, tools, implements, machinery, vehicles, buildings, structures, equipment and commodities, articles and things other than material, that are necessary for the due performance of the contract;

1.1.9 "subcontractor' means a person to whom the Contractor has, subject to GC4, subcontracted the whole or any part of the work;

1.1.10 "superintendant" 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 ths 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 o 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 proved 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 GC303.3 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, ar 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 wiring 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 that

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 n 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 Contactor.

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 INSUANCE 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.

Government of Canada / Gouvernement du Canada

Contract Number / Numéro du contrat
FOR TENDER
Security Classification / Classification de sécurité UNCLASSIFIED

SECURITY REQUIREMENTS CHECK LIST (SRCL)
LISTE DE VÉRIFICATION DES EXIGENCES RELATIVES À LA SÉCURITÉ (LVERS)

PART A - CONTRACT INFORMATION / PARTIE A - INFORMATION CONTRACTUELLE

1. Originating Government Department or Organization / Ministère ou organisme gouvernemental d'origine: National Research Council (NRC)	2. Branch or Directorate / Direction générale ou Direction: ASPM / SAGI
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
Project no. 5378 & 5379 - M2 & M59 Washrooms Renovation Project (phase 2)

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 ☐	NATO / OTAN ☐	Foreign / Étranger ☐

7. b) Release restrictions / Restrictions relatives à la diffusion

Canada	NATO / OTAN	Foreign / Étranger
No release restrictions / Aucune restriction relative à la diffusion ☑	All NATO countries / Tous les pays de l'OTAN ☐	No release restrictions / Aucune restriction relative à la diffusion ☐
Not releasable / À ne pas diffuser ☐		
Restricted to: / Limité à : ☐	Restricted to: / Limité à : ☐	Restricted to: / Limité à : ☐
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

Canada	NATO	Foreign / Étranger
PROTECTED A / PROTÉGÉ A ☐	NATO UNCLASSIFIED / NATO NON CLASSIFIÉ ☐	PROTECTED A / PROTÉGÉ A ☐
PROTECTED B / PROTÉGÉ B ☐	NATO RESTRICTED / NATO DIFFUSION RESTREINTE ☐	PROTECTED B / PROTÉGÉ B ☐
PROTECTED C / PROTÉGÉ C ☐	NATO CONFIDENTIAL / NATO CONFIDENTIEL ☐	PROTECTED C / PROTÉGÉ C ☐
CONFIDENTIAL / CONFIDENTIEL ☐	NATO SECRET / NATO SECRET ☐	CONFIDENTIAL / CONFIDENTIEL ☐
SECRET / SECRET ☐	COSMIC TOP SECRET / COSMIC TRÈS SECRET ☐	SECRET / SECRET ☐
TOP SECRET / TRÈS SECRET ☐		TOP SECRET / TRÈS SECRET ☐
TOP SECRET (SIGINT) / TRÈS SECRET (SIGINT) ☐		TOP SECRET (SIGINT) / TRÈS SECRET (SIGINT) ☐

Government of Canada / Gouvernement du Canada

Contract Number / Numéro du contrat
FOR TENDER
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? — ☑ No / Non ☐ Yes / Oui
Le fournisseur aura-t-il accès à des renseignements ou à des biens COMSEC désignés PROTÉGÉS et/ou CLASSIFIÉS?
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? — ☑ No / Non ☐ Yes / Oui
Le fournisseur aura-t-il accès à des renseignements ou à des biens INFOSEC de nature extrêmement délicate?

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

☑ RELIABILITY STATUS / COTE DE FIABILITÉ	☐ CONFIDENTIAL / CONFIDENTIEL	☐ SECRET / SECRET	☐ TOP SECRET / TRÈS SECRET
☐ TOP SECRET– SIGINT / TRÈS SECRET – SIGINT	☐ NATO CONFIDENTIAL / NATO CONFIDENTIEL	☐ NATO SECRET / NATO SECRET	☐ COSMIC TOP SECRET / COSMIC TRÈS SECRET
☐ SITE ACCESS / ACCÈS AUX EMPLACEMENTS			

Special comments:
Commentaires spéciaux : _____

NOTE: If multiple levels of screening are identified, a Security Classification Guide must be provided.
REMARQUE : Si plusieurs niveaux de contrôle de sécurité sont requis, un guide de classification de la sécurité doit être fourni.

10. b) May unscreened personnel be used for portions of the work? — ☑ No / Non ☐ Yes / Oui
Du personnel sans autorisation sécuritaire peut-il se voir confier des parties du travail?
If Yes, will unscreened personnel be escorted? — ☑ No / Non ☐ Yes / Oui
Dans l'affirmative, le personnel en question sera-t-il escorté?

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? — ☑ No / Non ☐ Yes / Oui
Le fournisseur sera-t-il tenu de recevoir et d'entreposer sur place des renseignements ou des biens PROTÉGÉS et/ou CLASSIFIÉS?

11. b) Will the supplier be required to safeguard COMSEC information or assets? — ☑ No / Non ☐ Yes / Oui
Le fournisseur sera-t-il tenu de protéger des renseignements ou des biens COMSEC?

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? — ☑ No / Non ☐ Yes / Oui
Les installations du fournisseur serviront-elles à la production (fabrication et/ou réparation et/ou modification) de matériel PROTÉGÉ et/ou CLASSIFIÉ?

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? — ☑ No / Non ☐ Yes / Oui
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?

11. e) Will there be an electronic link between the supplier's IT systems and the government department or agency? — ☑ No / Non ☐ Yes / Oui
Disposera-t-on d'un lien électronique entre le système informatique du fournisseur et celui du ministère ou de l'agence gouvernementale?

Government of Canada / Gouvernement du Canada

Contract Number / Numéro du contrat
FOR TENDER
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 A	PROTECTED / PROTÉGÉ B	PROTECTED / PROTÉGÉ C	CONFIDENTIAL / CONFIDENTIEL	SECRET	TOP SECRET / TRÈS SECRET
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, classifier 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, classifier le présent formulaire en indiquant le niveau de sécurité dans la case intitulée « Classification de sécurité » au haut et au bas du formulaire et indiquer qu'il y a des pièces jointes (p. ex. SECRET avec des pièces jointes).

Government of Canada / Gouvernement du Canada

Contract Number / Numéro du contrat
FOR TENDER
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)	Title - Titre	Signature
Isabelle D'Amour-Tanguay	Project Manager / Gestionnaire de projets	Isabelle D'Amour-Tanguay

Telephone No. - N° de téléphone	Facsimile No. - N° de télécopieur	E-mail address - Adresse courriel	Date
(613) 990-1152		isabelle.damour-tanguay@nrc-cnrc.gc.ca	April 19TH, 2017

14. Organization Security Authority / Responsable de la sécurité de l'organisme

Name (print) - Nom (en lettres moulées)	Title - Titre	Signature
Richard Bramucci	Analyst, Security in Contracting	

Telephone No. - N° de téléphone	Facsimile No. - N° de télécopieur	E-mail address - Adresse courriel	Date
(613) 991-1093	(613) 990-0946	richard.bramucci@nrc-cnrc.gc.ca	APR 21 2017

15. Are there additional instructions (e.g. Security Guide, Security Classification Guide) attached?
Des instructions supplémentaires (p. ex. Guide de sécurité, Guide de classification de la sécurité) sont-elles jointes?

☑ No / Non ☐ Yes / Oui

16. Procurement Officer / Agent d'approvisionnement

Name (print) - Nom (en lettres moulées)	Title - Titre	Signature
Alain Lemoyne	Senior Contracting Officer	

Telephone No. - N° de téléphone	Facsimile No. - N° de télécopieur	E-mail address - Adresse courriel	Date
613 991-1980		alain.lemoyne@nrc-cnrc.gc.ca	29-5-2017

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

INSURER'S CERTIFICATE OF INSURANCE

(TO BE COMPLETED BY INSURER (NOT BOKER) AND DELIVERD TO NATIONAL RESEARCH COUNCIL CANADA WITH 30 DAYS FOLLOWING ACCEPTANCE OF TENDER)

CONTRACT

DESCRIPTION OF WORK	CONTRACT NUMBER	AWARD DATE
LOCATION		

INSURER

NAME
ADDRESS

BROKER

NAME
ADDRESS

INSURED

NAME OF CONTRACTOR
ADDRESS

ADDITIONAL INSURED

HER MAJESTY THE QUEEN IN RIGHT OF CANADA AS REPRESENTED BY THE NATIONAL RESEARCH COUNCIL CANADA

THIS DOCUENT CERTIFIES THAT THE FOLLOWING POLICES OF INSURANCE ARE AT PRESENT IN FORCE COVERING ALL OPERATIONS OF THE INSURE IN CONNECTION WITH THE CONTRACT MADE BETWEEN THE NAMED INSURED AND THE NATIONAL RESEARCH COUNCIL CANADA AND IN ACCORDANCE WITH THE INSURANCE CONDITIONS "E"

POLICY					
TYPE	NUMBER	INCEPTION DATE	EXPIRY DATE	LIMITS OF LIABILITY	DEDUCTIBLE
COMMERCIAL GENERAL LIABILITY					
BUILDERS RISK "AL RISKS"					
INSTALLATION FLOATER "ALL RISKS"					

THE INSURER AGREES TO NOTIFY THE NATIONAL RESEARCH COUNCIL CANADA IN WRITING 30 DAYS PRIOR TO ANY MATERIAL CHANGE IN OR CANCELLATION OF ANY POLICY OR COVERAGE SPECIFICALLY RELATED TO THE CONTRACT

NAME OF INSURER'S OFFICER OR AUTHORIZED EMPLOYEE	SIGNATURE	DATE:
		TELEPHONE NUMBER:

ISSUANCE OF THIS CERTIFIATE SHALL NOT LIMIT OR RESTRICT THE RIGHT OF THE NATIONAL RESEARCH COUNCIL CANADA TO REQUEST AT ANY TIME DUPLICATE COPIES OF SAID INSURANCE POLICIES

CS1 Obligation to provide Contract Security

1.1 The Contractor shall, at the Contractor's own expense, provide one or more of the forms of contract security prescribed in CS2.

1.2 The Contractor shall deliver to the Departmental Representative the contract security referred to in CS1.1 within 14 days after the date that the Contractor receives notice that the Contractor's tender or offer was accepted by Her Majesty.

CS2 Prescribed Types and Amounts of Contract Security

2.1 The Contractor shall deliver to the Departmental Representative pursuant to CS1

2.1.1 a performance bond and a labour and material payment bond each in an amount that is equal to not less than 50% of the contract amount referred to in the Articles of Agreement, or

2.1.2 a labour and material payment bond in an amount that is equal to not less than 50% of the contract amount referred to in the Articles of Agreement, and a security deposit in an amount that is equal to

2.1.2.1 not less than 10% of the contract amount referred to in the Articles of Agreement where that amount does not exceed $250,000, or

2.1.2.2 $25,000 plus 5% of the part of the contract amount referred to in the Articles of Agreement that exceeds $250,000, or

2.1.3 a security deposit in an amount prescribed by CS2.12 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 a t 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.