



**REQUEST FOR PROPOSALS
DEMANDE DE PROPOSITIONS**

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

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

Title/Sujet CHCP : Biomass Boiler	
Solicitation No./N. de l'invitation 17-22024	Date 15 June 2017
Solicitation Closes/L'invitation prend fin at/à 14 :00 on/le 19 July 2017	Time Zone/Fuseau Horaire EST
Address Enquiries To/Adresser demandes de renseignements à : Collin Long Telephone No./N. de téléphone : (613)993-0431	

Instructions: See Herein

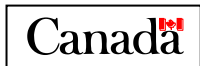
Instructions: Voir aux présentes

Proposal To:

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

Proposition aux:

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



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

Request for Proposal for
the Design and Construction of a Biomass Boiler
at the Central Heating and Cooling Plant, Ottawa

June-2017

1.0 PRESENTATION OF PROPOSALS

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

2.0 SCOPE OF WORK

- 2.1 To provide Professional Services to design, construct and commission one biomass fired boiler for the Confederation Heights Central Heating and Cooling Plant in accordance with the detailed Statement of Work attached as Appendix "A".

3.0 PERIOD OF CONTRACT

- 3.1 NRC anticipates that the work will begin on **contract award** and be completed by **March 31, 2018**

4.0 ENQUIRIES

- 4.1 If you require clarification regarding any aspect of this RFP, address all queries to the Contracting Authority, identified below, at least 7 working days before the closing date. All queries must be in writing and queries received less than 7 working days prior to the closing date cannot be guaranteed a response. Information received verbally will not be binding upon the NRC.

Collin Long

Contracting Authority, Procurement Services

National Research Council Canada

1200 Montreal Road, Bldg. M-22

Ottawa, Ontario K1A 0R6

Telephone: **613-993-0431**

E-mail: **Collin.Long@nrc-cnrc.gc.ca**

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

- 4.4 It is the responsibility of the Bidder to obtain clarification of the requirement contained herein, if necessary, prior to submitting its proposal. The Bidder must have written confirmation from the Contracting Authority for any changes, alterations, etc., concerning this RFP.

5.0 PROPOSAL CLOSING DATE AND BID SUBMISSION INSTRUCTIONS

- 5.1 Proposals must be delivered not later than 2:00 PM EST, (day), **19 July 2017**, to the following **Contracting Authority**:

Collin Long
Contracting Authority, Procurement Services
National Research Council Canada
1200 Montreal Road, Bldg. M-22
Ottawa, Ontario K1A 0R6 Telephone: (613) 993-0431

Proposals must not be sent directly to the Project Authority

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

6.0 SECURITY LEVEL

Prior to the performance of the obligations under this contract, all personnel that will be involved with the project must be cleared to the security level of **RELIABILITY** as defined in the security policy of Canada.

Any Contract resulting from this invitation will be subject to the Security Requirements Check List (SRCL), form TBS/SCT 350-103, attached at Appendix "G".

7.0 INTEGRITY PROVISIONS

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

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

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

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

8.0 EVALUATION CRITERIA

In order to receive consideration by NRC and PSPC, all proposals shall respond to the following mandatory requirements and shall include the referenced Section/Page in Bidders proposal. Any proposal that fails to indicate clearly that all mandatory requirements have been met will receive no further consideration.

Table A1: Mandatory Requirement Checklist

Requirement Reference No.	Reference to Statement of Work	Mandatory Requirements	Compliant (Yes/No)	Referenced Section/Page in Bidder's Proposal
M1	1.2, 1.3	1.5 MW thermal output, (150 BHP)		
M2	1.2	Equipment Maintenance Proposal with priced options at 3, 4 and 5 years		
M3	2.2.2	Two year fuel contract (\$/GJ HW)		

Requirement Reference No.	Reference to Statement of Work	Mandatory Requirements	Compliant (Yes/No)	Referenced Section/Page in Bidder's Proposal
		proposal with priced options at 3, 4 and 5 years		
M4	3.0	Verification fuel meets specifications		
M5	1.4	Fuel storage sustains 3 days continuous operation		
M6	1.2	Minimum turndown ratio is 3:1. Minimum parital load is 30% as per EASR requirements.		
M7	4.3.9	Metering & Sensor Requirements that are priced separately		
M8	1.2, 3.0	Training Program		
M9	5.1	Cost and design for modifications to 95/65 deg C hot water supply & return		
M10	5.1	Performance curve for both the supply & return temperatures of 145/110 deg C and 95/65 deg C		
M11	1.2, 5.3, 5.4	Details outlining how the Contractor will meet ESAR, MOECC and Emission Regulations		
M12	5.8	Detailed schedule to complete all work, including a successful		

Requirement Reference No.	Reference to Statement of Work	Mandatory Requirements	Compliant (Yes/No)	Referenced Section/Page in Bidder's Proposal
		Performance Test by March 2018		

Table A2: Optional Items Checklist

List of additional items that add value to the contract. This may be included on separate page if necessary.

Requirement Reference No.	Reference to Statement of Work	Optional Items	Included (Yes/No)	Referenced Section/Page in Bidder's Proposal
O1	1.2	Energy Efficiency (optional)		

Table B – RATED REQUIERMENTS

In order to qualify for the rating process, proposals shall respond to the following rated requirements and shall include the referenced Section/page in the Bidders proposal

Requirement Reference No.	Criteria	Evaluation	Points	Referenced Section/page in Bidders Proposal	Total Evaluation
Experience					20
R1	Similar technology projects completed between 2007 - 2017	One (1) point per successful project in Ontario, half point (0.5) for other provinces, quarter point for international (0.25) to max five (5) points	Max (5) pts		

Requirement Reference No.	Criteria	Evaluation	Points	Referenced Section/page in Bidders Proposal	Total Evaluation
R2	Similar scale projects completed within similar setting (CHCP) between 2007 - 2017	One (1) point per similar or larger scale successful project and one (1) pt per central plant installation to a maximum of five (5) points	Max (5) pts		
R3	History of collaboration and partnership with subcontractors between 2007 - 2017	Two (2) pts per successful project completion with main partner/designer, or within single-source company and one (1) pt per electrical/mechanical contractor to a maximum of five (5) points	Max (5) pts		
R4	Experience with procurement and management of biomass fuel contracts (GJ/yr)	Half (0.5) point per alternate biomass fuel contract (not graded wood chip), one (1) point per wood chip fuel contract max (5)	Max (5) pts		
	Technical Approach				35

Requirement Reference No.	Criteria	Evaluation	Points	Referenced Section/page in Bidders Proposal	Total Evaluation
R5	Reliability	Proven reliability one (1) point per year of proven commercial operation. Maximum five (5) points	Max (5) pts		
R6	Maintenance	Comprehensive package that is rated by lowest downtime for scheduled maintenance (5points), next lowest downtime (4points) etc.	Max (5) pts		
R7	Performance	Points for thermal output performance over 80%. One (1) point per each 1% exceeding boiler efficiency over 80% at MCR. Maximum of ten (10) points	Max (10) pts		
R8	Design	A design that integrates well with the plant in terms of space and access, supports operator leaning for a larger scale facility (Maximum of 15 points)	Max (15) pts		

Requirement Reference No.	Criteria	Evaluation	Points	Referenced Section/page in Bidders Proposal	Total Evaluation
Cost					30
R9		Maintenance (maximum five (5) points) and Fuel (maximum ten (10) points) contracts. Costs evaluated on five (5) year contract prices. Maximum points for lowest cost, 50% points for next lowest cost, 25% points for third lowest costs, 12.5% for fourth lowest	Max (15) pts		
R10		Total installed cost (max 15 points) with 15 points for lowest bid, 7.5 points for second lowest, 3.75 pts for third, 2 pts for 4th.	Max (15) pts		
Additional Considerations (equally weighted):					15
R11	Innovation of technology	To closely resemble larger scale plant with respect to fuel handling, fuel storage, maintenance, operation, higher performance. Up	Max (7.5) pts		

Requirement Reference No.	Criteria	Evaluation	Points	Referenced Section/page in Bidders Proposal	Total Evaluation
		to one (1) point for each item to maximum of 7.5 points			
R12	Fuel contract - service and utilization of local resources	Additional services that will minimize operator interventions up to one (1) point per service to a maximum of two (2) points. For delivery distance: 5.5 points for delivery within 250 km, 2.5 points for delivery within 500 km, and 1 point for delivery within 1000 km radius..	Max (7.5) pts		
Total					100

9.0 CONDITIONS OF SUBMISSION AND BASIS OF SELECTION

- 9.1 There shall be no payment by the National Research Council for costs incurred in the preparation and submission of proposals in response to this request. No payment shall be made for costs incurred for clarification(s) and/or demonstration(s) that may be required by NRC. The National Research Council reserves the right to reject any or all proposals submitted, or to accept any proposal in whole or in part without negotiation. A contract will not necessarily be issued as a result of this competition. NRC reserves the right to amend, cancel or reissue this requirement at any time.
- 9.2 Selection of the successful bidder will be on the basis of technical merit and best overall value, not on cost alone. The method of selection will be based on the bidder offering the highest compliant total point proposal. NRC reserves the right to enter into negotiations with the successful bidder prior to contract award on any and all aspects of its offer. The

following chart illustrates the relationship between point rating and bid price. The figures used are for illustration purposes only.

<u>Proposal</u>	<u>Rating</u>	<u>Winner</u>
A	72	
B	90	*****
C	78	
D	85	

9.3 Proposals submitted must be valid for not less than sixty (60) calendar days from the closing date of the RFP.

9.4 Your proposal should contain the following statement:

"We hereby certify that the price quote is not in excess of the lowest price charged anyone else, including our most favoured customer, for like services".

10. CONFIDENTIALITY

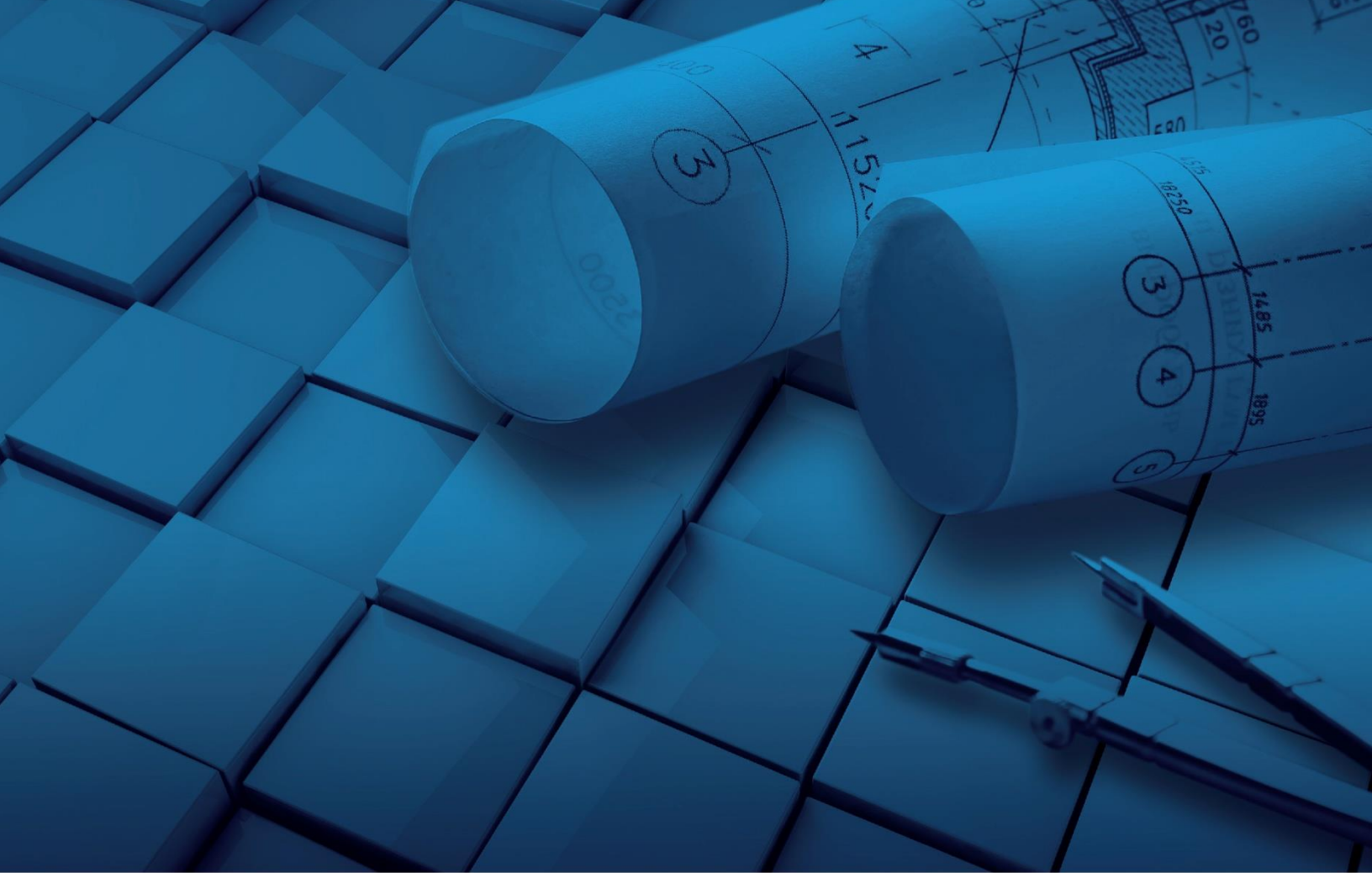
10.1 This document is UNCLASSIFIED, however; the contractor shall treat as confidential, during as well as after the services contracted for, any information of the affairs of NRC of a confidential nature to which its servants or agents become privy.

11.0 CRIMINAL CODE OF CANADA

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

12.0 DEBRIEFINGS

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



SPECIFICATIONS

SOLICITATION #: 17-22024

BUILDING: Confederation Heights Central Heating and Cooling Plant
501 Heron Road
Ottawa, Ontario

PROJECT: CHCP: Biomass Boiler

Date: June 2017

SPECIFICATION

TABLE OF CONTENTS

Buyandsell Notice

Ontario Sales Tax

Acceptable Bonding Companies

Articles of Agreement

Plans and Specifications **A**

**Measurements & Verification of Boiler
Efficiencies and Outputs** **A1**

Ontario Regulations 1/17 **A2**

**Environmental Activity and Sector Registry –
Limits and Other Requirements** **A3**

**Guideline for the Control of Air Emissions
From Small Wood-Fired Combustors (<3 MW)** **A4**

Wood Chip Fuel Specifications **A5**

Terms of Payment **B**

General Conditions **C**

Labour Conditions and Fair Wage Schedule **D**

N/A

Insurance Conditions	E
Contract Security Conditions	F
Security Requirement Check List	G

BUY AND SELL NOTICE

CHCP – Biomass Boiler

The National Research Council Canada, has a requirement for a project that includes:

The National Research Council (NRC) on behalf of PSPC is requesting a proposal for a turnkey solution (design/build) for the detailed engineering, design, construction and commissioning of one (1) Packaged Biomass fired boiler installation at the existing Confederation Heights Central Heating and Cooling Plant (CHCP), located at 501 Heron Road, Ottawa Ontario K1V 1A7. The thermal output capacity of the one (1) Packaged Biomass fired boiler installation shall be 1.5 MW (150 BHP). The proposal shall include a design and build solution complete with equipment and fuel supply contract, technical guidelines and locations for the installation of the boiler and accessories and maintenance package. Recommended locations are limited, and identified on attached drawings. Alternate locations may be recommended and included as an alternate option only.

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 26 and June 29, 2017 at **10:00** . Meet Lisa Paterick at 501 Heron 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 July 19 , 2017 at 14:00.

4. 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: **Lisa Paterick**
Telephone: **613 990-0460**.

Contracting Authority for this project is: **Collin Long** collin.long@nrc-cnrc.gc.ca
Telephone: **613 993-0431**.

Non-resident contractors

RST guide 804

Published August 2006

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

Publication Archived

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

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

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

Non-Resident Contractor Defined

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

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

1. a general contractor and subcontractor,
2. a carpenter, bricklayer, stonemason, electrician, plasterer, plumber, painter, decorator, paver, and bridge builder,
3. a sheet metal, tile and terrazzo, heating, air conditioning, insulation, ventilating, papering, road, roofing and cement contractor, who installs or incorporates items into real property. (See RST [Guide 206 - Real Property and Fixtures](#)).

Registration and Guarantee Deposit

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

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

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

Letter of Compliance

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

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

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

Calculation of RST

Fair Value

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

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

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

Machinery and Equipment - Leased

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

Machinery and Equipment - Owned by Contractor

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

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

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

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

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

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

net book value at date of import × tax rate

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

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

(See Completion of Contract section)

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

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

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

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

(See RST Guide 401 - Manufacturing Contractors)

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

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

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

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

E x e m p t i o n s

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

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

Status Indians, Indian Bands and Band Councils

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

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

Completion of Contract

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

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

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

All returns are subject to audit.

Legislative References

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

For More Information

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

Acceptable Bonding Companies

Published September 2010

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

1. Canadian Companies

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

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

2. Provincial Companies

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

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

3. Foreign Companies

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

Articles of Agreement

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

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

Articles of Agreement

These Articles of Agreement made in duplicate this day of .

Between

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

and

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

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

A1 Contract Documents

(23/01/2002)

- 1.1 Subject to A1.4 and A1.5, the documents forming the contract between Her Majesty and the Contractor, referred to herein as the contract documents, are
 - 1.1.1 these Articles of Agreement,
 - 1.1.2 the document attached hereto, marked “A” and entitled “Plans and Specifications”, referred to herein as the Plans and Specifications,
 - 1.1.3 the document attached hereto, marked “B” and entitled “Terms of Payment”, referred to herein as the Terms of Payment,
 - 1.1.4 the document attached hereto, marked “C” and entitled “General Conditions”, referred to herein as the General Conditions,
 - 1.1.5 the document attached hereto, marked “D” and entitled “Labour Conditions”, referred to herein as the Labour Conditions,
 - 1.1.6 the document attached hereto, marked “E” and entitled “Insurance Conditions”, referred to herein as the Insurance Conditions,
 - 1.1.7 the document attached hereto, marked “F” and entitled “Contract Security Conditions”, referred to herein as the Contract Security Conditions, and
 - 1.1.8 any amendment or variation of the contract documents that is made in accordance with the General Conditions.
 - 1.1.9 the document entitled Fair Wage Schedules for Federal Construction Contracts referred to herein as Fair Wage Schedules
 - 1.1.10

Articles of Agreement

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

1.2 In the contract

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

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

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

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

A2 Date of Completion of Work and Description of Work

(23/01/2002)

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

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

Articles of Agreement

A3 Contract Amount

(23/01/2002)

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

A4 Contractor's Address

(23/01/2002)

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

Articles of Agreement

A5 Unit Price Table

(23/01/2002)

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

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

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

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

Articles of Agreement

Signed on behalf of Her Majesty by

as Senior Contracting Officer

and _____

as _____

of the **National Research Council Canada**

on the _____

day of _____

Signed, sealed and delivered by

as _____ and
Position

by _____

as _____ and
Position

of

on the _____

day of _____

Seal

NATIONAL RESEARCH COUNCIL CANADA

Biomass Boiler Plant Pilot Project on Design Build Basis

Issued: May 2017

Contents

INTRODUCTION.....	4
1.1 Project Description.....	4
1.2 General Intent.....	4
2.0 Evaluation Criteria.....	6
2.1 Options.....	7
3 Fuel Specifications.....	7
3.1 Fuel Storage	8
4.0 TECHNICAL	8
4.1 Scope of Work.....	8
4.1.1 Introduction	8
4.2 Responsibilities of Owner (PSPC)	8
4.3 Responsibilities of Contractor.....	9
4.3.1 General.....	10
4.3.2 New Equipment.....	11
4.3.3 Fuel Contract.....	11
4.3.4 Modification to Existing CHCP.....	12
4.3.5 Mechanical Work	12
4.3.6 Electrical Work	12
4.3.7 Instrumentation and Control Work	12
4.3.8 Structural Work.....	12
4.3.9 Utility Connections.....	13
4.3.10 Metering and Sensors for Monitoring Operational Parameters.....	13
4.3.11 Testing, Start-up and Commissioning	14
4.3.12 Final Hand-Off to Owner.....	14
4.3.13 Soft Services and Engineering.....	15
4.4 Exclusions to Contractor’s Scope of Work	15
4.5 Project Services	15
5.0 Design Criteria.....	16
5.1 Base Conditions.....	16
5.2 Operation of Existing Boiler Plant During Construction.....	17
5.3 Emissions Regulations.....	17
5.4 Laws, Standards, and Codes.....	17

5.5 Drawings and Data	18
5.6 Functional and Performance Testing	18
5.6.1 Functional Test	19
5.6.2 Performance Test	19
5.6.3 Final Completion	20
5.6.4 Performance Test and Performance Guarantee	21
5.6.5 Post-Commissioning Responsibilities	21
5.7 Project Procedures	21
5.8 Project Schedule	23
6.0 COMMERCIAL	23
6.1 Insurance	23
6.2 Permits, Taxes	25
6.3 Site Conditions	25
6.4 Execution of Works	25
6.5 Acceptance of Work	26
6.6 Payments	27
Table A – MANDATORY REQUIREMENT CHECKLIST	28
Table B – RATED REQUIERMENTS	30

Performance Specifications

INTRODUCTION

Public Services and Procurement Canada (PSPC) is committed, within the Energy Service Acquisition Project (ESAP), to prepare to create a district energy system that is renewable energy based and will contribute to greater community efficiencies through the use of rejected heat from municipal and industrial waste sources. To this end PSPC wishes to undertake scalable pilot projects to demonstrate how renewable energy and community heat recovery can be an integral part of a comprehensive energy system plan that minimizes GHG emissions from the CHCPs in the National Capital Area.

1.1 Project Description

The National Research Council (NRC) on behalf of PSPC is requesting a proposal for a turnkey solution (design/build) for the detailed engineering, design, construction and commissioning of one (1) Packaged Biomass fired boiler installation at the existing Confederation Heights Central Heating and Cooling Plant (CHCP), located at 501 Heron Road, Ottawa Ontario K1V 1A7. The thermal output capacity of the one (1) Packaged Biomass fired boiler installation shall be 1.5 MW (150 BHP). The proposal shall include a design and build solution complete with equipment and fuel supply contract, technical guidelines and locations for the installation of the boiler and accessories and maintenance package. Recommended locations are limited, and identified on attached drawings. Alternate locations may be recommended and included as an alternate option only.

1.2 General Intent

The NRC is considering retaining the services of a Design-Build Contractor for the Design (schematic design through to construction drawings/tender document stage), Construction, and Commissioning of a Biomass Boiler Plant to be installed at the existing Confederation Heights CHCP. The Contractor shall also be responsible for the piping connections from the new Biomass Boiler to the existing hot water heating system supply and return piping headers within the existing CHCP. Associated fuel and maintenance contracts are included in the scope of work.

The Contractor shall assume for the basis of preparing his submission that valved and capped connections to the existing hot water heating system supply and return headers will not be provided by PSPC and be ready for connection by the Contractor. The Contractor shall provide at their cost the new valved tie-in connections to the existing main supply and return piping headers. The new tie-in connections shall be provided in accordance with the Confederation Heights CHCP piping/valving standard guidelines. The exact location of the new tie-in connections to the main supply and return headers shall be coordinated by the Contractor with the CHCP operating personnel, but in general the location of the new tie-ins shall not interfere with the normal daily operational and routine servicing and maintenance activities of the CHCP. The Contractor shall not be responsible for the shut-down, draining, venting and re-filling, etc. of the existing CHCP heating system, required for the Contractor to carry out the work involved in providing the new tie-ins. The Contractor shall provide the NRC/PSPC and CHCP operating personnel a minimum of 2 weeks' notice for all required revisions to any existing building systems and site conditions.

It is the intent of this Request for Proposal document to solicit bids from qualified contractors who have demonstrated experience in the successful execution of similar projects on a turnkey basis. The Contractor is expected to design, procure, deliver, construct, commission, test, and turn over a fully operational plant, ready for commercial operation on a continuous basis by 31 March 2018.

Within the Confederation Heights CHCP install a suitable boiler (1.5MW thermal output, or 150 BHP) complies with Ontario Regulation 1/17 (EASR) and that utilizes double screened graded wood chips meeting tight specifications for moisture and size as a source of fuel. The installation shall also include an EASR compliant biomass fuel (wood chip) storage and feed system that is largely automatic in operation; metering and sensors to assess the system energy performance and GHG emissions, a complete boiler flue gas exhaust system; and a hot water heating supply and return piping/pumping distribution system between the new boiler and CHCP main supply and return water piping headers.

A minimum turndown ratio of 3:1 (30%) is required for the biomass boiler to be EASR compliant for the partial load operation.

It is desirable to incorporate an energy efficient and low emissions design. Items such as flue gas heat recovery, variable speed drives, flue gas recirculation, flue gas scrubbers/filters, *electrostatic precipitator/bahgouse* etc. are to be priced separately if included.

The boiler plant system shall be as automated as possible as per automatic stoking described in EN 303-5 (2012) within the EASR compliance, to minimize the operator interventions.

The scope of work also includes the procurement, installation and commissioning of meters and sensors to meet the environmental and boiler certification criteria, Ministry of Environment (MOE) and Ministry of Environment and Climate Change (MOECC) EASR reporting requirements, as well as to enable adequate measurement and verification of performance. Detailed measurement and verification and data requirements are included in an attachment "Measurement & Verification of Boiler Efficiencies and Outputs".

NRC/PSPC requires that suitable and highly competent electrical, mechanical, structural, and other applicable sub-consultants and staff be used on this project. Bids shall include detailed information related to the sub-consultants and their experience. The services of the sub-consultants will be required throughout the project, including attending regular project meetings and performing required site reviews.

Information that shall be included in submissions is as follows:

1. A description of the design team in terms of skills and experience of staff, including identification of sub contracted companies (architect, mechanical, etc.)
2. Summary of comparable projects that have been completed by your firm during the past five years with references for significant projects.
3. The proposed organizational relationship between your team, sub-consultants, and the NRC/PSPC.
4. Detailed project schedule, including milestones and design reviews.

5. Guaranteed Maximum Price and open book reporting, with breakdown of costs including architectural, structural, mechanical, electrical, major equipment and maintenance and fuel contracts.

In order to receive consideration by NRC and PSPC, all proposals shall respond fully to the MANDATORY REQUIREMENTS in Appendix A and shall include the referenced Section/Page in Bidders proposal. Any proposal that fails to indicate clearly that all mandatory requirements have been met shall receive no further consideration.

Bids shall include the specific information on, the training program to be provided under this contract, including the number of days of training, topics to be covered, and course materials. A minimum of three separate complete training sessions shall be based on 10 participants consisting of NRC and PSPC operating and maintenance employees.

2.0 Evaluation Criteria

Evaluation of turnkey bids shall be made by giving consideration to the design and construction services required to successfully design and build the Confederation Heights CHCP Biomass Boiler Plant Pilot Project; the ideas and willingness of the Bidder to lower the capital cost, optimize the system availability; and the structure of the Bidder's project management and construction organization.

At a minimum, bid selection shall be based upon the following criteria:

1. **EXPERIENCE** - The extent to which the contractor, subcontractors, and key personnel have successfully completed similar projects
2. **TECHNICAL APPROACH and ENVIRONMENTAL COMPLIANCE** - Based on the description of the project and proposed systems with comments/clarifications and preliminary or typical drawings submitted by the proposer, the extent to which the proposed systems are likely to provide reliable service and ease of operation and maintenance. It is also of interest to design a system that could represent a larger scale operation, in part or in whole. The system shall be compliant with MOECC EASR requirements.
3. **COST** - All costs, based on proposed schedule shall be considered in evaluating the cost-effectiveness of alternative bids.
4. Additional considerations:
 - a. Innovation of Technology – implementation of a technology in line with the vision of PSPC for a safe, reliable and sustainable fuel and heat delivery system that will reduce the GHG emissions and improve the government of Canada's environmental performance.
 - b. Local fuel sourcing to support the community served by the project. Utilizing local and recycled resources reduces environmental impact.
 - c. Low product emissions, including odor and noise, minimal environmental impact.
 - d. Sustainability of the technology including fuel and delivery resources.

In order to qualify for the rating process, proposals shall respond fully to the RATED REQUIREMENTS provided in Appendix B and shall include the referenced Section/page in the Bidders proposal.

The method of selection shall be based on the bidder offering the compliant highest total point proposal.

2.1 Options

Contractors may include:

1. Comments on the Conceptual Design
2. Sketches proposing different major mechanical equipment and/or component locations, configurations, orientations.
3. Energy efficient and low emission design strategies such as flue gas heat recovery, variable speed drives, flue gas recirculation, flue gas scrubbers/filters, etc.
4. Alternate cost for expedited delivery of equipment.
5. Any other Options deemed by the Contractor to be of value to the project that they feel NRC/PSPC would benefit from reviewing and considering.

All inquiries/questions shall be received no later than Monday, July 10th, 2017 at 2:00 p.m.

The Owner will not be obliged to accept the lowest nor any other bid. The Owner may reject all bids without incurring claims for damages or losses from any tenderer.

3 Fuel Specifications

The Contractor shall source a secure, reliable and cost effective double screened graded wood chip fuel that meets the Grade B1 fuel specifications as described in the CAN/CSA-ISO 17225 part 4 Graded Wood chips. The Contractor will also provide a two-year supply, including, storage and delivery, with a priced option to renew at years three, four and five. The fuel contract shall specify \$/GJ of hot water boiler output, in addition to the cost per delivered volume of wood chip fuel, as well as a price adjustment to account for varying fuel volume on an annual basis.

With each delivery, the fuel provided shall include specified moisture content of the shipment (see [section 4.3.2](#) – Fuel Contract)

The Contractor shall also provide in-house sampling equipment and associated training for PSPC plant operators to measure moisture content of the fuel.

The contractor shall source and supply an EASR compliant graded wood chip fuel which follows the CAN/CSA-ISO 17225 Part 4 wood chip specification as detailed in Attachment 5, following P31 or P45 for size. Further required properties include Moisture content % w: 45 maximum (on wet basis), and ash w%: ≤ 3 (on dry basis).

3.1 Fuel Storage

The contractor shall design a safe, reliable and cost effective method and EASR compliant to supply, deliver, store and handle the biomass fuel. Available locations for storage are identified in the RFP Concept Drawings included as part of the Attachments of this RFP document and may be modified as required. Covered storage is required, as open wood chip piles at the Confederation Heights CHCP site are not permitted.

Capacity for the storage of the wood chips shall sustain a minimum of three days full operation at maximum continuous rating (MCR) of the boiler.

4.0 TECHNICAL

4.1 Scope of Work

4.1.1 Introduction

This statement of work is the basis for soliciting a firm, upset limit bid for the design-build engineering, design, procurement, construction, testing, start-up, and commissioning and maintenance for a Biomass Boiler Plant Pilot Project. The boiler shall be EASR compliant, have a thermal output capacity of 1.5 MW and be installed in the Confederation Heights CHCP.

The intention of this section is to define NRC/PSPC's (Owner) minimum technical requirements. This document is not intended to serve as a basis for Detailed Design. The information herein shall be used only as an aid in preparing Contractor's Bid and shall not be used as Detail Documentation. The Owner assumes no responsibility for any errors or omissions which may be contained herein. Design, engineering and construction techniques and methods used shall conform to the latest Laws, Codes, Standards, Regulations, and Engineering Best Practices. Equipment purchased for the project shall have at least two years proven experience in similar applications. Unproven, prototype designs are not acceptable and shall not be supplied.

Alternatives are welcome, if they provide demonstrated economic and technical advantages. The Contractor shall offer recommended alternatives to the Owner for consideration.

Refer to Attachments and the sections below for identification of the limits of the Contractor's scope of work

4.2 Responsibilities of Owner (PSPC)

The Owner shall supply the following:

Utilities

- Hot water supply and return headers located in the basement of the CHCP (tie-in connections to the main headers from the new Boiler to be made by the Contractor).

- Domestic water (commodity only, physical connections as required to be made by Contractor)
- Electrical service (commodity only, physical connections to be made by Contractor)

Construction and Commissioning

- The construction site including appropriate laydown areas and access to and from the site for Turnkey Contractor and its subcontractors and vendors, for the performance of the work.
- All operating consumables such as chemicals, lubricants, filters, lamps, etc., after initial commissioning and testing.
- Qualified operating personnel to assist the Contractor in the start-up, commissioning, and testing of the plant and its equipment.
- Additional project expenses arising from the discovery and safe removal of asbestos by qualified asbestos abatement professionals. (Coordination with asbestos abatement professionals to be completed by Contractor.)

Documents and Reports

- Arrange and pay for soils investigation (if required). Soils report and geotechnical results shall be provided to the Contractor.
- Arrange and pay for mapping, identification of sources and modeling to establish the baseline for air and noise at the CHCP. The reports and results shall be provided to the Contractor.

4.3 Responsibilities of Contractor

Contractor shall design, specify, furnish, fabricate, erect, install, start-up, test, and commission (unless noted otherwise) a complete Biomass Boiler Plant including, but not limited to, the following items and systems:

The Contractor's responsibilities shall be all-encompassing, except those items specifically identified in section 4.2

This document is intended as a Performance Specification/Scope of Work for Design-Build, Turnkey Construction, but is not intended to serve as a basis for detail design. The information herein shall be used only as an aid in preparing Contractor's bid and shall not be used as design documentation. Such required information shall be verified by the Contractor via site visits. Owner assumes no responsibility for any errors or omissions which may be contained herein. The Contractor shall confirm the suitability of all services, including pressure, temperature, pipe size, and material of all piping systems being tied into, prior to commencement of detail engineering design and construction. In the event of conflicts in the information or with local laws and regulations, or that a service identified for tie-in is deemed unsuitable for use, the Contractor shall immediately bring it to the attention of the Owner for review.

Design criterion for the proposed system are identified herein. The responsibility for detailed design, within these boundary points, is entirely the responsibility of the successful Contractor. Contractor shall investigate, understand, and confirm all information provided in this RFP document.

The following subsections generally outline the principal aspects of the work by Contractor:

4.3.1 General

The Contractor shall:

- Provide all labour, supervision, services, technical direction, tools, equipment, and consumable supplies required for the receiving, unloading, storage, protection, testing, start-up, installation, and erection of equipment within Contractor's scope of supply as described herein.
- Furnish and install all supplementary, auxiliary, or miscellaneous items, appurtenances, devices, and systems necessary for a complete and operational installation which is in accordance with the contract.
- Provide technical documentation as required for submission of application forms and application drawings (submitted by Contractor), as well as to support local utility incentive applications.
-
- Have exclusive responsibility for design and construction methods, means, techniques and procedures, and for the establishment of and compliance with safety procedures.
- Arrange for complete and safe handling and storage of all materials, equipment and construction equipment, including (but not limited to) inspection, expediting, shipping, unloading, receiving, protection, customs clearance and claims.
- Provide all temporary construction materials, equipment, supplies and construction utilities and facilities required by Contractor to accomplish work.
- Be responsible for obtaining appropriate building permits and certificates of occupancy, all damages, fines, and penalties which may arise (including but not limited to those that Owner pays or becomes liable to pay) because of noncompliance with any project requirements, other than any damages, fines, and penalties arising from any act or omission of Owner.
- Prepare all necessary documentation and register to the MOECC EASR program for new boiler system. An existing Environmental Compliance Approval is not available at this time. The Contractor shall provide all documentation to support the EASR registration application which shall be submitted by the Contractor on behalf of PSPC and serve as the Licensed Engineering Practitioner for the project registration.

- Be responsible for obtaining TSSA Certification for complete new installation.
- Effect interconnection with the new Boiler to the existing CHCP supply and return hot water heating systems, electrical distribution system, instrumentation and controls systems and other utilities.
- Develop and provide a critical path schedule for completion of the work. This schedule shall be updated monthly and issued to the Owner.
- Issue a monthly progress report describing in reasonable detail, all progress since the last progress report.
- Carry all required insurance (see Section 6.1).

Coordinate with asbestos abatement professionals should asbestos abatement be required. Asbestos abatement professionals shall be hired, and removal costs borne by the owner.

4. 3.2 New Equipment

The principal components of the new Boiler Plant are:

- One (1) EASR compliant Biomass Boiler (1.5 MW thermal output) and ancillary equipment and systems including but not limited to:
 - Biomass fuel (wood chip) storage and feed system that is largely automatic in operation;
 - Appropriate metering to assess energy efficiency and GHG emissions
 - A complete boiler flue gas exhaust system
 - A hot water heating supply and return piping/pumping distribution system between the new boiler and CHCP main supply and return water piping headers.
- Fuel Delivery and Supply contract
- Equipment Maintenance contract

4. 3.3 Fuel Contract

The Contractor shall source a safe, reliable and cost effective and EASR compliant biomass fuel supply and provide a two-year contract for cost, schedule, storage and delivery, with a priced option to renew at year three, four and five.

The contract shall also specify \$/GJ hot water boiler output, in addition to cost per delivered volume.

With each delivery, the fuel provider shall include the following fuel content analysis for each shipment;

- Moisture Content

The fuel supplier will perform periodic comprehensive fuel analysis on a quarterly basis on a delivery which will include the followings;

- Moisture content
- Calorific value (high heating and low heating)
- Particle size distribution
- Ash
- Ash components

The Contractor shall ensure that wood fuel management plan and procedures are established and in compliance with EASR.

4. 3.4 Modification to Existing CHCP

It is intended that the new boiler including ancillary equipment and systems be installed within the existing CHCP, within the approximate areas as shown in the RFP Concept Drawings provided in the Attachments with this document. However, other locations may be proposed by the Contractor for review and consideration by NRC/PSPC and the CHCP operating personnel. The final installation of the new boiler and all ancillary equipment and systems shall not interfere with the normal daily operational and routine servicing and maintenance activities of the CHCP.

4. 3.5 Mechanical Work

All piping, valves, and specialties necessary to install and tie-in the new equipment and systems into the existing plant shall be provided by Contractor unless indicated otherwise within this document.

4.3.6 Electrical Work

All electrical services, including wiring distribution and principal electrical components and specialties, required to serve the new mechanical equipment and systems, shall be connected to the existing power supply system and plant distribution system and be provided by the Contractor unless indicated otherwise within this document.

4.3.7 Instrumentation and Control Work

All necessary instrumentation and control systems and components for the new equipment, including integration of the new equipment and systems into the existing CHCP systems, shall be provided by the Contractor unless indicated otherwise within this document.

4.3.8 Structural Work

All modifications to the CHCP (including demolition, cutting, patching, coring, reconstruction, new housekeeping pads, structural steel supports, etc.) in preparation for and to accommodate the construction process and final installation of the new equipment and systems being provided as part of this project shall be provided by the Contractor unless indicated otherwise within this document.

4.3.9 Utility Connections

Utility connections to be made by the Contractor are described as follows:

Services provided from within the CHCP to the new boiler to be designed and installed by the Contractor include:

- Domestic cold water
- Drains and vents
- Controls and instrumentation
- Electrical service

The Contractor shall carry an allowance to compile or prepare test results or reports to establish the specification and quality of the above services prior to commencing detailed engineering.

4.3.10 Metering and Sensors for Monitoring Operational Parameters

The contractor is responsible for all measurement and verification requirements, and to comply with environmental compliance and boiler certification requirements.

Metering and sensors shall be priced separately.

1.) Flue Gas measurements

- Flue gas emissions (concentrations)
 - Oxygen (required under EASR)
 - Carbon Dioxide
 - Carbon Monoxide
- Humidity
- Temperature (required under EASR)
- Volumetric flow rate

2.) Electrical metering for the boiler and auxiliary equipment

3.) Water metering (volumetric flow and temperature input/output) (required under EASR)

4.) Induced draft fan operating level monitor (required under EASR)

5.) Remote connection (required under EASR)

The Contractor is responsible for the installation, commissioning and integration of meters and sensors. Work to install, connected and map to PSPC metering database shall be sole sourced to R&R Automation as a sub-contractor.

The Contractor shall ensure that the record keeping requirements for data collection and retaining of process monitoring parameters are EASR compliant.

Additional details for metering and sensors are included as an attachment “Measurement & Verification”.

4.3.11 Testing, Start-up and Commissioning

All testing and commissioning procedures required to provide PSPC with a safe and efficient EASR compliant system shall be provided by the Contractor unless indicated otherwise within this document.

Prior to full acceptance by Owner of the new equipment and systems, the Contractor shall perform the following:

- Hydrostatic test, chemical cleaning, flushing, draining, and drying of piping systems after erection. Contractor shall be responsible for supply and disposal of all chemicals, used in this cleaning process, in accordance with local regulations.
- Provide all personnel, equipment, and materials necessary for complete facility start-up and testing.
- Perform commission and testing of the new equipment and systems. Contractor shall be responsible for supply and use of all equipment, chemicals and services used in the commissioning and testing process in accordance with local regulations. All non-fuel and non-operator costs incurred in the performance of the Performance Test and EASR compliant Installation Test, including but not limited to, equipment maintenance, expendables, special test equipment, etc. are the responsibility of the Contractor.
- Provision of all operating consumables such as chemicals, lubricants, filters, lamps, etc., until acceptance by Owner. At such time, Contractor shall fully charge or recharge all operating consumables so as to provide Owner with fully charged plant at completion.
 - Prepare procedures for and supervise the performance of the EASR compliant Installation Test , 24-hour test and 14-day test.

4.3.12 Final Hand-Off to Owner

- Provide instruction to Owner’s personnel for operation and maintenance.
- Provide operation and maintenance manuals.
- Provide Owner with complete facility start-up documentation including system and equipment test documentation and other related documents.
 - Provide Owner with a minimum of three (3) separate complete training packages for the complete operation and maintenance of the new equipment and systems. PSPC reserves the right to record and or video training.
-

4.3.13 Soft Services and Engineering

The Contractor shall provide the following:

- Design Basis Report to be agreed upon by Owner prior to start of detailed Engineering
- Complete drawing sets, including as-built drawings of completed installation.
- Plant data book including listings of all equipment, valves, pipe lines, instrumentation, and cable lists.
- Obtain at Contractor's expense all federal, provincial, and local construction permits necessary for the construction of the project in accordance with the Contract. NRC/PSPC will provide necessary assistance required to obtain. The Contractor will assume the responsibility of P.Eng liability for EASR registration.

4.4 Exclusions to Contractor's Scope of Work

At this time, the following are outside the scope of the Design-Build Contractor:

- Amendment to existing Site Plan, if necessary, with the local municipality

4.5 Project Services

In its efforts to accomplish these tasks, as a minimum, the following project services shall be performed by the Design-Build Contractor:

- Mechanical design criteria, specifications, construction drawings.
- Electrical, Instrumentation and Controls design criteria, specifications, construction drawings.
- Project secretary and document control.
- Project engineering, project management, code compliance.
- Procurement of major and minor equipment (unless otherwise noted), preparation of purchase orders.
- Tender, evaluate, and award to specialized subcontractors.
- Construction management, including coordination of construction subcontractors.
- Transportation of equipment and materials (delivery, insurance, customs clearance, brokerage, i.e. importer of record).
- Inspection of purchased equipment in Vendor's shop.
- Expediting all purchases.

- Project Scheduling.
- Project accounting, invoicing.
- Coordinate construction tie-ins with Owner's existing electrical, mechanical systems.
- Configuration of control system.
- Commissioning of all new equipment and systems.
- Performance/acceptance/EASR compliant Installation test.
- Performance guarantees on start-up date.
- Design-build errors and omissions liability insurance.
- Post-commissioning service and warranty work, as well as spare parts.
- Prepare, submit, arrange, and expedite all construction Permits
- Comprehensive training program for Owner's staff.
- Safety coordination.
- All correspondence and meetings with Owner and others.
- Maintenance Contract, in compliance with the EASR requirement..
- O&M manuals, as-built drawings.

The Contractor shall retain and manage all specialized sub consultants as necessary to complete the scope of work, such as:

1. Mechanical / electrical / Instrumentation and Control / civil/structural steel design criteria, specifications, construction drawings, consulting engineers.
2. Pipe stress calculation.

5.0 Design Criteria

5.1 Base Conditions

The new Boiler shall be ASME certified (or equivalent) and EASR compliant with EN 303-5 (2012) at minimum

The new Boiler and ancillary equipment and systems shall be fully automated to the greatest extent possible.

Plant performance shall be based on the following operating conditions:

The new Boiler shall be designed and selected to provide the following services to the CHCP:

- Current Hot Water Supply and Return Temperatures in the CHCP are 145 deg C/110 deg C respectively. The new Boiler shall be designed and selected to meet these temperatures.
- The system operating pressure is 125psi to 135 psi
- The CHCP heating system will be transitioned to deliver Hot Water Supply and Return Temperatures at 95 deg C/65 deg C respectively in the future. The new Boiler and system shall be designed and selected to be easily transitioned to operate at these conditions. All design and equipment and system modifications required to satisfy the new hot water supply and return water temperatures are to be included in this scope of work. This work is expected to be required within 5 years of the signed contract. This work is to be priced separately.
- Boiler operating performance curves for both the hot water supply & return temperatures of 145/110 deg C and 95/65 deg C shall be provided for the proposed Boiler

Existing equipment and/or building features to be redeployed for use with the Boiler Plant include:

- Existing openings through the second floor slab and roof are to be used for routing of boiler exhaust flue

5.2 Operation of Existing Boiler Plant During Construction

The existing CHCP boilers are to remain operational throughout the construction of the new Pilot Plants. Any boiler plant shutdowns required for plant tie-ins shall be explicitly stated in the Design - Build bid.

The Contractor shall notify the Owner of any deviations from this shutdown schedule a minimum of twenty-one (21) days prior to the required plant shutdown. The duration of any single outage shall not exceed twelve (12) hours. Minimum notice requirements and maximum shutdown durations may vary depending on time of year the shutdown is required. All shutdowns shall occur after hours and on weekends.

5.3 Emissions Regulations

Air and noise emissions compliance limits are identified in Ontario Regulation 1/17 and associated EASR and other MOECC regulatory publications.

The Biomass Boiler emission limits shall be equal to or better than the laws, standards and codes identified in section 5.4

5.4 Laws, Standards, and Codes

The Biomass Boiler shall be designed in accordance with ASME Boiler and Pressure Vessel Code, Section I, and EN 303-5 (2012) for automatic stoking, and shall include a CSA registration number.

As per the Ministry of the Environment and Climate Change (MOECC) the biomass boiler shall comply with Ontario Regulation 1/17 and the EASR. The selected system shall satisfy the requirements described in EASR to achieve environmental approval. In addition to physical requirements of the design conditions shall include specific ongoing measurements and installation testing.

The work shall conform to the applicable laws, standards, and codes of the authorities and technical organizations listed hereunder in their full and abbreviated titles, and of any that may be listed or referred to elsewhere in these tendering and contract documents.

The procedure for implementation of the above requirements is as follows:

(a) The Contractor shall base its tender on the laws, standards, and codes, including those given in these tendering and contract documents, which are in effect at time of submission of tender.

(b) The Contractor and the Owner shall, throughout the duration of the contract, bring to the attention of each other any revisions to the said laws, standards, and codes subsequent to the submission of the Contractor's tender, which may merit adoption.

(c) Notwithstanding the provision of any standard or code applicable to the work, the Contractor and his sub-subcontractors shall be responsible for all inspection and testing of work necessary to meet the requirements of the contract.

5.5 Drawings and Data

The following preliminary drawings and data have been included in the Attachments to further define the project and systems:

RFP Concept Design Drawings

This information shall be used only as an aid in preparing Contractor's bid and not as design documentation. Such information shall be verified by the Bidder. Owner assumes no responsibility for any errors or omissions which may be contained therein.

5.6 Functional and Performance Testing

The Contractor shall be required to complete two (2) test procedures:

- (a) Functional Test
- (b) Performance Test

The bid shall indicate the maximum length of time to be allowed between the award of a contract and each of the two (2) test procedures. The EASR Compliant Installation Test shall be included within these test procedures.

5.6.1 Functional Test

The Functional Test shall demonstrate the ability of the system to run continuously for a period of fourteen (14) consecutive days and during such period (and while in compliance with all environmental conditions), distribute hot water within acceptable pressure and temperature drops.

5.6.2 Performance Test

The Performance Test shall demonstrate the ability of the system to perform, at a maximum continuous rating (MCR), for a period of 48 consecutive hours

The 48 -hour Performance Test , may be run concurrently with the 14 day Functional Test if there is sufficient load available at the time of the Functional Test,

For both the Functional and Performance Test

The operating status of the subsystems shall be monitored and recorded by the Owner's Representation. The original data sheets shall be property of Owner, copies shall be furnished to the Contractor for its records.

Normal plant operating procedures and configurations shall be employed during the Test. This requirement shall mean that during the Test, redundant subsystems shall not be operated simultaneously and that only the normal operating and maintenance personnel shall be operating and maintaining the facility. Only the normal contingent of spare parts shall be on hand.

The Contractor shall prepare and submit to Owner at least sixty (60) days prior to the expected date of each Test, a detailed description of the test procedures including proposed test report format for review and approval.

The Contractor shall prepare and submit to Owner a detailed test report including the test data sheets and calculated results.

All non-fuel and non-operator costs incurred in the performance of the Performance Test, including but not limited to, equipment maintenance, expendables, special test equipment, etc., shall be the sole responsibility of the Contractor.

Promptly after completion (whether or not successful) of the Performance Test (or any return of such Test), the Contractor shall advise Owner in writing of any defects and/or deficiencies in the facility which were discovered or occurred during the Performance Test.

Owner shall promptly notify Contractor in writing of any defects and/or deficiencies in the facility that NRC/PSPC personnel noted or determined from the test reports. If Contractor is notified of such defects and/or deficiencies, Contractor shall immediately commence and promptly complete corrective measures to remove such defects and/or deficiencies (including replacement of any defective parts at the Contractor's sole cost and expense).

Contractor shall then promptly provide notice to NRC/PSPC in writing that corrective measures have been completed and shall specify in such notice the date on which the facility shall be ready for the Performance Test (or any part thereof) to be rerun by the Contractor where said defects or deficiencies are of such a nature as to warrant retesting.

Upon approval by NRC/PSPC, the Contractor shall promptly re-perform the Performance Test, with NRC/PSPC personnel in attendance, and advise NRC/PSPC in writing of any additional remaining defects and/or deficiencies that shall be corrected by Contractor as a condition to completion of the facility.

In addition to the foregoing, NRC/PSPC shall promptly notify Contractor of any continuing defects or deficiencies which were noted in the Retest.

5.6.3 Final Completion

Substantial Completion of the project shall be deemed to have occurred when all of the following have occurred:

- (a) The new boiler plant installation has successfully completed both Functional and Performance Testing and an EASR compliant Installation Test.
- (b) The Contractor has notified Owner in writing that Contractor knows of no defects and/or deficiencies related to the new Boiler Plant installation that affects the performance of the new Boiler Plant installation.
- (c) The Contractor has satisfied all Owner requirements to correct defects and/or deficiencies related to the new Boiler Plant installation which may have been identified during the performance testing.
- (d) Owner has received all as-built drawings of the new Boiler Plant installation, test data, and other technical information required hereunder for Owner to operate and maintain the new Boiler Plant installation.
- (e) Owner has received all manuals and instruction books necessary to operate the new Boiler Plant installation in a safe, efficient, and effective manner.
- (f) All special tools and spare parts purchased by the Contractor as provided herein have been delivered to Owner.
- (g) All Contractor's and subcontractors' personnel, supplies, equipment, waste materials, rubbish, and temporary facilities have been removed from the jobsite.
- (h) Owner has received from Contractor (i) any waivers of liens and claims relating to the work which were not previously delivered by Contractor, and (ii) a final certificate of waivers of all liens and claims by Contractor, subcontractors, vendors relating to the work have been obtained by Contractor and delivered to NRC/PSPC.
- (i) Contractor has performed all other provisions, if any, and delivered all items required by the contract in a manner reasonably satisfactory to Owner.

(j) Owner has received from Contractor an executed copy of a completion certificate, such completion certificate to be in form and substance satisfactory to Owner.

5.6.4 Performance Test and Performance Guarantee

As its Performance Guarantee, Contractor warrants that the facility shall be designed and constructed to perform, and shall be tested to demonstrate its ability to perform, at a maximum continuous rating (MCR), for a period of 48 consecutive hours

The Performance Test shall also demonstrate the ability of the facility to run continuously for a period of fourteen (14) consecutive days and during such period (and while in compliance with all environmental conditions), distribute hot water within acceptable pressure and temperature drops. The following shall be conducted during the 20-day test period:

(a) The 24-hour test, which may be run concurrently, or prior to, the Performance Test.

(b) The operating status of the subsystems shall be monitored and recorded by Owner's Representation. The original data sheets shall be property of Owner, copies shall be furnished to the Contractor for its records.

(c) Normal plant operating procedures and configurations shall be employed during the Performance Test. This requirement shall mean that during the Performance Test, redundant subsystems shall not be operated simultaneously and that only the normal operating and maintenance personnel shall be operating and maintaining the facility. Only the normal contingent of spare parts shall be on hand.

(d) Contractor shall prepare and submit to Owner at least sixty (60) days prior to the expected date of the Performance Test, a detailed description of the test procedures including proposed test report format for review and approval.

(e) Contractor shall prepare and submit to Owner a detailed test report including the test data sheets and calculated results.

5.6.5 Post-Commissioning Responsibilities

Following substantial completion of the facility, the Contractor shall be responsible for:

(a) Post-commissioning air-borne emissions audit to verify air emissions, if necessary, at nominal and partial loads: Particulate Matter (TPM, PM10, PM2.5), O₂, CO, CO₂, SO₂, NO_x, PAH (benzo-a-pyrene).

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(b) Supplementary training for operators, as required.

5.7 Project Procedures

During the course of the work, the Contractor shall submit to NRC/PSPC for review and approval electronic copies of drawings/specifications/schedules or other data including as-builts

produced by the Contractor, Vendor, or subcontractor. The listing below represents the Owner's basic requirements and the Owner reserves the right to expand or decrease the categories listed.

1. Site Plans
2. Structural Steel Drawings
3. Buildings/Internals Drawings
4. P&IDs
5. Valve List
6. Specialty Item List
7. Physical Piping Drawings
8. General Arrangement Drawings
9. Equipment List, Major and Minor
10. Tank Drawings
11. Electrical Single Line Drawings
12. Motor Data Sheets
13. Electrical Layout and Details
14. Electrical Equipment List
15. Controls and Instrumentation Drawings and Lists
16. Insulation Details
17. Painting Details
18. Equipment Specifications, for Major Equipment Purchased by Contractor
19. Vendor Drawings
20. Equipment Catalogues
21. Erection Instructions
22. Operations Manual
23. Instruction Manuals
24. Spare Parts Manuals and Lists
25. Maintenance Manuals
26. Plant Data Book
27. Monthly Progress Reports
28. Engineering and Construction Schedules
29. Standards
30. Welding Procedures
31. Calculations (as requested by Owner)

Material issued by Contractor to Owner "FOR REVIEW" shall be returned to Contractor on or before five (5) working days after receipt. Owner may request additional time for review and Contractor shall grant additional time as long as Contractor's installation schedule shall not be delayed by such additional time for drawing review. Calculations and Lists (line, valve, etc.) prepared by Contractor shall be reviewed by Owner, but not approved. (**Note:** Approvals required by NRC/PSPC or others are subject to their approval schedules which may differ from the above.

Before starting erection of any building or concrete reinforcing steel, the Contractor shall submit four (4) copies of steel detail fabrication drawings for record-keeping purposes only. These drawings shall be reviewed by Owner, but not approved, and shall be placed on file in the offices of the Owner.

All drawings submitted to NRC/PSPC by Contractor shall be identified with the following data:

- (a) The Owner's name

- (b) Facility designation
- (c) Contract number
- (d) Specification item number, if applicable
- (e) The Contractor's name
- (f) The Contractor's drawing number

All drawing changes shall be clearly marked by Contractor, identified with a complete description in the revision block, and issued a revision number.

One (1) copy of all material issued by Contractor to Owner "FOR REVIEW" shall be returned to the Contractor marked "REVIEWED", "REVIEWED AS NOTED", or "REVISE AS INDICATED."

Upon completion of the work and as a condition of operational acceptance, the Contractor shall provide to Owner all drawings, specifications, operation manuals, instructions manuals, maintenance manuals, spare parts manuals, calculation manuals, and lists. These data shall be submitted to Owner sorted, assembled, categorized and in a condition that can easily be used by Owner's engineering, operations, and maintenance staff.

5.8 Project Schedule

The Contractor shall complete all work, including a successful Performance Test by 31 March 2018

6.0 COMMERCIAL

6.1 Insurance

The NRC/PSPC may provide an Owner Controlled Insurance program which will include coverage for Builder Risks and Wrap Up Liability. In the event the NRC/PSPC decides not to purchase the insurance coverage as mentioned, the successful Contractor shall be able to provide insurance during the term of the contract to protect the Owner from all claims arising out of the prosecution of the work under this contract. The Contractor shall provide

- (a) Wrap Up Liability
 - Bodily injury liability and Property Damage Liability Limits of at least \$10,000,000/\$10,000,000
- (b) Worker's Compensation
 - \$1,000,000 each accident.
- (c) Automobile Liability
 - Owned, Hired and Non-Owned Automobile Bodily Injury Coverage in the amount of \$2,000,000/\$2,000,000
 - Property Damage in the amount of \$500,000.
- (d) Comprehensive General Liability

- Bodily injury liability and Property Damage Liability Limits of at least \$5,000,000/\$5,000,000

(e) Builders All Risk

- The amount of the insurance policy shall be at least equal to the amount of the adjudicated contract to cover the risks to property and equipment and at least \$5,000,000 to cover civil responsibility

(f) Professional Liability for Errors and Omissions

- \$1,000,000 or 2.5 times the sub-contractors contract value, whichever is less, per occurrence

• **Workers Compensation Insurance**

Prior to commencing the work and prior to receiving payment on completion of the work, the Contractor shall provide evidence of compliance with the requirements of the Province with respect to Workers' Compensation Insurance, including payments due thereafter.

At any time during the term of the Contract, when requested by the Owner, the Contractor shall provide such evidence of compliance.

• **Wrap Up, Builder's Risk, Automobile, and Professional Liability**

In the event the Owner does not obtain the Wrap Up Liability and Builders Risk Coverages, the Contractor shall present to the Owner, within seven (7) days prior to the start of the project, proof that the insurance coverages required under clauses 6.1c (a), (b), (d), and (e) is in force and meets the requirements as stated in clause 3.3 covering the works, hazard to property, Contractor equipment and civil responsibility. The contractor shall pay for all insurance.

• **Other Insurances**

The Contractor shall present the Owner, within seven (7) days of the contract jurisdiction, with a copy of an "All-Risk" Insurance Policy covering site works, hazard to property, Contractor equipment and civil responsibility. This policy is to be paid for by the Contractor.

Where the Contractor is required for obtaining all insurance as required in Clauses 6.1 a),b),d) and e) the Contractor shall conform with the following items:

- (a) The policy shall stay in force until final approval of works.
- (b) Should the Contractor default in paying the premium, the Owner may pay for it and retain these costs from the Contractor's due.
- (c) The designated insured shall be both the Owner and the Contractor.
- (d) There shall be no deductible for claims against the Owner.
- (e) Earthquake and flood damages shall be covered.
- (f) In case of cancellation, a written advice shall be delivered to the Owner by registered mail, at least 30 days before date of effect of cancellation.
- (g) The amount of the Builders Risk insurance policy shall be at least equal to the amount of the adjudicated contract to cover the risks to property and equipment and at least \$1,000,000 to cover civil responsibility.

6.2 Permits, Taxes

The Contractor shall obtain, at his own expense, all permits, licenses, certifications, approvals etc., which includes obtaining, completing and submitting all documents required for execution of works prior to starting the work.

The Contractor shall bear the cost of all applicable federal, provincial, and municipal taxes.

6.3 Site Conditions

• Traffic Obstruction

Traffic obstruction to be managed as specified in the contract or letter of intent. Any other traffic obstruction will need Owner's approval.

• Production

The Central Heating Plant and existing equipment shall remain in operation 24/7 for the duration of the construction contract.

• Material Handling and Disposal

Access and exit routes for material handling and disposal will be indicated to the tenderers during the site visit. Tenderers to supply their own equipment. Equipment to be adapted to the route indicated by the Owner.

• Signs

Proper signs shall be erected by the Contractor for the protection and safety of workers and others. A construction identification sign will be prepared by the Owner.

• Cleaning

The Contractor shall at all times, keep the work site clean, orderly, and free of debris accumulation and wastes.

The Contractor shall leave the site in a clean condition as approved by the Engineer.

• Provide Laydown Area for Workers

The contractor is responsible for providing a rest area and lavatory facilities for workers.

• Safety

Contractor to conform to all applicable safety regulations, including mill safety requirements.

6.4 Execution of Works

• Start

After signing of the contract or upon receipt of a letter of intent, the Contractor shall follow the work schedule specified; all work, with the exception of shutdowns, shall occur Monday to Friday, between 7am and 4pm. All shutdowns shall occur after-hours.

• Inspection of Works

The Contractor shall cooperate with the Engineer to allow complete inspection for purposes of approval of works.

No work or part of work shall be backfilled or hidden before proper inspection has taken place.

- **Defective Work**

Defective work shall be demolished and rebuilt at Contractor's expenses. Defective work includes improperly executed work and work not conforming to plans and specifications.

- **Contractor Liability**

Supervision of works, as well as approval and acceptance of works, do not relieve the Contractor from his liabilities and obligations to provide materials and execution of works that conform to plans and specifications.

- **Protection of Works**

While executing the works and until final acceptance of works, the Contractor has the strict obligation of protecting all existing and completed works and shall take all measures to provide security to individuals.

The Contractor is solely responsible for all demolition and construction methods he is employing.

- **"As-Built" Drawings**

The Contractor shall keep a register of all modifications to original plans and specifications that were performed on site.

- **Modification and Addition to Works**

Modification or additions to works can occur. In that case, the Contractor is bound to follow related written instruction and shall advise the Owner in writing of any price modification.

Changes in price shall be in accordance with changes in scope of job and original pricing.

No change in price will be accepted by the Owner for any modification or addition to work unless such change corresponds to a written request by the Owner.

6.5 Acceptance of Work

- **Temporary Acceptance**

On notification by the Contractor, the Engineer may inspect for the purpose of approving that work completed to date is in accordance with plans and specifications.

After being notified by the Contractor, the Engineer shall proceed to the temporary acceptance of work to determine whether the works were done in conformity to plans and specifications.

If work to date is not approved, the Contractor shall promptly initiate prescribed corrections and request a second inspection.

- **Warranty**

The Contractor shall provide a warranty in conformity NRC/PSPC requirements.

- **Final Acceptance**

Before the warranty expiration date, a new inspection will be performed with the

Contractor. If all works are found satisfactory, a certificate of final acceptance will be issued by the Engineer.

In a contrary event, the Contractor will be advised of all remaining deficiencies to be corrected. Final acceptance will be given only after corrective measures are completed.

6.6 Payments

Payments will be according to the terms on the contract and/or the purchase order.

Table A – MANDATORY REQUIREMENT CHECKLIST

In order to receive consideration by NRC and PSPC, all proposals shall respond to the following mandatory requirements and shall include the referenced Section/Page in Bidders proposal. Any proposal that fails to indicate clearly that all mandatory requirements have been met will receive no further consideration.

Table A1: Mandatory Requirement Checklist

Requirement Reference No.	Reference to Statement of Work	Mandatory Requirements	Compliant (Yes/No)	Referenced Section/Page in Bidder's Proposal
M1	1.2, 1.3	1.5 MW thermal output, (150 BHP)		
M2	1.2	Equipment Maintenance Proposal with priced options at 3, 4 and 5 years		
M3	2.2.2	Two year fuel contract (\$/GJ HW) proposal with priced options at 3, 4 and 5 years		
M4	3.0	Verification fuel meets specifications		
M5	1.4	Fuel storage sustains 3 days continuous operation		
M6	1.2	Minimum turndown ratio is 3:1. Minimum parital load is 30% as per EASR requirements.		
M7	4.3.9	Metering & Sensor Requirements that are priced separately		
M8	1.2, 3.0	Training Program		
M9	5.1	Cost and design for modifications to 95/65 deg C hot water supply & return		
M10	5.1	Performance curve for both the supply & return temperatures of 145/110 deg C and 95/65 deg C		
M11	1.2, 5.3, 5.4	Details outlining how the Contractor will meet ESAR, MOECC and Emission Regulations		
M12	5.8	Detailed schedule to complete all work, including a successful Performance Test by March 2018		

Table A2: Optional Items Checklist

List of additional items that add value to the contract. This may be included on separate page if necessary.

Requirement Reference No.	Reference to Statement of Work	Optional Items	Included (Yes/No)	Referenced Section/Page in Bidder's Proposal
O1	1.2	Energy Efficiency (optional)		

Table B – RATED REQUIERMENTS

In order to qualify for the rating process, proposals shall respond to the following rated requirements and shall include the referenced Section/page in the Bidders proposal

Requirement Reference No.	Criteria	Evaluation	Points	Referenced Section/page in Bidders Proposal	Total Evaluation
Experience					20
R1	Similar technology projects completed between 2007 - 2017	One (1) point per successful project in Ontario, half point (0.5) for other provinces, quarter point for international (0.25) to max five (5) points	Max (5) pts		
R2	Similar scale projects completed within similar setting (CHCP) between 2007 - 2017	One (1) point per similar or larger scale successful project and one (1) pt per central plant installation to a maximum of five (5) points	Max (5) pts		
R3	History of collaboration and partnership with subcontractors between 2007 - 2017	Two (2) pts per successful project completion with main partner/designer, or within single-source company and one (1) pt per electrical/mechanical	Max (5) pts		

Requirement Reference No.	Criteria	Evaluation	Points	Referenced Section/page in Bidders Proposal	Total Evaluation
		contractor to a maximum of five (5) points			
R4	Experience with procurement and management of biomass fuel contracts (GJ/yr)	Half (0.5) point per alternate biomass fuel contract (not graded wood chip), one (1) point per wood chip fuel contract max (5)	Max (5) pts		
	Technical Approach				35
R5	Reliability	Proven reliability one (1) point per year of proven commercial operation. Maximum five (5) points	Max (5) pts		
R6	Maintenance	Comprehensive package that is rated by lowest downtime for scheduled maintenance (5points), next lowest downtime (4points) etc.	Max (5) pts		
R7	Performance	Points for thermal output performance over 80%. One (1) point per each 1% exceeding boiler efficiency over 80% at	Max (10) pts		

Requirement Reference No.	Criteria	Evaluation	Points	Referenced Section/page in Bidders Proposal	Total Evaluation
		MCR. Maximum of ten (10) points			
R8	Design	A design that integrates well with the plant in terms of space and access, supports operator leaning for a larger scale facility (Maximum of 15 points)	Max (15) pts		
Cost					30
R9		Maintenance (maximum five (5) points) and Fuel (maximum ten (10) points) contracts. Costs evaluated on five (5) year contract prices. Maximum points for lowest cost, 50% points for next lowest cost, 25% points for third lowest costs, 12.5% for fourth lowest	Max (15) pts		
R10		Total installed cost (max 15 points) with 15 points for lowest bid, 7.5 points for second lowest, 3.75 pts for third, 2 pts for 4th.	Max (15) pts		
Additional Considerations (equally weighted):					15
R11	Innovation of	To closely resemble	Max		

Requirement Reference No.	Criteria	Evaluation	Points	Referenced Section/page in Bidders Proposal	Total Evaluation
	technology	larger scale plant with respect to fuel handling, fuel storage, maintenance, operation, higher performance. Up to one (1) point for each item to maximum of 7.5 points	(7.5) pts		
R12	Fuel contract - service and utilization of local resources	Additional services that will minimize operator interventions up to one (1) point per service to a maximum of two (2) points. For delivery distance: 5.5 points for delivery within 250 km, 2.5 points for delivery within 500 km, and 1 point for delivery within 1000 km radius..	Max (7.5) pts		
Total					100

Performance Specifications

TABLE OF CONTENTS

	Pages
Division 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS	
Section 00 01 10 - Table of Contents	2
Division 01 - GENERAL REQUIREMENTS	
Section 01 14 00 - Work Restrictions	2
Section 01 32 16 - Construction Progress Schedule - Critical Path Method (CPM).....	2
Section 01 35 29 - Health And Safety Requirements.....	3
Section 01 45 00 - Quality Control.....	2
Section 01 52 00 - Construction Facilities.....	3
Section 01 56 00 - Temporary Barriers And Enclosures.....	2
Section 01 61 00 - Common Product Requirements.....	3
Section 01 74 11 - Cleaning.....	2
Section 01 74 21 - Construction/Demolition Waste Management And Disposal.....	5
Section 01 77 00 - Closeout Procedures	2
Section 01 78 00 - Closeout Submittals	8
Section 01 79 00 - Demonstration and Training.....	2
Section 01 91 13 - General Commissioning (CX) Requirements	9
Division 03 - CONCRETE	
Section 03 10 00 - Concrete Forming and Accessories	3
Section 03 20 00 - Concrete Reinforcing	3
Section 03 30 00 - Cast-in-Place Concrete.....	5
Division 05 - METALS	
Section 05 12 23 - Structural Steel for Buildings	4
Section 05 50 00 - Metal Fabrications	2
Section 05 51 29 - Metal Stairs and Ladders.....	3
Division 07 - THERMAL AND MOISTURE PROTECTION	
Section 07 62 00 - Sheet Metal Flashing and Trim	2
Section 07 81 00 - Applied Fireproofing	2
Section 07 84 00 - Fire Stopping	2
Division 21 - FIRE SUPPRESSION	
Section 21 05 01 - Common Work Results for Mechanical	3
Section 21 07 16 - Thermal Insulation For Equipment	6
Section 21 07 19 - Thermal Insulation for Piping	7

Division 22 - PLUMBING

Section 22 05 00 - Common Work Results for Plumbing.....	3
Section 22 11 16 - Domestic Water Piping	5
Section 22 13 17 - Drainage Waste and Vent Piping - Cast Iron and Copper	2
Section 22 15 00 - Boilers, Instrumentation and General Service Compressed Air Systems	5
Section 22 42 01 - Plumbing Specialties and Accessories.....	5

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

Section 23 05 00 - Common Work Results for HVAC	3
Section 23 05 05 - Installation of Pipework	6
Section 23 05 13 - Common Motor Requirements for HVAC Equipment	3
Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping.....	4
Section 23 05 17 - Pipe Welding	4
Section 23 05 19.01 - Thermometers and Pressure Gauges - Piping Systems	2
Section 23 05 23.01 - Valves - Bronze	4
Section 23 05 23.03 - Valves - Cast Steel	5
Section 23 05 23.05 - Butterfly Valves.....	3
Section 23 05 29 - Hangers and Supports for HVAC Piping and Equipment	5
Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment	4
Section 23 05 53.01 - Mechanical Identification	6
Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.....	4
Section 23 08 01 - Performance Verification Mechanical Piping Systems	2
Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems	2
Section 23 09 33 - Electric and Electronic Control System for HVAC	1
Section 23 11 23 - Facility Natural Gas Piping	4
Section 23 21 13.02 - Hydronic Systems: Steel	5
Section 23 21 14 - Hydronic Specialties	3
Section 23 51 00 – Breeching, Chimneys and Stacks.....	2
Section 23 52 00 – Heating Boilers	4

END OF TABLE

Part 1 General

1.1 ACCESS AND EGRESS

- .1 Design, construct and maintain temporary "access to" and "egress from" work areas, including stairs, runways, ramps or ladders and scaffolding, independent of finished surfaces and in accordance with relevant municipal, provincial and other regulations.

1.2 USE OF SITE AND FACILITIES

- .1 Execute work with least possible interference or disturbance to normal use of premises. Make arrangements with Departmental Representative to facilitate work as stated.
- .2 Maintain existing services to building and provide for personnel and vehicle access.
- .3 Where security is reduced by work provide temporary means to maintain security.
- .4 Closures: protect work temporarily until permanent enclosures are completed.

1.3 ALTERATIONS, ADDITIONS OR REPAIRS TO EXISTING BUILDING

- .1 Execute work with least possible interference or disturbance to building operations occupants, public and normal use of premises. Arrange with Departmental Representative to facilitate execution of work.

1.4 HOURS OF WORK

- .1 All work to be performed onsite during regular hours unless otherwise authorized by Departmental Representative in writing. Regular hours are 0700 hrs -1600 hrs Monday to Friday.

1.5 EXISTING SERVICES

- .1 Notify Departmental Representative and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give Departmental Representative minimum of two weeks notice for necessary interruption of mechanical or electrical service throughout course of work. More extensive shutdowns will require more notification. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to pedestrian vehicular traffic and tenant operations.
- .3 Provide alternative routes for personnel, pedestrian and vehicular traffic.
- .4 Establish location and extent of service lines in area of work before starting Work. Notify Departmental Representative of findings.
- .5 Submit schedule as part of Construction Progress Schedule Section 01 32 16 to obtain approval from Departmental Representative for any shut-down or closure of active

service or facility including heating, power and communications services. Adhere to approved Construction Progress Schedule and provide notice to affected parties.

- .6 Provide temporary services to maintain critical building and tenant systems.
- .7 Provide adequate bridging over trenches which cross sidewalks or roads to permit normal traffic.
- .8 Where unknown services are encountered, immediately advise Departmental Representative and confirm findings in writing.
- .9 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .10 Record locations of maintained, re-routed and abandoned service lines.
- .11 Construct barriers in accordance with Section 01 56 00 – Temporary Barriers and Enclosures.

1.6 SPECIAL REQUIREMENTS

- .1 Ensure that the Contractor's personnel employed on site become familiar with and obey regulations including safety, fire, traffic and security regulations.
- .2 Keep within limits of work and avenues of ingress and egress.

1.7 BUILDING SMOKING ENVIRONMENT

- .1 Comply with smoking restrictions. Smoking is not allowed

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 SYSTEM DESCRIPTION

- .1 Construction Progress Schedule (Project Time Management): describes processes required to ensure timely completion of Project. These processes ensure that various elements of Project are properly co-ordinated. It consists of planning, time estimating, scheduling, progress monitoring and control.
- .2 Planning: this is most basic function of management, that of determining presentation of action and is essential.
 - .1 It involves focusing on objective consideration of future, and integrating forward thinking with analysis; therefore, in planning, implicit assumptions are made about future so that action can be taken today.
 - .2 Planning and scheduling facilitates accomplishment of objectives and should be considered continuous interactive process involving planning, review, scheduling, analysis, monitoring and reporting.
- .3 Ensure that planning process is iterative and results in generally top-down processing with more detail being developed as planning progresses, and decisions concerning options and alternatives are made. This implies progressively more reliability of scheduling data. Detail Project schedule is used for analysis and progress monitoring.
- .4 Ensure project schedule efficiencies through monitoring.
 - .1 When activities begin on time and are performed according to estimated durations without interruptions, original Critical Path will remain accurate. Changes and delays will however, create an essential need for continual monitoring of Project activities.
 - .2 Monitor progress of Project in detail to ensure integrity of Critical Path, by comparing actual completions of individual activities with their scheduled completions, and review progress of activities that has started but are not yet completed.
 - .3 Monitoring should be done sufficiently often so that causes of delays are immediately identified and removed if possible.
- .5 Project monitoring and reporting: as Project progresses, keep team aware of changes to schedule, and possible consequences. In addition to Bar Charts and CPM networks, use narrative reports to provide advice on seriousness of difficulties and measures to overcome them.
 - .1 Narrative reporting begins with statement on general status of Project followed by summarization of delays, potential problems, corrective measures and Project status criticality.

1.2 CPM REQUIREMENTS

- .1 Ensure Master Plan and Detail Schedule are practical and remain within specified Contract duration.

- .2 Allow for and show Master Plan and Detail Schedule adverse weather conditions normally anticipated. Specified Contract duration has been predicated assuming normal amount of adverse weather conditions.
- .3 Provide necessary crews and manpower to meet schedule requirements for performing Work within specified Contract duration. Simultaneous use of multiple crews on multiple fronts on multiple critical paths may be required.

1.3 QUALITY ASSURANCE

- .1 Use experienced personnel, fully qualified in planning and scheduling to provide services from start of the design–build process, through construction to Final Certificate, Commissioning and handover of the project to the Departmental Representative.

1.4 PROJECT MEETING

- .1 Meet with Departmental Representative within 7 working days of Award of Contract date, to establish Work requirements and approach to project .

1.5 WORK BREAKDOWN STRUCTURE (WBS)

- .1 Prepare project Work Breakdown Structure (WBS) within 14 calender days of Award of Contract date. Develop WBS through at least five levels: Project, stage, element, sub-element and work package.

1.6 PROGRESS MONITORING AND REPORTING

- .1 On ongoing basis, Detail Schedule on job site must show "Progress to Date". Arrange participation on and off site of subcontractors and suppliers, as, and when necessary, for purpose of network planning, scheduling, updating and progress monitoring.
- .2 Update and reissue project Work Breakdown Structure and relevant coding structures as project develops and changes.
- .3 Monitor and report Work Progress as per Section 00 40 00 Project Management Guidelines.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Health and safety considerations required to ensure that PSPC shows due diligence towards health and safety on construction sites, and meets the requirements laid out in PSPC/RPB Departmental Policy DP 073 - Occupational Health and Safety - Construction.

1.2 REFERENCES

- .1 Province of Ontario
 - .1 Occupational Health and Safety Act and Regulations for Construction Projects. R.S.O (1990 amended 213/91), April 2009 Edition.

1.3 SUBMITTALS

- .1 Submit site-specific Health and Safety Plan to Departmental Representative: Within 7 days after date of Award of Contract and prior to commencement of Work. Health and Safety Plan must include:
 - .1 Results of site specific safety hazard assessment.
 - .2 Results of safety and health risk or hazard analysis for site tasks and operations.
- .2 Submit 1 copy of Contractor's work site health and safety inspection reports to Departmental Representative weekly.
- .3 Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
- .4 Submit copies of incident and accident reports.
- .5 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

1.4 FILING OF NOTICE

- .1 File Notice of Project with Provincial authorities prior to beginning of Work.

1.5 SAFETY ASSESSMENT

- .1 Perform site specific safety hazard assessment related to project.

1.6 MEETINGS

- .1 Schedule and administer Health and Safety meeting with Departmental Representative prior to commencement of Work.

1.7 GENERAL REQUIREMENTS

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 Departmental Representative may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

1.8 RESPONSIBILITY

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
- .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.9 COMPLIANCE REQUIREMENTS

- .1 Comply with Ontario Occupational Health and Safety Act and Regulations for Construction Projects.

1.10 UNFORSEEN HAZARDS

- .1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Departmental Representative verbally and in writing.

1.11 HEALTH AND SAFETY CO-ORDINATOR

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
 - .1 Have working knowledge of occupational safety and health regulations.
 - .2 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
 - .3 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.

1.12 POSTING OF DOCUMENTS

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction.

1.13 CORRECTION OF NON-COMPLIANCE

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Departmental Representative.
- .2 Provide Departmental Representative with written report of action taken to correct non-compliance of health and safety issues identified.
- .3 Departmental Representative may stop Work if non-compliance of health and safety regulations is not corrected.

1.14 BLASTING

- .1 Blasting or other use of explosives is not permitted without prior review by Departmental Representative.

1.15 POWDER ACTUATED DEVICES

- .1 Use powder actuated devices only after receipt of review from Departmental Representative.

1.16 WORK STOPPAGE

- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

Part 2 Products

2.1 NOT USED

- .1 Not used.

Part 3 Execution

3.1 NOT USED

- .1 Not used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 00 40 00 – Project Management Guidelines
- .2 Section 01 78 00 – Closeout Submittals

1.2 INDEPENDENT INSPECTION AGENCIES

- .1 Engage Independent Inspection/Testing Agencies for purpose of inspecting and/or testing portions of Work.
- .2 Provide equipment required for executing inspection and testing by appointed agencies.
- .3 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities. Pay costs for retesting and re-inspection.

1.3 ACCESS TO WORK

- .1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.
- .2 Co-operate to provide reasonable facilities for such access.

1.4 REJECTED WORK

- .1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.
- .2 Make good other Contractor's work damaged by such removals or replacements promptly.

1.5 REPORTS

- .1 Submit 4 copies of inspection and test reports to Departmental Representative when requested.
- .2 Provide copies to subcontractor of work being inspected or tested, manufacturer or fabricator of material being inspected or tested.
- .3 Submit quality control reports per section 01 78 00 Closeout Submittals.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 INSTALLATION AND REMOVAL

- .1 Prepare site plan indicating proposed location and dimensions of area to be fenced and used by the Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.
- .2 Identify areas which have to be gravelled to prevent tracking of mud.
- .3 Indicate use of supplemental or other staging area.
- .4 Provide construction facilities in order to execute work expeditiously.
- .5 Remove from site all such work after use.

1.2 SCAFFOLDING

- .1 Scaffolding in accordance with CAN/CSA-S269.2.
- .2 Provide and maintain scaffolding, ramps, ladders swing staging, platforms and temporary stairs.

1.3 HOISTING

- .1 Provide, operate and maintain hoists required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.
- .2 Hoists to be operated by qualified operator.

1.4 SITE STORAGE/LOADING

- .1 Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
- .2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

1.5 CONSTRUCTION PARKING

- .1 A maximum of 2 parking spaces will be permitted on site provided it does not disrupt performance of Work or normal operations of PSPC Plant.
- .2 Provide and maintain adequate access to project site and access to loading areas for normal Plant operations.

1.6 SECURITY

- .1 Provide if required and pay for responsible security personnel to guard site and contents of site after working hours and during holidays.

1.7 OFFICES

- .1 Provide office heated to 21 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.
- .2 Provide marked and fully stocked first-aid case in a readily available location.
- .3 Subcontractors to provide their own offices as necessary. Direct location of these offices.

1.8 EQUIPMENT, TOOL AND MATERIALS STORAGE

- .1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
- .2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

1.9 SANITARY FACILITIES

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances, keep facilities clean.

1.10 CONSTRUCTION SIGNAGE

- .1 No signs or advertisements, other than warning signs, are permitted on site.
- .2 Signs and notices for safety and instruction in both official languages Graphic symbols to CAN/CSA-Z321.
- .3 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by the Departmental Representative.

1.11 PROTECTION AND MAINTENANCE OF TRAFFIC

- .1 Provide access and temporary relocated roads as necessary to maintain traffic.
- .2 Maintain and protect traffic on affected roads during construction period.
- .3 Provide measures for protection and diversion of traffic, including provision of watch-persons and flag-persons, erection of barricades, placing of lights around and in front of equipment and work, and erection and maintenance of adequate warning, danger, and direction signs.
- .4 Protect travelling public from damage to person and property.
- .5 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.
- .6 Verify adequacy of existing roads and allowable load limit on these roads. Contractor is responsible for repair of damage to roads caused by construction operations.

- .7 Construct access and haul roads necessary constructed with suitable grades and widths; sharp curves, blind corners, and dangerous cross traffic shall be avoided.
- .8 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.
- .9 Dust control: adequate to ensure safe operation at all times.
- .10 Provide snow removal during period of Work.

1.12 CLEAN-UP

- .1 Clean dirt or mud tracked onto paved or surfaced roadways.
- .2 Store materials resulting from demolition activities that are salvageable.
- .3 Stack stored new or salvaged material not in construction facilities.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian General Standards Board (CGSB)
 - .1 CGSB 1.59-97, Alkyd Exterior Gloss Enamel.
 - .2 CAN/CGSB 1.189-00, Exterior Alkyd Primer for Wood.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-O121-M1978(R2003), Douglas Fir Plywood.
- .3 Public Works Government Services Canada (PWGSC) Standard Acquisition Clauses and Conditions (SACC)-ID: R0202D, Title: General Conditions 'C', In Effect as Of: May 14, 2004.

1.2 INSTALLATION AND REMOVAL

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

1.3 GUARD RAILS AND BARRICADES

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

1.4 WEATHER ENCLOSURES

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

1.5 DUST TIGHT SCREENS

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

1.6 ACCESS TO SITE

- .1 Provide and maintain access roads, sidewalk crossings, bicycle paths, ramps and construction runways as may be required for access to Work, and for normal operation of the NRC Plant, West Rideau Falls Dam and the construction zone along Sussex Drive.

1.7 PUBLIC TRAFFIC FLOW

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

1.8 FIRE ROUTES

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

1.9 PROTECTION FOR OFF-SITE AND PUBLIC PROPERTY

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

1.10 PROTECTION OF BUILDING FINISHES

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

1.11 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Within text of each specifications section, reference may be made to reference standards. Conform to these reference standards, in whole or in part as specifically requested in specifications.

1.2 QUALITY

- .1 Products, materials, equipment and articles incorporated in Work shall be new, not damaged or defective, and of best quality for purpose intended. If requested, furnish evidence as to type, source and quality of products provided.
- .2 Procurement policy is to acquire, in cost effective manner, items containing highest percentage of recycled and recovered materials practicable consistent with maintaining satisfactory levels of competition. Make reasonable efforts to use recycled and recovered materials and in otherwise utilizing recycled and recovered materials in execution of work.
- .3 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.
- .4 Unless otherwise indicated in specifications, maintain uniformity of manufacture for any particular or like item throughout building.
- .5 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.3 STORAGE, HANDLING AND PROTECTION

- .1 Handle and store products in manner to prevent damage, adulteration, deterioration and soiling and in accordance with manufacturer's instructions when applicable.
- .2 Remove and replace damaged products at own expense and to satisfaction of Departmental Representative.
- .3 Touch-up damaged factory finished surfaces to Departmental Representative's satisfaction. Use touch-up materials to match original. Do not paint over name plates.

1.4 TRANSPORTATION

- .1 Pay costs of transportation of products required in performance of Work.

1.5 MANUFACTURER'S INSTRUCTIONS

- .1 Unless otherwise indicated in specifications, install or erect products in accordance with manufacturer's instructions. Do not rely on labels or enclosures provided with products. Obtain written instructions directly from manufacturers.
- .2 Improper installation or erection of products, due to failure in complying with these requirements, authorizes Departmental Representative to require removal and re-installation at no increase in Contract Price or Contract Time.

1.6 QUALITY OF WORK

- .1 Ensure Quality of Work is of highest standard, executed by workers experienced and skilled in respective duties for which they are employed. Immediately notify Departmental Representative if required Work is such as to make it impractical to produce required results.
- .2 Do not employ anyone unskilled in their required duties.
- .3 Decisions as to standard or fitness of Quality of Work in cases of dispute rest solely with Departmental Representative, whose decision is final.

1.7 CO-ORDINATION

- .1 Ensure co-operation of workers in laying out Work. Maintain efficient and continuous supervision.
- .2 Be responsible for coordination and placement of openings, sleeves and accessories.

1.8 REMEDIAL WORK

- .1 Perform remedial work required to repair or replace parts or portions of Work identified as defective or unacceptable. Co-ordinate adjacent affected Work as required.
- .2 Perform remedial work by specialists familiar with materials affected. Perform in a manner to neither damage nor put at risk any portion of Work.

1.9 FASTENINGS

- .1 Provide metal fastenings and accessories in same texture, colour and finish as adjacent materials, unless indicated otherwise.
- .2 Prevent electrolytic action between dissimilar metals and materials.
- .3 Use non-corrosive hot dip galvanized steel fasteners and anchors for securing exterior work, unless stainless steel or other material is specifically requested in affected specification Section.
- .4 Space anchors within individual load limit or shear capacity and ensure they provide positive permanent anchorage. Wood, or any other organic material plugs are not acceptable.

- .5 Keep exposed fastenings to a minimum, space evenly and install neatly.
- .6 Fastenings which cause spalling or cracking of material to which anchorage is made are not acceptable.

1.10 FASTENINGS - EQUIPMENT

- .1 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.
- .2 Use heavy hexagon heads, semi-finished unless otherwise specified. Use No. 304 stainless steel for exterior areas.
- .3 Bolts may not project more than one diameter beyond nuts.
- .4 Use plain type washers on equipment, sheet metal and soft gasket lock type washers where vibrations occur. Use resilient washers with stainless steel.

1.11 PROTECTION OF WORK IN PROGRESS

- .1 Prevent overloading of parts of building. Do not cut, drill or sleeve load bearing structural member, unless specifically indicated without written approval of Departmental Representative.

1.12 EXISTING UTILITIES

- .1 When breaking into or connecting to existing services or utilities, execute Work at times directed by local governing authorities, with minimum of disturbance to Work, and/or building occupants and pedestrian and vehicular traffic.
- .2 Protect, relocate or maintain existing active services. When services are encountered, cap off in manner approved by authority having jurisdiction. Stake and record location of capped service.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 PROJECT CLEANLINESS

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

1.2 FINAL CLEANING

- .1 When Work is Substantially Completed remove surplus products, tools, construction machinery and equipment not required for performance of remaining Work.
- .2 Remove waste products and debris, and leave Work clean and suitable for occupancy.
- .3 Clean and polish glass, hardware, wall tile, stainless steel, chrome, porcelain enamel, baked enamel, plastic laminate, and mechanical and electrical fixtures. Replace broken, scratched or disfigured glass.
- .4 Remove stains, spots, marks and dirt from decorative work, electrical and mechanical fixtures, furniture fitments, walls and floors.
- .5 Clean lighting reflectors, lenses, and other lighting surfaces.
- .6 Vacuum clean and dust building interiors, behind grilles, louvres and screens.

- .7 Inspect finishes, fitments and equipment and ensure specified workmanship and operation.
- .8 Broom clean and wash exterior walks, steps and surfaces; rake clean other surfaces of grounds.
- .9 Remove dirt and other disfiguration from exterior surfaces.
- .10 Clean and sweep roofs, gutters, areaways, and sunken wells.
- .11 Sweep and wash clean paved areas.
- .12 Clean equipment and fixtures to sanitary condition; clean or replace filters of mechanical equipment.
- .13 Clean roofs, downspouts, and drainage systems.
- .14 Remove debris and surplus materials from crawl areas and other accessible concealed spaces.
- .15 Remove snow and ice from access to building.

1.3 WASTE MANAGEMENT AND DISPOSAL

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

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 References

- 1.1** .1 Ontario Ministry of the Environment O.Reg 102/94 and O.reg 103/94

Part 2 General

2.1 WASTE MANAGEMENT GOALS

- .1 Prior to start of Work conduct meeting with Departmental Representative to review and discuss PSPC's Waste Management Plan and Goals.
- .2 Follow all provisions of Real Property Services (RPS) Construction, Renovation, and Demolition (CRD) Non-hazardous Solid Waste Management Protocol. Submit monthly reports to Departmental Representative.
- .3 PSPC's Waste Management Goal: 75 percent of total Project Waste to be diverted from landfill sites. Provide Departmental Representative documentation certifying that waste management, recycling, reuse of recyclable and reusable materials have been extensively practiced.
- .4 Accomplish maximum control of solid construction waste.
- .5 Preserve environment and prevent pollution and environment damage.

2.2 DEFINITIONS

- .1 Class III: non-hazardous waste - construction renovation and demolition waste.
- .2 Demolition Waste Audit (DWA): relates to actual waste generated from project.
- .3 Inert Fill: inert waste - exclusively asphalt and concrete.
- .4 Materials Source Separation Program (MSSP): consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.
- .5 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.
- .6 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.
- .7 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- .8 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:

- .1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.
- .2 Returning reusable items including pallets or unused products to vendors.
- .9 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.
- .10 Separate Condition: refers to waste sorted into individual types.
- .11 Source Separation: acts of keeping different types of waste materials separate beginning from first time they became waste.
- .12 Waste Audit (WA): detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill. Refer to Schedule A.
- .13 Waste Management Co-ordinator (WMC): contractor representative responsible for supervising waste management activities as well as coordinating related, required submittal and reporting requirements.
- .14 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. Refer to Schedule B. WRW is based on information acquired from WA (Schedule A).

2.3 DOCUMENTS

- .1 Maintain at job site, one copy of following documents:
 - .1 Waste Audit.
 - .2 Waste Reduction Workplan.
 - .3 Material Source Separation Plan.
 - .4 Schedules A, B, C completed for project.

2.4 SUBMITTALS

- .1 Prepare and submit following prior to project start-up.
 - .1 Submit 2 copies of completed Waste Audit (WA): Schedule A.
 - .2 Submit 2 copies of completed Waste Reduction Workplan (WRW): Schedule B.
 - .3 Submit 2 copies of completed Demolition Waste Audit (DWA): Schedule C.
 - .4 Submit 2 copies of Materials Source Separation Program (MSSP) description.
- .2 Submit monthly reports documenting quantities of waste removed from site for reuse, recycle and landfill.
- .3 Submit before final payment summary of waste materials salvaged for reuse, recycling or disposal by project using deconstruction/disassembly material audit form.

2.5 WASTE AUDIT (WA)

- .1 Conduct WA prior to project start-up.
- .2 Prepare WA: Schedule A.
- .3 Record, on WA - Schedule A, extent to which materials or products used consist of recycled or reused materials or products.

2.6 WASTE REDUCTION WORKPLAN (WRW)

- .1 Prepare WRW prior to project start-up.
- .2 WRW should include but not limited to:
 - .1 Destination of materials listed.
 - .2 Deconstruction/disassembly techniques and sequencing.
 - .3 Schedule for deconstruction/disassembly.
 - .4 Location.
 - .5 Security.
 - .6 Protection.
 - .7 Clear labelling of storage areas.
 - .8 Details on materials handling and removal procedures.
 - .9 Quantities for materials to be salvaged for reuse or recycled and materials sent to landfill.
- .3 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.
- .4 Describe management of waste.
- .5 Identify opportunities for reduction, reuse, and recycling of materials. Based on information acquired from WA.
- .6 Post WRW or summary where workers at site are able to review content.
- .7 Set realistic goals for waste reduction, recognize existing barriers and develop strategies to overcome these barriers.
- .8 Monitor and report on waste reduction by documenting total volume and cost of actual waste removed from project.

2.7 MATERIALS SOURCE SEPARATION PROGRAM (MSSP)

- .1 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.
- .2 Provide containers to deposit reusable and recyclable materials.

- .3 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.
- .4 Locate separated materials in areas which minimize material damage.
- .5 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.
 - .1 Transport to approved and authorized recycling facility to users of material for recycling.
 - .2 Collect, handle, store on-site, and transport off-site, salvaged materials in combined

2.8 DISPOSAL OF WASTES

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

Part 3 Products

3.1 NOT USED

- .1 Not Used.

Part 4 Execution

4.1 SELECTIVE DEMOLITION

- .1 Reuse of Building Elements: this project is intended to result in end of project rates for reuse of building elements as follows:
 - .1 Building Structure and Shell: 100 percent.
 - .2 Interior Non-Shell Elements: 50 percent.

4.2 APPLICATION

- .1 Do Work in compliance with WRW.
- .2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

4.3 DIVERSION OF MATERIALS

- .1 Separate materials from general waste stream and stockpile in separate piles or containers, consistent with applicable fire regulations.
 - .1 Mark containers or stockpile areas.
- .2 On-site sale of salvaged recovered reusable recyclable materials is not permitted.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Acceptance of Work Procedures:
 - .1 Contractor's Inspection: conduct inspection of Work, identify deficiencies and defects, and repair as required to conform to Contract Documents.
 - .1 Notify Departmental Representative in writing of satisfactory completion of Contractor's inspection.
 - .2 Request Departmental Representative's inspection.
 - .2 Departmental Representative's Inspection:
 - .1 Departmental Representative and Contractor to inspect Work and identify defects and deficiencies.
 - .2 Contractor to correct Work as directed.
 - .3 Completion Tasks: submit written certificates to Departmental Representative in English and French that tasks have been performed as follows:
 - .1 Work: completed and inspected for compliance with Contract Documents.
 - .2 Defects: corrected and deficiencies completed.
 - .3 Equipment and systems: tested, adjusted and balanced and fully operational.
 - .4 Certificates required by Boiler Inspection Branch, Fire Commissioner Utility companies: submitted.
 - .5 Operation of systems: demonstrated to Departmental Representative's personnel.
 - .6 Commissioning of mechanical systems: completed in accordance with 01 91 13 - General Commissioning (Cx) Requirements and copies of final Commissioning Report submitted to Departmental Representative.
 - .7 Storage tank inspection documentation, registration, forms, decommissioning and removal in accordance with CEPA 1999 SOR/2008-197.
 - .8 Work: complete and ready for final inspection.
 - .4 Final Inspection:
 - .1 When completion tasks are done, request final inspection of Work by Departmental Representative.
 - .2 When Work is incomplete according to Departmental Representative, complete outstanding items and request re-inspection.

1.2 FINAL CLEANING

- .1 Clean in accordance with Section 01 74 11 – Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

Part 2 Products

2.1 NOT USED

.1 Not Used.

Part 3 Execution

3.1 NOT USED

.1 Not Used.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Canadian Environmental Protection Act (CEPA)
 - .1 SOR/2008-197, Storage Tank Systems for Petroleum Products and Allied Petroleum Products Regulations.

1.2 ADMINISTRATIVE REQUIREMENTS

- .1 Pre-warranty Meeting:
 - .1 Convene meeting one week prior to contract completion with Contractor's representative and Departmental Representative to:
 - .1 Verify Project requirements.
 - .2 Review manufacturer's installation instructions and warranty requirements.
 - .2 Departmental Representative to establish communication procedures for:
 - .1 Notifying construction warranty defects.
 - .2 Determine priorities for type of defects.
 - .3 Determine reasonable response time.
 - .3 Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
 - .4 Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four final copies of operating and maintenance manuals in English and French.
- .2 Provide evidence, if requested, for type, source and quality of products supplied.

1.4 FORMAT

- .1 Organize data as instructional manual.
- .2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
- .3 When multiple binders are used correlate data into related consistent groupings.
 - .1 Identify contents of each binder on spine.
- .4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

- .5 Arrange content by systems, process flow, under Section numbers and sequence of Table of Contents.
- .6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
- .7 Text: manufacturer's printed data, or typewritten data.
- .8 Drawings: provide with reinforced punched binder tab.
 - .1 Bind in with text; fold larger drawings to size of text pages.
- .9 Provide 1:1 scaled CAD files in dwg format on CD-ROM or DVD.

1.5 CONTENTS - PROJECT RECORD DOCUMENTS

- .1 Table of Contents for Each Volume: provide title of project;
 - .1 Date of submission; names.
 - .2 Addresses, and telephone numbers of Contractor with name of responsible parties.
 - .3 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
 - .1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data.
 - .1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00 - Quality Control.
- .6 Training: refer to Section 01 79 00 - Demonstration and Training.
- .7 CRD Waste management report and plan.

1.6 AS -BUILT DOCUMENTS AND SAMPLES

- .1 Maintain, in addition to requirements in General Conditions, at site for Departmental Representative one record copy of:
 - .1 Project manual and addendums
 - .2 Contractor's proposal
 - .3 Specifications and drawings as prepared by Contractor's design engineers and consultants.
 - .4 Construction drawings.
 - .5 Change Orders and other modifications to Contract.

- .6 Reviewed shop drawings, product data, and samples.
- .7 Field test records.
- .8 Inspection certificates.
- .9 Manufacturer's certificates.
- .10 Geotechnical reports
- .2 Store record documents and samples in field office apart from documents used for construction.
 - .1 Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
 - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition.
 - .1 Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Departmental Representative.

1.7 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS

- .1 Record information on set of black line opaque drawings, and in copy of Project Manual.
- .2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress.
 - .1 Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
 - .1 Measured depths of elements of foundation in relation to finish first floor datum.
 - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
 - .4 Field changes of dimension and detail.
 - .5 Details not on original Contract Drawings.
 - .6 References to related shop drawings and modifications.
- .5 Specifications: mark each item to record actual construction, including:
 - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.

- .7 Provide digital photos, if requested, for site records.

1.8 FINAL SURVEY

- .1 Submit final site survey certificate in accordance with Section 01 71 00 - Examination and Preparation, confirming elevations and locations of completed Work.

1.9 EQUIPMENT AND SYSTEMS

- .1 For each item of equipment and each system include description of unit or system, and component parts.
 - .1 Give function, normal operation characteristics and limiting conditions.
 - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
- .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
- .3 Include installed colour coded wiring diagrams.
- .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.
 - .1 Include regulation, control, stopping, shut-down, and emergency instructions.
 - .2 Include summer, winter, and any special operating instructions.
- .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- .6 Provide servicing and lubrication schedule, and list of lubricants required.
- .7 Include manufacturer's printed operation and maintenance instructions.
- .8 Include sequence of operation by controls manufacturer.
- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Include test and balancing reports as specified in Section 01 45 00 - Quality Control and 01 91 13 - General Commissioning (Cx) Requirements.

- .15 Storage tank inspection documentation, registration, forms, decommissioning and removal in accordance with CEPA 1999 SOR/2008-197.
- .16 Registration and identification requirements as defined by storage tank regulations SOC 2008-197 and PWGSC storage tank management program.
- .17 Additional requirements: as specified in individual specification sections.

1.10 MATERIALS AND FINISHES

- .1 Building products, applied materials, and finishes: include product data, with catalogue number, size, composition, and colour and texture designations.
 - .1 Provide information for re-ordering custom manufactured products.
- .2 Instructions for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .3 Moisture-protection and weather-exposed products: include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.
- .4 Additional requirements: as specified in individual specifications sections.

1.11 MAINTENANCE MATERIALS

- .1 Spare Parts:
 - .1 Provide spare parts, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to location as directed; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- .2 Extra Stock Materials:
 - .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
 - .2 Provide items of same manufacture and quality as items in Work.
 - .3 Deliver to site location as directed; place and store.
 - .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.
 - .5 Obtain receipt for delivered products and submit prior to final payment.
- .3 Special Tools:
 - .1 Provide special tools, in quantities specified in individual specification section.
 - .2 Provide items with tags identifying their associated function and equipment.

- .3 Deliver to site location as directed; place and store.
- .4 Receive and catalogue items.
 - .1 Submit inventory listing to Departmental Representative.
 - .2 Include approved listings in Maintenance Manual.

1.12 DELIVERY, STORAGE AND HANDLING

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
- .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
- .3 Store components subject to damage from weather in weatherproof enclosures.
- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and for review by Departmental Representative.

1.13 WARRANTIES AND BONDS

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Departmental Representative for approval.
- .3 Warranty management plan to include required actions and documents to assure that Departmental Representative receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Submit, warranty information made available during construction phase, to Departmental Representative for approval prior to each monthly pay estimate.
- .6 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
 - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
 - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
 - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.
 - .4 Verify that documents are in proper form, contain full information, and are notarized.
 - .5 Co-execute submittals when required.
 - .6 Retain warranties and bonds until time specified for submittal.
- .7 Except for items put into use with departmental representative permission, leave date of beginning of time of warranty until Date of Substantial Performance is determined.

- .8 Conduct joint 4 month and 9 month warranty inspection, measured from time of acceptance, by Departmental Representative.
- .9 Include information contained in warranty management plan as follows:
 - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
 - .2 Listing and status of delivery of Certificates of Warranty for extended warranty items, to include roofs, HVAC balancing, pumps, motors, transformers, and commissioned systems such as fire protection, alarm systems, sprinkler systems.
 - .3 Provide list for each warranted equipment, item, feature of construction or system indicating:
 - .1 Name of item.
 - .2 Model and serial numbers.
 - .3 Location where installed.
 - .4 Name and phone numbers of manufacturers or suppliers.
 - .5 Names, addresses and telephone numbers of sources of spare parts.
 - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
 - .7 Cross-reference to warranty certificates as applicable.
 - .8 Starting point and duration of warranty period.
 - .9 Summary of maintenance procedures required to continue warranty in force.
 - .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
 - .11 Organization, names and phone numbers of persons to call for warranty service.
 - .12 Typical response time and repair time expected for various warranted equipment.
 - .4 Contractor's plans for attendance at 4 and 9 month post-construction warranty inspections.
 - .5 Procedure and status of tagging of equipment covered by extended warranties.
 - .6 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .10 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .11 Written verification to follow oral instructions.
 - .1 Failure to respond will be cause for the Departmental Representative to proceed with action against Contractor.

1.14 WARRANTY TAGS

- .1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Departmental Representative.

- .2 Attach tags with copper wire and spray with waterproof silicone coating.
- .3 Leave date of acceptance until project is accepted for occupancy.
- .4 Indicate following information on tag:
 - .1 Type of product/material.
 - .2 Model number.
 - .3 Serial number.
 - .4 Contract number.
 - .5 Warranty period.
 - .6 Inspector's signature.
 - .7 Construction Contractor.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 ADMINISTRATIVE REQUIREMENTS

- .1 Demonstrate scheduled operation and maintenance of equipment and systems to Departmental Representative's personnel in both official languages two weeks prior to date of interim completion.
- .2 Departmental Representative: provide list of personnel to receive instructions, and coordinate their attendance at agreed-upon times.
- .3 Preparation:
 - .1 Verify conditions for demonstration and instructions comply with requirements.
 - .2 Verify designated personnel are present.
 - .3 Ensure equipment has been inspected and put into operation.
 - .4 Ensure testing, adjusting, and balancing has been performed in accordance with Section 01 91 13 - General Commissioning (Cx) Requirements. and equipment and systems are fully operational.
- .4 Demonstration and Instructions:
 - .1 Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, and maintenance of each item of equipment at agreed upon times, at the designated location.
 - .2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.
 - .3 Review contents of manual in detail to explain aspects of operation and maintenance.
 - .4 Prepare and insert additional data in operations and maintenance manuals when needed during instructions.
- .5 Time Allocated for Instructions: 3 sessions of 3 formal days

1.2 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Submit to Departmental Representative schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Departmental Representative's approval.
- .2 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.
- .3 Give time and date of each demonstration, with list of persons present.
- .4 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

1.3 QUALITY ASSURANCE

- .1 When specified in individual Sections requiring manufacturer to provide authorized representative to demonstrate operation of equipment and systems:
 - .1 Instruct Departmental Representative's personnel.
 - .2 Provide written report that demonstration and instructions have been completed.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 General requirements relating to commissioning of project's components and systems, specifying general requirements to PV of components, equipment, sub-systems, systems, and integrated systems.
 - .2 Acronyms:
 - .1 AFD - Alternate Forms of Delivery, service provider.
 - .2 BMM - Building Management Manual.
 - .3 Cx - Commissioning.
 - .4 EMCS - Energy Monitoring and Control Systems.
 - .5 O&M - Operation and Maintenance.
 - .6 PI - Product Information.
 - .7 PV - Performance Verification.
 - .8 TAB - Testing, Adjusting and Balancing.

1.2 GENERAL

- .1 Cx is a planned program of tests, procedures and checks carried out systematically on systems and integrated systems of the finished Project. Cx is performed after systems and integrated systems are completely installed, functional and Performance Verification responsibilities have been completed and approved. Objectives:
 - .1 Verify installed equipment, systems and integrated systems operate in accordance with contract documents and design criteria and intent.
 - .2 Ensure appropriate documentation is compiled into the BMM.
 - .3 Effectively train O&M staff.
- .2 Contractor conducts Cx process, operating equipment and systems, troubleshooting and making adjustments as required.
 - .1 Systems to be operated at full capacity under various modes to determine if they function correctly and consistently at peak efficiency. Systems to be interactively with each other as intended in accordance with Contract Documents and design criteria.
 - .2 During these checks, adjustments to be made to enhance performance to meet environmental or user requirements.
- .3 Design Criteria: meet Project functional and operational requirements.

1.3 COMMISSIONING OVERVIEW

- .1 Section 01 91 13 – General Commissioning (Cx) Requirements.
- .2 Cx to be a line item of Contractor's cost breakdown.

- .3 Cx activities supplement field quality and testing procedures described in relevant technical sections.
- .4 Cx is conducted in concert with activities performed during each stage of project delivery. Cx identifies issues in Planning and Design stages which are addressed during Construction and Cx stages to ensure the built facility is constructed and proven to operate satisfactorily under weather, environmental and occupancy conditions to meet functional and operational requirements. Cx activities includes transfer of critical knowledge to facility operational personnel.
- .5 Departmental Representative will issue Interim Acceptance Certificate when:
 - .1 Completed Cx documentation has been received, reviewed for suitability and approved by Departmental Representative.
 - .2 Equipment, components and systems have been commissioned.
 - .3 O&M training has been completed.

1.4 NON-CONFORMANCE TO PERFORMANCE VERIFICATION REQUIREMENTS

- .1 Should equipment, system components, and associated controls be incorrectly installed or malfunction during Cx, correct deficiencies, re-verify equipment and components within the non-functional system, including related systems as deemed required by Departmental Representative to ensure effective performance.
- .2 Costs for corrective work, additional tests, inspections, to determine acceptability and proper performance of such items to be borne by Contractor. Above costs to be in form of progress payment reductions or hold-back assessments.

1.5 PRE-CX REVIEW

- .1 Before Construction:
 - .1 Review contract documents, confirm by writing to Departmental Representative.
 - .1 Adequacy of provisions for Cx.
 - .2 Aspects of design and installation pertinent to success of Cx.
- .2 During Construction:
 - .1 Co-ordinate provision, location and installation of provisions for Cx.
- .3 Before start of Cx:
 - .1 Have completed Cx Plan up-to-date.
 - .2 Ensure installation of related components, equipment, sub-systems, systems is complete.
 - .3 Fully understand Cx requirements and procedures.
 - .4 Have Cx documentation shelf-ready.
 - .5 Understand completely design criteria and intent and special features.
 - .6 Submit complete start-up documentation to Departmental Representative.
 - .7 Have Cx schedules up-to-date.

- .8 Ensure systems have been cleaned thoroughly.
- .9 Complete TAB procedures on systems, submit TAB reports to Departmental Representative for review.
- .10 Ensure "As-Built" system schematics are available.
- .4 Inform Departmental Representative in writing of discrepancies and deficiencies on finished works.

1.6 CONFLICTS

- .1 Report conflicts between requirements of this section and other sections to Departmental Representative before start-up and obtain clarification.
- .2 Failure to report conflict and obtain clarification will result in application of most stringent requirement.

1.7 COMMISSIONING DOCUMENTATION

- .1 Provide Cx documentation to Departmental Representative at various design stages.
- .2 Provide completed and approved Cx documentation to Departmental Representative.

1.8 COMMISSIONING SCHEDULE

- .1 Provide detailed Cx schedule as part of Work schedule in accordance with Section 01 32 16 - Construction Progress Schedule - Critical Path Method (CPM).
- .2 Provide adequate time for Cx activities prescribed in technical sections and commissioning sections including:
 - .1 Approval of Cx reports.
 - .2 Verification of reported results.
 - .3 Repairs, retesting, re-commissioning, re-verification.
 - .4 Training.

1.9 COMMISSIONING MEETINGS

- .1 Convene Cx meetings following project meetings: Section 00 40 00 Project Management Guidelines, and as specified herein.
- .2 Purpose: to resolve issues, monitor progress, identify deficiencies, relating to Cx.
- .3 Continue Cx meetings on regular basis until commissioning deliverables have been addressed.
- .4 At 66 % construction completion stage. Call a separate Cx scope meeting to review progress, discuss schedule of equipment start-up activities and prepare for Cx. Issues at meeting to include:
 - .1 Review duties and responsibilities of Contractor and the Contractor's subcontractors, addressing delays and potential problems.

- .2 Determine the degree of involvement of trades and manufacturer's representatives in the commissioning process.
- .5 Thereafter Cx meetings to be held until project completion and as required during equipment start-up and functional testing period.
- .6 Meeting will be chaired by Contractor's Cx Agent , who will record and distribute minutes.
- .7 Ensure subcontractors and relevant manufacturer representatives are present at 60% and subsequent Cx meetings and as required.

1.10 STARTING AND TESTING

- .1 Contractor assumes liabilities and costs for inspections. Including disassembly and re-assembly after approval, starting, testing and adjusting, including supply of testing equipment.

1.11 WITNESSING OF STARTING AND TESTING

- .1 Provide 14 days notice prior to commencement.
- .2 Departmental Representative to witness of start-up and testing.
- .3 Contractor's Cx Agent to be present at tests performed and documented by sub-trades, suppliers and equipment manufacturers.

1.12 MANUFACTURER'S INVOLVEMENT

- .1 Factory testing: manufacturer to:
 - .1 Coordinate time and location of testing.
 - .2 Provide testing documentation for review by Departmental Representative.
 - .3 Arrange for Departmental Representative to witness tests.
 - .4 Obtain written approval of test results and documentation from Departmental Representative before delivery to site.
- .2 Obtain manufacturers installation, start-up and operations instructions prior to start-up of components, equipment and systems and review with Departmental Representative.
 - .1 Compare completed installation with manufacturer's published data, record discrepancies, and review with manufacturer.
 - .2 Modify procedures detrimental to equipment performance and review same with manufacturer before start-up.
- .3 Integrity of warranties:
 - .1 Use manufacturer's trained start-up personnel where specified elsewhere in other divisions or required to maintain integrity of warranty.
 - .2 Verify with manufacturer that testing as specified will not void warranties.
- .4 Qualifications of manufacturer's personnel:

- .1 Experienced in design, installation and operation of equipment and systems.
- .2 Ability to interpret test results accurately.
- .3 To report results in clear, concise, logical manner.

1.13 PROCEDURES

- .1 Verify that equipment and systems are complete, clean, and operating in normal and safe manner prior to conducting start-up, testing and Cx.
- .2 Conduct start-up and testing in following distinct phases:
 - .1 Included in delivery and installation:
 - .1 Verification of conformity to specification, approved shop drawings and completion of PI report forms.
 - .2 Visual inspection of quality of installation.
 - .2 Start-up: follow accepted start-up procedures.
 - .3 Operational testing: document equipment performance.
 - .4 System PV: include repetition of tests after correcting deficiencies.
 - .5 Post-substantial performance verification: to include fine-tuning.
- .3 Correct deficiencies and obtain approval from Departmental Representative after distinct phases have been completed and before commencing next phase.
- .4 Document require tests on approved PV forms.
- .5 Failure to follow accepted start-up procedures will result in re-evaluation of equipment by an independent testing agency selected by Departmental Representative. If results reveal that equipment start-up was not in accordance with requirements, and resulted in damage to equipment, implement following:
 - .1 Minor equipment/systems: implement corrective measures approved by Departmental Representative.
 - .2 Major equipment/systems: if evaluation report concludes that damage is minor, implement corrective measures approved by Departmental Representative.
 - .3 If evaluation report concludes that major damage has occurred, Departmental Representative shall reject equipment.
 - .1 Rejected equipment to be remove from site and replace with new.
 - .2 Subject new equipment/systems to specified start-up procedures.

1.14 START-UP DOCUMENTATION

- .1 Assemble start-up documentation and submit to Departmental Representative for approval before commencement of commissioning.
- .2 Start-up documentation to include:
 - .1 Factory and on-site test certificates for specified equipment.
 - .2 Pre-start-up inspection reports.
 - .3 Signed installation/start-up check lists.
 - .4 Start-up reports,

- .5 Step-by-step description of complete start-up procedures, to permit Departmental Representative to repeat start-up at any time.

1.15 OPERATION AND MAINTENANCE OF EQUIPMENT AND SYSTEMS

- .1 After start-up, operate and maintain equipment and systems as directed by equipment/system manufacturer.
- .2 With assistance of manufacturer develop written maintenance program and submit to Departmental Representative for approval before implementation.
- .3 Operate and maintain systems for length of time required for commissioning to be completed.
- .4 After completion of commissioning, operate and maintain systems until issuance of certificate of interim acceptance.

1.16 TEST RESULTS

- .1 If start-up, testing and/or PV produce unacceptable results, repair, replace or repeat specified starting and/or PV procedures until acceptable results are achieved.
- .2 Provide manpower and materials, assume costs for re-commissioning.

1.17 START OF COMMISSIONING

- .1 Notify Departmental Representative at least 21 days prior to start of Cx.
- .2 Start Cx after elements of building affecting start-up and performance verification of systems have been completed.

1.18 INSTRUMENTS / EQUIPMENT

- .1 Submit to Departmental Representative for review and approval:
 - .1 Complete list of instruments proposed to be used.
 - .2 Listed data including, serial number, current calibration certificate, calibration date, calibration expiry date and calibration accuracy.
- .2 Provide the following equipment as required:
 - .1 2-way radios.
 - .2 Ladders.
 - .3 Equipment as required to complete work.

1.19 COMMISSIONING PERFORMANCE VERIFICATION

- .1 Carry out Cx:
 - .1 Under actual operating conditions, over entire operating range, in all modes.
 - .2 On independent systems and interacting systems.
- .2 Cx procedures to be repeatable and reported results are to be verifiable.

- .3 Follow equipment manufacturer's operating instructions.
- .4 EMCS trending to be available as supporting documentation for performance verification.

1.20 WITNESSING COMMISSIONING

- .1 Departmental Representative to witness activities and verify results.

1.21 AUTHORITIES HAVING JURISDICTION

- .1 Where specified start-up, testing or commissioning procedures duplicate verification requirements of authority having jurisdiction, arrange for authority to witness procedures so as to avoid duplication of tests and to facilitate expedient acceptance of facility.
- .2 Obtain certificates of approval, acceptance and compliance with rules and regulation of authority having jurisdiction.
- .3 Provide copies to Departmental Representative within 5 days of test and with Cx report.

1.22 COMMISSIONING CONSTRAINTS

- .1 Since access into secure or sensitive areas will be very difficult after occupancy it is necessary to complete Cx of occupancy, weather, and seasonal sensitive equipment and systems in these areas before issuance of the Interim Certificate, using, if necessary, simulated thermal loads.

1.23 EXTRAPOLATION OF RESULTS

- .1 Where Cx of weather, occupancy, or seasonal-sensitive equipment or systems cannot be conducted under near-rated or near-design conditions, extrapolate part-load results to design conditions when approved by Departmental Representative in accordance with equipment manufacturer's instructions, using manufacturer's data, with manufacturer's assistance and using approved formulae.

1.24 EXTENT OF VERIFICATION

- .1 Heating Plant areas:
 - .1 Provide manpower and instrumentation to verify up to 100 % of reported results.
- .2 Number and location to be at discretion of Departmental Representative.
- .3 Conduct tests repeated during verification under same conditions as original tests, using same test equipment, instrumentation.
- .4 Review and repeat commissioning of systems if inconsistencies found in more than 20 % of reported results.
- .5 Perform additional commissioning until results are acceptable to Departmental Representative.

1.25 REPEAT VERIFICATIONS

- .1 Assume costs incurred by Departmental Representative for third and subsequent verifications where:
 - .1 Verification of reported results fail to receive Departmental Representative's approval.
 - .2 Repetition of second verification again fails to receive approval.
 - .3 Departmental Representative deems Contractor's request for second verification was premature.

1.26 SUNDRY CHECKS AND ADJUSTMENTS

- .1 Make adjustments and changes which become apparent as Cx proceeds.
- .2 Perform static and operational checks as applicable and as required.

1.27 DEFICIENCIES, FAULTS, DEFECTS

- .1 Correct deficiencies found during start-up and Cx to satisfaction of Departmental Representative.
- .2 Report problems, faults or defects affecting Cx to Departmental Representative in writing. Stop Cx until problems are rectified. Proceed with written approval from Departmental Representative.

1.28 COMPLETION OF COMMISSIONING

- .1 Upon completion of Cx leave systems in normal operating mode.
- .2 Except for warranty and seasonal verification activities specified in Cx specifications, complete Cx prior to issuance of Interim Certificate of Completion.
- .3 Cx to be considered complete when contract Cx deliverables have been submitted and accepted by Departmental Representative.

1.29 ACTIVITIES UPON COMPLETION OF COMMISSIONING

- .1 When changes are made to baseline components or system settings established during Cx process, provide updated Cx form for affected item.

1.30 MAINTENANCE MATERIALS, SPARE PARTS, SPECIAL TOOLS

- .1 Supply, deliver, and document maintenance materials, spare parts, and special tools as specified in contract.

1.31 OCCUPANCY

- .1 Cooperate fully with Departmental Representative during stages of acceptance and occupancy of facility.

1.32 INSTALLED INSTRUMENTATION

- .1 Use instruments installed under Contract for TAB and PV if:
 - .1 Accuracy complies with these specifications.
 - .2 Calibration certificates have been deposited with Departmental Representative.
- .2 Calibrated EMCS sensors may be used to obtain performance data provided that sensor calibration has been completed and accepted.

1.33 PERFORMANCE VERIFICATION TOLERANCES

- .1 Application tolerances:
 - .1 Specified range of acceptable deviations of measured values from specified values or specified design criteria. Except for special areas, to be within +/- 10 % of specified values.
- .2 Instrument accuracy tolerances:
 - .1 To be of higher order of magnitude than equipment or system being tested.
- .3 Measurement tolerances during verification:
 - .1 Unless otherwise specified actual values to be within +/- 2 % of recorded values.

1.34 DEPARTMENTAL REPRESENTATIVE'S PERFORMANCE TESTING

- .1 Performance testing of equipment or system by Departmental Representative will not relieve Contractor from compliance with specified start-up and testing procedures.

Part 2 Products

2.1 NOT USED

- .1 Not Used.

Part 3 Execution

3.1 NOT USED

- .1 Not Used.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 03 20 00 – Concrete Reinforcing.
- .2 03 30 00 – Cast-in-Place Concrete.

1.2 REFERENCES

- .1 Use the latest applicable edition to the following references.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/ Methods of Test and Standard Practices for Concrete.
 - .2 CSA-O86S1, Supplement No. 1 to CAN/CSA-O86-01, Engineering Design in Wood.
 - .3 CSA O121, Douglas Fir Plywood.
 - .4 CSA O151, Canadian Softwood Plywood.
 - .5 CSA O153, Poplar Plywood.
 - .6 CAN/CSA-O325.0, Construction Sheathing.
 - .7 CSA O437 Series, Standards for OSB and Waferboard.
 - .8 CSA S269.1, Falsework for Construction Purposes.
 - .9 CAN/CSA-S269.3, Concrete Formwork, National Standard of Canada
- .3 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S701, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

Part 2 Products

2.1 MATERIALS

- .1 Formwork materials:
 - .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121, CAN/CSA-O86, CSA O437 Series, and CSA-O153.
 - .2 For concrete with special architectural features, use formwork materials to CSA-A23.1/A23.2.
- .2 Form ties:
 - .1 For concrete not designated 'Architectural', use removable or snap-off metal ties, fixed or adjustable length, free of devices leaving holes larger than 25 mm diameter in concrete surface.

- .2 For Architectural concrete, use snap ties complete with plastic cones and light grey concrete plugs.
- .3 Form release agent: non-toxic, biodegradable, low VOC.
- .4 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene.
- .5 Falsework materials: to CSA-S269.1.

Part 3 Execution

3.1 FABRICATION AND ERECTION

- .1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
- .2 Hand trim sides and bottoms and remove loose earth from earth forms before placing concrete.
- .3 Fabricate and erect falsework in accordance with CSA S269.1.
- .4 Do not place shores and mud sills on frozen ground.
- .5 Provide site drainage to prevent washout of soil supporting mud sills and shores.
- .6 Fabricate and erect formwork in accordance with CAN/CSA-S269.3 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.
- .7 Align form joints and make watertight.
 - .1 Keep form joints to minimum.
- .8 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.
- .9 Line forms for following surfaces:
 - .1 Exposed faces of walls: do not stagger joints of form lining material and align joints to obtain uniform pattern.
 - .2 Secure lining taut to formwork to prevent folds.
 - .3 Pull down lining over edges of formwork panels.
 - .4 Ensure lining is new and not reused material.
 - .5 Ensure lining is dry and free of oil when concrete is poured.
 - .6 Application of form release agents on formwork surface is prohibited where drainage lining is used.
 - .7 If concrete surfaces require cleaning after form removal, use only pressurized water stream so as not to alter concrete's smooth finish.
- .10 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

3.2 REMOVAL AND RESHORING

- .1 Leave formwork in place for minimum periods of time after placing concrete, as to requirements of CSA-A23.1/A23.2.
- .2 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

- .1 Use the latest applicable edition of the following references.
- .2 American Concrete Institute (ACI)
 - .1 SP-66, ACI Detailing Manual 2004.
 - .1 ACI 315, Details and Detailing of Concrete Reinforcement.
 - .2 ACI 315R, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.
 - .3 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A143/A143M, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
 - .2 ASTM A185/A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - .3 ASTM A497/A497M, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
 - .4 ASTM A775/A775M, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
 - .4 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/ Methods of Test and Standard Practices for Concrete.
 - .2 CSA-A23.3, Design of Concrete Structures.
 - .3 CAN/CSA-G30.18, Billet-Steel Bars for Concrete Reinforcement, A National Standard of Canada.
 - .4 CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .5 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles, A National Standard of Canada.
 - .6 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .3 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A143/A143M, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
 - .2 ASTM A185/A185M, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
 - .3 ASTM A497/A497M, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
 - .4 ASTM A775/A775M, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/ Methods of Test and Standard Practices for Concrete.
 - .2 CSA-A23.3, Design of Concrete Structures.
 - .3 CAN/CSA-G30.18, Billet-Steel Bars for Concrete Reinforcement, A National Standard of Canada.
 - .4 CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .5 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles, A National Standard of Canada.
 - .6 CSA W186, Welding of Reinforcing Bars in Reinforced Concrete Construction.
- .5 Reinforcing Steel Institute of Canada (RSIC)
 - .1 RSIC, Reinforcing Steel Manual of Standard Practice.

Part 2 Products

2.1 MATERIALS

- .1 Reinforcing steel: billet steel, grade 400, deformed bars to CAN/CSA-G30.18, unless indicated otherwise.
- .2 Reinforcing steel: weldable low alloy steel deformed bars to CAN/CSA-G30.18.
- .3 Cold-drawn annealed steel wire ties: to ASTM A497/A497M.
- .4 Deformed steel wire for concrete reinforcement: to ASTM A497/A497M.
- .5 Welded steel wire fabric: to ASTM A185/A185M.
- .6 Welded deformed steel wire fabric: to ASTM A497/A497M.
- .7 Epoxy Coating of non-prestressed reinforcement: to ASTM A775/A775M.
- .8 Galvanizing of non-prestressed reinforcement: to CAN/CSA-G164, minimum zinc coating 610 g/m².
- .9 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .10 Plain round bars: to CSA-G40.20/G40.21.

2.2 FABRICATION

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2, ACI 315, and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
- .2 Ship bundles of bar reinforcement, clearly identified in accordance with bar bending details and lists.

2.3 SOURCE QUALITY CONTROL

- .1 Upon request, provide Departmental Representative with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.

Part 3 Execution

3.1 PREPARATION

- .1 Galvanizing to include chromate treatment.
 - .1 Duration of treatment to be 1 hour per 25 mm of bar diameter.
- .2 Conduct bending tests to verify galvanized bar fragility in accordance with ASTM A143/A143M.

3.2 PLACING REINFORCEMENT

- .1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.
- .2 Use plain round bars as slip dowels in concrete.
 - .1 Paint portion of dowel intended to move within hardened concrete with one coat of asphalt paint.
 - .2 When paint is dry, apply thick even film of mineral lubricating grease.
- .3 Ensure cover to reinforcement is maintained during concrete pour.
- .4 Protect epoxy and paint coated portions of bars with covering during transportation and handling.

3.3 FIELD TOUCH-UP

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

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

1.2 REFERENCES

- .1 Use the latest applicable edition to the following references.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM C260, Standard Specification for Air-Entraining Admixtures for Concrete.
 - .2 ASTM C309, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 - .3 ASTM C330, Standard Specification for Lightweight Aggregates for Structural Concrete.
 - .4 ASTM C494/C494M, Standard Specification for Chemical Admixtures for Concrete.
 - .5 ASTM C1017/C1017M, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
 - .6 ASTM D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
 - .7 ASTM D624, Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomer.
 - .8 ASTM D1751, Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
 - .9 ASTM D1752, Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-37.2, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
 - .2 CAN/CGSB-51.34, Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA-A23.1/A23.2, Concrete Materials and Methods of Concrete Construction/ Methods of Test and Standard Practices for Concrete.
 - .2 CSA A283, Qualification Code for Concrete Testing Laboratories.
 - .3 CAN/CSA-A3000, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
 - .1 CSA-A3001, Cementitious Materials for Use in Concrete.

1.3 ACRONYMS AND TYPES

- .1 Cement: hydraulic cement or blended hydraulic cement (XXb - where b denotes blended).
 - .1 Type GU or GUb – General use cement.
 - .2 Type MS or MSb – Moderate sulphate-resistant cement.
 - .3 Type MH or MHb – Moderate heat of hydration cement.
 - .4 Type HE or Heb – High early-strength cement.
 - .5 Type LH or LHb – Low heat of hydration cement.
 - .6 Type HS or HSb – High sulphate-resistant cement.
- .2 Fly ash:
 - .1 Type F – with CaO content less than 8%.
 - .2 Type CI – with CaO content ranging from 8 to 20%.
 - .3 Type CH – with CaO greater than 20%.
- .3 GGBFS – Ground, granulated blast-furnace slag.

1.4 DESIGN REQUIREMENTS

- .1 In accordance with CSA-A23.1/A23.2.

1.5 DELIVERY, STORAGE AND HANDLING

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

Part 2 Products

2.1 MATERIALS

- .1 Cement: to CAN/CSA-A3001, Type GU.
- .2 Blended hydraulic cement: Type GU to CAN/CSA-A3001.

- .3 Supplementary cementing materials: with minimum 20% Type F, CI, CH fly ash replacement N, GGBFS, by mass of total cementitious materials to CAN/CSA-A3001.
- .4 Water: to CSA-A23.1.
- .5 Aggregates: to CAN/CSA-A23.1/A23.2.
- .6 Admixtures:
 - .1 Air entraining admixture: to ASTM C260.
 - .2 Chemical admixture: to ASTM C494 and ASTM C1017.
- .7 Curing compound: to CSA-A23.1/A23.2 white and ASTM C309, Type 1-chlorinated rubber or Type 1-D with fugitive dye.
- .8 Premoulded joint fillers:
 - .1 Bituminous impregnated fiber board: to ASTM D1751.
 - .2 Sponge rubber: to ASTM D1752, Type I.
 - .3 Cork: to ASTM D1752.

2.2 MIXES

- .1 Performance Method for specifying concrete: to meet Contractor's Engineer's performance criteria in accordance with CAN/CSA-A23.1/A23.2.
 - .1 Ensure concrete supplier meets performance criteria as established below and provide verification of compliance.
 - .2 Provide concrete mix to meet following plastic state requirements, stipulated on drawings and specifications concerning the following items:
 - .1 Uniformity.
 - .2 Placeability.
 - .3 Workability.
 - .4 Finishability.
 - .5 Set time.
 - .3 Provide concrete mix to meet following hard state requirements, stipulated on drawings and specifications concerning the following items:
 - .1 Durability and class of exposure.
 - .2 Minimum compressive strength.
 - .3 Intended application.
 - .4 Volume stability.
 - .5 Surface texture.
 - .6 Geometrical requirements.
 - .7 Other special requirements.
 - .4 Provide quality management plan to ensure verification of concrete quality to specified performance.
 - .5 Concrete supplier's certification.

Part 3 Execution

3.1 PREPARATION

- .1 Place concrete reinforcing in accordance with Section 03 20 00 – Concrete Reinforcing.
- .2 During concreting operations:
 - .1 Development of cold joints not allowed.
 - .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.
- .3 Ensure reinforcement and inserts are not disturbed during concrete placement.
- .4 Prior to placing of concrete, obtain Contractor's Engineer's approval of proposed method for protection of concrete during placing and curing.
- .5 Protect previous Work from staining.
- .6 Clean and remove stains prior to application for concrete finishes.
- .7 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .8 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.
 - .1 Place steel dowels of deformed steel reinforcing bars and pack solidly with epoxy grout to anchor and hold dowels in positions as indicated.
- .9 Do not place load upon new concrete until authorized by Contractor's Engineer.

3.2 CONSTRUCTION

- .1 Do cast-in-place concrete work in accordance with CSA-A23.1/A23.2.
- .2 Sleeves and inserts:
 - .1 Do not eliminate or displace reinforcement to accommodate hardware.
 - .2 Check locations and sizes of sleeves and openings shown on drawings.
- .3 Anchor bolts:
 - .1 Set anchor bolts to templates under supervision of appropriate trade prior to placing concrete.
 - .2 Grout anchor bolts in preformed holes or holes drilled after concrete has set. Formed holes to be minimum 100 mm diameter. Drilled holes to be minimum 25 mm larger in diameter than bolts used to manufacturers' recommendations.
 - .3 Protect anchor bolt holes from water accumulations, snow and ice build-ups.
 - .4 Set bolts and fill holes with epoxy grout.
 - .5 Locate anchor bolts used in connection with expansion shoes, rollers and rockers with due regard to ambient temperature at time of erection.
- .4 Drainage holes and weep holes:

- .1 Form weep holes and drainage holes in accordance with Section 03 10 00 – Concrete Forming and Accessories. If wood forms are used, remove them after concrete has set.
- .2 Install weep hole tubes and drains as indicated.
- .5 Grout under base plates using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.
- .6 Finishing and curing:
 - .1 Finish concrete in accordance with CSA-A23.1/A23.2.
 - .2 Use curing compounds compatible with applied finish on concrete surfaces. Applied finish on concrete. Provide written declaration that compounds used are compatible.
 - .3 Finish concrete floor to meet requirements of CSA-A23.1/A23.2.
 - .4 Provide screed finish unless otherwise indicated.
 - .5 Rub exposed sharp edges of concrete with carborundum to produce 3 mm radius edges unless otherwise indicated.
- .7 Dampproof membrane:
 - .1 Install dampproof membrane under concrete slabs-on-grade inside building.
 - .2 Lap dampproof membrane minimum 150 mm at joints and seal.
 - .3 Seal punctures in dampproof membrane before placing concrete.
 - .4 Use patching material at least 150 mm larger than puncture and seal.

3.3 SURFACE TOLERANCE

- .1 Concrete tolerance in accordance with CSA-A23.1/A23.2 to tolerance schedule as indicated.

3.4 FIELD QUALITY CONTROL

- .1 Site tests: conduct following tests and submit report to Contractor's Engineer.
 - .1 Concrete pours.
 - .2 Slump tests.
- .2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory for review in accordance with CSA-A23.1/A23.2.
 - .1 Ensure testing laboratory is certified in accordance with CSA A283.
- .3 Ensure test results are distributed for discussion at pre-pouring concrete meeting.
- .4 Non-Destructive Methods for Testing Concrete: in accordance with CSA-A23.1/A23.2.

3.5 VERIFICATION

- .1 Quality Control Plan: ensure concrete supplier meets performance criteria of concrete, and provide verification of compliance.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Use the latest applicable edition of the following references.
- .2 ASTM International Inc.
 - .1 ASTM A36/A36M, Standard Specification for Carbon Structural Steel.
 - .2 ASTM A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature or High-Pressure Service and Other Special Purpose Applications.
 - .3 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .4 ASTM A325, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
 - .5 ASTM A325M, Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength, Metric.
 - .6 ASTM A490M, Standard Specification for High-Strength Steel Structural Bolts, Classes 10.9 and 10.9.3, for Structural Steel Joints, Metric.
- .3 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-85.10, Protective Coatings for Metals.
- .4 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturers Association (CPMA).
 - .1 Handbook of the Canadian Institute of Steel Construction.
 - .2 CISC/CPMA Standard 2-75, Quick-Drying Primer for use on Structural Steel.
- .5 Canadian Standards Association (CSA International)
 - .1 CSA G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
 - .2 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
 - .3 CAN/CSA-S16, Limit States Design of Steel Structures.
 - .4 CAN/CSA-S136, North American Specifications for the Design of Cold Formed Steel Structural Members.
 - .5 CSA W47.1, Certification of Companies for Fusion Welding of Steel.
 - .6 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.
 - .7 CSA W55.3, Resistance Welding Qualification Code for Fabricators of Structural Members Used in Buildings.
 - .8 CSA W59, Welded Steel Construction (Metal Arc Welding).
- .6 Master Painters Institute
 - .1 MPI-INT 5.1, Structural Steel and Metal Fabrications.
 - .2 MPI-EXT 5.1, Structural Steel and Metal Fabrications.

- .7 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE) International
 - .1 NACE No. 3/SSPC SP-6, Commercial Blast Cleaning.

Part 2 Products

2.1 DESIGN REQUIREMENTS

- .1 Design details and connections in accordance with requirements of CAN/CSA-S16 and CAN/CSA-S136 with CSA-S136.1 to resist forces, moments, shears and allow for movements indicated.
- .2 Shear connections:
 - .1 Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction" when connection for shear only (standard connection) is required.
 - .2 Select or design connections to support reaction from maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam, when shears are not indicated.
- .3 For composite construction select or design minimum end connection to resist reaction resulting from factored movement resistance as tabulated in the "Handbook of the Canadian Institute of Steel Construction" assuming 100% shear connection with depth of steel deck and/or slab shown on drawings.
- .4 Submit sketches and design calculations stamped and signed by qualified professional engineer licensed in Province of Ontario, Canada for non standard connections.

2.2 MATERIALS

- .1 Structural steel: to CSA-G40.20/G40.21, Grade as indicated and CAN/CSA-S136.
- .2 Anchor bolts: to CSA-G40.20/G40.21, Grade 300W.
- .3 High strength anchor bolts: to ASTM A193/A193M.
- .4 Bolts, nuts and washers: to ASTM A325.
- .5 Welding materials: to CSA W48 Series and CSA W59 and certified by Canadian Welding Bureau.
- .6 Shop paint primer: to CISC/CPMA2-75 solvent reducible alkyd, grey oxide.
- .7 Hot dip galvanizing: galvanize steel, where indicated, to CAN/CSA-G164, minimum zinc coating of 600 g/m².

2.3 FABRICATION

- .1 Fabricate structural steel in accordance with CAN/CSA-S16 and in accordance with approved shop drawings.

- .2 Continuously seal members by continuous welds where indicated.

2.4 SHOP PAINTING

- .1 Clean, prepare surfaces and shop prime structural steel in accordance with CAN/CSA-S16 except where members to be encased in concrete.
- .2 Clean members, remove loose mill scale, rust, oil, dirt and foreign matter. Prepare surface according to NACE No.3/SSPC-SP-6.
- .3 Apply one coat of primer in shop to steel surfaces to achieve minimum dry film thickness of 1.5 to 2.0 mils, except:
 - .1 Surfaces to be encased in concrete.
 - .2 Surfaces to receive field installed stud shear connections.
 - .3 Surfaces and edges to be field welded.
 - .4 Faying surfaces of slip-critical connections.
 - .5 Below grade surfaces in contact with soil.
- .4 Apply paint under cover, on dry surfaces when surface and air temperatures are above 5 degrees C.
- .5 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.
- .6 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

Part 3 Execution

3.1 APPLICATION

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

3.2 GENERAL

- .1 Structural steel work: in accordance with CAN/CSA-S16.
- .2 Welding: in accordance with CSA W59.
- .3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

3.3 CONNECTION TO EXISTING WORK

- .1 Verify dimensions and condition of existing work, coordinate discrepancies and potential problem areas before commencing fabrication.

3.4 ERECTION

- .1 Erect structural steel, in accordance with CAN/CSA-S16 and in accordance with approved erection drawings.

- .2 Field cutting or altering structural members: to approval of Contractor's Engineer.
- .3 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.
- .4 Continuously seal members by continuous welds Grind smooth.

3.5 FIELD QUALITY CONTROL

- .1 Submit test reports to Departmental Representative within 2 weeks of completion of inspection.

3.6 FIELD PAINTING

- .1 Touch up damaged surfaces and surfaces without shop coat with primer to NACE No.3/SSPC-SP-6 except as specified otherwise. Apply in accordance: MPI Architectural Painting Specification Manual.

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A53/A53M-02, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Stainless.
 - .2 ASTM A307-02, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
- .2 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).

1.2 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 Steel sections and plates: to CAN/CSA-G40.20/G40.21.
- .2 Steel pipe: to ASTM A53/A53M.
- .3 Welding materials: to CSA W59.
- .4 Welding electrodes: to CSA W48 Series.
- .5 Bolts and anchor bolts: to ASTM A307.
- .6 Grout: non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

2.2 FINISHES

- .1 Galvanizing: hot dipped galvanizing with zinc coating 600 g/m² to CAN/CSA-G164.

2.3 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 Make field connections with bolts to CAN/CSA-S16.1, or weld.
- .3 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.
- .4 Touch-up galvanized surfaces with zinc rich primer where burned by field welding.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 01 74 21 – Construction/Demolition Waste Management and Disposal.
- .2 Section 03 30 00 – Cast-in-Place Concrete.

1.2 REFERENCES

- .1 Use the latest applicable edition to the following references.
- .2 American National Standards Institute/National Association of Architectural Metal Manufacturers (ANSI/NAAMM)
 - .1 ANSI/NAAMM MBG531, Metal Bar Grating Manual.
- .3 American Society for Testing and Materials International, (ASTM)
 - .1 ASTM A53/A53M, Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A307, Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .3 ASTM A325M, Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.40, Anti-corrosive Structural Steel Alkyd Primer.
 - .2 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating.
 - .3 CAN/CSA-G40.20/G40.21, General Requirements for Rolled or Welded Structural Quality Steel.
 - .4 CAN/CSA-G164, Hot Dip Galvanizing of Irregularly Shaped Articles.
- .5 Canadian Standards Association (CSA International)
 - .1 CSA W59, Welded Steel Construction (Metal Arc Welding/Imperial Version).
- .6 National Association of Architectural Metal Manufactures (NAAMM)
 - .1 AMP 510, Metal Stair Manual.
- .7 Steel Structures Painting Council (SSPC), Systems and Specifications Manual, Volume 2.

1.3 SYSTEM DESCRIPTION

- .1 Design Requirements:
- .2 Design metal stair, balustrade and landing construction and connections to NBC vertical and horizontal live load requirements.
- .3 Detail and fabricate stairs to NAAMM Metal Stairs Manual.

1.4 SUBMITTALS

- .1 Shop Drawings
 - .1 Indicate construction details, sizes of steel sections and thickness of steel sheet.

- .2 Submit shop drawing bearing stamp of a qualified professional engineer registered in Province of Ontario.

1.5 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.

1.6 WASTE MANAGEMENT AND DISPOSAL

- .1 Separate and recycle waste materials in accordance with Section 01 74 21 – Construction/ Demolition Waste Management and Disposal.

Part 2 Products

2.1 MATERIALS

- .1 Steel sections: to CAN/CSA-G40.20/G40.21 Grade 300 W for L and C sections
- .2 Steel plate: to CAN/CSA-G40.20/G40.21, Grade 300 W
- .3 Steel pipe: to ASTM A53/A53M, standard weight, schedule 40 seamless black.
- .4 Steel tubing: to CAN/CSA-G40.20/G40.21, Grade 350 W.
- .5 Metal bar grating: to ANSI/NAAMM MBG 531
- .6 Welding materials: to CSA W59.
- .7 Bolts: to ASTM A307.
- .8 High strength bolts: to ASTM A325M.

2.2 FABRICATION

- .1 Fabricate to NAAMM, Metal Stair Manual.
- .2 Weld connections where possible, otherwise bolt connections. Countersink exposed fastenings, cut off bolts flush with nuts. Make exposed connections of same material, colour and finish as base material on which they occur.
- .3 Accurately form connections with exposed faces flush; mitres and joints tight. Make risers of equal height.
- .4 Grind or file exposed welds and steel sections smooth.
- .5 Shop fabricated stairs in sections as large and complete as practicable.

2.3 SHOP PAINTING

- .1 Clean surfaces in accordance with Steel Structures Painting Council Manual Volume 2.
- .2 Apply one coat of shop primer except interior surfaces of pans.
- .3 Apply two coats of primer of different colours to parts inaccessible after final assembly.
- .4 Use primer as prepared by manufacturer without thinning or adding admixtures. Paint on dry surfaces, free from rust, scale, grease, do not paint when temperature is below 7 degrees C.

- .5 Do not paint surfaces to be field welded.

Part 3 Execution

3.1 INSTALLATION OF STAIRS

- .1 Install in accordance with NAAMM, Metal Stair Manual.
- .2 Install plumb and true in exact locations, using welded connections wherever possible to provide rigid structure. Provide anchor bolts, bolts and plates for connecting stairs to structure.
- .3 Hand items over for casting into concrete or building into masonry to appropriate trades together with setting templates.
- .4 Do welding work in accordance with CSA W59 unless specified otherwise.
- .5 Touch up shop primer to bolts, welds, and burned or scratched surfaces at completion of erection.

3.2 CLEANING

- .1 Perform cleaning as soon as possible 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 REFERENCES

- .1 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A606-04, Standard Specification for Steel, Sheet and Strip, High-Strength, Low-Alloy, Hot-Rolled and Cold-Rolled, with Improved Atmospheric Corrosion Resistance.
 - .2 ASTM A653/A653M-07, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
 - .3 ASTM A792/A792M-06a, Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
 - .4 ASTM B32-04, Standard Specification for Solder Metal.
 - .5 ASTM B370-03, Standard Specification for Copper Sheet and Strip for Building Construction.
 - .6 ASTM D523-89(1999), Standard Test Method for Specular Gloss.
 - .7 ASTM D822-01(2006), Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.
- .2 Canadian Roofing Contractors Association (CRCA)
 - .1 Roofing Specifications Manual 1997.
- .3 Canadian Copper in Architecture Design Handbook
- .4 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-51.32-M77, Sheathing, Membrane, Breather Type.
- .5 Canadian Standards Association (CSA International)
 - .1 CSA A123.3-05, Asphalt Saturated Organic Roofing Felt.

Part 2 Products

2.1 SHEET METAL MATERIALS

- .1 Copper sheet: to ASTM B370.
- .2 Zinc sheet: to ASTM A918-06
- .3 Zinc coated steel sheet: commercial quality to ASTM A653/A653M, with Z275 designation zinc coating.
- .4 Aluminum-zinc alloy coated steel sheet: to ASTM A792/A792M.
- .5 Stainless steel sheet: to ASTM A167 and ASTM A240/A240M.

2.2 FABRICATION

- .1 Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details and the Copper in Architecture Design Handbook.
- .2 Fabricate aluminum flashings and other sheet aluminum work in accordance with AAI-Aluminum Sheet Metal Work in Building Construction.

2.3 METAL FLASHINGS

- .1 Form exterior flashings, copings and fascias to profiles indicated of lead coated copper or zinc.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install sheet metal work in accordance with CRCA FL series details, Aluminum Sheet Metal Work in Building Construction and the Copper in Architecture Design Handbook. Use concealed fastenings except where approved before installation.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 Section 07 84 00 Firestopping

1.2 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .2 Underwriter's Laboratories of Canada (ULC)
 - .1 CAN-ULC-S101-04, Standard Methods of fire Endurance Tests of Building Construction and Materials.
 - .2 CAN-ULC-S102-03, Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 SUBMITTALS

- .1 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control, when requested.
 - .1 Test Reports:
 - .1 Submit product data including certified copies of test reports verifying fireproofing applied to substrate as constructed on project will meet or exceed requirements of Specification.
 - .2 Submit test results in accordance with CAN-ULC-S101 for fire endurance and CAN-ULC-S102 for surface burning characteristics.
 - .3 For assemblies not tested and rated, submit proposals based on related designs using accepted fireproofing design criteria.
 - .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 and cleaning procedures.

1.4 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Installer: company person specializing in sprayed-on fireproofing and licenced/approved by manufacturer.

Part 2 Products

2.1 MATERIALS

- .1 Sprayed fireproofing: ULC certified cementitious or asbestos-free mineral fibre fireproofing qualified for use in ULC Designs specified and fungus resistant for 28 days.

- .2 Curing compound: type recommended by fireproofing manufacturer, qualified for use in ULC Designs specified.
- .3 Sealer: type recommended by fireproofing manufacturer, qualified for use in ULC Design specified.
 - .1 Colour: green
- .4 Fireproofing: minimum dry density and cohesion/adhesion properties as follows:
 - .1 Fireproofing for structural components concealed above ceiling, or within wall, chase, or furred space: minimum average applied dry density of 240 kg per cubic meter and cohesion/adhesion strength of 9.57 kPa.
 - .2 Fireproofing for exposed structural components, except where otherwise specified or indicated: minimum applied dry density of 350 kg per cubic meter and cohesion/adhesion strength of 20.83 kPa.
 - .3 Fireproofing for structural components located in mechanical rooms and storage areas: minimum applied dry density of 640 kg per cubic meter and cohesion/adhesion strength of 350 kPa.
 - .4 Ensure spray-applied fireproofing: does not crack, spall or delaminate under downward deflection conditions over 3 m clear span.
 - .5 Minimum compressive strength: 48 kPa.
 - .6 Spray-Applied fireproofing material: not contribute to corrosion of test panels.
 - .7 Dust removal: not exceed 0.25 gram per square meter.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 FIELD QUALITY CONTROL

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

END OF SECTION

Part 1 General

1.1 REFERENCES

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .2 Underwriter's Laboratories of Canada (ULC)
 - .1 ULC-S115-1995, Fire Tests of Fire stop Systems.

1.2 DEFINITIONS

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

1.3 SUBMITTALS

- .1 Quality assurance submittals: submit following in accordance with Section 01 45 00 - Quality Control, when requested.
 - .1 Test reports: in accordance with CAN-ULC-S101 for fire endurance and CAN-ULC-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.

1.4 QUALITY ASSURANCE

- .1 Qualifications:

- .1 Installer: company specializing in fire stopping installations and licenced/approved by manufacturer.

Part 2 Products

2.1 MATERIALS

- .1 Fire stopping and smoke seal systems: in accordance with CAN-ULC-S115.
 - .1 Asbestos-free materials and systems capable of maintaining effective barrier against flame, smoke and gases in compliance with requirements of CAN-ULC-S115 and not to exceed opening sizes for which they are intended.
- .2 Service penetration assemblies: systems tested to CAN-ULC-S115.
- .3 Service penetration fire stop components: certified by test laboratory to CAN-ULC-S115.
- .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 (if applicable): 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 MANUFACTURER'S INSTRUCTIONS

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 01 35 43 - Health and Safety Requirements.
- .2 01 45 00 - Quality Control.
- .3 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .4 01 78 00 - Closeout Submittals.
- .5 23 05 93 - Testing, Adjusting and Balancing for HVAC.

1.2 SUBMITTALS

- .1 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
 - .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.

- .6 Approvals:
 - .1 Submit two (2) copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
 - .2 Make changes as required and re-submit as directed by Departmental Representative.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

1.4 MAINTENANCE

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals.
- .2 Provide one (1) set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Execution

2.1 PAINTING REPAIRS AND RESTORATION

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

2.2 CLEANING

- .1 Clean interior and exterior of all systems including strainers

2.3 DEMONSTRATION

- .1 Trial usage to apply to all equipment and systems.
- .2 Supply tools, equipment and personnel to demonstrate and instruct operating and maintenance personnel in operating, controlling, adjusting, trouble-shooting and servicing of all systems and equipment during regular work hours, prior to acceptance.

- .3 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .4 Instruction duration time requirements as specified in appropriate sections.

2.4 PROTECTION

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 01 35 29 - Health and Safety Requirements.
- .2 01 61 00 - Common Product Requirements.
- .3 01 74 11 – Cleaning.
- .4 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.2 REFERENCES

Use the latest applicable edition of the following references.

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ANSI/ASHRAE 90.1-SI Edition, Energy Standard for Buildings except Low-Rise Residential Buildings.
- .2 ASTM International Inc.
 - .1 ASTM C335, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .2 ASTM C449/C449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .3 ASTM C533, Standard Specification for Calcium Silicate Block and Pipe Thermal Insulation.
 - .4 ASTM C547, Standard Specification for Mineral Fiber Pipe Insulation.
 - .5 ASTM C553, Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications.
 - .6 ASTM C612, Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
 - .7 ASTM C795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .8 ASTM C921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52MA, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.
 - .2 CAN/CGSB 51.53, Poly (Vinyl Chloride) Jacketing Sheet, for Insulated Pipes, Vessels and Round Ducts.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

- .5 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1168, Adhesive and Sealant Applications.
- .6 Thermal Insulation Association of Canada (TIAC)
 - .1 National Insulation Standards.
- .7 Underwriters Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for insulation and adhesives include product characteristics, performance criteria, physical size, finish and limitations.
- .2 Samples:
 - .1 Provide for approval by Contractor's Engineer: complete assembly of each type of insulation system, insulation, coating, and adhesive proposed.
 - .1 Mount sample on 12 mm plywood board.
 - .2 Affix typewritten label beneath sample indicating service.
- .3 Manufacturer's Instructions:
 - .1 Include procedures to be used and installation standards to be achieved.

Part 2 Products

2.1 FIRE AND SMOKE RATING

- .1 Fire and smoke ratings to CAN/ULC-S102:
 - .1 Maximum flame spread rating: 25.
 - .2 Maximum smoke developed rating: 50.

2.2 INSULATION

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

- .1 Mineral fibre: ASTM C547.
- .2 Jacket: to CGSB 51-GP-52MA.
- .3 Maximum "k" factor: ASTM C547.
- .5 TIAC Code C-1: rigid mineral fibre board, unfaced.
 - .1 Mineral fibre: ASTM C612.
 - .2 Maximum "k" factor: ASTM C612.
- .6 TIAC Code C-4: rigid mineral fibre board faced with factory applied vapour retarder jacket.
 - .1 Mineral fibre: ASTM C612.
 - .2 Jacket: to CGSB 51-GP-52MA.
 - .3 Maximum "k" factor: ASTM C612.
- .7 TIAC Code C-2: mineral fibre blanket unfaced or faced with factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
 - .1 Mineral fibre: ASTM C553.
 - .2 Jacket: to CGSB 51-GP-52MA.
 - .3 Maximum "k" factor: ASTM C553.
- .8 TIAC Code A.6: flexible unicellular tubular elastomer.
 - .1 Insulation: with vapour retarder jacket.
 - .2 Jacket: to CGSB 51-GP-52MA.
 - .3 Maximum "k" factor.
 - .4 Certified by manufacturer free of potential stress corrosion cracking corrodents.
- .9 TIAC Code A-2: rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.
 - .1 Insulation: ASTM C533.
 - .2 Maximum "k" factor: ASTM C533.
 - .3 Design to permit periodic removal and re-installation.

2.3 CEMENT

- .1 Thermal insulating and finish
 - .1 To: ASTM C449/C449M.
 - .2 Hydraulic setting or Air drying on mineral wool, to ASTM C449.

2.4 JACKETS

- .1 Aluminum:
 - .1 To ASTM B209.
 - .2 Thickness: 0.50 mm sheet.
 - .3 Finish: smooth.
 - .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, 0.5mm thick at 300 mm spacing.

2.5 INSULATION SECUREMENTS

- .1 Tape: self-adhesive, aluminum, reinforced, 50 mm wide minimum.
- .2 Contact adhesive: quick setting.
 - .1 Maximum VOC limit 250 g/L to SCAQMD Rule 1168 and GSES GS-36.
- .3 Canvas adhesive: washable.
 - .1 Maximum VOC limit 80 g/L to SCAQMD Rule 1168 and GSES GS-36.
- .4 Tie wire: 1.5 mm diameter stainless steel.
- .5 Bands: Stainless steel, 19 mm wide, 0.5 mm thick.
- .6 Facing: 25 mm galvanized steel hexagonal wire mesh on both faces of insulation.
- .7 Fasteners: 4 mm diameter pins with 35 mm diameter clips. Length of pin to suit thickness of insulation.

2.6 VAPOUR RETARDER LAP ADHESIVE

- .1 Water based, fire retardant type, compatible with insulation.
 - .1 Maximum VOC limit 80 g/L to SCAQMD Rule 1168 and GSES GS-36.

2.7 INDOOR VAPOUR RETARDER FINISH

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

2.8 OUTDOOR VAPOUR RETARDER MASTIC

- .1 Vinyl emulsion type acrylic, compatible with insulation.
- .2 Reinforcing fabric: Fibrous glass, untreated 305 g/m².

Part 3 Execution

3.1 APPLICATION

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

3.2 PRE- INSTALLATION REQUIREMENTS

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

3.3 INSTALLATION

- .1 Install in accordance with TIAC National Standards
 - .1 Hot equipment: To TIAC code 1503-H.
 - .2 Cold equipment: to TIAC code 1503-C.
- .2 Elastomeric Insulation: to remain dry. Overlaps to manufacturer's instructions. Joints tight and sealed properly.
- .3 Provide vapour retarder as recommended by manufacturer.
- .4 Apply materials in accordance with insulation and equipment manufacturer's instructions and this specification.
- .5 Use two layers with staggered joints when required nominal wall thickness exceeds 75 mm.
- .6 Maintain uninterrupted continuity and integrity of vapour retarder jacket and finishes.
 - .1 Hangers, supports outside vapour retarder jacket.
- .7 Supports, Hangers:
 - .1 Apply high compressive strength insulation, suitable for service, at oversized saddles and shoes where insulation saddles have not been provided.

3.4 REMOVABLE, PRE-FABRICATED, INSULATION AND ENCLOSURES

- .1 Application: At expansion joints, valves, primary flow measuring elements flanges and unions at equipment.
- .2 Installation to permit movement of expansion joint and to permit periodic removal and replacement without damage to adjacent insulation.

3.5 EQUIPMENT INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 Hot Equipment:
 - .1 TIAC code A-1 with mechanical fastenings or wire or bands and 13 mm cement reinforced with one layer of reinforcing mesh.
 - .2 Thicknesses:
 - Heat exchangers 50 mm

- .3 Breechings:
 - .1 TIAC code A-2 with 25 mm air gap, mechanical fastenings and 13 mm cement reinforced with one layer of reinforcing mesh.
- .4 Finishes:
 - .1 Equipment in mechanical rooms: TIAC code CEF/1 with jacket.
 - .2 Equipment elsewhere: TIAC code CEF/2 with 13 mm cement jacket.

3.6 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Thermal insulation for piping and piping accessories in commercial type applications.
 - .2 Sustainable requirements for construction and verification.
- .3 Related Sections:
 - .1 01 35 29 - Health and Safety Requirements.
 - .2 01 61 00 - Common Product Requirements.
 - .3 01 74 11 – Cleaning.
 - .4 01 74 21 - Construction/Demolition Waste Management and Disposal.

1.2 REFERENCES

Use the latest applicable edition of the following references.

- .1 American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE)
 - .1 ASHRAE Standard 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA co-sponsored; ANSI approved; Continuous Maintenance Standard).
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM B209M, Standard Specification for Aluminum and Aluminum Alloy Sheet and Plate [Metric].
 - .2 ASTM C335, Standard Test Method for Steady State Heat Transfer Properties of Horizontal Pipe Insulation.
 - .3 ASTM C411, Standard Test Method for Hot-Surface Performance of High-Temperature Thermal Insulation.
 - .4 ASTM C449/C449M, Standard Specification for Mineral Fiber-Hydraulic-Setting Thermal Insulating and Finishing Cement.
 - .5 ASTM C533, Calcium Silicate Block and Pipe Thermal Insulation.
 - .6 ASTM C547, Mineral Fiber Pipe Insulation.
 - .7 ASTM C795, Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel.
 - .8 ASTM C921, Standard Practice for Determining the Properties of Jacketing Materials for Thermal Insulation.
- .3 Canadian General Standards Board (CGSB)
 - .1 CGSB 51-GP-52Ma, Vapour Barrier, Jacket and Facing Material for Pipe, Duct and Equipment Thermal Insulation.

- .2 CAN/CGSB-51.53, Poly (Vinyl Chloride) Jacketting Sheet, for Insulated Pipes, Vessels and Round Ducts
- .4 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Assessment Act (CEAA), c. 37.
 - .2 Canadian Environmental Protection Act (CEPA), c. 33.
 - .3 Transportation of Dangerous Goods Act (TDGA), c. 34.
- .5 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .6 Manufacturer's Trade Associations
 - .1 Thermal Insulation Association of Canada (TIAC): National Insulation Standards.
- .7 Underwriters' Laboratories of Canada (ULC)
 - .1 CAN/ULC-S102, Surface Burning Characteristics of Building Materials and Assemblies.
 - .2 CAN/ULC-S701, Thermal Insulation, Polystyrene, Boards and Pipe Covering.
 - .3 CAN/ULC-S702, Thermal Insulation, Mineral Fibre, for Buildings
 - .4 CAN/ULC-S702.2, Thermal Insulation, Mineral Fibre, for Buildings, Part 2: Application Guidelines.

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 specified.
- .2 TIAC ss:
 - .1 CRF: Code Rectangular Finish.
 - .2 CPF: Code Piping Finish.

1.4 SUBMITTALS

- .1 Product Data:
 - .1 Submit manufacturer's printed product literature, specifications and datasheet. Include product characteristics, performance criteria, and limitations.
- .2 Quality assurance submittals:
 - .1 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
 - .2 Instructions: submit manufacturer's installation instructions.
 - .1 Contractor will make available one (1) copy of systems supplier's installation instructions.

1.5 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

1.6 DELIVERY, STORAGE AND HANDLING

- .1 Storage and Protection:
 - .1 Protect from weather, construction traffic.
 - .2 Protect against damage.
 - .3 Store at temperatures and conditions required by manufacturer.

Part 2 Products

2.1 Application

- .1 For use on indoor piping only.

2.2 FIRE AND SMOKE RATING

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

2.3 INSULATION

- .1 Mineral fibre specified includes glass fibre, rock wool, slag wool.
- .2 Thermal conductivity ("k" factor) not to exceed specified values at 24 degrees C mean temperature when tested in accordance with ASTM C335.
- .3 TIAC Code A-1: rigid moulded mineral fibre without factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702 and ASTM C547.
 - .2 Maximum "k" factor: to CAN/ULC-S702.
- .4 TIAC Code A-3: rigid moulded mineral fibre with factory applied vapour retarder jacket.
 - .1 Mineral fibre: to CAN/ULC-S702 and ASTM C547.
 - .2 Jacket: to CGSB 51-GP-52Ma.
 - .3 Maximum "k" factor: to CAN/ULC-S702 and ASTM C547.
- .5 TIAC Code C-2: mineral fibre blanket faced without factory applied vapour retarder jacket (as scheduled in PART 3 of this section).
 - .1 Mineral fibre: to CAN/ULC-S702 and ASTM C547.
 - .2 Jacket: to CGSB 51-GP-52Ma.

- .3 Maximum "k" factor: to CAN/ULC-S702 and ASTM C547.
- .6 TIAC Code A-2: rigid moulded calcium silicate in sections and blocks, and with special shapes to suit project requirements.
 - .1 Insulation: to ASTM C533.
 - .2 Design to permit periodic removal and re-installation.

2.4 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.

2.5 CEMENT

- .1 Thermal insulating and finishing cement:
 - .1 Air drying on mineral wool, to ASTM C449/C449M.

2.6 VAPOUR RETARDER LAP ADHESIVE

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

2.7 INDOOR VAPOUR RETARDER FINISH

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

2.8 JACKETS.

- .1 Aluminum:
 - .1 To ASTM B209.
 - .2 Thickness: 0.50 mm sheet.
 - .3 Finish: stucco 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.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 PRE-INSTALLATION REQUIREMENT

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

3.3 INSTALLATION

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

3.4 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: aluminum.

3.5 INSTALLATION OF ELASTOMERIC INSULATION

- .1 Insulation to remain dry. Overlap to manufacturer's instructions. Ensure tight joints.
- .2 Provide vapour retarder as recommended by manufacturer.

3.6 PIPING INSULATION SCHEDULES

- .1 Includes valves, valve bonnets, strainers, flanges and fittings unless otherwise specified.
- .2 TIAC Code: A-1.
 - .1 Securements: SS bands at 300 mm on centre.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code 1501-H.
- .3 TIAC Code: A-3.
 - .1 Securements: SS bands at 300 mm on centre.
 - .2 Seals: VR lap seal adhesive, VR lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .4 TIAC Code: C-2 without vapour retarder jacket.
 - .1 Insulation securements: SS bands at 300 mm on centre.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-C.
- .5 TIAC Code: A-2.
 - .1 Insulation securements: SS bands at 300 mm on centre.
 - .2 Seals: lap seal adhesive, lagging adhesive.
 - .3 Installation: TIAC Code: 1501-H.
- .6 Thickness of insulation as listed in following table.
 - .1 Run-outs to individual units and equipment not exceeding 4000 mm long.
 - .2 Do not insulate exposed runouts to plumbing fixtures, chrome plated piping, valves, fittings.

Applica- tion	Temp degrees C	TIAC code	Pipe sizes (NPS) and insulation thickness (mm)					
			Run out	to 1	1 1/4 to 2	2 1/2 to 4	5 to 6	8 & over
LTHW	up to 175	A-1	38	50	65	75	90	90

- .7 Finishes:

- .1 Exposed indoors: aluminum or SS jacket.
- .2 Exposed in mechanical rooms: aluminum or SS jacket.
- .3 Concealed, indoors: canvas on valves, fittings. No further finish.
- .4 Use vapour retarder jacket on TIAC code A-3 insulation compatible with insulation.
- .5 Finish attachments: SS screws and bands, at 150 mm on centre. Seals: wing or closed.
- .6 Installation: to appropriate TIAC code CRF/1 through CPF/5.

3.7 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 01 35 29 - Health and Safety Requirements.
- .2 01 45 00 - Quality Control.
- .3 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .4 01 78 00 - Closeout Submittals.
- .5 23 05 93 - Testing, Adjusting and Balancing for HVAC.

1.2 SUBMITTALS

- .1 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
 - .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
 - .6 Approvals:

- .1 Submit two (2) copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
- .2 Make changes as required and re-submit as directed by Departmental Representative.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 As-built drawings:
 - .1 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .9 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 MAINTENANCE

- .1 Furnish spare parts in accordance with Section 01 78 00 - Closeout Submittals as follows:
 - .1 One set of packing for each pump.
 - .2 One casing joint gasket for each size pump.
 - .3 One glass for each gauge glass.
- .2 Provide one set of special tools required to service equipment as recommended by manufacturers and in accordance with Section 01 78 00 - Closeout Submittals.
- .3 Furnish one commercial quality grease gun, grease and adapters to suit different types of grease and grease fittings.

Part 2 Products

2.1 N/A

Part 3 Execution

3.1 PAINTING REPAIRS AND RESTORATION

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

3.2 CLEANING

- .1 Clean interior and exterior of all systems including strainers.

3.3 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests in accordance with Section 01 45 00 - Quality Control and submit report as described in PART 1 - SUBMITTALS.

3.4 DEMONSTRATION

- .1 Contractor's Engineer will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Trial usage to apply to all equipment and systems.
- .3 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.
- .4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.

3.5 PROTECTION

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

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 01 78 00 - Closeout Submittals.
- .2 01 91 13 - General Commissioning (Cx) Requirements.
- .3 21 05 01 - Common Work Results for Mechanical.
- .4 23 05 05 - Installation of Pipe work.
- .5 23 05 23 01 - Valves – Bronze.
- .6 23 05 23 02 - Valves - Cast Iron.
- .7 23 05 93 - Testing, Adjusting and Balancing for HVAC.

1.2 REFERENCES

Use the latest applicable edition of the following references.

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers International (ASME)
 - .1 ANSI/ASME B16.15, Cast Bronze Threaded Fittings, Classes 125 and 250.
 - .2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.
 - .3 ANSI/ASME B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 - .4 ANSI/ASME B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings, Class 150, 300, 400, 600, 900, 1500 and 2500.
- .2 ASTM International Inc.
 - .1 ASTM A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
 - .2 ASTM A536, Standard Specification for Ductile Iron Castings.
 - .3 ASTM B88M, Standard Specification for Seamless Copper Water Tube (Metric).
- .3 American National Standards Institute/American Water Works Association (ANSI)/(AWWA)
 - .1 ANSI/AWWA C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.
- .5 Department of Justice Canada (Jus)

- .1 Canadian Environmental Protection Act, c. 33 (CEPA).
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .7 Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS).
 - .1 MSS-SP-70, Gray Iron Gate Valves, Flanged and Threaded Ends.
 - .2 MSS-SP-71, Gray Iron Swing Check Valves, Flanged and Threaded Ends.
 - .3 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.
- .8 National Research Council (NRC)/Institute for Research in Construction
 - .1 NRCC 38728, National Plumbing Code of Canada (NPC).
- .9 Transport Canada (TC)
 - .1 Transportation of Dangerous Goods Act, c. 34 (TDGA).

Part 2 Products

2.1 PIPING

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

2.2 FITTINGS

- .1 Bronze pipe flanges and flanged fittings, Class 150: to ANSI/ASME B16.24.
- .2 Cast bronze threaded fittings, Class 125: to ANSI/ASME B16.15.
- .3 Cast copper, solder type: to ANSI/ASME B16.18.
- .4 Wrought copper and copper alloy, solder type: to ANSI/ASME B16.22.
- .5 NPS 2 and larger: ANSI/ASME B16.18 or ANSI/ASME B16.22 roll grooved to CSA B242.
- .6 NPS 1 1/2 and smaller: wrought copper to ANSI/ASME B16.22; with 301 stainless steel internal components and EPDM seals. Suitable for operating pressure to 1380 kPa.

2.3 JOINTS

- .1 Rubber gaskets, latex-free 1.6 mm thick: to AWWA C111.
- .2 Bolts, nuts, hex head and washers: to ASTM A307, heavy series.
- .3 Solder: 95/5.

- .4 Teflon tape: for threaded joints.
- .5 Grooved couplings: designed with angle bolt pads to provide rigid joint, complete with EPDM gasket.
- .6 Dielectric connections between dissimilar metals: dielectric fitting, complete with thermoplastic liner.

2.4 GATE VALVES

- .1 NPS 2 and under, soldered:
 - .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 - Valves - Bronze.
- .2 NPS 2 and under, screwed:
 - .1 Rising stem: to MSS-SP-80, Class 125, 860 kPa, bronze body, screw-in bonnet, solid wedge disc as specified Section 23 05 23.01 - Valves - Bronze.
- .3 NPS 2 1/2 and over, in mechanical rooms, flanged:
 - .1 Rising stem: to MSS-SP-70, Class 125, 860 kPa, flat flange faces, cast-iron body, OS&Y bronze trim specified Section 23 05 23.02 - Valves - Cast Iron.

2.5 GLOBE VALVES

- .1 NPS2 and under, soldered:
 - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, renewable composition disc, screwed over bonnet as specified Section 23 05 23.01 - Valves - Bronze.
 - .2 Lock shield handles: as required.
- .2 NPS 2 and under, screwed:
 - .1 To MSS-SP-80, Class 150, 1 MPa, bronze body, screwed over bonnet, renewable composition disc as specified Section 23 05 23.01 - Valves - Bronze.
 - .2 Lock shield handles: as required.

2.6 SWING CHECK VALVES

- .1 NPS 2 and under, soldered:
 - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 - Valves - Bronze.
- .2 NPS 2 and under, screwed:
 - .1 To MSS-SP-80, Class 125, 860 kPa, bronze body, bronze swing disc, screw in cap, regrindable seat as specified Section 23 05 23.01 - Valves - Bronze.
- .3 NPS 2 1/2 and over, flanged:
 - .1 To MSS-SP-71, Class 125, 860 kPa, cast iron body, flat flange faces, renewable seat, bronze disc, bolted cap specified Section 23 05 23.02 - Valves - Cast Iron: Gate, Globe, Check.

2.7 BALL VALVES

- .1 NPS 2 and under, screwed:
 - .1 Class 150.
 - .2 Bronze body, chrome plated brass ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle as specified Section 23 05 23.01 - Valves - Bronze.
- .2 NPS 2 and under, soldered:
 - .1 To ANSI/ASME B16.18, Class 150.
 - .2 Bronze body, chrome plated brass ball, PTFE adjustable packing, brass gland and PTFE seat, steel lever handle, with NPT to copper adaptors as specified Section 23 05 23.01 - Valves - Bronze.

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

- .1 Install in accordance with NPC and Province Plumbing Code and local authority having jurisdiction.
- .2 Install pipe work in accordance with Section 23 05 05 - Installation of Pipe work, supplemented as specified herein.
- .3 Assemble piping using fittings manufactured to ANSI standards.
- .4 Install CWS piping below and away from HWS and HWC and other hot piping so as to maintain temperature of cold water as low as possible.
- .5 Connect to fixtures and equipment in accordance with manufacturer's written instructions unless otherwise indicated.
- .6 Buried tubing:
 - .1 Lay in well compacted washed sand in accordance with AWWA Class B bedding.
 - .2 Bend tubing without crimping or constriction. Minimize use of fittings.

3.3 VALVES

- .1 Isolate equipment, fixtures and branches with gate or ball valves.

3.4 PRESSURE TESTS

- .1 Conform to requirements of Section 21 05 01 - Common Work Results for Mechanical.
- .2 Test pressure: greater of 1 time maximum system operating pressure or 860 kPa.

3.5 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 air chambers, expansion compensators are installed properly.

3.6 START-UP

- .1 Timing: start up after:
 - .1 Pressure tests have been completed.
 - .2 Certificate of static completion has been issued.
- .2 Provide continuous supervision during start-up.

3.7 PERFORMANCE VERIFICATION

- .1 Reports:
 - .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Reports, using report forms as specified in Section 01 91 13 - General Commissioning (Cx) 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.

3.8 OPERATION REQUIREMENTS

- .1 Co-ordinate operation and maintenance requirements including, cleaning and maintenance of specified materials and products with Section 23 05 05 - Installation of Pipe work.
- .2 Operation, include:
 - .1 Cleaning materials and schedules.
 - .2 Repair and maintenance materials and instructions.

3.9 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 01 61 00 - Common Product Requirements.
- .2 01 74 11 – Cleaning.
- .3 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .4 23 0 593 - Testing, Adjusting and Balancing for HVAC.

1.2 REFERENCES

Use the latest applicable edition of the following references.

- .1 ASTM International Inc.
 - .1 ASTM B32, Standard Specification for Solder Metal.
 - .2 ASTM B306, Standard Specification for Copper Drainage Tube (DWV).
 - .3 ASTM C564, Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
- .2 Canadian Standards Association (CSA International).
 - .1 CSA B67, Lead Service Pipe, Waste Pipe, Traps, Bends and Accessories.
 - .2 CAN/CSA-B70, Cast Iron Soil Pipe, Fittings and Means of Joining.
 - .3 CAN/CSA-B125.3, Plumbing Fittings.
- .3 Green Seal Environmental Standards (GSES)
 - .1 Standard GS-36, Commercial Adhesives.
- .4 South Coast Air Quality Management District (SCAQMD), California State
 - .1 SCAQMD Rule 1168, Adhesive and Sealant Applications.

Part 2 Products

2.1 COPPER TUBE AND FITTINGS

- .1 Above ground sanitary vent Type DWV to: ASTM B306.
 - .1 Fittings.
 - .1 Cast brass: to CAN/CSA-B125.3.
 - .2 Wrought copper: to CAN/CSA-B125.3.
 - .2 Solder: tin-lead, 50:50, type 50A, to ASTM B32.

2.2 CAST IRON PIPING AND FITTINGS

- .1 Buried sanitary, storm and vent minimum NPS 3, to: CAN/CSA-B70, with one layer of protective polyurethane coating.
 - .1 Joints:
 - .1 Mechanical joints:
 - .1 Neoprene or butyl rubber compression gaskets: to ASTM C564 or CAN/CSA-B70.
 - .2 Stainless steel clamps.
 - .2 Hub and spigot:
 - .1 Caulking lead: to CSA B67.
 - .2 Cold caulking compounds.
- .2 Above ground sanitary, storm and vent: to CAN/CSA-B70.
 - .1 Mechanical joints:
 - .1 Neoprene or butyl rubber compression gaskets with stainless steel clamps.

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

- .1 In accordance with Section 23 05 01 - Use of HVAC Systems During Construction.
- .2 Install in accordance with National Plumbing Code, Provincial Plumbing Code, and local authority having jurisdiction.

3.3 TESTING

- .1 Pressure test buried systems before backfilling.
- .2 Hydraulically test to verify grades and freedom from obstructions.

3.4 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for piping, fittings, equipment used in compressed air systems.
 - .2 Sustainable requirements for construction and verification.
- .2 Related Sections:
 - .1 01 35 29 - Health and Safety Requirements.
 - .2 01 45 00 - Quality Control.
 - .3 01 78 00 - Closeout Submittals.
 - .4 21 05 01 - Common Work Results for Mechanical.
 - .5 23 05 16 - Expansion Fittings and Loops for HVAC Piping.
 - .6 23 05 17 - Pipe Welding.
 - .7 23 08 01 - Performance Verification of Mechanical Piping Systems.
 - .8 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems.

1.2 REFERENCES

Use the latest applicable edition of the following references.

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME Boiler and Pressure Vessel Code Section VIII Pressure Vessels.
 - .1 BPVC-VIII B, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 1.
 - .2 BPVC-VIII-2 B, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 2 - Alternative Rules.
 - .3 BPVC-VIII-3 B, BPVC Section VIII - Rules for Construction of Pressure Vessels Division 3 - Alternative Rules High Press Vessels.
 - .2 ASME B16.5, Pipe Flanges and Flanged Fittings.
 - .3 ASME B16.11, Forged Fittings, Socket-Welding and Threaded.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A181/A181M, Standard Specification for Carbon Steel Forgings for General Purpose Piping.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.

- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

Part 2 Products

2.1 AIR COMPRESSOR

- .1 General: Two (2) stage, air-cooled, reciprocating, vertical or horizontal, tank-mounted or base-mounted, V-belt driven.
- .2 Motor: standard protected.
- .3 Control:
 - .1 Manual control with H-0-A starter switch.
 - .2 Pressure switch to cut out and with minimum differential pressure.
- .4 Accessories: belt guard and pressure gauges.
- .5 Air intakes: complete with bird screen, replaceable cartridge type intake filter and silencer.
- .6 Capacity: as required.
- .7 Vibration isolation: 95% minimum efficiency.

2.2 AIR RECEIVER

- .1 Vertical or horizontal tank: to CSA B51, ASME Section VIII and provincial regulations. Capacity: as required.
- .2 Accessories: adjustable pressure regulator, safety valve, 125 mm diameter gauge with pressure range of 0 to 1500 kPa, drain cock and automatic condensate trap.
- .3 Provincial inspector's certificate and label.
- .4 Finish: shop primed, ready for field painting.

2.3 REFRIGERATED AIR DRYER

- .1 Self-contained, hermetically sealed, complete with air cooled heat exchanger, compressor, automatic controls, moisture removal trap, wiring, piping and refrigerant charge.
- .2 Inlet and outlet connections to be factory insulated.
- .3 Capacity as required:

- .1 Dew point of minus 35 degrees C, 800 kPa and 35 degrees C inlet air at evaporator. 20 degrees C air to condenser.
- .2 Size to operate at 40 % of time at design capacity.
- .4 Electrical supply: as required.

2.4 COMBINATION FILTER-REGULATOR

- .1 Factory assembled, heavy-duty with mounting bracket and low pressure side relief valve.
- .2 Maximum inlet pressure: 800 kPa.
- .3 Operating temperature: minus 18 degrees C to plus 52 degrees C.
- .4 Filter element: 40 micron. Bowls: polycarbonate.
- .5 Pressure range in regulator: 34 kPa to 800 kPa.
- .6 Gauge range: 0 kpa to 1100 kPa.

2.5 PIPING

- .1 Piping: to ASTM A53/A53M, schedule 80 seamless black steel.
- .2 Fittings:
 - .1 NPS2 and smaller: to ASME B16.11, schedule 80 steel, socket welded.
 - .2 NPS2 1/2 and larger: to ASME B16.11, schedule 80 steel, butt or socket welded.
- .3 Couplings: to ASME B16.11, socket welded or threaded half coupling type.
- .4 Unions: 1000 kPa malleable iron with brass-to-iron ground seat.
- .5 Dissimilar metal junctions: use dielectric unions.
- .6 Flanges:
 - .1 NPS2 and smaller: to ASME B16.5, forged steel, raised face and socket welded.
 - .2 NPS2 1/2 and larger: to ASME B16.5, forged steel, raised face and slip-on or weld neck.
- .7 Joints:
 - .1 NPS2 and smaller: socket welded.
 - .2 NPS2 1/2 and larger: butt welded.

2.6 BALL VALVES

- .1 Three piece design or top entry for ease of in-line maintenance.
 - .1 To ASTM A181/A181M, Class 70, carbon steel body screwed ends, carbon steel ball and associated trim suitable for compressed air application.

.2 To withstand 1034 kPa maximum pressure.

2.7 COUPLERS/CONNECTORS

- .1 Industrial interchange series, full-bore.
- .2 Maximum inlet pressure: 1700 kPa.
- .3 Valve seat: moulded nylon.
- .4 Body: zinc plated steel.
- .5 Threads: NPT.

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 COMPRESSOR STATION

- .1 Install on vibration isolators on housekeeping pad as indicated.

3.3 REFRIGERATED AIR DRYER

- .1 Install on three-valve bypass.
- .2 Install tee connection after dryer for emergency connection to instrument control air system.

3.4 COMPRESSED AIR LINE FILTER

- .1 Install on discharge line from refrigerated air dryer.

3.5 MAIN AIR PRESSURE REGULATORS

- .1 Install at air compressor station.
- .2 Install additional regulators as required.

3.6 COMPRESSED AIR PIPING CONNECTIONS AND INSTALLATION

- .1 Install flexible connection in accordance with Section 23 05 16 - Expansion Fittings and Loops for HVAC Piping.
- .2 Install shut-off valves at outlets, major branch lines and in locations as indicated.

- .3 Install quick-coupler chucks and pressure gauges on drop pipes.
- .4 Install unions to permit removal or replacement of equipment.
- .5 Install tees in lieu of elbows at changes in direction of piping. Install plug in open ends of tees.
- .6 Grade piping at 1% slope minimum.
- .7 Install compressed air trap and pressure equalizing pipe at moisture collecting points. Drain pipe to nearest floor drain.
- .8 Make branch connections from top of main.
- .9 Install compressed air trap at bottom of risers and at low points in mains, piped to nearest drain. Distance between drain points to be 30 m maximum.
- .10 Provide drain from refrigerated air dryer.
- .11 Weld steel piping in accordance with Section 23 05 17 - Pipe Welding and;
 - .1 To ASME code and requirements of authority having jurisdiction.
 - .2 Weld concealed and inaccessible piping regardless of size.

3.7 FIELD QUALITY CONTROL

- .1 Site Tests/Inspection:
 - .1 Testing: pressure test in accordance with requirements of Section 21 05 01 - Common Work Results for Mechanical, for 4 h minimum, to 1100 kPa, with outlets closed and with compressor isolated from system. Pressure drop not to exceed 10 kPa.

3.8 CLEANING

- .1 Refer to Section 23 08 01 - Performance Verification of Mechanical Piping Systems and Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping System.
- .2 Cleaning: blow out piping to clean interior thoroughly of oil and foreign matter.
- .3 Check entire installation is approved by authority having jurisdiction.
- .4 Perform cleaning operations as specified in Section 01 74 11 - Cleaning and in accordance with manufacturer's recommendations.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for plumbing specialties and accessories..
 - .2 Sustainable requirements for construction and verification.
- .2 Related Sections:
 - .1 01 35 29 - Health and Safety Requirements.
 - .2 01 45 00 - Quality Control.
 - .3 01 78 00 - Closeout Submittals.
 - .4 01 91 13 - General Commissioning (Cx) Requirements.

1.2 REFERENCES

Use the latest applicable edition of the following references.

- .1 American Society for Testing and Materials International (ASTM).
 - .1 ASTM A126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
 - .2 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.
- .2 American Water Works Association (AWWA).
 - .1 AWWA C700, Cold Water Meters-Displacement Type, Bronze Main Case.
 - .2 AWWA C701, Cold Water Meters-Turbine Type for Customer Service.
 - .3 AWWA C702-1, Cold Water Meters-Compound Type.
- .3 Canadian Standards Association (CSA International).
 - .1 CSA-B64 Series, Backflow Preventers and Vacuum Breakers.
 - .2 CSA-B79, Floor, Area and Shower Drains, and Cleanouts for Residential Construction.
 - .3 CSA-B356, Water Pressure Reducing Valves for Domestic Water Supply Systems.
- .4 Health Canada/Workplace Hazardous Materials Information System (WHMIS).
 - .1 Material Safety Data Sheets (MSDS).
- .5 Plumbing and Drainage Institute (PDI).
 - .1 PDI-G101, Testing and Rating Procedure for Grease Interceptors with Appendix of Sizing and Installation Data.
 - .2 PDI-WH201, Water Hammer Arresters Standard.

1.3 SUBMITTALS

- .1 Closeout submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals, include:
 - .1 Description of plumbing specialties and accessories, giving manufacturers name, type, model, year and capacity.
 - .2 Details of operation, servicing and maintenance.
 - .3 Recommended spare parts list.

Part 2 Products

2.1 FLOOR DRAINS

- .1 Floor Drains and Trench Drains: to CSA B79.
- .2 Type 2: heavy duty; cast iron body, heavy duty non-tilting or hinged lacquered cast iron grate, integral seepage pan and clamping collar.
- .3 Type 3: combination funnel floor drain; cast iron body with integral seepage pan, clamping collar, nickel-bronze adjustable head strainer with integral funnel.

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.
- .2 Access Covers:
 - .1 Wall Access: face or wall type, polished nickel bronze or stainless steel square and or round cover with flush head securing screws, bevelled edge frame complete with anchoring lugs.
 - .2 Floor Access: cast box with anchor lugs and:
 - .1 Plugs: bolted bronze with neoprene gasket.
 - .2 Cover for Unfinished Concrete Floors: cast iron round or square, gasket, vandal-proof screws.

2.3 WATER HAMMER ARRESTORS

- .1 Copper construction, piston type: to PDI-WH201.

2.4 BACK FLOW PREVENTERS

- .1 Preventers: to CSA-B64 Series, application as required, back flow preventer with intermediate atmospheric vent.

2.5 VACUUM BREAKERS

- .1 Breakers: to CSA-B64 Series, vacuum breaker atmospheric.

2.6 PRESSURE REGULATORS

- .1 Capacity: as required.
- .2 Up to NPS1-1/2 bronze bodies, screwed: to ASTM B62.
- .3 NPS2 and over, semi-steel bodies, Class 125, flanged: to ASTM A126, Class B.
- .4 Semi-steel spring chambers with bronze trim.

2.7 WATER MAKE-UP ASSEMBLY

- .1 Complete with backflow preventer pressure gauge on inlet and outlet, pressure reducing valve to CSA B356, pressure relief valve on low pressure side and gate valves on inlet and outlet.

2.8 STRAINERS

- .1 860 kPa, Y type with 20 mesh, monel, bronze or stainless steel removable screen.
- .2 NPS2 and under, bronze body, screwed ends, with brass cap.
- .3 NPS2 1/2 and over, cast iron body, flanged ends, with bolted cap.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install in accordance with National Plumbing Code of Canada and provincial codes.
- .2 Install in accordance with manufacturer's instructions and as specified.

3.3 CLEANOUTS

- .1 Install cleanouts at base of soil and waste stacks, and rainwater leaders, at locations required code, and as indicated.
- .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 BACK FLOW PREVENTORS

- .1 Install in accordance with CSA-B64 Series, where indicated and elsewhere as required by code.
- .2 Pipe discharge to terminate over nearest drain.

3.6 STRAINERS

- .1 Install with sufficient room to remove basket.

3.7 WATER MAKE-UP ASSEMBLY

- .1 Install on valved bypass.
- .2 Pipe discharge from relief valve to nearest floor drain.

3.8 START-UP

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

3.9 TESTING AND ADJUSTING

- .1 General:
 - .1 In accordance with Section 01 91 13- General Commissioning (Cx)
Requirements : General Requirements, supplemented as specified.
- .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 Commissioning Reports:
 - .1 In accordance with Section 01 91 13 - General Commissioning (Cx)
Requirements: Reports, supplemented as specified.
- .5 Training:
 - .1 In accordance with Section 01 91 13 - General Commissioning (Cx)
Requirements: Training of O&M Personnel, supplemented as specified.
 - .2 Demonstrate full compliance with Design Criteria.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 01 35 29 - Health and Safety Requirements.
- .2 01 45 00 - Quality Control.
- .3 01 74 21 - Construction/Demolition Waste Management and Disposal.
- .4 01 78 00 - Closeout Submittals.
- .5 23 05 93 - Testing, Adjusting and Balancing for HVAC

1.2 SUBMITTALS

- .1 Closeout Submittals:
 - .1 Provide operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
 - .2 Operation and maintenance manual approved by, and final copies deposited with, Departmental Representative before final inspection.
 - .3 Operation data to include:
 - .1 Control schematics for systems including environmental controls.
 - .2 Description of systems and their controls.
 - .3 Description of operation of systems at various loads together with reset schedules and seasonal variances.
 - .4 Operation instruction for systems and component.
 - .5 Description of actions to be taken in event of equipment failure.
 - .6 Valves schedule and flow diagram.
 - .7 Colour coding chart.
 - .4 Maintenance data to include:
 - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
 - .2 Data to include schedules of tasks, frequency, tools required and task time.
 - .5 Performance data to include:
 - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
 - .2 Equipment performance verification test results.
 - .3 Special performance data as specified.
 - .4 Testing, adjusting and balancing reports as specified in Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
 - .6 Approvals:

- .1 Submit two (2) copies of draft Operation and Maintenance Manual to Departmental Representative for approval. Submission of individual data will not be accepted unless directed by Departmental Representative.
- .2 Make changes as required and re-submit as directed by Departmental Representative.
- .7 Additional data:
 - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
- .8 As-built drawings:
 - .1 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.
- .9 Submit copies of as-built drawings for inclusion in final TAB report.

1.3 QUALITY ASSURANCE

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Health and Safety Requirements: do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

Part 2 Execution

2.1 CLEANING

- .1 Clean interior and exterior of all systems including strainers. Vacuum interior of ductwork and air handling units.

2.2 DEMONSTRATION

- .1 Contractor's Engineer will use equipment and systems for test purposes prior to acceptance. Supply labour, material, and instruments required for testing.
- .2 Trial usage to apply to following equipment and systems:
 - .1 Safeties, interlocks, alarms and emergency modes.
 - .2 Boilers and all equipment and systems related to their operation.
- .3 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.
- .4 Use operation and maintenance manual, as-built drawings, and audio visual aids as part of instruction materials.
- .5 Instruction duration time requirements as specified in appropriate sections.

2.3 PROTECTION

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

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 01 61 00 - Common Product Requirements.
- .2 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.
- .3 07 84 00 - Fire Stopping.

1.2 REFERENCES

Use the latest applicable edition of the following references.

- .1 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.181, Ready-Mixed Organic Zinc-Rich Coating.
- .2 Canadian Standards Association (CSA International)
 - .1 CSA B139, Installation Code for Oil Burning Equipment.
 - .2 CSA B149.1, Natural Gas and Propane Installation Code.
- .3 Green Seal Environmental Standards (GSES)
 - .1 Standard GS-11, Environmental Standard for Paints and Coatings.
- .4 National Fire Code of Canada (NFCC)

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Provide manufacturer's printed product literature, specifications and datasheets for piping and equipment and include product characteristics, performance criteria, physical size, finish and limitations.

Part 2 Products

2.1 MATERIAL

- .1 Paint: zinc-rich to CAN/CGSB-1.181.
 - .1 Primers, paints: in accordance with manufacturer's recommendations for surface conditions.
 - .2 Primer: maximum VOC limit 100 g/L to Standard GS-11.
 - .3 Paints: maximum VOC limit 300 g/L to Standard GS-11.
- .2 Sealants: maximum VOC limit to SCAQMD Rule 1168 or to GSES GS-36, whichever is most stringent.

- .3 Adhesives: maximum VOC limit to SCAQMD Rule 1168 or to GSES GS-36, whichever is more stringent.
- .4 Fire Stopping: in accordance with Section 07 84 00 - Fire Stopping.

Part 3 Execution

3.1 APPLICATION

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

3.2 CONNECTIONS TO EQUIPMENT

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

3.3 CLEARANCES

- .1 Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer, National Fire Code of Canada, CSA B139 and CSA B149.
- .2 Provide space for disassembly, removal of equipment and components as recommended by manufacturer, CSA B139 and CSA B149 without interrupting operation of other system, equipment, and components.

3.4 DRAINS

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

3.5 AIR VENTS

- .1 Install air vents to CSA B139, CSA B149 and ASME B31.1 at high points in piping systems.
- .2 Install isolating valve at each automatic air valve.

- .3 Install drain piping to approved location and terminate where discharge is visible.

3.6 DIELECTRIC COUPLINGS

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

3.7 PIPE WORK INSTALLATION

- .1 Install pipe work to CSA B139, CSA B149 and ASME B31.1.
- .2 Screwed fittings jointed with Teflon tape.
- .3 Protect openings against entry of foreign material.
- .4 Install to isolate equipment and allow removal without interrupting operation of other equipment or systems.
- .5 Assemble piping using fittings manufactured to ANSI standards.
- .6 Saddle type branch fittings may be used on mains if branch line is no larger than half size of main.
 - .1 Hole saw (or drill) and ream main to maintain full inside diameter of branch line prior to welding saddle.
- .7 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.
- .8 Install concealed pipe work to minimize furring space, maximize headroom, conserve space.
- .9 Slope piping, in direction of flow for positive drainage and venting.
- .10 Install, to permit separate thermal insulation of each pipe.
- .11 Group piping wherever possible.
- .12 Ream pipes, remove scale and other foreign material before assembly.
- .13 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.
- .14 Provide for thermal expansion.
- .15 Valves:
 - .1 Install in accessible locations.
 - .2 Remove interior parts before soldering.

- .3 Install with stems above horizontal position.
 - .4 Valves accessible for maintenance without removing adjacent piping.
 - .5 Install globe valves in bypass around control valves.
 - .6 Use gate or ball valves at branch take-offs for isolating purposes.
 - .7 Use chain operators on valves NPS 2 1/2 and larger where installed more than 2400 mm above floor in Mechanical Rooms.
- .16 Check Valves:
- .1 Install silent check valves on discharge of pumps and in vertical pipes with downward flow.
 - .2 Install swing check valves in horizontal lines on discharge of pumps.

3.8 SLEEVES

- .1 General: install where pipes pass through masonry, concrete structures, fire rated assemblies, and as indicated.
- .2 Material: schedule 40 black steel pipe.
- .3 Construction: use annular fins continuously welded at mid-point at foundation walls and where sleeves extend above finished floors.
- .4 Sizes: 50 mm minimum clearance between sleeve and uninsulated pipe or between sleeve and insulation.
- .5 Installation:
 - .1 Concrete, masonry walls, concrete floors on grade: terminate flush with finished surface.
 - .2 Other floors: terminate 25 mm above finished floor.
- .6 Sealing:
 - .1 Foundation walls and below grade floors: fire retardant, waterproof non-hardening mastic.
 - .2 Elsewhere:
 - .1 Provide space for firestopping.
 - .2 Maintain fire rating integrity.
 - .3 Sleeves installed for future use: fill with lime plaster or other easily removable filler.
 - .4 Ensure no contact between copper pipe or tube and sleeve.

3.9 PREPARATION FOR FIRE STOPPING

- .1 Install firestopping within annular space between pipes, ducts, insulation and adjacent fire separation in accordance with Section 07 84 00 - Fire Stopping.

- .2 Uninsulated unheated pipes not subject to movement: no special preparation.
- .3 Uninsulated heated pipes subject to movement: wrap with non-combustible smooth material to permit pipe movement without damaging fires topping material or installation.
- .4 Insulated pipes and ducts: ensure integrity of insulation and vapour barriers.

3.10 FLUSHING OUT OF PIPING SYSTEMS

- .1 Flush system in accordance with Section 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.
- .2 Before start-up, clean interior of piping systems in accordance with requirements of Section 01 74 11 - Cleaning.
- .3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.11 PRESSURE TESTING OF EQUIPMENT AND PIPEWORK

- .1 Advise Departmental Representative 48 hours minimum prior to performance of pressure tests.
- .2 Pipe work: test as specified in relevant sections of heating, ventilating and air conditioning work.
- .3 Maintain specified test pressure without loss for four (4) hours minimum unless specified for longer period of time in relevant mechanical sections.
- .4 Prior to tests, isolate equipment and other parts which are not designed to withstand test pressure or media.
- .5 Conduct tests in presence of Departmental Representative and inspector.
- .6 Pay costs for repairs or replacement, retesting, and making good. Insulate or conceal work only after approval and certification of tests by inspector.

3.12 EXISTING SYSTEMS

- .1 Connect into existing piping systems at times approved by Departmental Representative.
- .2 Request written approval by Departmental Representative ten (10) days minimum, prior to commencement of work.
- .3 Be responsible for damage to existing plant by this work.

3.13 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

- .1 Electrical motors, drives and guards for mechanical equipment and systems.
- .2 Supplier and installer responsibility indicated in Motor, Control and Equipment Schedule on electrical drawings and related mechanical responsibility is indicated on Mechanical Equipment Schedule on mechanical drawings.
- .3 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 Division 22 and 23. Refer to Division 26 for quality of materials and workmanship.

.2 Related Sections:

- .1 01 45 00 - Quality Control.
- .2 01 61 00 - Common Product Requirements.
- .3 01 74 11 – Cleaning.
- .4 01 74 21 - Construction/Demolition Waste Management And Disposal.
- .5 01 78 00 - Closeout Submittals.

1.2 REFERENCES

Use the latest applicable edition of the following references.

- .1 American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE)
 - .1 ASHRAE 90.1, Energy Standard for Buildings Except Low-Rise Residential Buildings (IESNA cosponsored; ANSI approved; Continuous Maintenance Standard).
- .2 Electrical Equipment Manufacturers' Association Council (EEMAC)
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

.1 Closeout Submittals

- .1 Provide maintenance data for motors, drives and guards for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

- .1 Regulatory Requirements: work to be performed in compliance with CEPA, CEAA, TDGA and applicable Provincial /Territorial regulations.

Part 2 Products

2.1 MOTORS

- .1 Provide motors for mechanical equipment as specified.
- .2 Motors under 373 W: speed as indicated (continuous or variable), continuous duty, built-in overload protection, resilient mount, single phase, 120 V, unless otherwise specified or indicated.
- .3 Motors 373 W and larger: EEMAC Class B, squirrel cage induction, speed as indicated, (continuous or variable), continuous duty, drip proof, ball bearing, maximum temperature rise 40 degrees C, 3 phase, 600 V, unless otherwise indicated.

2.2 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 indicated.
- .3 For motors under 7.5 kW: 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 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 Minimum drive rating: 1.5 times nameplate rating on motor. Keep overhung loads within manufacturer's design requirements on prime mover shafts.
- .6 Motor slide rail adjustment plates to allow for centre line adjustment.

2.3 DRIVE GUARDS

- .1 Provide guards for unprotected drives.
- .2 Guards for belt drives;
 - .1 Expanded metal screen welded to steel frame.
 - .2 Minimum 1.2 mm thick sheet metal tops and bottoms.
 - .3 38 mm dia. holes on both shaft centres for insertion of tachometer.
 - .4 Removable for servicing.
- .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 Guard for flexible coupling:
 - .1 "U" shaped, minimum 1.6 mm thick galvanized mild steel.

- .2 Securely fasten in place.
- .3 Removable for servicing.
- .6 Unprotected fan inlets or outlets:
 - .1 Wire or expanded metal screen, galvanized, 19 mm mesh.
 - .2 Net free area of guard: not less than 80% of fan openings.
 - .3 Securely fasten in place.
 - .4 Removable for servicing.

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.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 01 61 00 - Common Product Requirements.
- .2 01 74 11 – Cleaning.
- .3 01 78 00 - Closeout Submittals.
- .4 03 20 00 - Concrete Reinforcing.
- .5 03 30 00 - Cast-in-Place Concrete.
- .6 23 05 17 - Pipe Welding.
- .7 23 08 01 - Performance Verification Mechanical Piping Systems.
- .8 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

1.2 REFERENCES

Use the latest applicable edition of the following references.

- .1 ASTM International Inc.
 - .1 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.
 - .2 ASTM A105/A105M, Standard Specification for Carbon Steel Forgings, for Piping Applications.

1.3 ACTION AND INFORMATIONAL SUBMITTALS

- .1 Product Data:
 - .1 Provide manufacturer's printed product literature and datasheets for fixtures, and include product characteristics, performance criteria, physical size, finish and limitations.
 - .1 Manufacturer, model number, line contents, pressure and temperature rating.
 - .2 Movement handled, axial, lateral, angular and the amounts of each.
 - .3 Nominal size and dimensions including details of construction and assembly.

1.4 CLOSEOUT SUBMITTALS

- .1 Provide maintenance and operation data in accordance with Section 01 78 00 - Closeout Submittals.
 - .1 Data to include:

- .1 Servicing requirements, including special requirements, stuffing box packing, lubrication and recommended procedures.

Part 2 Products

2.1 BELLOWS TYPE EXPANSION JOINTS

- .1 Bellows type expansion joints may be used for axial, lateral, angular or combination of these movements.
- .2 For axial movement only use externally pressurized packless expansion joints.
- .3 Maximum operating pressure: 1275 kPa. Maximum design pressure: as per safety-relief valves settings.
- .4 Maximum operating temperature: 195 degrees C. Maximum design temperature: as per safety-relief valves settings.
- .5 Type A: controlled flexing, factory tested to 1 1/2 times maximum working pressure. Provide test certificates.
- .6 Bellows:
 - .1 Multiple bellows, hydraulically formed, single or two (2) ply, austenitic stainless steel for specified fluid, pressure and temperature, water treatment and pipeline cleaning procedures.
- .7 Reinforcing or control rings:
 - .1 2 piece nickel iron, if necessary.
- .8 Ends:
 - .1 Raised face flanges to match pipe.
- .9 Liner:
 - .1 Austenitic stainless steel in direction of flow.
- .10 Shroud:
 - .1 Carbon steel, painted.

2.2 FLEXIBLE CONNECTION

- .1 Application: to suit motion.
- .2 Minimum length in accordance with manufacturer's recommendations to suit offset.
- .3 Inner hose: stainless steel, corrugated.

- .4 Braided wire mesh stainless steel, outer jacket.
- .5 Diameter and type of end connection: as indicated.
- .6 Operating conditions:
 - .1 Working pressure: 1275 kPa.
 - .2 Working temperature: 195 degrees C.
 - .3 To match system requirements.

2.3 ANCHORS AND GUIDES

- .1 Anchors:
 - .1 Provide as required.
 - .2 Concrete: to Section 03 30 00 - Cast-in-Place Concrete.
 - .3 Reinforcement: to Section 03 20 00 - Concrete Reinforcing.
- .2 Alignment guides:
 - .1 As required.
 - .2 To accommodate specified thickness of insulation.
 - .3 Vapour barriers, jackets to remain uninterrupted.

Part 3 Execution

3.1 APPLICATION

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

3.2 INSTALLATION

- .1 Install expansion joints and flexible connections in accordance with manufacturer's instructions.
- .2 Install pipe anchors and guides as required. Anchors to withstand 150% of axial thrust.
- .3 Do welding in accordance with section 23 05 17 - Pipe Welding.

3.3 PIPE CLEANING AND START-UP

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

3.4 PERFORMANCE VERIFICATION

- .1 In accordance with Section 23 08 01 - Performance Verification: Mechanical Piping Systems.

3.5 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.

END OF SECTION

Part 1 General

1.1 RELATED REQUIREMENTS

- .1 01 61 00 - Common Product Requirements.
- .2 01 74 11 - Cleaning.
- .3 01 74 21 - Construction/Demolition Waste Management And Disposal.

1.2 REFERENCES

Use the latest applicable edition of the following references.

- .1 American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
 - .1 ANSI/ASME B31.1, Power Piping.
 - .2 ANSI/ASME B31.3, Process Piping.
 - .3 ANSI/ASME Boiler and Pressure Vessel Code:
 - .1 BPVC Section I: Power Boilers.
 - .2 BPVC Section V: Nondestructive Examination.
 - .3 BPVC Section IX: Welding and Brazing Qualifications.
- .2 American National Standards Institute/American Water Works Association (ANSI/AWWA)
 - .1 ANSI/AWWA C206, Field Welding of Steel Water Pipe.
- .3 American Welding Society (AWS)
 - .1 AWS C1.1M/C1.1, Recommended Practices for Resistance Welding.
 - .2 AWS Z49.1, Safety in Welding, Cutting and Allied Process.
 - .3 AWS W1, Welding Inspection Handbook..
- .4 Canadian Standards Association (CSA International)
 - .1 CSA W48, Filler Metals and Allied Materials for Metal Arc Welding.
 - .2 CSA B51, Boiler, Pressure Vessel and Pressure Piping Code.
 - .3 CSA-W117.2, Safety in Welding, Cutting and Allied Processes.
 - .4 CSA W178.1, Certification of Welding Inspection Organizations.
 - .5 CSA W178.2, Certification of Welding Inspectors.

1.3 QUALITY ASSURANCE

- .1 Qualifications:
 - .1 Welders:

- .1 Welding qualifications in accordance with CSA B51.
- .2 Use qualified and licensed welders possessing certificate for each procedure performed from authority having jurisdiction.
- .3 Each welder to possess identification symbol issued by authority having jurisdiction.
- .2 Inspectors:
 - .1 Inspectors qualified to CSA W178.2.
- .3 Certifications:
 - .1 Registration of welding procedures in accordance with CSA B51.
 - .2 Copy of welding procedures available for inspection.
 - .3 Safety in welding, cutting and allied processes in accordance with CSA-W117.2.

Part 2 Products

2.1 ELECTRODES

- .1 Electrodes: in accordance with CSA W48 Series.

Part 3 Execution

3.1 APPLICATION

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

3.2 QUALITY OF WORK

- .1 Welding: in accordance with ANSI/ASME B31.1 and B31.3, ANSI/ASME Boiler and Pressure Vessel Code, Sections I and IX and ANSI/AWWA C206, using procedures conforming to AWS B3.0, AWS C1.1, and special procedures specified elsewhere in Division 15 applicable requirements of provincial authority having jurisdiction.

3.3 INSTALLATION REQUIREMENTS

- .1 Identify each weld with welder's identification symbol.
- .2 Backing rings:
 - .1 Where used, fit to minimize gaps between ring and pipe bore.
 - .2 Do not install at orifice flanges.
- .3 Fittings:
 - .1 NPS 2 and smaller: install welding type sockets.
 - .2 Branch connections: install welding tees or forged branch outlet fittings.

3.4 INSPECTION AND TESTS - GENERAL REQUIREMENTS

- .1 Do not conceal welds until they have been inspected, tested and approved by inspector.
- .2 Provide for inspector to visually inspect welds during early stages of welding procedures in accordance with Welding Inspection Handbook. Repair or replace defects as required by codes and as specified.

3.5 SPECIALIST EXAMINATIONS AND TESTS

- .1 General:
 - .1 Perform examinations and tests by specialist qualified to CSA W178.1 and CSA W178.2.
 - .2 To ANSI/ASME Boiler and Pressure Vessels Code, Section V, CSA B51 and requirements of authority having jurisdiction.
 - .3 Inspect and test 5 % of welds in accordance with "Inspection and Test Plan" by non-destructive visual examination and magnetic particle (hereinafter referred to as "particle") tests and full gamma ray radiographic (hereinafter referred to as "radiography") tests.
- .2 Hydrostatically test welds to ANSI/ASME B31.1.
- .3 Visual examinations: include entire circumference of weld externally and wherever possible internally.
- .4 Failure of visual examinations:
 - .1 Upon failure of welds by visual examination, perform additional testing of total of up to 10 % of welds, selected at random by Departmental Representative by radiographic tests.
- .5 Full radiographic tests for high pressure steam and chilled water piping systems.
 - .1 Spot radiography:
 - .1 Conduct spot radiographic tests of up to 10 % of welds, selected at random from welds which would be most difficult to repair in event of failure after system is operational.
 - .2 Radiographic film:
 - .1 Identify each radiographic film with date, location, name of welder. Replace film if rejected because of poor quality.
 - .3 Interpretation of radiographic films:
 - .1 By qualified radiographer.
 - .4 Failure of radiographic tests:
 - .1 Extend tests to welds by welder responsible when those welds fails tests.

3.6 DEFECTS CAUSING REJECTION

- .1 As described in ANSI/ASME B31.1 and ANSI/ASME Boiler and Pressure Vessels Code.

3.7 REPAIR OF WELDS WHICH FAILED TESTS

- .1 Re-inspect and re-test repaired or re-worked welds at Contractor's expense.

3.8 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
- .2 Waste Management: separate waste materials for reuse and recycling in accordance with Section 01 74 21 - Construction/Demolition Waste Management and Disposal.

END OF SECTION

Part 1 General

1.1 SECTION INCLUDES

- .1 Materials and installation for thermometers and pressure gauges in piping systems.

1.2 RELATED SECTIONS

- .1 01 35 29 - Health and Safety Requirements.
- .2 23 05 53.01 - Mechanical Identification.

1.3 REFERENCES

Use the latest applicable edition of the following references.

- .1 American Society of Mechanical Engineers (ASME).
 - .1 ASME B40.100, Pressure Gauges and Gauge Attachments.
 - .2 ASME B40.200, Thermometers, Direct Reading and Remote Reading.
- .2 Canadian General Standards Board (CGSB).
 - .1 CAN/CGSB-14.4, Thermometers, Liquid-in-Glass, Self Indicating, Commercial/Industrial Type.
 - .2 CAN/CGSB-14.5, Thermometers, Bimetallic, Self-Indicating, Commercial/Industrial Type.

Part 2 Products

2.1 GENERAL

- .1 Design point to be at midpoint of scale or range.

2.2 DIRECT READING THERMOMETERS

- .1 Industrial, variable angle type, liquid filled, 125 mm scale length: to CAN/CGSB14.4 and ASME B40.200.

2.3 REMOTE READING THERMOMETERS

- .1 100 mm diameter liquid filled activated dial type: to CAN/CGSB-14.5, ASME B40.200, accuracy within one scale division, brass movement, stainless steel capillary, stainless steel spiral armour, stainless steel bulb and polished stainless steel case for wall mounting.

2.4 THERMOMETER WELLS

- .1 Copper pipe: copper or bronze.
- .2 Steel pipe: stainless steel.

2.5 PRESSURE GAUGES

- .1 112 mm, dial type: to ASME B40.100, Grade 2A, stainless steel bourdon tube having 0.5% accuracy full scale unless otherwise specified.
- .2 Provide:
 - .1 Gasketed pressure relief back with solid front.
 - .2 Bronze stop cock.

Part 3 Execution

3.1 GENERAL

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

3.2 THERMOMETERS

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

3.3 PRESSURE GAUGES

- .1 Install in following locations:
 - .1 Suction and discharge of pumps.
 - .2 Upstream and downstream of PRV's.
 - .3 Upstream and downstream of control valves.
 - .4 Inlet and outlet of heat exchangers
 - .5 Outlet of boilers.
 - .6 In other locations as indicated.
- .2 Use extensions where pressure gauges are installed through insulation.

3.4 NAMEPLATES

- .1 Install engraved lamoid nameplates as specified in Section 23 05 53.01 - Mechanical Identification, identifying medium.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Bronze - valves.

.2 Related Sections:

.1 01 35 29 - Health and Safety Requirements.

.2 01 78 00 - Closeout Submittals.

.3 23 05 01 - Installation of Pipe work.

1.2 REFERENCES

Use the latest applicable edition of the following references.

.1 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME).

.1 ANSI/ASME B1.20.1, Pipe Threads, General Purpose (Inch).

.2 ANSI/ASME B16.18, Cast Copper Alloy Solder Joint Pressure Fittings.

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

.1 ASTM A276, Specification for Stainless Steel Bars and Shapes.

.2 ASTM B62, Specification for Composition Bronze or Ounce Metal Castings.

.3 ASTM B283, Specification for Copper and Copper Alloy Die Forgings (Hot-Pressed).

.4 ASTM B505/B505M, Specification for Copper-Base Alloy Continuous Castings.

.3 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).

.1 MSS-SP-25, Standard Marking System for Valves, Fittings, Flanges and Unions.

.2 MSS-SP-80, Bronze Gate Globe, Angle and Check Valves.

.3 MSS-SP-110, Ball Valves, Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.

1.3 SUBMITTALS

.1 Closeout Submittals:

.1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 MATERIALS

.1 Application:

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

- .5 Stuffing box: threaded to bonnet with gland follower, packing nut, high grade non-asbestos packing.
- .6 Handwheel: non-ferrous.
- .7 Handwheel Nut: bronze to ASTM B62.
- .2 NPS 2 and under, composition disc, Class 125:
 - .1 Body and bonnet: screwed bonnet.
 - .2 Disc and seat: renewable rotating disc (composition to suit service conditions), regrindable bronze seat, loosely secured to bronze stem to ASTM B505.
 - .3 Operator: Handwheel.
- .3 NPS 2 and under, composition disc, Class 150:
 - .1 Body and bonnet: union bonnet.
 - .2 Disc and seat: renewable rotating disc in easily removable disc holder, regrindable bronze seat, loosely secured to bronze stem to ASTM B505.
 - .3 Operator: Handwheel.
- .4 NPS 2 and under, plug disc, Class 150, screwed ends:
 - .1 Body and bonnet: union bonnet.
 - .2 Disc and seat ring: tapered plug type with disc stem ring of AISI S420 stainless steel to ASTM A276, loosely secured to stem.
 - .3 Operator: Handwheel.
- .5 Angle valve, NPS 2 and under, composition disc, Class 150:
 - .1 Body and bonnet: union bonnet.
 - .2 Disc and seat: renewable rotating PTFE disc in slip-on easily removable disc holder having integral guides, regrindable bronze seat, loosely secured to stem.
 - .3 Operator: Handwheel.
- .6 Check Valves:
 - .1 Requirements common to check valves, unless specified otherwise:
 - .1 Standard specification: MSS SP-80.
 - .2 Connections: screwed with hexagonal shoulders.
 - .2 NPS 2 and under, swing type, bronze disc, Class 125:
 - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
 - .2 Disc and seat: renewable rotating disc, two (2)-piece hinge disc construction; seat: regrindable.
 - .3 NPS 2 and under, swing type, bronze disc:
 - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.
 - .2 Disc and seat: renewable rotating disc, two-piece hinge disc construction; seat: regrindable.
 - .4 NPS 2 and under, swing type, composition disc, Class 200:
 - .1 Body: Y-pattern with integral seat at 45 degrees, screw-in cap with hex head.

- .2 Disc: renewable rotating disc to suit service conditions, bronze two-piece hinge disc construction.
- .5 NPS 2 and under, horizontal lift type, composition disc, Class 150:
 - .1 Body: with integral seat, union bonnet ring with hex shoulders, cap.
 - .2 Disc: renewable rotating disc in disc holder having guides top and bottom, of bronze to ASTM B62.
- .6 NPS 2 and under, vertical lift type, bronze disc, Class 125:
 - .1 Disc: rotating disc having guides top and bottom, disc guides, retaining rings.
- .7 Silent Check Valves:
 - .1 NPS 2 and under:
 - .1 Body: cast high tensile bronze to ASTM B62 with integral seat.
 - .2 Connections: screwed ends to ANSI B1.20.1 and with hex. shoulders.
 - .3 Disc and seat: renewable rotating disc.
 - .4 Stainless steel spring, heavy duty.
 - .5 Seat: regrindable.
- .8 Ball Valves:
 - .1 NPS 2 and under:
 - .1 Body and cap: cast high tensile bronze to ASTM B62.
 - .2 Pressure rating: 4140-kPa CWP, 860 kPa steam.
 - .3 Connections: Screwed ends to ANSI B1.20.1 and with hexagonal shoulders.
 - .4 Stem: tamperproof ball drive.
 - .5 Stem packing nut: external to body.
 - .6 Ball and seat: replaceable hard chrome solid ball and teflon seats.
 - .7 Stem seal: TFE with external packing nut.
 - .8 Operator: removable lever handle.

Part 3 Execution

3.1 INSTALLATION

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

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Valves Cast Steel, gate, globe, and check.

.2 Related Sections:

.1 01 74 21 - Construction/Demolition Waste Management and Disposal.

.2 01 35 29 - Health and Safety Requirements.

.3 01 78 00 - Closeout Submittals.

.4 23 05 01 - Installation of Pipe work.

.5 23 05 23.01 - Valves – Bronze.

1.2 REFERENCES

Use the latest applicable edition of the following references.

.1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME).

.1 ANSI/ASME B16.5, Pipe Flanges and Flanged Fittings.

.2 ANSI/ASME B16.10, Face-to-Face and End-to-End Dimensions Valves.

.3 ANSI/ASME B16.25, Buttwelding Ends.

.4 ANSI/ASME B16.34, Valves - Flanged, Threaded and Welding End.

.2 American Petroleum Institute (API).

.1 API 598, Valve Inspection and Testing.

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

.1 ASTM A49, Specification for Heat-Treated Carbon Steel Joint Bars.

.2 ASTM A193/A193M, Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.

.3 ASTM A194/A194M, Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.

.4 ASTM A216/A216M, Specification for Steel Castings, Carbon Suitable for Fusion Welding for High-Temperature Service.

.4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS).

.1 MSS SP-25-1998, Standard Marking System for Valves, Fittings, Flanges and Unions.

.2 MSS SP-61-2003, Pressure Testing of Steel Valves.

1.3 SUBMITTALS

- .1 Closeout Submittals:
 - .1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

Part 2 Products

2.1 MATERIAL

- .1 Valves:
 - .1 Except for specialty valves, to be of single manufacturer.
 - .2 Valves to be individually tested.
- .2 Requirements common to valves, unless specified otherwise:
 - .1 Pressure-temperature ratings: to ANSI B16.34.
 - .2 Inspections and tests: to API 598.
 - .3 Pressure Testing: to MSS SP-61.
 - .4 Flanged valves:
 - .1 Face-to-face dimensions: to ANSI B16.10.
 - .2 Flange dimensions: to ANSI B16.5 with 1.6 mm raised face.
 - .5 Butt-weld valves:
 - .1 End-to-end dimensions: to ANSI B16.10.
 - .2 End dimensions: to ANSI B16.25 bored for used pipe schedule.
 - .6 Handwheel: non-heating type with raised rim of die-cast aluminum alloy to ASTM B85 or malleable iron to ASTM A49.
 - .7 Markings: to MSS SP-25.
 - .8 Identification:
 - .1 Plate showing catalogue number, size, material of body disc, stem seat, fluid, pressure-temperature rating.
 - .2 Body markings: manufacturer, size, primary service rating, material symbol.
 - .9 CRN registration number required for all products.

2.2 GATE VALVES

- .1 NPS 2 1/2 - 12, rising stem, OS&Y, flexible wedge disc, flanged ends, Class 150 and 300.

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

2.3 GLOBE VALVES

- .1 NPS 2 1/2 - 12, rising stem, OS&Y, flanged ends, Class 150 and 300:
 - .1 Body and multiple-bolted integral yoke and bonnet: cast steel to ASTM A216/A216M WCB.
 - .2 Body/bonnet joint: male-female face with corrugated metallic gasket.
 - .3 Bonnet studs: to ASTM A193/A193M Type B7.
 - .4 Bonnet nuts: to ASTM A194/A194M Type 2H.
 - .5 Stuffing box: including non-galling two-piece ball-jointed packing gland, with swing-type eye bolts and nuts.
 - .6 Gland packing: containing corrosion inhibitor to prevent stem pitting.
 - .7 Yoke bushing: Ni-Resist, minimum melting point above 954 degrees C.
 - .8 Hydraulic grease fitting: for lubrication of yoke sleeve bearing surfaces.
 - .9 Disc: Plug type with 15 degrees taper seat and bottom guide.
 - .10 Seat rings: with 1.6 mm thick cobalt-chromium-tungsten alloy facings with minimum hardness of 375 HB (cold), slipped in, seal welded, ground to match disc.
 - .11 Stem: heat treated corrosion and heat resistant 13% chromium steel with bonnet bushing, long engagement with yoke bushing for accurate seating, accurately-cut precision-machined Acme or 60 degrees V threads, top screwed for handwheel nut.

.12 Operator: see elsewhere this section.

2.4 VALVE OPERATORS

- .1 Handwheel: on all valves except as specified.
- .2 Handwheel with chain operators: on valves installed more than 2400 mm above floor in boiler rooms and mechanical equipment rooms.
- .3 Pneumatic operators:
 - .1 Application: control valves.

2.5 BYPASSES FOR GLOBE VALVES

- .1 Size of bypass valve:
 - .1 Main valve up to NPS 8: NPS 3/4.
 - .2 Main valve NPS 10 and over: NPS 1.
- .2 Type of bypass valves:
 - .1 On globe valve: globe, with composition bronze disc, bronze trim, to Section 23 05 23.02 - Valves – Cast Iron.

2.6 CHECK VALVES

- .1 NPS 2 1/2 and over, flanged ends, Class 150 and 300: swing check.
 - .1 Body and multiple-bolted cap: cast steel to ASTM A216/A216M WCB.
 - .2 Cap studs: to ASTM A193/A193M Type B7.
 - .3 Cap nuts: to ASTM A194/A194M Type 2H.
 - .4 Body/cap joint: male-female face with corrugated metallic gasket.
 - .5 Disc: heat treated corrosion and heat resistant 13% chromium steel.
 - .6 Seat rings: heat treated corrosion and heat resistant 13% chromium steel, slipped in, seal welded, ground to match disc.
 - .7 Hinge: WCB.
 - .8 Hinge pin: stainless steel.

2.7 SILENT CHECK VALVES

- .1 Construction:
 - .1 Body: Cast steel to ASTM A216/A216M WCB with integral seat.
 - .2 Pressure rating: Class 125 and 250.
 - .3 Connections: flanged ends.
 - .4 Double bronze disc with SS seat and stem. Renewable disc, seat, stem and spring. Spring rating must match system design for silent operation and installation.
 - .5 Stainless steel spring, heavy duty.
 - .6 Seat: regrindable.

Part 3 Execution

3.1 INSTALLATION

- .1 Install in accordance with manufacturer's recommendations in upright position with stem above horizontal.

3.2 COMMISSIONING

- .1 As part of commissioning activities, develop schedule of valves and record thereon identifier, location, service, purchase order number and date, manufacturer, identification data specified above.

END OF SECTION

1.1 REFERENCES (use the latest applicable edition of the following references)

- .1 American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
 - .1 ASME B1.20.1, Pipe Threads, General Purpose (Inch).
 - .2 ASME B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25,125 and 250.
 - .3 ANSI/ASME B16.5, Pipe Flanges and Flanged Fittings: NPS 1/2 through 24.
 - .4 ANSI/ASME B16.11, Forged Fittings, Socket-Welding and Threaded.
 - .5 ANSI/ASME B16.25, Buttwelding Ends.
 - .6 ANSI/ASME B16.34, Valves - Flanged, Threaded and Welding Ends.
- .2 American Petroleum Institute (API)
 - .1 API Std. 609, Butterfly Valves: Double Flanged, Lug- and Wafer-Type.
- .3 ASTM International Inc.
 - .1 ASTM A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
 - .2 ASTM A536, Standard Specification for Ductile Iron Castings.
 - .3 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
 - .4 ASTM B209M, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate Metric.
- .4 Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS)
 - .1 MSS SP-67, Butterfly Valves.

1.2 CLOSEOUT SUBMITTALS

- .1 Submit maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 BUTTERFLY VALVES - RESILIENT SEAT - 250 PSIG

- .1 Except to specialty valves, to be of single manufacturer.
- .2 To be suitable for dead-end service.
- .3 CRN registration number required for products.
- .4 Sizes:
 - .1 Lug type: NPS 2 to 30.
- .5 Pressure rating for tight shut-off at temperatures up to maximum for seat material.

- .1 NPS 2 - 12: 250 psig.
- .2 NPS 14 - 48: 250 psig.
- .6 Minimum seat temperature ratings to 121 degrees C.
- .7 Application: on-off operation on water systems only.
- .8 Operators:
 - .1 NPS 2 - 6: handles capable of locking in any of ten (10) positions - 0 degrees to 90 degrees. Handle and release trigger - ductile iron. Return spring and hinge pin: carbon steel. Latch plate and mounting hardware: cadmium plated carbon steel. Standard coating: black laquer.
 - .2 NPS 8 - 30: manual enclosed gear operator
- .9 Designed to comply with MSS SP-67 and API 609.
- .10 Compatible with ANSI Class 250/Class 300 flanges.
- .11 Construction:
 - .1 Body ductile iron.
 - .2 Disc: 316 SS.
 - .3 Seat: Buna-N.
 - .4 Shaft: 316 stainless steel.
 - .5 Taper pin: 316 SS.
 - .6 Key: stainless.
 - .7 O-Ring: Buna-N.
 - .8 Bushings.
 - .9

2.2 MOUNTING FLANGES

- .1 Class 250 cast iron to ANSI B16.1 or Class 300 steel to B16.5 pipe flanges.

Part 3 Execution

3.1 PREPARATION

- .1 Valve and mating flange preparation.
 - .1 Inspect adjacent pipeline, remove rust, scale, welding slag, other foreign material.
 - .2 Ensure that valve seats and pipe flange faces are free of dirt or surface irregularities which may disrupt flange seating and cause external leakage.
 - .3 Install butterfly valves with disc in almost closed position.
 - .4 Inspect valve disc seating surfaces and waterway and eliminate dirt or foreign material.

3.2 INSTALLATION OF VALVES

- .1 Install in accordance with manufacturer's instructions.
- .2 Do not use gaskets between pipe flanges and valves unless instructed otherwise by valve manufacturer.
- .3 Verify suitability of valve for application by inspection of identification tag.
- .4 Mount actuator on to valve prior to installation.
- .5 Handle valve with care so as to prevent damage to disc and seat faces.
- .6 Valves in horizontal pipe lines should be installed with stem in horizontal position to minimize liner and seal wear.
- .7 Ensure that valves are centered between bolts before bolts are tightened and then opened and closed to ensure unobstructed disc movement. If interference occurs due, for example to pipe wall thickness, taper bore adjacent piping to remove interference.

3.3 ACTUATOR INSTALLATION

- .1 Cycle valve operation from fully closed to fully open then back to fully closed.
- .2 At same time, check travel stop settings for proper disc alignment.

3.4 CLEANING

- .1 Clean installed products in accordance to manufacturer's recommendation.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Concrete housekeeping pads, hangers and supports for mechanical piping, ducting and equipment.
 - .2 Sustainable requirements for construction and verification.
- .2 Related Sections:
 - .1 01 35 29 - Health and Safety Requirements.
 - .2 01 45 00 - Quality Control.
 - .3 01 61 00 - Common Product Requirements.
 - .4 01 78 00 - Closeout Submittals.
 - .5 03 30 00 – Cast-in-place Concrete
 - .6 05 12 23 – Structural Steel for Buildings.
 - .7 05 50 00 – Metal Fabrications.
 - .8 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

1.2 REFERENCES

Use the latest applicable edition of the following references.

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

1.3 SYSTEM DESCRIPTION

- .1 Design Requirements:
 - .1 Construct pipe hanger and support to manufacturer's recommendations utilizing manufacturer's regular production components, parts and assemblies.
 - .2 Base maximum load ratings on allowable stresses prescribed by MSS SP69, ASME B31.1 and ASME B31.3.
 - .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 conditions of operation, allow free expansion and contraction, prevent excessive stresses from being introduced into pipe work or connected equipment.
 - .5 Provide for vertical adjustments after erection and during commissioning. Amount of adjustment in accordance with MSS SP58.
- .2 Performance Requirements:
 - .1 Design supports, platforms, catwalks, hangers, to withstand seismic events as specified Section 230548 – Vibration and Seismic Controls for HVAC Piping and Equipment.

1.4 SUBMITTALS

- .1 Closeout Submittals:
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.5 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

Part 2 Products

2.1 GENERAL

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

2.2 PIPE HANGERS

- .1 Finishes:
 - .1 Pipe hangers and supports: galvanized after manufacture.
 - .2 Use hot dipped galvanizing process.
 - .3 Ensure steel hangers in contact with copper piping are copper plated.

2.3 RISER CLAMPS

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

2.4 INSULATION PROTECTION SHIELDS

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

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 Certified Mill Test Report (CMTR).
- .2 Load adjustability: 10 % minimum adjustability each side of calibrated load. Adjustment without special tools. Adjustments not to affect travel capabilities.
- .3 Provide upper and lower factory set travel stops.
- .4 Provide load adjustment scale for field adjustments.
- .5 Total travel to be actual travel + 20%. Difference between total travel and actual travel 25 mm minimum.
- .6 Individually calibrated scales on each side of support calibrated prior to shipment, complete with calibration record.

2.6 VARIABLE SUPPORT SPRING HANGERS

- .1 Vertical movement: 13 mm minimum, 50 mm maximum, use single spring pre-compressed variable spring hangers.
- .2 Vertical movement greater than 50 mm: use double spring pre-compressed variable spring hanger with two (2) springs in series in single casing.
- .3 Variable spring hanger complete with factory calibrated travel stops. Provide certificate of calibration for each hanger.

- .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 for Buildings. Submit calculations with shop drawings.

2.8 PLATFORMS AND CATWALKS

- .1 To Section 05 50 00 - Metal Fabrications.

2.9 HOUSE-KEEPING PADS

- .1 Provide 100 mm high concrete housekeeping pads for base-mounted equipment; size pads 50 mm larger than equipment; chamfer pad edges.
- .2 Concrete: to Section 03 30 00 - Cast-in-place Concrete.

2.10 OTHER EQUIPMENT SUPPORTS

- .1 Fabricate equipment supports from structural grade steel.

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 Vibration Control Devices:
 - .1 Install on piping systems at pumps, boilers, chillers, cooling towers, and as required.
- .2 Provide supplementary structural steelwork where structural bearings do not exist or where concrete inserts are not in correct locations.
- .3 Use approved constant support type hangers where:
 - .1 Vertical movement of pipe work is 13 mm or more,
 - .2 Transfer of load to adjacent hangers or connected equipment is not permitted.
- .4 Use variable support spring hangers where:
 - .1 Transfer of load to adjacent piping or to connected equipment is not critical.
 - .2 Variation in supporting effect does not exceed 25 % of total load.

3.3 HANGER SPACING

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

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

- .6 Pipe work greater than NPS 12: to MSS SP69.

3.4 HORIZONTAL MOVEMENT

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

3.5 FIELD QUALITY CONTROL

- .1 Site Tests: conduct following tests:
 - .1 To MSS SP-58 and MSS SP-69.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Section Includes:

.1 Vibration isolation materials and components, seismic control measures and their installation.

.2 Related Sections:

- .1 01 35 29 - Health and Safety Requirements.
- .2 01 61 00 - Common Product Requirements.
- .3 01 74 11 - Cleaning.
- .4 03 30 00 - Cast-in-Place Concrete.
- .5 23 05 93 - Testing, Adjusting and Balancing for HVAC.

1.2 REFERENCES

Use the latest applicable edition of the following references.

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

.1 Material Safety Data Sheets (MSDS).

.2 National Fire Protection Association (NFPA)

.1 NFPA 13, Standard for the Installation of Sprinkler Systems.

.3 National Building Code of Canada (NBC).

1.3 SUBMITTALS

.1 Quality assurance submittals.

.1 Certificates: submit certificates to Contractor's Engineer signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.2 Instructions: submit manufacturer's installation instructions.

.1 Make available one (1) copy of systems supplier's installation instructions.

Part 2 Products

2.1 GENERAL

.1 Size and shape of bases type and performance of vibration isolation as required.

2.2 ACOUSTIC BARRIERS FOR ANCHORS AND GUIDES

.1 Acoustic barriers: between pipe and support, consisting of 25 mm minimum thick heavy duty duck and neoprene isolation material.

2.3 HORIZONTAL THRUST RESTRAINT

- .1 Spring and elastomeric element housed in box frame; assembly complete with rods and angle brackets for equipment and ductwork attachment; provision for adjustment to limit maximum start and stop movement to 9 mm.
- .2 Arrange restraints symmetrically on either side of unit and attach at centerline of thrust.

2.4 SEISMIC CONTROL MEASURES

- .1 General:
 - .1 Following systems and/or equipment to remain operational during and after earthquakes:
 - .1 Boilers.
 - .2 Seismic control systems to work in every direction.
 - .3 Fasteners and attachment points to resist same maximum load as seismic restraint.
 - .4 Drilled or power driven anchors and fasteners not permitted.
 - .5 No equipment, equipment supports or mounts to fail before failure of structure.
 - .6 Supports of cast iron or threaded pipe not permitted.
 - .7 Seismic control measures not to interfere with integrity of firestopping.
 - .2 Static equipment:
 - .1 Anchor equipment to equipment supports. Anchor equipment supports to structure.
 - .2 Suspended equipment:
 - .1 Use one or more of following methods depending upon site conditions:
 - .1 Install tight to structure.
 - .2 Cross brace in every direction.
 - .3 Brace back to structure.
 - .4 Cable restraint system.
 - .3 Seismic restraints:
 - .1 Cushioning action gentle and steady.
 - .2 Never reach metal-like stiffness.
 - .3 Vibration isolated equipment:
 - .1 Seismic control measures not to jeopardize noise and vibration isolation systems. Provide 6 to 9 mm clearance during normal operation of equipment and systems between seismic restraint and equipment.
 - .2 Incorporate seismic restraints into vibration isolation system to resist complete isolator unloading.
 - .3 As required.
 - .4 Piping systems:
 - .1 Piping systems: hangers longer than 300 mm; brace at each hanger.

- .2 Compatible with requirements for anchoring and guiding of piping systems.
- .5 Bracing methods:
 - .1 Structural angles or channels.
 - .2 Cable restraint system incorporating grommets, shackles and other hardware to ensure alignment of restraints and to avoid bending of cables at connection points. Incorporate neoprene into cable connections to reduce shock loads.

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 Seismic control measures to meet requirements of NBC.
- .2 Install vibration isolation equipment in accordance with manufacturer's instructions and adjust mountings to level equipment.
- .3 Ensure piping, ducting and electrical connections to isolated equipment do not reduce system flexibility and that piping, conduit and ducting passage through walls and floors do not transmit vibrations.
- .4 Unless indicated otherwise, support piping connected to isolated equipment with spring mounts or spring hangers with 25 mm minimum static deflection as follows:
 - .1 Up to NPS4: first three (3) points of support. NPS5 to NPS8: first four (4) points of support. NPS10 and over: first six (6) points of support.
 - .2 First point of support: static deflection of twice deflection of isolated equipment, but not more than 50 mm.
- .5 Where isolation is bolted to floor use vibration isolation rubber washers.
- .6 Block and shim level bases so that ductwork and piping connections can be made to rigid system at operating level, before isolator adjustment is made. Ensure that there is no physical contact between isolated equipment and building structure.

3.3 FIELD QUALITY CONTROL

- .1 Inspection and Certification:
 - .1 Experienced and competent sound and vibration testing professional engineer to take vibration measurement for HVAC systems after start up and TAB of systems to Section 23 05 93 - Testing, Adjusting and Balancing for HVAC.
 - .2 Take vibration measurements for equipment listed below.
 - .1 Boilers.
 - .2 Pumps.

- .3 Establish adequacy of equipment isolation and acceptability of noise levels in occupied areas and where appropriate, remedial recommendations (including sound curves).
- .4 Submit to Contractor's Engineer complete report of test results including sound curves.

3.4 CLEANING

- .1 Proceed in accordance with Section 01 74 11 - Cleaning.
- .2 Upon completion and verification of performance of installation, remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and requirements for the identification of piping systems, duct work, valves and controllers, including the installation and location of identification systems.
- .2 Related Sections:
 - .1 01 61 00 - Common Product Requirements.

1.2 REFERENCES

Use the latest applicable edition of the following references.

- .1 Canadian Gas Association (CGA)
 - .1 CSA/CGA B149.1, Natural Gas and Propane Installation Code.
 - .2 CSA/CGA B139, Installation Code for Oil Burning Equipment.
- .2 Canadian General Standards Board (CGSB)
 - .1 CAN/CGSB-1.60, Interior Alkyd Gloss Enamel.
 - .2 CAN/CGSB-24.3, Identification of Piping Systems.
- .3 National Fire Protection Association (NFPA)
 - .1 NFPA 13, Standard for the Installation of Sprinkler Systems.
 - .2 NFPA 14, Standard for the Installation of Standpipe and Hose Systems.

Part 2 Products

2.1 MANUFACTURER'S EQUIPMENT NAMEPLATES

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

2.2 SYSTEM NAMEPLATES

- .1 Colours:
 - .1 Hazardous: red letters, white background.

.2 Elsewhere: black letters, white background (except where required otherwise by applicable codes).

.2 Construction:

.1 3 mm thick laminated plastic or white anodized aluminum, matte finish, with square corners, letters accurately aligned and machine engraved into core.

.3 Sizes:

.1 Conform to following table:

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

.2 Use maximum of 25 letters/numbers per line.

.4 Locations:

.1 Terminal cabinets, control panels: use size # 5.

.2 Equipment in Mechanical Rooms: use size # 9.

.5 Identification for PWGSC Preventive Maintenance Support System (PMSS):

.1 Use arrangement of Main identifier, Source identifier, Destination identifier.

.2 Equipment in Mechanical Room:

.1 Main identifier: size #9.

.2 Source and Destination identifiers: size #6.

.3 Terminal cabinets, control panels: size #5.

.3 Equipment elsewhere: sizes as appropriate.

2.3 EXISTING IDENTIFICATION SYSTEMS

.1 Apply existing identification system to new work.

.2 Where existing identification system does not cover for new work, use identification system specified this section.

.3 Before starting work, obtain written approval of identification system from Departmental Representative.

2.4 PIPING SYSTEMS GOVERNED BY CODES

.1 Identification:

.1 Natural gas: to CSA/CGA B149.1.

2.5 IDENTIFICATION OF PIPING SYSTEMS

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

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

3 Background colour marking and legends for piping systems:

Contents	Background colour marking	Legend
** Add design temperature		
++ Add design temperature and pressure		
Make-up water	Yellow	MAKE-UP WTR
Domestic cold water supply	Green	DOM. CWS
Waste water	Green	WASTE WATER
Sanitary	Green	SAN
Plumbing vent	Green	SAN. VENT
Natural gas	to Codes	
Gas regulator	to Codes	
vents		
Compressed air (<700kPa)	Green	COMP. AIR <700 kPa
Compressed air (>700kPa)	Yellow	COMP. AIR >700 kPa
Instrument air	Green	INSTRUMENT AIR

2.6 VALVES, CONTROLLERS

- .1 Brass tags with 12 mm 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.

2.7 CONTROLS COMPONENTS IDENTIFICATION

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

2.8 LANGUAGE

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

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

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

3.3 NAMEPLATES

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

3.4 LOCATION OF IDENTIFICATION ON PIPING AND DUCTWORK SYSTEMS

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

3.5 VALVES, CONTROLLERS

- .1 Valves and operating controllers, except 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 Departmental Representative. 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 SUMMARY

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

1.2 QUALIFICATIONS OF TAB PERSONNEL

- .1 Provide documentation confirming qualifications, successful experience.
- .2 TAB: performed in accordance with the requirements of standard under which TAB Firm's qualifications are approved:
 - .1 Associated Air Balance Council, (AABC) National Standards for Total System Balance, MN-1.
 - .2 National Environmental Balancing Bureau (NEBB) TABES, Procedural Standards for Testing, Adjusting, Balancing of Environmental Systems.
 - .3 Sheet Metal and Air Conditioning Contractors' National Association (SMACNA), HVAC TAB HVAC Systems - Testing, Adjusting and Balancing.
- .3 Recommendations and suggested practices contained in the TAB Standard: mandatory.
- .4 Use TAB Standard provisions, including checklists, and report forms to satisfy Contract requirements.
- .5 Use TAB Standard for TAB, including qualifications for TAB Firm and Specialist and calibration of TAB instruments.
- .6 Where instrument manufacturer calibration recommendations are more stringent than those listed in TAB Standard, use manufacturer's recommendations.
- .7 TAB Standard quality assurance provisions such as performance guarantees form part of this contract.
 - .1 For systems or system components not covered in TAB Standard, use TAB procedures developed by TAB Specialist.
 - .2 Where new procedures, and requirements, are applicable to Contract requirements have been published or adopted by body responsible for TAB Standard used (AABC, NEBB, or TABB), requirements and recommendations contained in these procedures and requirements are mandatory.

1.3 PURPOSE OF TAB

- .1 Test to verify proper and safe operation, determine actual point of performance, evaluate qualitative and quantitative performance of equipment, systems and controls at design, average and low loads using actual or simulated loads.

- .2 Adjust and regulate equipment and systems to meet specified performance requirements and to achieve specified interaction with other related systems under normal and emergency loads and operating conditions.
- .3 Balance systems and equipment to regulate flow rates to match load requirements over full operating ranges.

1.4 EXCEPTIONS

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

1.5 CO-ORDINATION

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

1.6 PRE-TAB

- .1 During construction, co-ordinate location and installation of TAB devices, equipment, accessories, measurement ports and fittings.

1.7 START-UP

- .1 Follow start-up procedures as recommended by equipment manufacturer unless specified otherwise.

1.8 OPERATION OF SYSTEMS DURING TAB

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

1.9 START OF TAB

- .1 Start TAB when building is essentially completed, including:
 - .1 Installation of ceilings, doors, windows, other construction affecting TAB.
 - .2 Application of weatherstripping, sealing, and caulking.
 - .3 Pressure, leakage, other tests specified elsewhere Division 23.
- .2 Provisions for TAB installed and operational.
- .3 Start-up, verification for proper, normal and safe operation of mechanical and associated electrical and control systems affecting TAB including but not limited to:
 - .1 Proper thermal overload protection in place for electrical equipment.
 - .2 Liquid systems:
 - .1 Flushed, filled, vented.
 - .2 Correct pump rotation.
 - .3 Strainers in place, baskets clean.

- .4 Isolating and balancing valves installed, open.
- .5 Calibrated balancing valves installed, at factory settings.
- .6 Chemical treatment systems complete, operational.

1.10 APPLICATION TOLERANCES

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

1.11 ACCURACY TOLERANCES

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

1.12 INSTRUMENTS

- .1 Calibrate in accordance with requirements of most stringent of referenced standard for either applicable system or HVAC system.

1.13 SUBMITTALS

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

1.14 PRELIMINARY TAB REPORT

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

1.15 TAB REPORT

- .1 Format in accordance with AABC Standards.

- .2 TAB report to show results in SI units and to include:
 - .1 Project record drawings.
 - .2 System schematics.
- .3 Submit six (6) copies of TAB Report to Departmental Representative for verification, in either English or French in D-ring binders, complete with index tabs.

1.16 SETTINGS

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

1.17 COMPLETION OF TAB

- .1 TAB considered complete when final TAB Report received and approved by Contractor's Engineer.

END OF SECTION

Part 1 General

1.1 SUMMARY

.1 Related Sections:

- .1 01 91 13 - General Commissioning (Cx) Requirements
- .2 22 15 00 – Boilers, instrumentation and general service compressed air systems.
- .3 23 08 02- Cleaning and Start-up of Mechanical Piping Systems.

1.2 REFERENCES

Use the latest applicable edition of the following references.

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

- .1 ASTM E202, Standard Test Methods for Analysis of Ethylene Glycols and Propylene Glycols.

1.3 CLEANING AND START-UP OF MECHANICAL PIPING SYSTEMS

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

1.4 HYDRONIC SYSTEMS – PERFORMANCE VERIFICATION (PV)

- .1 Perform hydronic systems performance verification after cleaning is completed and system is in full operation.
- .2 When systems are operational, perform following tests:
 - .1 Conduct full scale tests at maximum design flow rates, temperatures and pressures for continuous consecutive period of 48 hours to demonstrate compliance with design criteria.
 - .2 Verify performance of hydronic system circulating pumps as specified, recording system pressures, temperatures, fluctuations by simulating maximum design conditions and varying.
 - .1 Pump operation.
 - .2 Boiler operation.
 - .3 Pressure bypass open/closed.
 - .4 Control pressure failure.
 - .5 Maximum heating demand.
 - .6 Boiler failure.
 - .7 Outdoor reset. Re-check heat exchanger output supply temperature at 100 % and 50 % reset, maximum water temperature.

1.5 FUEL OIL SYSTEMS

- .1 Environmental protection systems:
 - .1 Test spill protection and over-fill protection systems using manufacturer's recommended procedures.
- .2 Fuel oil pumps:
 - .1 Check strainers on pump inlet, relief valve on pump outlet with discharge to oil return piping, pressure gauge on strainer inlet, pump inlet and pump discharge.
- .3 Notify authorities having jurisdiction to enable witnessing of tests as required.

1.6 INDUSTRIAL QUALITY COMPRESSED AIR SYSTEMS

- .1 Commissioning Agency: installing Contractor.
- .2 Commissioning Procedures:
 - .1 Air Compressor: refer to Section 221500 – Boilers, instrumentation and general service compressed air systems.
 - .2 Check operation of automatic drain valves.
 - .3 Bleed off measured flow rate of compressed air from receiver.
 - .4 Measure cumulative length of time that air compressor operates to recover pressure. Carry out test over extended period of time.
 - .5 Test compressor unloading systems at stages of operation. This may be performed by repeating above test at several bleed-off rates.

1.7 REPORTS

- .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Reports, supplemented as specified herein.

1.8 TRAINING

- .1 In accordance with Section 01 91 13 - General Commissioning (Cx) Requirements: Training of O&M Personnel, supplemented as specified herein.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Procedures and cleaning solutions for cleaning mechanical piping systems.
- .2 Related Sections:
 - .1 01 35 29 - Health and Safety Requirements.
 - .2 01 61 00 - Common Product Requirements.
 - .3 23 05 93 - Testing, Adjusting and Balancing for HVAC.
 - .4 23 25 00 - HVAC Water Treatment Systems.

1.2 REFERENCES

Use the latest applicable edition of the following references.

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

1.3 QUALITY ASSURANCE

- .1 Health and Safety:
 - .1 Do construction occupational health and safety in accordance with Section 01 35 29 - Health and Safety Requirements.

Part 2 Products

2.1 CLEANING SOLUTIONS

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

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 CLEANING HYDRONIC SYSTEMS

- .1 Cleaning Agency:
 - .1 Retain qualified water treatment specialist to perform system cleaning.
- .2 Report on Completion of Cleaning:
 - .1 When cleaning is completed, submit report, complete with certificate of compliance with specifications of cleaning component supplier.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation procedures for electric heating and cooling controls.
- .2 Related Sections:
 - .1 01 35 29 - Health and Safety Requirements.
 - .2 01 61 00 - Common Product Requirements.

1.2 REFERENCES

Use the latest applicable edition of the following references.

- .1 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

Part 2 Products

2.1 FLOW SWITCH

- .1 Flow switch pipe size as indicated, CSA Enclosure , rated at 16 A at 120 V. Maximum liquid temperature: 121 degrees C. Maximum liquid gauge pressure of 1034 kPa ambient temperature range 0 degrees C to 82 degrees C.

2.2 PRESSURE SWITCH

- .1 Pressure switch for air with auto reset, contacts open on rise. Maximum allowable gauge pressure of 1.2 MPa. Full load 16 A at 120 V.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install control devices.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials and installation for piping, valves and fittings for gas fired equipment.
- .2 Related Sections:
 - .1 01 35 29 - Health and Safety Requirements.
 - .2 01 45 00 - Quality Control.
 - .3 01 78 00 - Closeout Submittals.
 - .4 23 05 01 - Installation of Pipework.
 - .5 23 08 01 - Performance Verification of Mechanical Piping Systems.
 - .6 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems.

1.2 REFERENCES

Use the latest applicable edition of the following references.

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME B16.5 Pipe Flanges and Flanged Fittings.
 - .2 ASME B18.2.1 Square and Hex Bolts and Screws Inch Series.
- .2 American Society for Testing and Materials International (ASTM)
 - .1 ASTM A47/A47M, Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless.
- .3 American Petroleum Institute (API)
 - .1 API 5L, Specification for Line Pipe.
 - .2 API 6D, Specification for Pipeline Valves (Gate, Ball and Check Valves).
 - .3 ANSI/API 1104, Standard for Welding Pipeline and Related Facilities.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA W47.1 Certification of Companies for Fusion Welding of Steel.
- .5 Canadian Standards Association (CSA)/Canadian Gas Association (CGA)
 - .1 CAN/CSA B149.1HB, Natural Gas and Propane Installation Code Handbook.
 - .2 CAN/CSA B149.2, Propane Storage and Handling Code.
 - .3 Ministry of Municipal Affairs and Housing, Ontario Building Code.
- .6 Department of Justice Canada (Jus)
 - .1 Canadian Environmental Assessment Act (CEAA).
 - .2 Canadian Environmental Protection Act (CEPA).
 - .3 Transportation of Dangerous Goods Act (TDGA).

- .7 Transport Canada/Canadian Transport Commission
 - .1 General Order No. 0-32, Regulations Respecting the Design, Location, Construction, Operation and Maintenance of Stationary Bulk Storage for Flammable Liquids.
- .8 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).

1.3 SUBMITTALS

- .1 Closeout Submittals: submit maintenance and engineering data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 PIPE

- .1 Steel pipe: to ASTM A53/A53M, Schedule 40, seamless as follows:
 - .1 NPS 1/2 to 2, screwed.
 - .2 NPS 2 1/2 and over, plain end.

2.2 JOINTING MATERIAL

- .1 Screwed fittings: pulverized lead paste.
- .2 Welded fittings: to CSA W47.1.
- .3 Flange gaskets: non metallic flat.

2.3 FITTINGS

- .1 Steel pipe fittings, screwed, flanged or welded:
 - .1 Malleable iron: screwed, banded, Class 150.
 - .2 Steel pipe flanges and flanged fittings: to ASME B16.5.
 - .3 Welding: butt-welding fittings.
 - .4 Unions: malleable iron, brass to iron, ground seat, to ASTM A47/A47M.
 - .5 Bolts and nuts: to ASME B18.2.1.
 - .6 Nipples: schedule 40, to ASTM A53/A53M.

2.4 VALVES

- .1 Provincial Code approved lubricated ball type.

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 PIPING

- .1 Install in accordance with Section 23 05 01 - Installation of Pipe work, applicable Provincial Codes, CAN/CSA B149.1 and CAN/CSA B149.2, supplemented as specified.
- .2 Install drip points:
 - .1 At low points in piping system.
 - .2 At connections to equipment.

3.3 VALVES

- .1 Install valves with stems upright unless otherwise approved by Departmental Representative.
- .2 Install valves at branch take-offs to isolate pieces of equipment, and as indicated.

3.4 FIELD QUALITY CONTROL

- .1 Site Tests/Inspection:
 - .1 Test system in accordance with CAN/CSA B149.1, CAN/CSA B149.2 and requirements of authorities having jurisdiction.
- .2 Performance Verification:
 - .1 Refer to Section 23 08 01 - Performance Verification of Mechanical Piping Systems.
- .3 PV procedures:
 - .1 Test performance of components.

3.5 ADJUSTING

- .1 Purging: purge after pressure test in accordance with CAN/CSA B149.1 and CAN/CSA B149.2.
- .2 Pre-Start-Up Inspections:
 - .1 Check vents from regulators, control valves, terminate outside building in approved location, protected against blockage, damage.
 - .2 Check gas trains, entire installation is approved by authority having jurisdiction.

3.6 CLEANING

- .1 Cleaning: in accordance with Section 23 08 02 - Cleaning and Start-Up of Mechanical Piping Systems, CAN/CSA B149.1 and CAN/CSA B149.2 supplemented as specified.

- .2 Perform cleaning operations as specified in Section 230802 - Cleaning and Start-up of Mechanical Piping Systems and in accordance with manufacturer's recommendations.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes.
 - .1 Materials and installation for steel piping, valves and fittings for hydronic systems in building services piping.
- .2 Related Sections.
 - .1 01 35 29 - Health and Safety Requirements.
 - .2 01 78 00 - Closeout Submittals.
 - .3 21 05 01 - Common Work Results for Mechanical.
 - .4 23 05 17 - Pipe Welding.
 - .5 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.
 - .6 23 05 01 - Installation of Pipework.
 - .7 23 05 23.01 - Valves - Bronze.
 - .8 23 05 93 - Testing, Adjusting and Balancing for HVAC.
 - .9 23 08 01 - Performance Verification of Mechanical Piping.
 - .10 23 08 02 - Cleaning and Start-up of Mechanical Piping Systems.

1.2 REFERENCES

Use the latest applicable edition of the following references.

- .1 American Society of Mechanical Engineers (ASME).
 - .1 ASME B16.1, Cast Iron Pipe Flanges and Flanged Fittings.
 - .2 ASME B16.3, Malleable Iron Threaded Fittings.
 - .3 ASME B16.5, Pipe Flanges and Flanged Fittings.
 - .4 ASME B16.9, Factory-Made Wrought Buttwelding Fittings.
 - .5 ASME B18.2.1, Square and Hex Bolts and Screws (Inch Series).
 - .6 ASME B18.2.2, Square and Hex Nuts (Inch Series).
- .2 American Society for Testing and Materials International, (ASTM).
 - .1 ASTM A47/A47M, Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated Welded and Seamless.
 - .3 ASTM A536, Standard Specification for Ductile Iron Castings.
 - .4 ASTM B61, Standard Specification for Steam or Valve Bronze Castings.
 - .5 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
 - .6 ASTM E202, Standard Test Method for Analysis of Ethylene Glycols and Propylene Glycols.

- .3 American Water Works Association (AWWA).
 - .1 AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- .4 Canadian Standards Association (CSA International).
 - .1 CSA B242, Groove and Shoulder Type Mechanical Pipe Couplings.
 - .2 CAN/CSA W48, Filler Metals and Allied Materials for Metal Arc Welding (Developed in cooperation with the Canadian Welding Bureau).
- .5 Manufacturer's Standardization of the Valve and Fittings Industry (MSS).
 - .1 MSS-SP-67, Butterfly Valves.
 - .2 MSS-SP-70, Cast Iron Gate Valves, Flanged and Threaded Ends.
 - .3 MSS-SP-71, Cast Iron Swing Check Valves Flanged and Threaded Ends.
 - .4 MSS-SP-80, Bronze Gate, Globe, Angle and Check Valves.
 - .5 MSS-SP-85, Cast Iron Globe and Angle Valves, Flanged and Threaded Ends.

1.3 SUBMITTALS

- .1 Closeout Submittals.
 - .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals and include following:
 - .1 Special servicing requirements.

Part 2 Products

2.1 Application

- .1 On Low Temperature Hot Water systems.

2.2 PIPE

- .1 Steel pipe: to ASTM A53/A53M, Grade B.

2.3 PIPE JOINTS

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

.8 Bolts and nuts: to ASME B18.2.1 and ASME B18.2.2.

.9 Roll grooved coupling gaskets: type EPDM.

2.4 FITTINGS

.1 Screwed fittings: malleable iron, to ASME B16.3, Class 300.

.2 Pipe flanges and flanged fittings:

.1 Cast iron: to ASME B16.1.

.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.

2.5 VALVES

.1 Connections:

.1 NPS2 and smaller: screwed ends.

.2 NPS2.1/2 and larger: Flanged ends.

.2 Gate valves: to MSS-SP-70 or to MSS-SP-80. Application: Isolating equipment, control valves, pipelines:

.1 NPS2 and under:

.1 Mechanical Rooms: Class 300, rising stem, split wedge disc, as specified Section 23 05 23.01 - Valves – Bronze.

.2 Elsewhere: Class 300, non-rising stem, solid wedge disc, as specified Section 23 05 23.01 - Valves – Bronze.

.2 NPS2 1/2 and over:

.1 Non-rising stem, solid wedge disc, bronze trim, as specified Section 23 05 23.02 - Valves - Cast Iron: Gate, Globe, Check.

.1 Operators: hand wheel or manual gear.

.3 Globe valves: to MSS-SP-80 or 85. Application: Throttling, flow control, emergency bypass:

.1 NPS2 and under:

.1 Mechanical Rooms: with PTFE disc, as specified Section 23 05 23.01 - Valves - Bronze.

.2 Elsewhere: Globe, with composition disc, as specified Section 23 05 23.01 - Valves - Bronze.

.2 NPS2 1/2 and over:

.1 With bronze disc, bronze trim, as specified Section 23 05 23.02 - Valves - Cast Iron: Gate, Globe, Check.

- .2 Operators: hand wheel, manual gear or pneumatic,
- .4 Balancing, for TAB:
 - .1 Sizes: Calibrated balancing valves, as specified this section.
 - .2 NPS2 and under:
 - .1 Globe, with plug disc as specified Section 23 05 23.01 - Valves – Bronze.
- .5 Drain valves: Gate, Class 300, non-rising stem, solid wedge disc, as specified Section 23 05 23.01 - Valves – Bronze.
- .6 Bypass valves on globe valves NPS8 and larger: NPS 1, Globe, with PTFE disc as specified Section 23 05 23.01 - Valves - Bronze.
- .7 Swing check valves: to MSS-SP-71 or MSS-SP-80.
 - .1 NPS2 and under:
 - .1 Class 300, swing, with composition disc, as specified Section 23 05 23.01 - Valves - Bronze.
 - .2 NPS2 1/2 and over:
 - .1 Flanged or Grooved ends: as specified Section 23 05 23.02 - Valves - Cast Iron: Gate, Globe, Check.
- .8 Silent check valves:
 - .1 NPS2 and under:
 - .1 As specified Section 23 05 23.01 - Valves – Bronze.
 - .2 NPS2 1/2 and over:
 - .1 Grooved ends: as specified Section 23 05 23.02 - Valves - Cast Iron: Gate, Globe, Check.
- .9 Ball valves:
 - .1 NPS2 and under: as specified Section 23 05 23.01 - Valves – Bronze.
- .10 Lubricated Plug Valves
 - .1 NPS2 1/2 and over:
 - .1 As specified Section 23 05 23.02 - Valves - Cast Iron: Gate, Globe, Check.

Part 3 Execution

3.1 PIPING INSTALLATION

- .1 Install pipe work in accordance with Section 23 05 01 - Installation of Pipe Work.

3.2 CLEANING, FLUSHING AND START-UP

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

3.3 TESTING

- .1 Test system in accordance with Section 21 05 01 - Common Work Results for Mechanical.

3.4 PERFORMANCE VERIFICATION

- .1 In accordance with Section 23 08 01 - Performance Verification of Mechanical Piping.

END OF SECTION

Part 1 General

1.1 RELATED SECTIONS

- .1 01 61 00 - Common Product Requirements.
- .2 01 74 11 - Cleaning.
- .3 01 74 21 - Construction/Demolition Waste Management and Disposal
- .4 01 78 00 - Closeout Submittals.

1.2 REFERENCES

Use the latest applicable edition of the following references.

- .1 American Society of Mechanical Engineers (ASME)
 - .1 ASME-04, Boiler and Pressure Vessel Code.
- .2 ASTM International Inc.
 - .1 ASTM A47/A47M-99, Standard Specification for Ferritic Malleable Iron Castings.
 - .2 ASTM A278/A278M-01, Standard Specification for Gray Iron Castings for Pressure-Containing Parts for Temperatures up to 650 degrees F (350 degrees C).
 - .3 ASTM A516/A516M, Standard Specification for Pressure Vessel Plates, Carbon Steel, for Moderate - and Lower - Temperature Service.
 - .4 ASTM A536-84, Standard Specification for Ductile Iron Castings.
 - .5 ASTM B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
 - .6 ASTM/ASME B31.1, Power Piping.
 - .7 ASTM/ASME B31.3, Process Piping.
- .3 Canadian Standards Association (CSA International)
 - .1 CSA B51-03, Boiler, Pressure Vessel, and Pressure Piping Code.
 - .2 CSA B51-03, Boiler, Pressure Vessel, and Pressure Piping Code, Supplement #1.

1.3 CLOSEOUT SUBMITTALS

- .1 Submit maintenance and operation data in accordance with Section 01 78 00 - Closeout Submittals.

Part 2 Products

2.1 AUTOMATIC AIR VENT

- .1 Standard float vent: brass body and NPS 1/8 connection and rated at 1276 kPa working pressure.
- .2 Industrial float vent: cast iron body and NPS 1/2 connection and rated at 1276 kPa working pressure.

- .3 Float: solid material suitable for 115 degrees C working temperature.

2.2 AIR SEPARATOR - BOILER MOUNTED

- .1 Complete with dip tube.
.2 Working pressure : 1276 kPa.

2.3 AIR SEPARATOR - EXPANSION TANK FITTING

- .1 Complete with adjustable vent tube and built-in manual vent valve.
.2 Working pressure : 1276 kPa.

2.4 AIR SEPARATOR - IN-LINE

- .1 Working pressure: 1276 kPa.
.2 Size: as required.

2.5 COMBINATION SEPARATORS/STRAINERS

- .1 Steel, tested and stamped in accordance with ANSI/ASME BPVC, for 1276 kPa operating pressure, with galvanized steel integral strainer with 5 mm perforations, tangential inlet and outlet connections, and internal stainless steel air collector tube.

2.6 COMBINATION LOW PRESSURE RELIEF AND REDUCING VALVE

- .1 Adjustable pressure setting.
.2 Low inlet pressure check valve.
.3 Removable strainer.

2.7 PIPE LINE STRAINER

- .1 NPS 1/2 to 2: bronze body to ASTM B62, screwed connections, Y pattern.
.2 NPS 2 1/2 to 12: cast steel body to ASTM A278/A278M, Class 30, or cast iron body to ASTM A278/A278M, Class 30 flanged connections.
.3 NPS 2 to 12: T type with ductile iron body to ASTM A536, grooved ends.
.4 Blowdown connection: NPS 1.
.5 Screen: stainless steel with 1.19 mm perforations.
.6 Working pressure: 1276 kPa.

Part 3 Execution

3.1 APPLICATION

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

datasheets.

- .2 The Contractor must retain the services of the buried piping system manufacturer's representative to inspect the installation and finished field joints prior to backfilling. The inspection report must be transmitted to Departmental Representative.

3.2 GENERAL

- .1 Run drain lines and blow off connections to terminate above nearest drain.
- .2 Maintain adequate clearance to permit service and maintenance.
- .3 Check shop drawings for conformance of tappings for ancillaries and for equipment operating weights.

3.3 STRAINERS

- .1 Install in horizontal or down flow lines.
- .2 Ensure clearance for removal of basket.
- .3 Install ahead of each pump.
- .4 Install ahead of each automatic control valve larger than NPS 1 and as required.

3.4 AIR VENTS

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

3.5 PRESSURE SAFETY RELIEF VALVES

- .1 Run discharge pipe to terminate above nearest drain.

3.6 SUCTION DIFFUSERS

- .1 Install on inlet to pumps having suction size greater than 50.

3.7 CLEANING

- .1 Clean in accordance with Section 01 74 11 - Cleaning.
 - .1 Remove surplus materials, excess materials, rubbish, tools and equipment.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Materials, accessories and installation for breechings, chimneys and stacks.
- .2 Related Sections:
 - .1 01 35 29 - Health and Safety Requirements.
 - .2 01 61 00 - Common Product Requirements.
 - .3 01 78 00 - Closeout Submittals.
 - .4 03 30 00 – Cast-in-Place Concrete.

1.2 REFERENCES

Use the latest applicable edition of the following references.

- .1 Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
- .2 Underwriters' Laboratories of Canada (ULC)
- .3 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .4 Environmental Protection Act of Ontario
- .5 Technical Standards and Safety Act of Ontario

1.3 SUBMITTALS

- .1 Closeout Submittals
 - .1 Submit operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

- .1 Regulatory Requirements: work to be performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial regulations.

Part 2 Products

2.1 FUELS: PRESSURE BREECHING

- .1 ULC labelled, 760 degrees C rated.
- .2 Sectional, prefabricated, single wall with mineral wool insulation and stainless steel outer jacket with mated fittings and couplings.
 - .1 Type 316 stainless steel.

2.2 ACCESSORIES

- .1 Cleanouts: bolted, gasketed type, full size of breeching, as required.
- .2 Hangers and supports: in accordance with recommendations of Sheet Metal and Air Conditioning Contractors National Association Inc. (SMACNA).
- .3 Expansion sleeves with heat resistant caulking, held in place as required.

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 - GENERAL

- .1 Follow manufacturer's and SMACNA installation recommendations for shop fabricated components.
- .2 Suspend breeching at 1.5 m centres and at each joint.
- .3 Support chimney as required.
- .4 Install thimbles where penetrating roof, floor, ceiling and where breeching enters masonry chimney. Pack annular space with heat resistant caulking.
- .5 Install flashings on chimneys penetrating roofs, as required.
- .6 Install rain caps and cleanouts, as required.

END OF SECTION

Part 1 General

1.1 SUMMARY

- .1 Section Includes:
 - .1 Heating boiler units:
 - .1 Low Temperature Hot Water boilers.
 - .2 Installation.
 - .3 Commissioning.
 - .2 Related Sections:
 - .1 01 35 29 - Health and Safety Requirements.
 - .2 01 61 00 - Common Product Requirements.
 - .3 01 78 00 - Closeout Submittals.
 - .4 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

1.2 REFERENCES

Use the latest applicable edition of the following references.

- .1 American Boiler Manufacturer's Association (ABMA)
- .2 American National Standards Institute (ANSI)
- .3 American National Standards Institute (ANSI)/ American Society of Mechanical Engineers (ASME)
 - .1 ANSI/ASME Boiler and Pressure Vessel Code, Section IV.
- .4 Canadian Standards Association (CSA International)
 - .1 CSA B51, Boiler, Pressure Vessel, and Pressure Piping Code.
- .5 Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
- .6 Health Canada/Workplace Hazardous Materials Information System (WHMIS)
 - .1 Material Safety Data Sheets (MSDS).
- .7 Environmental Protection Act of Ontario
- .8 Technical Standards and Safety Act of Ontario

1.3 SUBMITTALS

Closeout Submittals:

- .1 Submit operation and maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.

1.4 QUALITY ASSURANCE

- .1 Regulatory Requirements: work to be performed in compliance with CEPA, CEAA, TDGA, and applicable Provincial regulations.

1.5 MAINTENANCE

- .1 Extra materials:
 - .1 Special tools for burners, manholes, handholes and Operation and Maintenance.
 - .2 Spare burner tips.
 - .3 Spare burner gun.

Part 2 Products

2.1 GENERAL

2.2.1 Packaged boiler:

- .1 Packaged boiler:
 - .1 Complete with burner, and all necessary accessories and controls.
 - .2 Factory tested at rated capacity
 - .3 Ready for attachment to piping, electrical power, controls, flue gases exhaust.
 - .4 Designed and constructed to ANSI/ASME Boiler and Pressure vessel Code.
 - .5 CRN (Canadian Registration Number), to CSA B51.
 - .6 Boiler/burner package to bear ULC label.
- .2 Electrical:
 - .1 Power: 600 V, 3 phase, 60 Hz.
 - .2 Controls: 120 V, 1 phase, 60 Hz.
 - .3 Electrical components: CSA approved.
- .3 Controls: factory wired. Enclosed in Electrical and Electronic Manufacturers' Association of Canada (EEMAC) 1 steel cabinet.
- .5 Thermal insulation:
 - .1 Mineral fibre. Seal insulation at handholes, manholes, piping connections with insulating cement or asphaltic paint. Finish with heat resisting paint.
- .6 Jackets: heavy gauge metal, finished with heat resisting paint.
- .7 Mounting:
 - .1 Structural steel base, lifting lugs.
- .8 Anchor bolts and templates:
 - .1 Supply for installation by other Divisions. Anchor bolts to be sized to Section 23 05 48 – Vibration and Seismic Controls for HVAC Piping and Equipment
- .9 Start-up, instruction, on-site performance tests: three (3) days per boiler.
- .10 Trial usage:
 - .1 Contractor's Engineer may use boilers for test purposes prior to acceptance and commencement of warranty period. Departmental Representative to be given advance notification of tests.
 - .2 Supply labour, materials and instruments required for tests.

- .11 Temporary use by contractor:
 - .1 Monitor and record performance continuously. Keep log of maintenance activities carried out.
 - .2 Refurbish to as new condition before final inspection and acceptance.

2.4 AUXILIARIES

- .1 Provide auxiliaries for each boiler and to meet ANSI/ASME requirements.
- .2 CRN (Canadian Registration Number), to CSA B51

2.5 EMISSION CONTROL

- .1 Rate of discharge of air contaminants from boiler not to exceed limits defined under Ontario Environmental Protection Act and federal regulations. Flue Gas Recirculation should be used to meet requirements.

2.6 NOISE CONTROL

- .1 Noise level inside and outside the plant shall be kept below the requirements of local, provincial and federal regulations.

Part 3 Execution

3.1 MANUFACTURER'S INSTRUCTIONS

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

3.2 INSTALLATION

- .1 Install in accordance with ANSI/ASME Boiler and Pressure Vessels Code Section IV, regulations of Province of Ontario having jurisdiction, except where specified otherwise, and manufacturers recommendations.
- .2 Make required piping connections to inlets and outlets recommended by boiler manufacturer.
- .3 Maintain clearances as indicated or if not indicated, as recommended by manufacturer for operation, servicing and maintenance without disruption of operation of any other equipment/system.
- .4 Mount unit level using specified vibration isolation in Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.

3.3 MOUNTINGS AND ACCESSORIES

- .1 Safety valves and relief valves:
 - .1 Run drain pipe from each valve outlet and drip pan elbow to above nearest drain.

3.4 FIELD QUALITY CONTROL

- .1 Commissioning:
 - .1 Manufacturer to:
 - .1 Certify installation.
 - .2 Start up and commission installation.
 - .3 Carry out on-site performance verification tests.
 - .4 Demonstrate operation and maintenance.
 - .2 Provide Departmental Representative at least 24 hours notice prior to inspections, tests, and demonstrations. Submit written report of inspections and test results to Contractor's Engineer.

END OF SECTION

Biomass (Graded Wood Chip Fuel) Pilot Project

Measurement & Verification of Boiler Efficiencies and Outputs

Measure

1. Combustion Efficiency
2. Boiler efficiency
3. Comparison of efficiencies and emissions at different operation modes - full and partial loads
4. Annual Fuel Utilization Efficiency (ASHRAE standard 103-2007)

1.) Combustion Efficiency

Calculated from energy input minus heat losses (in flue gas). Flue gas composition and temperature will need to be measured. This is also useful to compare different operation modes, as different air ratios or flue gas temperatures can immediately be evaluated.

2.) Boiler Efficiency

Useful (heat output/energy input) per time unit. Note, that the boiler will have a significant heat and fuel storage capacity, therefore the boiler efficiency is best calculated during stationary conditions.

3.) Part load operation can have a significant influence on pollutant emissions.

4.) Annual Fuel Utilization Efficiency

Is the thermal efficiency measure of combustion to represent the actual, season-long average efficiency of the boiler, measured as per AHRAE Standard 103-2007

Required Measurements

Flue Gas measurements both at partial (30%) and nominal full loads

- emissions (concentrations)
 - Oxygen (required under EASR)
 - Carbon Dioxide
 - Carbon Monoxide
- Humidity
- Temperature (required under EASR)
- Volumetric flow rate

1.) Boiler Measurements both at partial (30%) and nominal loads

- Electric Meter for boiler and (Virtual) sub-meter for auxiliary equipment
- Water meter (volume and temperature input/output) (required under EASR)

2.) Fuel Measurements

Biofuel (woodchips) – measured in both tonnage and \$/MMBtu or \$/GJ (per hot water boiler output)

- Calorific value (high heating and low heating)
- Particle size distribution
- Ash
- Ash components

As per the Ministry of the Environment and Climate Change (MOECC) the biomass boiler must comply with the Environmental Activity and Sector Registry – Limits and Other Requirements (“EASR”). The selected system must satisfy the requirements described in EASR to achieve environmental approval. In addition to physical requirements of the design conditions must include specific ongoing measurements and installation testing.

The following documents are included with this attachment;

1. Ontario Regulation 1/17
2. Environmental Activity and Sector Registry – Limits and Other Requirement
3. Guideline for the control of air emissions from small wood-fired combustors (<3MW)
4. Fuel Specifications for wood Chip as per the CAN/CSA-ISO 17225 Part 4 Graded Wood Chips

Fuel Accounting

Biomass

Fuel volume is easily determined, however the energy content has significant uncertainties

Regular fuel sampling will be required to accurately evaluate fuel efficiencies

Assumption is that fuel sized chips are relatively homogenous MEETING p31 OR p45

Moisture content should be sampled on a regular basis.

- In-house fuel sampling equipment and training is included as part of this contract, as well as external third party monthly sampling of fuel.

Supply installation and integration of meters and sensors

Supply installation and integration of meters and sensors for ongoing measurement and verifications are included in this contract. Work to install, connected and map to PSPC metering database by R&R Automation as a sub-contractor.

ONTARIO REGULATION 1/17

made under the

ENVIRONMENTAL PROTECTION ACT

Made: December 14, 2016

Filed: January 3, 2017

Published on e-Laws: January 3, 2017

Printed in *The Ontario Gazette*: January 21, 2017**REGISTRATIONS UNDER PART II.2 OF THE ACT — ACTIVITIES REQUIRING ASSESSMENT OF AIR EMISSIONS****CONTENTS****PART I****INTERPRETATION AND APPLICATION**

- [1.](#) Interpretation
[2.](#) Prescribed activities, s. 20.21 (1) of the Act
[3.](#) Application, activities prescribed by more than one EASR regulation

PART II**REGISTRATION MATTERS**

- [4.](#) Prescribed date environmental compliance approval ceases to have effect
[5.](#) Registration of all activities at facility when first activity is registered
[6.](#) Registration requirement, Environmental Assessment Act undertakings
[7.](#) Registration requirement, Niagara Escarpment Planning and Development Act
[8.](#) Registration requirement, information to be filed
[9.](#) Continuation of applications for environmental compliance approval
[10.](#) Registration exemptions, modifications to facility

PART III**ACTIVITY REQUIREMENTS - CLAUSE 20.21 (1) (C) OF THE ACT****AIR**

- [11.](#) Air contaminants
[12.](#) EASR ESDM report requirements
[13.](#) EASR ESDM report supplement
[14.](#) Notice under s. 24 of Ontario Regulation 419/05
[15.](#) Notice to submit in-stack testing results

NOISE

- [16.](#) Noise emissions
[17.](#) Noise report
[18.](#) Noise setback, subpara 8 i of s. 17 (1)
[19.](#) Primary noise screening, subpara 8 ii of s. 17 (1)
[20.](#) Secondary noise screening, subpara 8 iii of s. 17 (1)
[21.](#) Acoustic assessment, subpara 8 iv of s. 17 (1)
[22.](#) Noise abatement action plan, subpara 8 v of s. 17 (1)
[23.](#) Notice to prepare acoustic audit report

ODOUR

- [24.](#) Odour emissions
[25.](#) Odour screening report
[26.](#) Best management practices plan for odour
[27.](#) Odour control report
[28.](#) Notice to submit best management practices plan for odour

FUGITIVE DUST

- [29.](#) Best management practices plan for fugitive dust control
[30.](#) Notice to submit best management practices plan for fugitive dust control

OTHER ACTIVITY REQUIREMENTS

- [31.](#) Small wood-fired combustors
[32.](#) Modifications to facility — requirement re reports
[33.](#) Procedures
[34.](#) Complaints

PART IV**MISCELLANEOUS**

- [35.](#) Records

[36.](#) Form of reports, etc.

PART V
COMMENCEMENT

[37.](#) Commencement
[Schedule](#)

PART I
INTERPRETATION AND APPLICATION

Interpretation

1. (1) In this Regulation,

“ACB list” means the document entitled “Air Contaminants Benchmarks (ACB) List: Standards, guidelines and screening levels for assessing point of impingement concentrations of air contaminants”, as amended from time to time and published by the Ministry and available on a Government website;

“acoustic assessment” means a detailed assessment of sound discharged into the air from sources of sound at a facility that assesses the predictable worst case sound levels at affected points of noise reception using calculations or measurements capable of accurately determining sound levels at points of noise reception;

“biogas” has the same meaning as in Ontario Regulation 160/99 (Definitions and Exemptions) made under the *Electricity Act, 1998*;

“biomass” has the same meaning as in Ontario Regulation 160/99;

“boiler” means a piece of equipment that includes a combustion source and that is used for the purpose of generating hot water or steam;

“combustion source” means a device in which combustible material is oxidized, resulting in the release of heat and products of combustion;

“combustion turbine” means a combustion source containing an engine that operates according to the Brayton thermodynamic cycle, in which fuel is burned and the products of combustion are allowed to expand through the blades of a rotating turbine at a high temperature;

“EASR ESDM report” means an Environmental Activity and Sector Registry Emission Summary and Dispersion Modelling report;

“EASR publication” means the document entitled “Environmental Activity and Sector Registry - Limits and Other Requirements”, setting out matters such as limits, intensity rates and requirements relating to the equipment and technology used at facilities, the operation of facilities, record-keeping and the monitoring and reporting of information relating to facilities, as amended from time to time and published by the Ministry and available on a Government website;

“EASR regulation” means a regulation made under the Act by which one or more activities are prescribed for the purposes of subsection 20.21 (1) of the Act;

“facility” means all plants, structures, equipment, apparatuses, mechanisms or things, including surfaces and storage piles, that function as a single integrated operation and that are,

(a) owned or operated by the same person, and

(b) located on the same site;

“heater” means a piece of equipment that includes a combustion source and that is used to transfer heat directly or indirectly to material that is being processed;

“land disposal”, with respect to waste, has the same meaning as in Regulation 347 (General —Waste Management) made under the Act;

“licensed engineering practitioner” means a person who holds a licence, limited licence or temporary licence under the *Professional Engineers Act*;

“modification”, in respect of a facility, means any of the following that may discharge or alter the rate or manner of discharge of a contaminant into the air:

1. the construction, alteration, extension or replacement of any plant, structure, equipment, apparatus, mechanism or thing,

2. the alteration of a process or rate of production;

“NAICS” means the North American Industry Classification System maintained for Canada by Statistics Canada, as amended from time to time;

“point of noise reception” means a point described in Chapter 3 of the EASR publication at which sound discharged into the air from a source of sound at a facility is received;

“point of odour reception” means a point described in Chapter 4 of the EASR publication at which odour discharged into the air from a source of odour at a facility is received;

“Primary Noise Screening Method” means the method, published by the Ministry as updated from time to time and available on a Government of Ontario website, for determining the minimum separation distance that would result in sound levels less than or equal to the sound level limits set out in Chapter 3 of the EASR publication;

“Registry” means the Environmental Activity and Sector Registry established under Part II.2 of the Act;

“Secondary Noise Screening Method” means the method, published by the Ministry as updated from time to time and available on a Government of Ontario website, for determining the combined sound level at an affected point of noise reception;

“site”, with respect to a facility, means the property on which the facility is located;

“small wood-fired combustor” means a wood-fired combustor that has a nominal load heat input capacity of less than three megawatts;

“thermal treatment” has the same meaning as in Regulation 347;

“wood-fired combustor” means a combustion source designed to burn wood fuel such as hogged wood fuel, wood chips, wood pellets, bark, sawdust, woodwaste, cellulosic plant material, paper or paper sludge.

(2) A reference in this Regulation to an activity being engaged in or another thing occurring at a facility is a reference to the activity being engaged in or the thing occurring at the site on which the facility is located.

Prescribed activities, s. 20.21 (1) of the Act

2. (1) Subject to subsections (2) and (3), the following are prescribed activities for the purposes of subsection 20.21 (1) of the Act:

1. The use, operation, construction, alteration, extension or replacement of any plant, structure, equipment, apparatus, mechanism or thing at a facility that may discharge or from which may be discharged a contaminant into any part of the natural environment other than water.
2. The alteration of a process or rate of production at a facility if the alteration may result in,
 - i. the discharge of a contaminant into any part of the natural environment other than water, or
 - ii. the alteration of the rate or manner of discharge of a contaminant into any part of the natural environment other than water.

(2) Subsection (1) does not apply in respect of the following activities:

1. An activity engaged in at a facility that is part of a class identified by a NAICS code listed in the Schedule to this Regulation, if the NAICS code is the primary NAICS code for the facility.
2. An activity engaged in at a facility that is part of a class identified by a NAICS code that begins with 3212 (Veneer, plywood and engineered wood product manufacturing) if that NAICS code is the primary NAICS code for the facility. However, subsection (1) does apply in respect of an activity engaged in at a facility that is part of a class identified by the NAICS code 321211 (Hardwood veneer and plywood mills).
3. An activity engaged in at a facility at which at least one of the following activities takes place:
 - i. The land disposal of waste.
 - ii. The processing or disposal of waste by way of thermal treatment, other than the thermal treatment of the fuel described in subparagraph iii in a small wood-fired combustor that was installed at the facility on or after January 31, 2017.
 - iii. The use of a wood-fired combustor, other than a small wood-fired combustor that was installed at the facility on or after January 31, 2017 and that exclusively uses as fuel one or more of the following:
 - A. Wood briquettes that meet the specifications set out in Chapter 5 of the EASR publication.
 - B. Wood chips that meet the specifications set out in Chapter 5 of the EASR publication.
 - C. Wood pellets that meet the specifications set out in Chapter 5 of the EASR publication.
 - iv. The use of a plating process that uses cadmium, cyanide, chromium or nickel, including chrome plating, electroplating or electroless plating.
 - v. The use of an electrolytic stripping process that removes cadmium, chromium or nickel from an object.

- vi. The processing of metals outdoors, including torching, shearing, shredding or plasma cutting, other than for the purpose of routine maintenance carried out at the facility on any plant, structure, equipment, apparatus or thing.
 - vii. The operation of an alternative low-carbon fuel site within the meaning of Ontario Regulation 79/15 (Alternative Low-Carbon Fuels) made under the Act.
 - viii. The operation of an end-of-life vehicle waste disposal site within the meaning of Ontario Regulation 85/16 (Registrations under Part II.2 of the Act - End-of-life Vehicles) made under the Act.
 - ix. The operation of a fossil-fuel electric power generation facility with a maximum electrical power output capacity equal to or greater than 25 megawatts.
 - x. The operation of a combustion source that uses biogas, biomass, coal, petroleum coke or waste as a fuel or that uses a fuel derived from biogas, biomass, coal, petroleum coke or waste. However, this does not include the operation of a small wood-fired combustor that was installed at the facility on or after January 31, 2017 and that exclusively uses one or more of the fuels described in subparagraph iii.
 - xi. The use of a combustion turbine.
4. An activity engaged in at a facility if a landfilling site that is no longer permitted to accept waste is located on the site on which the facility is located.
 5. An activity engaged in at a facility if a site-specific air standard is or has previously been set in respect of the facility under section 35 of Ontario Regulation 419/05 (Air Pollution — Local Air Quality) made under the Act for a contaminant discharged from the facility.
 6. An activity engaged in at a facility if, in respect of the facility, a person is or has previously been registered in the Ministry's Technical Standards Registry – Air Pollution under section 39 of Ontario Regulation 419/05.
 7. A discrete activity involving the use of equipment that is intended to be moved from one site to another to perform the same function at each site, such as the use of mobile rock crushing equipment or mobile PCB destruction equipment.
 8. An activity engaged in at a facility that is located on a property that is one of a group of properties that are deemed to be a single property under subsection 4 (2) of Ontario Regulation 419/05.
 9. An activity that is exempt from subsection 9 (1) of the Act, other than an activity that is exempt by operation of subsection 9 (4) of the Act.
- (3) Subsection (1) does not apply to activities engaged in with respect to a renewable energy project if, by operation of subsection 9 (1) of Ontario Regulation 359/09 (Renewable Energy Approvals Under Part V.0.1 of the Act) made under the Act, section 47.3 of the Act does not apply to a person engaging in the project.

Application, activities prescribed by more than one EASR regulation

3. (1) This section sets out the rules governing the application of this Regulation with respect to an activity that is prescribed for the purposes of subsection 20.21 (1) of the Act by section 2 of this Regulation and that is also prescribed by another EASR regulation.

(2) This Regulation applies with respect to an activity described in subsection (1) and the other EASR regulation is deemed not to apply with respect to the activity.

(3) Despite subsection (2), this Regulation does not apply with respect to an activity described in subsection (1), and the other EASR regulation continues to apply with respect to the activity, if the only activities engaged in at the facility at which the activity is engaged in are one or more of the following:

1. Activities described in subsection (1) that are all prescribed under a single other EASR regulation.
2. Activities described in paragraph 9 of subsection 2 (2).

(4) Despite subsection (2), if the person engaging in an activity described in subsection (1) at a facility has registered the activity in the Registry before the day this Regulation came into force, this Regulation does not apply with respect to the activity and the other EASR regulation continues to apply with respect to the activity until the earlier of the following days:

1. The date, as set out in a confirmation of registration provided by the Director, on which a registration is in effect in respect of an additional activity in which the person engages at the facility and that is prescribed for the purposes of subsection 20.21 (1) of the Act under this Regulation.
2. January 31, 2027.

**PART II
REGISTRATION MATTERS**

Prescribed date environmental compliance approval ceases to have effect

4. For the purposes of clause 20.17 (b) of the Act, January 31, 2027 is prescribed as the day on which an environmental compliance approval issued in respect of an activity prescribed by section 2 of this Regulation ceases to apply to the activity.

Registration of all activities at facility when first activity is registered

5. (1) This section applies to a person who, before January 31, 2027, registers an activity that is prescribed by section 2 in the Registry if, immediately before the person registers the activity in respect of a facility, an environmental compliance approval in respect of the activity is in effect.

(2) Subject to sections 6 and 7, a person to whom this section applies shall, when registering the activity in the Registry, register all other activities prescribed by section 2 in which the person engages or proposes to engage at the facility.

Registration requirement, *Environmental Assessment Act* undertakings

6. A person who proposes to engage in an activity prescribed by section 2 that forms part of an undertaking to which Part II or II.1 of the *Environmental Assessment Act* applies shall not register the activity in the Registry until,

- (a) if a class environmental assessment approved under Part II.1 of that Act applies with respect to the undertaking and no order has been issued with respect to the proposed undertaking under section 16 of that Act, the day all requirements necessary to proceed with the undertaking under the class environmental assessment have been satisfied; or
- (b) in the case of any other undertaking, the day an approval is given under Part II of that Act to proceed with the undertaking.

Registration requirement, *Niagara Escarpment Planning and Development Act*

7. (1) A person who proposes to engage in an activity prescribed by section 2 at a facility that is located in an area of development control within the Niagara Escarpment Planning Area shall not register the activity in the Registry before a development permit required under section 24 of the *Niagara Escarpment Planning and Development Act* has been issued in respect of the facility.

(2) In this section,

“Niagara Escarpment Planning Area” has the same meaning as in the *Niagara Escarpment Planning and Development Act*.

Registration requirement, information to be filed

8. The following information shall be filed in the Registry under subsection 2 (1) of Ontario Regulation 245/11 (Registrations Under Part II.2 of the Act — General) made under the Act:

1. The Emissions Summary Table required under section 12 of this Regulation to be included in the EASR ESDM report in respect of the facility at which the activity is engaged in.
2. If an acoustic assessment has been conducted in respect of that facility, the Acoustic Assessment Summary Table required under Chapter 3 of the EASR publication for the purposes of sections 21 and 22 of this Regulation.

Continuation of applications for environmental compliance approval

9. (1) If an application for approval to engage in an activity mentioned in subsection 9 (1) of the Act was submitted to the Director on or before December 31, 2016 and the Director did not make a decision with respect to the application before that day,

- (a) the application is exempt from subsection 20.2 (3) of the Act; and
- (b) the application is exempt from subsection 20.3 (2) of the Act.

(2) A person who is engaging in an activity in respect of which an application for approval described in subsection (1) has been made is exempt from subsection 20.21 (1) of the Act until the earliest of the following days:

1. The day the person withdraws the application.
2. The day the Director refuses to issue an environmental compliance approval in respect of the activity.
3. If the Director issues an environmental compliance approval in respect of the activity, the day the approval ceases to apply in respect of the activity as determined under section 20.17 of the Act.

Registration exemptions, modifications to facility

10. (1) This section applies with respect to a person who modifies or proposes to modify a facility if the modification involves an activity prescribed by section 2.

- (2) Subject to subsection (3), the person is exempt from clauses 20.21 (1) (a) and (b) of the Act in respect of the activity if,
 - (a) the activity is engaged in at a facility in respect of which the person has previously registered an activity prescribed by section 2 of this Regulation; and

(b) the registration in respect of the previously registered activity has been neither suspended nor removed from the Registry.

(3) Subsection (2) does not apply if the previous registration was filed in respect of an activity that is prescribed by another EASR regulation.

**PART III
ACTIVITY REQUIREMENTS - CLAUSE 20.21 (1) (C) OF THE ACT**

AIR

Air contaminants

11. (1) For the purposes of clause 20.21 (1) (c) of the Act, a person who engages in an activity prescribed by section 2 of this Regulation shall ensure that the following requirements are complied with in respect of the facility at which the activity is engaged in:

1. At all times when engaging in the activity, an EASR ESDM report that meets the requirements in section 12 must be available at the facility.

2. A new EASR ESDM report that meets the requirements in section 12 must be prepared at least once every 10 years.

3. Each EASR ESDM report prepared in respect of the facility must be accompanied by an EASR ESDM report supplement that meets the requirements in section 13.

4. At all times when engaging in the activity, the person engaging in the activity must ensure that the facility is operating within the operational parameters set out in the EASR ESDM report supplement.

5. At all times when engaging in the activity, the person shall ensure that the following rules are adhered to with respect to the concentration of each of the following contaminants discharged from the facility at a point of impingement:

i. If the contaminant is identified in the ACB list as belonging to the category “Benchmark 1”, the concentration must be at or below the concentration for each specified averaging period set out for the contaminant in that document.

ii. If the contaminant is identified in the ACB list as belonging to the category “Benchmark 2”,

A. the concentration must be at or below the concentration for each specified averaging period set out for the contaminant in that document, or

B. if the concentration is above the concentration for a specified averaging period set out for the contaminant in that document, the concentration must not be likely to cause an adverse effect for that averaging period.

iii. If subparagraphs i and ii do not apply to the contaminant, the concentration must not be likely to cause an adverse effect for a specified averaging period that relates to the adverse effect.

6. Subject to paragraph 7, at all times when engaging in the activity, the person shall ensure that each piece of combustion equipment listed in the EASR ESDM supplement as required by paragraph 9 of subsection 13 (1) is operated in a manner that does not result in the discharge of a contaminant,

i. at an emission intensity rate that exceeds an applicable intensity rate set out for the contaminant in Chapter 1 of the EASR publication, or

ii. in a concentration that exceeds an applicable limit set out for the contaminant in Chapter 1 of the EASR publication.

7. Paragraph 6 does not apply,

i. to combustion equipment during its start-up and shut-down periods, or

ii. to a boiler or heater during a period when, in a year, it uses a fuel other than the primary fuel identified in the EASR ESDM supplement in respect of the boiler or heater if,

A. the supplement confirms that the total number of hours during which the boiler or heater uses non-primary fuels in a year does not exceed 500, and

B. the boiler or heater has not used non-primary fuels for more than 500 hours in that year.

(2) In this section,

“shut-down” means an operating condition during which the operation of a piece of combustion equipment is decreased from normal operating conditions to an inoperative state;

“start-up” means an operating condition during which the operation of a piece of combustion equipment is increased from an inoperative state to normal operating conditions.

EASR ESDM report requirements**12. (1) The following are the requirements for an EASR ESDM report:**

1. It must be dated, signed and sealed by a licensed engineering practitioner and set out the practitioner's name and licence number.
2. The information in the report must be accurate as of the date it is signed and sealed.
3. It must set out the primary NAICS code and any other applicable NAICS codes for the facility.
4. It must be prepared in accordance with section 26 of Ontario Regulation 419/05 (Air Pollution — Local Air Quality) made under the Act, subject to subsection (2) of this section, using one or more approved dispersion models in accordance with subsection 6 (1) of that Regulation. The approved dispersion models must be used in accordance with sections 9 to 17 of that Regulation.
5. It must demonstrate that the concentration of each contaminant discharged or proposed to be discharged from the facility into the air, predicted by the approved dispersion model for the point of impingement with the highest concentration of the contaminant, meets one of the following criteria:
 - i. If the contaminant is identified in the ACB list as belonging to the category "Benchmark 1", the concentration must be at or below the concentration for each specified averaging period set out for the contaminant in that document.
 - ii. If the contaminant is identified in the ACB list as belonging to the category "Benchmark 2",
 - A. the concentration must be at or below the concentration for each specified averaging period set out for the contaminant in that document, or
 - B. if the concentration is above the concentration for a specified averaging period set out for the contaminant in that document, the concentration must not be likely to cause an adverse effect for that averaging period.
 - iii. If subparagraphs i and ii do not apply to the contaminant, the concentration must not be likely to cause an adverse effect for a specified averaging period that relates to the adverse effect.

(2) The Emissions Summary Table described in paragraph 14 of subsection 26 (1) of Ontario Regulation 419/05 and required to be prepared under paragraph 4 of subsection (1) must include the following information in addition to the information required by Ontario Regulation 419/05:

1. With respect to each contaminant to which sections 19 and 20 of Ontario Regulation 419/05 do not apply in respect of an averaging period, a comparison between the concentration predicted by the approved dispersion model for the point of impingement with the highest concentration and the concentration for the contaminant set out in the ACB list.
2. The comparison described in paragraph 1 must be included for each averaging period set out for the contaminant in the ACB list.
3. The comparison described in paragraph 1 must be expressed as a percentage of the concentration set out in the ACB list.

EASR ESDM report supplement**13. (1) The following are the requirements for an EASR ESDM report supplement:**

1. It must set out the name of the person who completed it and must be dated and signed by that person.
2. The information in the report must be accurate as of the date it is signed.
3. It must set out the legal name of each owner of the facility and the name under which each owner carries on business, if it is not the owner's legal name.
4. If the person who operates the facility is not an owner, the supplement must set out the legal name of each person who operates the facility and the name under which each operator carries on business, if it is not the operator's legal name.
5. It must set out the site address of the facility.
6. It must contain a statement signed by the person engaging in the prescribed activity confirming that all information the person gave to the licensed engineering practitioner in order to prepare the EASR ESDM report was complete and accurate.
7. It must contain a statement, signed by the licensed engineering practitioner who signed and sealed the EASR ESDM report, that includes the following:
 - i. Confirmation that, based on the information provided to the practitioner, the information in the report is accurate as of the date it is signed and sealed.

- ii. Confirmation that the EASR ESDM report was prepared in accordance with section 26 of Ontario Regulation 419/05 (Air Pollution — Local Air Quality) made under the Act and with subsection 12 (2) of this Regulation.
 - iii. Confirmation that one or more approved dispersion models were used to prepare the EASR ESDM report and that the models were used in accordance with sections 9 to 17 of Ontario Regulation 419/05.
 - iv. A statement indicating whether the information set out in the EASR ESDM report under paragraph 5 of subsection 12 (1) with respect to the concentration of contaminants is based on proposed discharges.
 - v. A description of the methods and procedures that were employed in preparing the report to ensure minimization of errors and omissions.
 - vi. A description of the operational parameters that were determined for the purpose of preparing the EASR ESDM report, including the maximum rates of production, process limits, performance limits and parameters relating to equipment and infrastructure.
 - vii. A description of the operating and maintenance procedures required to ensure that the facility is operating within the operational parameters referred to in subparagraph vi and subparagraph 9 i.
8. It must contain a statement, signed by a licensed engineering practitioner, confirming that each piece of combustion equipment listed in subsection (2) that is used or proposed to be used at the facility is designed to discharge the contaminants set out in Chapter 1 of the EASR publication with respect to the piece of combustion equipment in an amount that is less than or equal to the applicable limit set out for the contaminant in that Chapter.
9. The statement required by paragraph 8 must set out the basis for the confirmation provided under that paragraph, including the following information with respect to each piece of combustion equipment:
- i. The information required under Chapter 1 of the EASR publication related to the design of the combustion equipment, the operational parameters for the combustion equipment and emission estimating techniques used to form the basis for the confirmation under paragraph 8.
 - ii. For a boiler or heater, its maximum energy input capacity, the primary type of fuel it uses and any non-primary fuels that it may use, the total number of hours in a year that non-primary fuels may be used, the air pollution control equipment installed in or attached to it, the date it was installed or is proposed to be installed at the facility, the date of the most recent modification made to it, and, if applicable, the hours it is intended to be used.
 - iii. For an electricity generation engine, the type of fuel used in it, its power rating, its intended purpose, the air pollution control equipment installed in or attached to it, the date it was installed or is proposed to be installed at the facility, the date of the most recent modification made to it and, if applicable, the hours it is intended to be used.
 - iv. For a small wood-fired combustor, the type of fuel used in it, confirmation that it has an automated wood fuel feed system, its nominal load heat input and output capacity, its partial load heat input and output capacity, the air pollution control equipment installed in or attached to it, the date it was installed or is proposed to be installed at the facility and the date of the most recent modification made to it.

(2) The combustion equipment referred to in paragraph 8 of subsection (1) is the following:

- 1. A boiler or heater, unless the boiler or heater meets any of the following criteria:
 - i. It uses a fuel other than gaseous fuel, distillate oil or residual oil.
 - ii. Its maximum energy input capacity is less than or equal to 10.5 gigajoules per hour.
 - iii. It was installed at the facility before March 31, 2001 and has not been modified since its installation.
 - iv. It uses fuel derived from a primary process or operation at the facility and the fuel is not produced for commercial purposes at the facility.
 - v. It is used to recover heat from the exhaust gases of another combustion source.
 - vi. The combustion source included in the boiler or heater is a combustion turbine, a small wood-fired combustor or an electricity generation engine.
- 2. An electricity generation engine, unless the electricity generation engine meets any of the following criteria:
 - i. It is in a standby power system.
 - ii. It is used to generate electricity for use in a community or facility that is located in an off-grid area described in Chapter 2 of the EASR publication.
 - iii. It is used to generate electricity for use in a remote community or a remote facility described in Chapter 2 of the EASR publication.

- iv. It was installed in the facility before February 27, 2009, it has not been modified since its installation, and on the day immediately before the first registration in respect of the facility is filed in the Registry, an environmental compliance approval in respect of the engine is in effect.

3. A small wood-fired combustor, unless the small wood-fired combustor meets the following criterion:

i. It is exempt from the application of section 9 of the Act by Ontario Regulation 524/98 (Environmental Compliance Approvals — Exemptions from Section 9 of the Act) made under the Act.

(3) If an EASR ESDM report lists a contaminant set out in Schedule 3 to Ontario Regulation 419/05 that is discharged or proposed to be discharged before February 1, 2020, the EASR ESDM report supplement may contain a statement by the licensed engineering practitioner confirming that the EASR ESDM report has been prepared as if section 20 of that Regulation applies to the contaminant.

(4) If the EASR ESDM report supplement contains the statement described in subsection (3), the person engaging in the activity is deemed to have requested the notice mentioned in subsection 20 (4) of Ontario Regulation 419/05 and the Director is deemed to have given notice to the person requiring the person to comply with section 20 of that Regulation with respect to the contaminant as of the date the EASR ESDM report was prepared.

(5) In this section,

“electricity generation engine” means a combustion source that is a reciprocating engine and that is used to generate electricity;

“standby power system” means any apparatus, mechanism, equipment or other thing, and any related exhaust stacks, fuel tanks and piping, that includes one or more electricity generation engines and that is intended to be used only for the provision of electrical power during power outages or involuntary power reductions.

Notice under s. 24 of Ontario Regulation 419/05

14. (1) A person who engages in an activity prescribed by section 2 and who receives a notice from the Director under section 24 of Ontario Regulation 419/05 (Air Pollution — Local Air Quality) made under the Act shall prepare, not later than the date specified in the notice,

- (a) a new EASR ESDM report that meets the requirements of section 12; and
- (b) a new EASR ESDM report supplement that meets the requirements in section 13.

(2) If the person is also required to update a report under subsection 25 (5) of Ontario Regulation 419/05, the person shall also prepare, in accordance with the timelines applicable to that subsection,

- (a) a new EASR ESDM report that meets the requirements of section 12; and
- (b) a new EASR ESDM report supplement that meets the requirements in section 13.

Notice to submit in-stack testing results

15. (1) The Director may give written notice to a person who engages in an activity prescribed by section 2 that involves a piece of combustion equipment listed in subsection 13 (2) requiring the person to submit to the Director the results of in-stack testing if no such results in respect of the piece of combustion equipment have previously been submitted to the Director.

(2) The Director may also give written notice to a person who engages in an activity prescribed by section 2 that involves a piece of combustion equipment listed in subsection 13 (2) requiring the person to submit to the Director the results of in-stack testing if the Director has reasonable grounds to believe that,

- (a) a discharge from the combustion equipment may cause an adverse effect; or
- (b) the combustion equipment is discharging a contaminant in an amount that is greater than the intensity rate or limit set out in Chapter 1 of the EASR publication for the contaminant and the combustion equipment.

(3) Before the Director gives a person a notice under this section, the Director shall give the person a draft of the notice, with reasons, and an opportunity to make written submissions to the Director during the period that ends 30 days after the draft is given.

(4) A person to whom the Director has given written notice under subsection (1) or (2) shall ensure that the in-stack testing is conducted in accordance with the Director’s notice and that the results are submitted not later than the date specified in the notice.

(5) In this section,

“flue gas” means a gas that is generated by a combustion process;

“in-stack testing” means the measurement of the amount of combustion contaminants in the flue gas of a piece of combustion equipment.

NOISE

Noise emissions

16. For the purposes of clause 20.21 (1) (c) of the Act, a person who engages in an activity prescribed by section 2 of this Regulation shall ensure that the following requirements are complied with in respect of the facility at which the person engages in the activity:

1. At all times when engaging in the activity, a noise report that meets the requirements in sections 17 to 22 must be available at the facility.
2. A new noise report that meets the requirements in sections 17 to 22 must be prepared at least once every 10 years.
3. If a noise abatement action plan is prepared under subparagraph 8 v of subsection 17 (1), it must be implemented in accordance with its contents.
4. At all times when engaging in the activity, the person engaging in the activity must ensure that the facility is operating within the operational parameters, if any, set out in the noise report. However, this requirement does not apply if a noise abatement action plan is being implemented at the facility.
5. At all times when engaging in the activity, the person shall ensure that the combined sound level resulting from the sound discharged from the facility does not exceed the applicable sound level limit set out in Chapter 3 of the EASR publication at each affected point of noise reception. However, this requirement does not apply if a noise abatement action plan is being implemented at the facility.
6. At all times when engaging in the activity, the person engaging in the activity must ensure that the facility is implementing the noise control measures and procedures, if any, set out in the noise report.
7. Each record described in Chapter 3 of the EASR publication in respect of a source of sound must be prepared and retained at the facility for the period set out in that Chapter, or if no retention period is set out in that Chapter, for 20 years after its creation.

Noise report

17. (1) The following are the requirements for a noise report:

1. It must be dated, signed and sealed by a licensed engineering practitioner and set out the practitioner's name and licence number.
2. The information in the report must be accurate as of the date it is signed and sealed.
3. It must set out the primary NAICS code and any other applicable NAICS codes for the facility.
4. It must contain a statement by the licensed engineering practitioner mentioned in paragraph 1 confirming that, based on the information provided to the practitioner, the information in the report is accurate as of the date it is signed and sealed.
5. It must set out the legal name of each owner of the facility and the name under which each owner carries on business, if it is not the owner's legal name.
6. If the person who operates the facility is not an owner, the noise report must set out the legal name of each person who operates the facility and the name under which each operator carries on business, if it is not the operator's legal name.
7. It must set out the site address of the facility.
8. It must contain a statement by the licensed engineering practitioner mentioned in paragraph 1 confirming that one of the following criteria is met:
 - i. The distance between the facility and the property boundary of the closest point of noise reception is equal to or greater than 1000 metres.
 - ii. The actual separation distance from the facility to the closest point of noise reception is equal to or greater than the minimum separation distance, as determined by using the Primary Noise Screening Method.
 - iii. The combined sound level resulting from sound discharged from the facility at each affected point of noise reception, as determined using the Secondary Noise Screening Method, is less than or equal to the applicable sound level limit set out in Chapter 3 of the EASR publication.
 - iv. The combined sound level resulting from sound discharged from the facility at each affected point of noise reception, as determined using an acoustic assessment, is less than or equal to the applicable sound level limit set out in Chapter 3 of the EASR publication.
 - v. A noise abatement action plan is included in the noise report. This criterion applies only in respect of a facility that commenced operation before the day this Regulation came into force and at which, as of the day the first registration in respect of the facility is filed in the Registry, the combined sound level resulting from sound

discharged from the facility at an affected point of noise reception, as determined using an acoustic assessment, is greater than the applicable sound level limit set out in Chapter 3 of the EASR publication.

(2) For the purpose of subparagraph 8 i of subsection (1), the distance between a facility and the property boundary of a point of noise reception shall be measured from Point A to Point B in accordance with the following:

1. Point A is,
 - i. the point that is located on the exterior wall of a building at the facility and that is closest to the property boundary of the point of noise reception, or
 - ii. if there is an outdoor source of sound at the facility that is located closer to the property boundary of the point of noise reception than the point mentioned in subparagraph i, the point that is located on the edge of the outdoor source of sound and that is closest to the property boundary of the point of noise reception.
2. Point B is the point that is located on the property boundary of the point of noise reception and that is closest to Point A.

Noise setback, subpara 8 i of s. 17 (1)

18. If the licensed engineering practitioner confirms that the criterion in subparagraph 8 i of subsection 17 (1) is met, the noise report must contain a drawing, made to scale, that shows Points A and B described in subsection 17 (2).

Primary noise screening, subpara 8 ii of s. 17 (1)

19. If the licensed engineering practitioner confirms that the criterion in subparagraph 8 ii of subsection 17 (1) is met, the noise report must contain the following:

1. Confirmation that the comparison of the actual separation distance and the minimum separation distance was performed in accordance with the Primary Noise Screening Method.
2. A copy of all the information used for the Primary Noise Screening Method and the results it generated.

Secondary noise screening, subpara 8 iii of s. 17 (1)

20. If the licensed engineering practitioner confirms that the criterion in subparagraph 8 iii of subsection 17 (1) is met, the noise report must contain the following:

1. Confirmation that the combined sound levels were determined using the Secondary Noise Screening Method.
2. Confirmation that the affected points of noise reception were determined using the Secondary Noise Screening Method.
3. A copy of all the information used for the Secondary Noise Screening Method and the results it generated.
4. A description of any acoustical barrier used or proposed to be used with respect to each source of sound.
5. A description of the operational parameters that were determined for the purpose of the noise report, including,
 - i. the facility's maximum rates of production, process limits and performance limits,
 - ii. parameters relating to equipment and infrastructure at the facility,
 - iii. the time of day a source of sound is operating or is proposed to be operating,
 - iv. the duration of time a source of sound is operating or is proposed to be operating, and
 - v. whether the sound is tonal or non-tonal.
6. A description of the operating and maintenance procedures required to ensure that the facility is operating within the operational parameters referred to in paragraph 5.
7. A statement signed by the person engaging in the prescribed activity confirming that all information the person gave to the licensed engineering practitioner in order to prepare the noise report was complete and accurate.

Acoustic assessment, subpara 8 iv of s. 17 (1)

21. If the licensed engineering practitioner confirms that the criterion in subparagraph 8 iv of subsection 17 (1) is met, the noise report must contain the following:

1. The information and confirmations described in paragraphs 5 to 7 of section 20.
2. A description of each noise control measure or procedure used with respect to a source of sound in order to ensure that the sound level at each affected point of noise reception does not exceed the applicable sound level limits set out in Chapter 3 of the EASR publication.
3. Confirmation that the affected points of noise reception were determined in accordance with Chapter 3 of the EASR publication.

4. A description of the methods and procedures that were employed in preparing the report to ensure minimization of error and omissions.
5. The information required under Chapter 3 of the EASR publication, including the Acoustic Assessment Summary Table required under that Chapter.

Noise abatement action plan, subpara 8 v of s. 17 (1)

22. If the licensed engineering practitioner confirms that the criterion in subparagraph 8 v of subsection 17 (1) is met, the noise report must contain the following:

1. The information and confirmations described in paragraphs 5 and 7 of section 20.
2. A description of each noise control measure or procedure used with respect to a source of sound.
3. Confirmation that the affected points of noise reception were determined in accordance with Chapter 3 of the EASR publication.
4. A description of the methods and procedures that were employed in preparing the report to ensure minimization of error and omissions.
5. The information required under Chapter 3 of the EASR publication, including the Acoustic Assessment Summary Table required under that Chapter.
6. A noise abatement action plan that describes the measures and procedures required to be implemented to prevent or minimize the sound discharged from the facility in order to ensure that the sound level at each affected point of noise reception does not exceed the applicable sound level limits set out in Chapter 3 of the EASR publication.
7. A schedule for implementing the noise control measures and procedures described in paragraph 6, including specific dates by which they will be implemented.

Notice to prepare acoustic audit report

23. (1) The Director may give written notice to a person who engages in an activity prescribed by section 2 requiring the person to submit to the Director an acoustic audit report that meets the requirements in subsection (3) if the person discharges or causes or permits the discharge of sound into the air from a source of sound at the facility at which the person engages in the activity, and

- (a) the Director has reasonable grounds to believe that,
 - (i) the discharge may cause an adverse effect, or
 - (ii) the sound level resulting from the discharge at an affected point of noise reception is greater than the applicable sound level limit set out in Chapter 3 of the EASR publication; or
- (b) the most recent noise report in respect of the facility confirms that the criterion in subparagraph 8 iv or v of subsection 17 (1) is met.

(2) Before the Director gives a person a notice under this section, the Director shall give the person a draft of the notice, with reasons, and an opportunity to make written submissions to the Director during the period that ends 30 days after the draft is given.

(3) The following are the requirements for an acoustic audit report:

1. It must be dated, signed and sealed by a licensed engineering practitioner and set out the practitioner's name and licence number.
2. It must set out the primary NAICS code and any other applicable NAICS codes for the facility.
3. It must summarize the results of an acoustic audit conducted in accordance with the Director's notice.
4. The licensed engineering practitioner who signs and seals the report must not be the same licensed engineering practitioner who signed and sealed the most recent noise report prepared for the purposes of paragraph 1 of section 16.

(4) A person to whom the Director has given a notice under this section shall ensure that the acoustic audit report is prepared in accordance with the Director's notice and submitted not later than the date specified in the notice.

(5) For the purpose of this section, an acoustic audit must,

- (a) verify the sound level at one or more affected points of noise reception by,
 - (i) measuring the sound level at the affected point of noise reception, or
 - (ii) if it is not possible to measure the sound level at the affected point of noise reception, measuring the sound level at a point near to the affected point of noise reception and predicting the sound level at the affected point of noise reception;

- (b) confirm that the noise control measures and procedures set out in the noise report are being implemented; and
- (c) verify the sound level limits and affected points of noise reception set out in the noise report.

ODOUR

Odour emissions

24. For the purposes of clause 20.21 (1) (c) of the Act, a person who engages in an activity prescribed by section 2 of this Regulation shall ensure that the following requirements are complied with:

1. At all times when engaging in the activity, an odour screening report that meets the requirements in section 25 must be available at the facility at which the person engages in the activity.
2. A new odour screening report that meets the requirements in section 25 must be prepared at least once every 10 years.
3. At all times when engaging in the activity, a best management practices plan for odour that meets the requirements in section 26 must be available at the facility if, as of the date the odour screening report is completed, any of the following circumstances exists:
 - i. The activity is engaged in at a facility for which the primary or secondary NAICS code is set out in Table 1 of Chapter 4 of the EASR publication, the design capacity of the facility meets the criteria set out opposite the NAICS code in that Table, and the distance between the facility and the closest point of odour reception is less than the distance set out opposite the NAICS code in that Table as measured in accordance with that Chapter.
 - ii. The activity relates to a process set out in Table 2 of Chapter 4 of the EASR publication and the distance between the facility and the closest point of odour reception is less than the distance set out opposite the process in that Table as measured in accordance with that Chapter.
 - iii. The activity is engaged in at a facility for which the primary or secondary NAICS code is set out in Table 3 of Chapter 4 of the EASR publication and the design capacity of the facility meets the criteria set out opposite the NAICS code in that Table.
 - iv. The activity relates to a process set out in Table 4 of Chapter 4 of the EASR publication.
 - v. The Director has given the person a notice under section 28 requiring the person to submit a best management practices plan for odour to the Director, the date for submitting the plan has passed, and the notice has not been revoked.
4. The best management practices plan for odour must be implemented in accordance with its contents.
5. At all times when engaging in the activity, an odour control report that meets the requirements in section 27 must be available at the facility if either of the following circumstances exists:
 - i. The activity is engaged in at a facility for which the primary or secondary NAICS code is set out in Table 3 of Chapter 4 of the EASR publication, the design capacity of the facility meets the criteria set out opposite the NAICS code in that Table, and the distance between the facility and the closest point of odour reception is less than the distance set out opposite the NAICS code in that Table as measured in accordance with that Chapter.
 - ii. The activity relates to a process set out in Table 4 of Chapter 4 of the EASR publication and the distance between the facility and the closest point of odour reception is less than the distance set out opposite the process in that Table as measured in accordance with that Chapter.
6. The best management practices plan for odour and the odour control report must be reviewed at least once in every 10-year period by a licensed engineering practitioner.
7. An updated best management practices plan for odour must be prepared at least once in every 10-year period by a licensed engineering practitioner. However, this requirement does not apply if a licenced engineering practitioner provides the person engaging in the activity with an addendum to the most recent best management plan confirming that the practitioner has reviewed the plan, the information in the plan remains accurate, and no additional measures are necessary to prevent or minimize the discharge of odour from the facility. The addendum must be dated and signed by the licenced engineering practitioner.
8. An updated odour control report must be prepared at least once in every 10-year period by a licensed engineering practitioner. However, this requirement does not apply if a licenced engineering practitioner provides the person engaging in the activity with an addendum to the most recent odour control report confirming that the practitioner has reviewed the report and that the information in the report remains accurate. The addendum must be dated and signed by the licenced engineering practitioner.
9. Each record described in Chapter 4 of the EASR publication in respect of a source of odour must be prepared and retained at the facility for the period set out in that Chapter, or if no retention period is set out in that Chapter, for 20 years after its creation.

Odour screening report

25. The following are the requirements for an odour screening report:

1. It must set out the name of the person who completed it and must be dated and signed by that person.
2. The information in the report must be accurate as of the date the report is completed.
3. It must set out the primary NAICS code and, if applicable, the secondary NAICS code for the facility.
4. It must set out the legal name of each owner of the facility and the name under which each owner carries on business, if it is not the owner's legal name.
5. If the person who operates the facility is not an owner, the odour screening report must set out the legal name of each person who operates the facility and the name under which each operator carries on business, if it is not the operator's legal name.
6. It must set out the site address of the facility.
7. It must include a description of any of the circumstances set out in paragraph 3 or 5 of section 24 that exist in respect of the facility.

Best management practices plan for odour

26. The following are the requirements for a best management practices plan for odour:

1. It must be dated, signed and sealed by a licensed engineering practitioner and set out the practitioner's name and licence number.
2. The information in the plan must be accurate as of the date it is signed and sealed.
3. It must contain a statement by the licensed engineering practitioner mentioned in paragraph 1 confirming that, based on the information provided to the practitioner, the information in the plan is accurate as of the date it is signed and sealed.
4. It must contain a statement signed by the person engaging in the prescribed activity confirming that all information the person gave to the licensed engineering practitioner in order to prepare the plan was complete and accurate.
5. It must set out the legal name of each owner of the facility and the name under which each owner carries on business, if it is not the owner's legal name.
6. If the person who operates the facility is not an owner, the plan must set out the legal name of each person who operates the facility and the name under which each operator carries on business, if it is not the operator's legal name.
7. It must set out the site address of the facility.
8. It must set out the following with respect to each source of odour at the facility, including each fugitive source of odour:
 - i. Potential causes for occasional increases in the discharge of odour from the source into the air.
 - ii. If the best management practices plan for odour is the first such plan prepared in respect of the facility, confirmation that the terms or conditions, if any, relating to the control of the discharge of odour from the facility included in an environmental compliance approval that was in effect immediately before the registration in the Registry of an activity engaged in at the facility were considered in the preparation of the best management practices plan for odour.
 - iii. Measures and procedures implemented at the facility to prevent or minimize the discharge of odour from the source into the air.
 - iv. Inspection, maintenance and monitoring procedures to ensure the adoption and continued implementation of measures and procedures to prevent or minimize the discharge of odour from the source into the air.
 - v. Identification of additional measures and procedures that should be implemented at the facility to prevent or minimize the discharge of odour from the source into the air, if any, including:
 - A. A description of the additional measures to be implemented.
 - B. A description of the additional preventative procedures to be implemented.
 - C. If the additional preventative procedures are to be implemented periodically, the frequency with which the procedures are to be implemented.
 - D. A schedule for the implementation of the additional measures, including training of workers.

E. Inspection, maintenance and monitoring procedures to ensure the adoption and continued implementation of the measures and procedures.

Odour control report

27. The following are the requirements for an odour control report:

1. It must be dated, signed and sealed by a licensed engineering practitioner and set out the practitioner's name and licence number.
2. The information in the report must be accurate as of the date it is signed and sealed.
3. It must contain a statement by the licensed engineering practitioner mentioned in paragraph 1 confirming that, based on the information provided to the practitioner, the information in the report is accurate as of the date it is signed and sealed.
4. It must contain a statement signed by the person engaging in the prescribed activity confirming that all information the person gave to the licensed engineering practitioner in order to prepare the report was complete and accurate.
5. It must set out the legal name of each owner of the facility and the name under which each owner carries on business, if it is not the owner's legal name.
6. If the person who operates the facility is not an owner, the report must set out the legal name of each person who operates the facility and the name under which each operator carries on business, if it is not the operator's legal name.
7. It must set out the site address of the facility.
8. It must set out the following:
 - i. A list of the measures and procedures that are used in similar facilities, including facilities in other jurisdictions, to prevent or minimize the discharge of odour, including measures and procedures such as the use of air pollution control technology and the implementation of changes to equipment, processes or materials.
 - ii. An analysis of the measures and procedures identified under subparagraph i, and potential combinations of them, to determine which would be technically feasible to implement at the facility in order to prevent or minimize the discharge of odour.
 - iii. A list of the measures and procedures or combinations that are determined under subparagraph ii to be technically feasible to implement at the facility and, for each measure or procedure that is not included in the best management practices plan for odour, an explanation of why that measure or procedure is not necessary to adequately prevent or minimize the discharge of odour from the facility.
 - iv. An explanation of why the measures and procedures set out in the best management practices plan for odour are adequate to prevent or minimize the discharge of odour from the facility.

Notice to submit best management practices plan for odour

28. (1) The Director may give written notice to a person who engages in an activity prescribed by section 2 requiring the person to submit to the Director a best management practices plan for odour that meets the requirements in section 26 if the person discharges or causes or permits the discharge of odour into the air, and,

- (a) the Director has reasonable grounds to believe that the discharge may cause an adverse effect; and
- (b) either,
 - (i) the person is not otherwise required to prepare a best management practices plan for odour under subparagraphs 3 i to iv of section 24, or
 - (ii) the best management practices plan for odour did not include the source of the odour.

(2) Before the Director gives a person a notice under this section, the Director shall give the person a draft of the notice, with reasons, and an opportunity to make written submissions to the Director during the period that ends 30 days after the draft is given.

(3) The best management practices plan for odour required under subsection (1) must be prepared in accordance with the Director's notice and must be submitted not later than the date specified in the notice.

FUGITIVE DUST

Best management practices plan for fugitive dust control

29. (1) For the purposes of clause 20.21 (1) (c) of the Act, a person who engages in an activity prescribed by section 2 of this Regulation shall ensure that the following requirements are complied with if the most recent EASR ESDM report in respect of the facility at which the person engages in the activity identifies a source of fugitive dust:

1. At all times when engaging in the activity, a best management practices plan for fugitive dust control in respect of the facility that meets the requirements in subsection (2) must be available at the facility.
 2. The plan must be implemented in accordance with its contents.
 3. The best management practices plan for fugitive dust control must be reviewed at least once in every 10-year period by a licensed engineering practitioner.
 4. An updated best management practices plan for fugitive dust control must be prepared at least once in every 10-year period by a licensed engineering practitioner. However, this requirement does not apply if a licenced engineering practitioner provides the person engaging in the activity with an addendum to the most recent best management plan confirming that the practitioner has reviewed the plan, the information in the plan remains accurate, and no additional measures are necessary to prevent or minimize the discharge of fugitive dust from the facility. The addendum must be dated and signed by the licenced engineering practitioner.
- (2) The following are the requirements for a best management practices plan for fugitive dust control:
1. It must be dated, signed and sealed by a licensed engineering practitioner and set out the practitioner's name and licence number.
 2. The information in the plan must be accurate as of the date it is signed and sealed.
 3. It must contain a statement by the licensed engineering practitioner mentioned in paragraph 1 confirming that, based on the information provided to the practitioner, the information in the plan is accurate as of the date it is signed and sealed.
 4. It must contain a statement signed by the person engaging in the prescribed activity confirming that all information the person gave to the licensed engineering practitioner in order to prepare the plan was complete and accurate.
 5. It must set out the legal name of each owner of the facility and the name under which each owner carries on business, if it is not the owner's legal name.
 6. If the person who operates the facility is not an owner, the plan must set out the legal name of each person who operates the facility and the name under which each operator carries on business, if it is not the operator's legal name.
 7. It must set out the site address of the facility.
 8. It must set out the following with respect to each significant source of fugitive dust at the facility, including each source of fugitive dust that would be a significant source of fugitive dust if it were not controlled:
 - i. Possible causes of the fugitive dust.
 - ii. Measures and procedures implemented at the facility to prevent or minimize the discharge of fugitive dust into the air.
 - iii. Inspection, maintenance and monitoring procedures to ensure the adoption and continued implementation of measures and procedures to prevent or minimize the discharge of fugitive dust into the air.
 - iv. Identification of additional measures and procedures that should be implemented at the facility to prevent or minimize the discharge of fugitive dust into the air, if any, including:
 - A. A description of the additional measures to be implemented.
 - B. A description of the additional preventative procedures to be implemented.
 - C. If the additional preventative procedures are to be implemented periodically, the frequency with which the procedures should be implemented and material application rates, as applicable.
 - D. A schedule for the implementation of the additional measures, including training of workers.
 - E. Inspection, maintenance and monitoring procedures to ensure the adoption and continued implementation of the additional measures.

Notice to submit best management practices plan for fugitive dust control

30. (1) The Director may give written notice to a person who engages in an activity prescribed by section 2 requiring the person to submit to the Director a best management practices plan for fugitive dust control that meets the requirements in subsection 29 (2) if,

- (a) the person discharges or causes or permits the discharge of fugitive dust into the air;
- (b) the Director has reasonable grounds to believe that the discharge may cause an adverse effect; and
- (c) either,

- (i) the most recent EASR ESDM report in respect of the facility at which the person engages in the activity does not identify the source of fugitive dust, or
 - (ii) the best management practices plan for fugitive dust control does not identify the source as a significant source of fugitive dust.
- (2) Before the Director gives a person a notice under this section, the Director shall give the person a draft of the notice, with reasons, and an opportunity to make written submissions to the Director during the period that ends 30 days after the draft is given.
- (3) A person to whom the Director has given written notice under subsection (1) shall,
 - (a) ensure that the best management practices plan is prepared in accordance with the Director's notice and submitted not later than the date specified in the notice; and
 - (b) comply with the requirements in subsection 29 (1) in respect of the best management practices plan.

OTHER ACTIVITY REQUIREMENTS

Small wood-fired combustors

31. For the purposes of clause 20.21 (1) (c) of the Act, a person who engages in an activity prescribed by section 2 of this Regulation that involves a small wood-fired combustor shall ensure that the following requirements are met:

1. The small wood-fired combustor must use an automated wood fuel feed system that meets the criteria set out in Chapter 5 of the EASR publication.
2. A wood fuel management plan in respect of the small wood-fired combustor must be prepared and implemented in accordance with Chapter 5 of the EASR publication.
3. The small wood-fired combustor must meet the design criteria set out in Chapter 5 of the EASR publication.
4. The small wood-fired combustor must be operated within the operational parameters set out in Chapter 5 of the EASR publication.
5. The operational parameters set out in Chapter 5 of the EASR publication must be measured using the measurement methods set out in that Chapter.
6. A statement setting out the results of an installation test in respect of the small wood-fired combustor conducted in accordance with Chapter 5 of the EASR publication must be available at all times when engaging in the activity.
7. A performance assessment of the small wood-fired combustor must be conducted in accordance with Chapter 5 of the EASR publication at least once per year, and the results of each assessment must be recorded.
8. Each record described in Chapter 5 of the EASR publication in respect of the small wood-fired combustor must be prepared and retained at the facility for the period set out in that Chapter or, if no retention period is set out in that Chapter, for 20 years after its creation.

Modifications to facility — requirement re reports

32. (1) Subject to subsections (2) and (3), a person who engages in an activity prescribed by section 2 shall ensure that before a modification is made to the facility at which the person engages in the activity, the person has available at the facility,

- (a) an EASR ESDM report that reflects the proposed modification and that meets the requirements in section 12;
 - (b) an EASR ESDM report supplement that reflects the proposed modification and that meets the requirements in section 13;
 - (c) a noise report that reflects the proposed modification and that meets the requirements in sections 17 to 22; and
 - (d) an odour screening report that reflects the proposed modification and that meets the requirements in section 25.
- (2) Clauses (1) (a) and (b) do not apply if a licensed engineering practitioner provides the person engaging in the activity with an addendum to the most recent EASR ESDM report setting out,
- (a) a description of the proposed modification; and
 - (b) an explanation about why the licensed engineering practitioner is of the opinion that the information in the most recent EASR ESDM report and EASR ESDM report supplement will remain accurate after the modification is made.
- (3) Clause (1) (c) does not apply if a licensed engineering practitioner provides the person engaging in the activity with an addendum to the most recent noise report setting out,
- (a) a description of the proposed modification; and

- (b) an explanation about why the licensed engineering practitioner is of the opinion that the information in the most recent noise report will remain accurate after the modification is made.
- (4) Each addendum mentioned in subsections (2) and (3) must be dated and signed by the licenced engineering practitioner who provides it.
- (5) For greater certainty,
 - (a) an EASR ESDM report or an EASR ESDM report supplement prepared for the purpose of subsection (1) does not satisfy the requirements in paragraphs 1 to 3 of subsection 11 (1) until the facility is modified as set out in the report;
 - (b) a noise report prepared for the purpose of subsection (1) does not satisfy the requirements in paragraphs 1 and 2 of section 16 until the facility is modified as set out in the report; and
 - (c) an odour screening report prepared for the purpose of subsection (1) does not satisfy the requirements in paragraphs 1 and 2 of section 24 until the facility is modified as set out in the report.
- (6) An Emissions Summary Table prepared as part of an EASR ESDM report for the purpose of subsection (1) may be filed in the Registry for the purpose of section 8.

Procedures

33. For the purposes of clause 20.21 (1) (c) of the Act, a person who engages in an activity prescribed by section 2 of this Regulation shall ensure that the following procedures are developed and implemented at the facility at which the person engages in the activity:

1. Operating, maintenance and monitoring procedures to ensure that the facility is operating within the operational parameters set out in the EASR ESDM report supplement in respect of the facility. The procedures must be developed and implemented having regard to the operating and maintenance procedures set out in the EASR ESDM report supplement and must include any recommendations from the manufacturers of sources of contaminant or of equipment related to sources of contaminant.
2. Operating, maintenance and monitoring procedures to ensure that the facility is operating within the operational parameters, if any, set out in the noise report in respect of the facility. The procedures must be developed and implemented having regard to the operating and maintenance procedures set out in the noise report and must include any recommendations from the manufacturers of sources of sound or of equipment related to sources of sound.
3. If a noise report in respect of the facility indicates that a noise abatement action plan referred to in subparagraph 8 v of subsection 17 (1) is being implemented at the facility, procedures to ensure that the noise abatement action plan is implemented.
4. Procedures setting out the frequency of inspections and scheduled preventative maintenance of sources of contaminant at the facility and equipment related to the sources of contaminant.
5. Procedures for record-keeping activities and logs relating to the operating, maintenance and monitoring procedures and plans.
6. Procedures to prevent and respond to spills from sources of contaminant.
7. Procedures for training persons who operate and maintain sources of contaminant and the equipment related to sources of contaminant.
8. Procedures for recording and responding to complaints that relate to the facility and the natural environment.

Complaints

34. A person who engages in an activity prescribed by section 2 and who receives a complaint that relates to the discharge of a contaminant into the air from the facility at which the person engages in the activity shall ensure that the Ministry's Spills Action Centre is immediately notified of the complaint.

PART IV MISCELLANEOUS

Records

- 35.** (1) A person who engages in an activity prescribed by section 2 shall,
- (a) subject to subsections (2), (3) and (4), retain each report, supplement and plan that the person is required to ensure is prepared under this Regulation at the facility to which the document relates for at least 20 years after the date the document is signed; and
 - (b) retain each addendum to a report mentioned in clause (a) at the facility to which the document relates for at least as long as the report mentioned in clause (a) is required to be kept.

(2) Subsection (1) does not apply to a report prepared for the purpose of a proposed modification to a facility if the facility is not modified as set out in the report, but subsection (1) does apply with respect to an Emissions Summary Table mentioned in subsection 32 (6).

(3) If a noise report includes a noise abatement action plan, the noise report shall be retained for at least 20 years after the date on which the implementation of the noise abatement action plan is completed.

(4) Subsection (1) does not apply to a record required to be prepared under the following provisions if a different retention period is established with respect to the record under those provisions:

1. Paragraph 7 of section 16, in connection with sources of sound.
2. Paragraph 9 of section 24, in connection with sources of odour.
3. Paragraph 8 of section 31, in connection with small wood-fired combustors.

(5) A person who engages in an activity prescribed by section 2 shall ensure that a record of each procedure required to be developed and implemented under section 33 is created and retained at the facility for at least five years after the day the procedure is no longer being implemented at the facility.

(6) A person who engages in an activity prescribed by section 2 shall ensure that each of the following records is created and retained at the facility for at least five years after its creation:

1. A record of each comment the person receives from a provincial officer or the Director with respect to a plan, report or procedure required to be prepared under this Regulation that includes the comment, a description of whether or not the comment was addressed, and,
 - i. if the comment was addressed, a description of the actions taken to do so and the date each was implemented, and
 - ii. if the comment was not addressed, a description of the reasons it was not addressed.
2. A record of the following information with respect to each complaint received by the person with respect to an activity engaged in at the facility or a discharge into the air from the facility, if the complaint relates to the natural environment:
 - i. The date and time when the complaint was received.
 - ii. A copy of the complaint, if it is a written complaint.
 - iii. A summary of the complaint, if it is not a written complaint.
 - iv. A summary of the measures taken, if any, to address the complaint.

(7) A person who engages in an activity prescribed by section 2 shall ensure that a log containing the following information is created, updated and retained at the facility:

1. A description of each modification made to the facility and the date on which the modification was made.
2. A description of each change in the manner in which an approved dispersion model is used in the preparation of an EASR ESDM report and the date on which the change occurred.
3. A summary of how the information in paragraphs 1 and 2 has been reflected in the relevant report, supplement or plan.

(8) A person who engages in an activity prescribed by section 2 that involves a boiler or heater shall ensure that a log containing the following information is created, updated and retained at the facility:

1. Each date the boiler or heater uses a non-primary fuel.
2. For each date mentioned in paragraph 1, the duration, in hours, over which the boiler or heater uses the non-primary fuel.

(9) An entry in a log shall be maintained for at least 20 years after the day the entry is made.

Form of reports, etc.

36. With respect to any report, plan, table or log that a person is required to prepare or any method that a person is required to use under this Regulation,

- (a) if the Director has approved a form the person shall prepare or use it in that form; and
- (b) if the Director has specified an electronic format the person shall prepare or use it in that format.

**PART V
COMMENCEMENT**

Commencement

37. This Regulation comes into force on the later of January 31, 2017 and the day it is filed.

SCHEDULE

NAICS codes, paragraph 1 of s. 2 (2) of the Regulation

1. (1) For the purposes of this Schedule, a facility is part of a class identified by a NAICS code if the facility is identified by a NAICS code that begins with a NAICS code listed in subsection (2).

(2) The following are the NAICS codes mentioned in paragraph 1 of subsection 2 (2) of the Regulation:

1. 2122 (Metal ore mining).
2. 2123 (Non-metallic mineral mining and quarrying).
3. 22132 (Sewage treatment facilities).
4. 31122 (Starch and vegetable fat and oil manufacturing).
5. 31161 (Animal slaughtering and processing).
6. 321111 (Sawmills (except shingle and shake mills)).
7. 3221 (Pulp, paper and paperboard mills).
8. 32411 (Petroleum refineries).
9. 32412 (Asphalt paving, roofing and saturated materials manufacturing).
10. 32419 (Other petroleum and coal product manufacturing).
11. 325 (Chemical manufacturing).
12. 32615 (Urethane and other foam product (except polystyrene) manufacturing).
13. 3262 (Rubber product manufacturing).
14. 32731 (Cement manufacturing).
15. 32732 (Ready-mix concrete manufacturing).
16. 32741 (Lime manufacturing).
17. 3279 (Other non-metallic mineral product manufacturing).
18. 331 (Primary metal manufacturing).
19. 3321 (Forging and stamping).
20. 33281 (Coating, engraving, cold and heat treating and allied activities).
21. 332999 (All other miscellaneous fabricated metal product manufacturing).
22. 336 (Transportation equipment manufacturing).
23. 56211 (Waste collection).
24. 5622 (Waste treatment and disposal).
25. 5629 (Remediation and other waste management services).
26. 81222 (Cemeteries and crematoria).

[Back to top](#)

Environmental Activity and Sector Registry – Limits and Other Requirements

Version 1.0

**Published by the
Ministry of the Environment and Climate Change**

December, 2016

Cette publication hautement spécialisée *Environmental Activity and Sector Registry - Limits and Other Requirements* n'est disponible qu'en anglais conformément au Règlement 671/92, selon lequel il n'est pas obligatoire de la traduire en vertu de la *Loi sur les services en français*. Pour obtenir des renseignements en français, veuillez communiquer avec le ministère de l'Environnement et de l'Action en matière de changement climatique au 416-314-8001 ou par courriel à EAASIBGen@ontario.ca.

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Foreword

This document, “Environmental Activity and Sector Registry - Limits and Other Requirements, December, 2016, version 1.0” (the EASR publication) sets out the requirements that facilities must follow if its activities are registered under the Air Emissions EASR Regulation. This publication will be made available through a website maintained by the Ministry of the Environment and Climate Change on the Internet and copies will also be available at the Ministry’s Public Information Centre.

A reference to “the Regulation” in this EASR publication is a reference to Ontario Regulation 1/17 entitled “Registrations Under Part II.2 of The Act — Activities Requiring Assessment of Air Emissions”.

The EASR publication includes requirements for In-stack limits for combustion equipment, noise, odour and small wood-fired combustors. It also includes a list of off-grid and remote facilities/communities for the purposes of subsection 13 (2)2.ii and iii of the Regulation.

The Ministry has additional guidance material available to clients to support the completion of documents required by this Regulation including:

- Air Emissions User Guide for Environmental Activity and Sector Registry
- Procedure for Preparing an Emission Summary and Dispersion Modelling Report
- Air Dispersion Modelling Guideline for Ontario
- Air Contaminants Benchmarks (ACB) List: Standards, guidelines and screening levels for assessing point of impingement concentrations of air contaminants
- Primary Noise Screening Method Guide
- Secondary Noise Screening Method Guide
- Odour Screening Method

The contents of this document may also be updated from time to time. Any changes will be based upon public consultation consistent with the Ontario Environmental Bill of Rights legislation. All web site addresses referred to in this document were current at the time of release.

For any addenda or revisions to the Environmental Activity and Sector Registry - Limits and Other Requirements publication, please visit the MOECC [website](#) or contact:

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Table of Contents

Foreword.....	3
Chapter 1: In-stack Limits for Combustion Equipment.....	6
General	6
Heaters and Boilers - Emission Intensity Rates	6
Electricity Generation Engines - Emission Intensity Rates.....	7
Small wood-fired combustors - Emission Limits.....	8
Chapter 2: Off-grid and Remote Facilities/Communities.....	9
Chapter 3: Noise	10
Definitions.....	10
Class 4 Areas	10
Sound level limits – background, roadways and highways	12
Affected points of noise reception.....	12
Sound Level Limits	13
Prohibition and Emergency Equipment.....	13
Sound Level Limits – Steady Sound and Quasi-Steady Impulsive Sound	14
Sound Level Limits – Impulsive Sound.....	15
Acoustic Assessment Part.....	20
Acoustic Assessment Report.....	20
Chapter 4: Odour	23
Definitions.....	23
Point of Odour Reception	24
Tables.....	24
Measuring Distances	28
Records.....	29

Definitions.....	30
Wood fuel specifications	30
Automated wood fuel feed system.....	31
Wood fuel management.....	31
Design criteria.....	33
Operational parameters	34
Monitoring operational parameters	34
Installation test.....	35
Routine Inspections or Remote Connection.....	36
Performance Assessment.....	37
Records	38
Appendix A: Record of Publications	40
Chapter 5: Small Wood-fired Combustors	30

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this chapter is important

Chapter 1: In-stack Limits for Combustion Equipment

General

1. (1) For the purposes of this Chapter, an amount (or concentration) of nitrogen oxides shall be calculated in accordance with the following formula:

$$A = (B \times 1.53) + C$$

where,

A = the amount (or concentration) of nitrogen oxides,

B = the amount (or concentration) of nitric oxide,

C = the amount (or concentration) of nitrogen dioxide.

(2) In this Chapter, reference to a concentration, as it relates to requirements for a small wood-fired combustor, is a reference to a concentration, corrected to 11 percent oxygen on a dry basis at reference conditions of temperature of 25 degrees Celsius and pressure of 101.3 kilopascals in the flue gas.

Heaters and Boilers - Emission Intensity Rates

2. An emission intensity rate referred to in paragraph 6 of subsection 11 (1) and paragraph 8 of subsection 13 (1) of the Regulation in respect of nitrogen oxides for a boiler or heater with an energy input capacity set out in Column 1 of Table 1 that uses a type of fuel set out opposite the capacity in Column 2, is the emission intensity rate set out in Column 3.

Table 1- Emission Intensity Rates for Heaters and Boilers

Item	Column 1: Energy input capacity of the boiler or heater (gigajoules per hour)	Column 2: Type of fuel used in boiler or heater	Column 3: Maximum nitrogen oxides emission intensity rate (grams per gigajoule)
1.	>10.5 ≤ 105	Gas	26
2.	>105	Gas	40
3.	>10.5 ≤ 105	Distillate oil	40
4.	>105	Distillate oil	50
5.	>10.5	Residual oil with less than 0.35% nitrogen	90
6.	>10.5 ≤ 105	Residual oil with equal to or greater than 0.35% nitrogen	110
7.	>105	Residual oil with equal to or greater than 0.35% nitrogen	125

Electricity Generation Engines - Emission Intensity Rates

3. An emission intensity rate referred to in paragraph 6 of subsection 11 (1) and paragraph 8 of subsection 13 (1) of the Regulation in respect of a contaminant set out in Column 1 of Table 2 that is discharged from an electricity generation engine is the emission intensity rate set out in Column 2.

Table 2 – Emission Intensity Rates for Electricity Generation Engines

Item	Column 1: Contaminant	Column 2: Intensity Rate (kg/MW-hr)
1.	Carbon Monoxide	3.5
2.	Non-methane hydrocarbons	0.19
3.	Nitrogen oxides	0.40
4.	Particulate Matter	0.02

Small wood-fired combustors - Emission Limits

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4. A concentration referred to in paragraph 6 of subsection 11 (1) and subsection 13 (1) of the Regulation in respect of a contaminant set out in Table 3 that is discharged from a small wood-fired combustor is the limit set out in Column 2.

ON emission limits to be met by the pilot scale wood chips fuel boiler

Table 3 – In-stack Emission limits for small wood-fired combustors

Item	Column 1: Contaminant	Column 2: Emission Limit
1.	Carbon Monoxide	400 ppmv (averaged over a 24-hour period)
2.	Particulate matter	75 mg/Rm ³

Chapter 2: Off-grid and Remote Facilities/Communities

1. For the purpose of subparagraphs 2 ii and iii of subsection 13 (2) of the Regulation, an electricity generation engine is considered to generate electricity for a facility or community located in an off-grid area or for a remote facility or community if the engine is used in one of the following areas:

- i. Armstrong
- ii. Auden
- iii. Bearskin Lake
- iv. Big Trout Lake
- v. Biscotasing
- vi. Collins
- vii. Deer Lake
- viii. Ferland
- ix. Fort Severn
- x. Graham
- xi. Gull Bay
- xii. Hillsport
- xiii. Kasabonika Lake
- xiv. Kingfisher Lake
- xv. Lac Seul
- xvi. Lansdowne House
- xvii. MacDowell
- xviii. Moose River Crossing
- xix. Ogoki/Marten Falls
- xx. Oba
- xxi. Ponask
- xxii. Ramsey
- xxiii. Sachigo Lake
- xxiv. Sandy Lake
- xxv. Sultan
- xxvi. Wapekeka
- xxvii. Weagamow
- xxviii. Webequie
- xxix. Whitesand

Chapter 3: Noise

Definitions

1. (1) In this Chapter,

“background sound level” means the sound level that is present in the environment, produced by sources of sound other than the sources under assessment;

“Class 1 area” means an area where the background sound level during the day and night is dominated by the activities of people;

“Class 2 area” means an area where the background sound level during the day is dominated by the activities of people (07:00 to 19:00) and by natural sounds during the night (19:00 to 07:00 hours);

“Class 3 area” means an area where the background sound level during the day and night is dominated by natural sounds;

“dBA” means the A-weighted sound level;

“dBAI” means the A-weighted sound level of an impulsive sound;

“equivalent sound level (Leq)” means, for sound levels that vary over a period of time, the constant sound level that, over an equal period of time, has the same A-weighted energy as the varying sound (expressed in dBA);

“impulsive sound” means a single pressure pulse or a single burst of pressure pulses, such as a hammer blow;

“logarithmic mean impulse sound level (LLM)” means ten times the logarithm to the base 10 of the arithmetic mean of ten to the power of one tenth the impulse sound level of each impulsive sound;

“quasi-steady impulsive sound” means a sequence of impulsive sounds emitted from the same source, having a time interval of less than 0.5 seconds between successive impulsive sounds;

“steady sound” means non-impulsive sound.

Class 4 Areas

2. (1) A portion of a Class 1 or 2 area is deemed to be a Class 4 area if development of a noise-sensitive property is intended for that portion and, at the date on which the approval for the noise-sensitive property is approved by the relevant land use planning authority,

- (a) there are no other noise-sensitive properties in the portion;
- (b) there is at least one facility that,
 - (i) discharges sound to a point that will be a point of noise reception at the noise-sensitive property;
 - (ii) has a noise report that meets the requirements of sections 17 to 21 of the Regulation that indicates that the Class 1 or 2 sound level limits, as applicable, are met; and
 - (iii) is party to an agreement with the person proposing the development that sets out noise control measures that are to be implemented at the noise-sensitive property.

(2) A person engaging in an activity prescribed by section 2 of the Regulation who relies on the deeming provision in subsection (1) prior to the construction of the noise-sensitive property shall have written confirmation of the proposed presence of the noise-sensitive property from the relevant land use planning authority.

(3) A portion of an area that has been deemed a Class 4 area in respect of the facility mentioned under subsection (1) or in respect of which an environmental compliance approval was issued by the Director under the Act, is considered a Class 4 area in respect of other facilities.

(4) For the purpose of this section,

“noise-sensitive commercial-purpose building” means a building used for a commercial purpose that includes one or more habitable rooms used as sleeping facilities such as a hotel or a motel;

“noise-sensitive institutional-purpose building” means a building used for an institutional purpose, including an educational facility, a day nursery, a hospital, a health care facility, a shelter for emergency housing, a community centre, a place of worship and a detention centre. A place of worship located on commercially or industrially-zoned land is not considered a noise-sensitive institutional-purpose building;

“noise-sensitive property” means a property upon which is located a dwelling, a building used for a legal non-conforming residential use, or a building used for a noise-sensitive commercial or institutional purpose;

“noise-sensitive space” means the living and sleeping quarters of dwellings, and sleeping quarters of a noise-sensitive commercial or institutional building;

“plane of window” means a point in space corresponding with the location of the centre of a window of a noise-sensitive space

Sound level limits – background, roadways and highways

3. (1) For the purpose of this Chapter, background sound level must be measured or predicted according to methods or models that result in the accurate determination of the sound level at a point of noise reception.

(2) A sound level limit used for the purposes of the Secondary Noise Screening Method does not include a sound level limit set out in clauses 6(1)(a), (2)(a), (3)(a), (4)(a) and (5)(a) and clauses 7 (1)(a), (2)(a), (3)(a), (4)(a) and (5)(a).

(3) Despite the sound level limits set out in sections 6 and 7, a sound level limit used for the purposes of the Secondary Noise Screening Method may be increased by 5 dBA in respect of an affected point of noise reception that is located,

- (a) less than 100 m from any point on the edge of the pavement of a 400 series highway; or
- (b) less than 30 m from any point on the edge of the pavement of a provincial roadway or regional road.

Affected points of noise reception

4. (1) Subject to subsection (2), for the purposes of the definition of “point of noise reception” in subsection 1 (1) of the Regulation, a point is **only** a point of noise reception if it is located on a property that contains one or more of the following buildings:

- 1. A building or structure that contains one or more dwellings.
- 2. A building used for a commercial purpose that includes one or more habitable rooms used as sleeping facilities, such as a hotel or motel.
- 3. A building used for an institutional purpose, including an educational facility, a child care centre, a hospital, a health care facility, a shelter for emergency housing, a community centre or a detention centre.
- 4. A building used for a place of worship, other than a place of worship located on land that is zoned for commercial or industrial use.
- 5. A location on a vacant lot, other than an inaccessible vacant lot, that has been zoned to permit a building mentioned in paragraph 1, 2, 3 or 4.
- 6. A portion of a property that is used as a campsite or campground at which overnight accommodation is provided by or on behalf of a public agency or as part of a commercial operation.

(2) A point located on a property on which a building that contains only one dwelling is located is not a point of noise reception if the building is located on the same property as the source of sound and in a separate building from the source of sound.

(3) Subject to subsection (4), an affected point of noise reception is a point of noise reception.

(4) A point of noise reception may be considered not to be an affected point of noise reception if,

1. The distance from the source of sound to the point of noise reception is greater than or equal to the minimum separation distance determined using the Primary Noise Screening Method.
2. The point is one of several points in close proximity and one of the other points is an affected point of noise reception that represents the sound level at the point.
3. The background sound level at the point of noise reception is high relative to the sources of sound being assessed.
4. Having regard to the class of the area in which the point of noise reception is located, the sound level at the point of noise reception is less than the sound level limits that would apply at the point of noise reception in accordance with sections 6 and 7.

(5) Despite subsection (4), if there is a point of noise reception in a cardinal direction, there must be at least one affected point of noise reception in that direction.

Sound Level Limits

Prohibition and Emergency Equipment

5. (1) Subject to subsection (2), for the purpose of the Regulation, the applicable sound level limit must be determined in accordance with sections 6 and 7 with respect to an affected point of noise reception.

(2) It is not necessary to include the sound discharged from emergency equipment when determining the combined sound discharged from all sources of sound at the facility for the purpose of subsection (1).

(3) For each affected point of noise reception determined under section 4 that receives sound discharged from emergency equipment operating in non-emergency situations, the owner and operator of the facility shall ensure that the sound discharged from the emergency equipment does not result in the sound level at the affected point of noise reception exceeding a sound level limit that is 5 dB higher than the applicable sound level limit determined in accordance with sections 6 and 7 with respect to the affected point of noise reception.

(4) Sound level limits do not apply with respect to sound produced by emergency equipment operating in emergency situations.

Sound Level Limits – Steady Sound and Quasi-Steady Impulsive Sound

6. (1) For each affected point of noise reception determined under section 4 that is located outdoors in an area set out in Column 1 of Table 1 and that receives steady sound or quasi-steady impulsive sound from the facility, the sound level limit at the point of noise reception between the hours of 07:00 to 19:00 is the greater of,

- (a) the background sound level at the point of noise reception; and
- (b) the value set out opposite the area in Column 2 of Table 1.

(2) For each affected point of noise reception located outdoors in an area set out in Column 1 of Table 1 that receives steady sound or quasi-steady impulsive sound from the facility, the sound level limit at the point of noise reception between the hours of 19:00 to 23:00 is the greater of,

- (a) the background sound level at the point of noise reception; and
- (b) the value set out opposite the area in Column 3 of Table 1.

Table 1 – Sound Level Limits for Outdoor Points of noise reception - Steady Sound or Quasi-Steady Impulsive Sound

Item	Column 1: Point of noise reception location	Column 2: 1-Hr L_{eq} (dBA) (07:00 – 19:00)	Column 3: 1-Hr L_{eq} (dBA) (19:00 – 23:00)
1.	Class 1 Area	50	50
2.	Class 2 Area	50	45
3.	Class 3 Area	45	40
4.	Class 4 Area	55	55

(3) For each affected point of noise reception determined under section 4 that is a plane of window located in an area set out in Column 1 of Table 2 and that receives steady sound or quasi-steady impulsive sound from the facility, the sound level limit at the point of noise reception between the hours of 07:00 to 19:00 is the greater of,

- (a) the background sound level at the point of noise reception; and
- (b) the value set out opposite the area in Column 2 of Table 2.

(4) For each affected point of noise reception determined under section 4 that is a plane of window located in an area set out in Column 1 of Table 2 that receives steady sound or

quasi-steady impulsive sound from the facility, the sound level limit at the point of noise reception between the hours of 19:00 to 23:00 is the greater of,

- (a) the background sound level at the point of noise reception; and
- (b) the value set out opposite the area in Column 3 of Table 2.

(5) For each affected point of noise reception determined under section 4 that is a plane of window located in an area set out in Column 1 of Table 2 that receives steady sound or quasi-steady impulsive sound from the facility, the sound level limit at the point of noise reception between the hours of 23:00 to 07:00 is the greater of,

- (a) the background sound level at the point of noise reception; and
- (b) the value set out opposite the area in Column 4 of Table 2.

Table 2 – Sound Level Limits for Plane of Window Points of noise reception - Steady Sound or Quasi-Steady Impulsive Sound

Item	Column 1: Point of noise reception location	Column 2: 1-Hr L_{eq} (dBA) (07:00 – 19:00)	Column 3: 1-Hr L_{eq} (dBA) (19:00 – 23:00)	Column 4: 1-Hr L_{eq} (dBA) (23:00 – 07:00)
1.	Class 1 Area	50	50	45
2.	Class 2 Area	50	45	45
3.	Class 3 Area	45	40	40
4.	Class 4 Area	60	60	55

Sound Level Limits – Impulsive Sound

7. (1) For each affected point of noise reception determined under section 4 that is located outdoors in an area set out in Column 1 of Table 3 and that receives an impulsive sound from the facility, the sound level limit at the point of noise reception between the hours of 07:00 to 23:00 is the greater of,

- (a) the background sound level at the point of noise reception; and
- (b) if the number of impulses in a one-hour period is,
 - (i) one, the value set out opposite the area in Column 2 of Table 3,
 - (ii) two, the value set out opposite the area in Column 3 of Table 3,
 - (iii) three, the value set out opposite the area in Column 4 of Table 3,
 - (iv) four, the value set out opposite the area in Column 5 of Table 3,

- (v) five to six, the value set out opposite the area in Column 6 of Table 3,
- (vi) seven to eight, the value set out opposite the area in Column 7 of Table 3,
- (vii) nine or more, the value set out opposite the area in Column 8 of Table 3.

Table 3 - Sound Level Limits for Outdoor Points of noise reception – Impulsive Sound

Item	Column 1: Point of noise reception location	Column 2: L _{LM} (dBAI) (1 Impulse / hr)	Column 3: L _{LM} (dBAI) (2 Impulses / hr)	Column 4: L _{LM} (dBAI) (3 Impulses / hr)	Column 5: L _{LM} (dBAI) (4 Impulses / hr)	Column 6: L _{LM} (dBAI) (5-6 Impulses / hr)	Column 7: L _{LM} (dBAI) (7-8 Impulses / hr)	Column 8: L _{LM} (dBAI) (9 or more Impulses / hr)
1.	Class 1 Area	80	75	70	65	60	55	50
2.	Class 2 Area	80	75	70	65	60	55	50
3.	Class 3 Area	75	70	65	60	55	50	45
4.	Class 4 Area	85	80	75	70	65	60	55

(2) For each affected point of noise reception determined under section 4 that is a plane of window located in an area set out in Item 1, 2 or 4 of Column 1 of Table 4 and that receives an impulsive sound from the facility, the sound level limit at the point of noise reception between the hours of 07:00 to 23:00 is the greater of,

- (a) the background sound level at the point of noise reception; and
- (b) if the number of impulses in a one-hour period is,
 - (i) one, the value set out opposite the area in Column 2 of Table 4,
 - (ii) two, the value set out opposite the area in Column 3 of Table 4,
 - (iii) three, the value set out opposite the area in Column 4 of Table 4,
 - (iv) four, the value set out opposite the area in Column 5 of Table 4,
 - (v) five to six, the value set out opposite the area in Column 6 of Table 4,
 - (vi) seven to eight, the value set out opposite the area in Column 7 of Table 4,

(vii) nine or more, the value set out opposite the area in Column 8 of Table 4.

(3) For each affected point of noise reception determined under section 4 that is a plane of window located in an area set out in Item 3 of Column 1 of Table 4 and that receives an impulsive sound from the facility, the sound level limit at the point of noise reception between the hours of 07:00 to 19:00 is the greater of,

- (a) the background sound level at the point of noise reception; and
- (b) if the number of impulses in a one-hour period is,
 - (i) one, the value set out opposite the area in Column 2 of Table 4,
 - (ii) two, the value set out opposite the area in Column 3 of Table 4,
 - (iii) three, the value set out opposite the area in Column 4 of Table 4,
 - (iv) four, the value set out opposite the area in Column 5 of Table 4,
 - (v) five to six, the value set out opposite the area in Column 6 of Table 4,
 - (vi) seven to eight, the value set out opposite the area in Column 7 of Table 4,
 - (vii) nine or more, the value set out opposite the area in Column 8 of Table 4.

Table 4 – Day and Evening Sound Level Limits for Plane of Window Points of noise reception – Impulsive Sound

Item	Column 1: Point of noise reception location	Column 2: LLM (dBAI) (1 Impulse / hr)	Column 3: LLM (dBAI) (2 Impulses / hr)	Column 4: LLM (dBAI) (3 Impulses / hr)	Column 5: LLM (dBAI) (4 Impulses / hr)	Column 6: LLM (dBAI) (5-6 Impulses / hr)	Column 7: LLM (dBAI) (7-8 Impulses / hr)	Column 8: LLM (dBAI) (9 or more Impulses / hr)
1.	Class 1 Area	80	75	70	65	60	55	50
2.	Class 2 Area	80	75	70	65	60	55	50
3.	Class 3 Area	75	70	65	60	55	50	45
4.	Class 4 Area	90	85	80	75	70	65	60

(4) For each affected point of noise reception determined under section 4 that is a plane of window located in an area set out in Item 1, 2 or 4 of Column 1 of Table 5 and that receives an impulsive sound from the facility, the sound level limit at the point of noise reception between the hours of 23:00 to 07:00 is the greater of,

- (a) the background sound level at the point of noise reception; and
- (b) if the number of impulses in a one-hour period is,
 - (i) one, the value set out opposite the area in Column 2 of Table 5,
 - (ii) two, the value set out opposite the area in Column 3 of Table 5,
 - (iii) three, the value set out opposite the area in Column 4 of Table 5,
 - (iv) four, the value set out opposite the area in Column 5 of Table 5,
 - (v) five to six, the value set out opposite the area in Column 6 of Table 5,
 - (vi) seven to eight, the value set out opposite the area in Column 7 of Table 5,
 - (vii) nine or more, the value set out opposite the area in Column 8 of Table 5

(5) For each affected point of noise reception determined under section 4 that is a plane of window located in an area set out in Item 3 of Column 1 of Table 5 and that receives an impulsive sound from the facility, the sound level limit at the point of noise reception between the hours of 19:00 to 07:00 is the greater of,

- (a) the background sound level at the point of noise reception; and
- (b) if the number of impulses in a one-hour period is,
 - (i) one, the value set out opposite the area in Column 2 of Table 5,
 - (ii) two, the value set out opposite the area in Column 3 of Table 5,
 - (iii) three, the value set out opposite the area in Column 4 of Table 5,
 - (iv) four, the value set out opposite the area in Column 5 of Table 5,
 - (v) five to six, the value set out opposite the area in Column 6 of Table 5,
 - (i) seven to eight, the value set out opposite the area in Column 7 of Table 5,
 - (ii) nine or more, the value set out opposite the area in Column 8 of Table 5.

Table 5 – Night Sound Level Limits for Plane of Window Points of noise reception – Impulsive Sound

Item	Column 1: Location of point of noise reception	Column 2: L _{LM} (dBAI) (1 Impulse / hr)	Column 3: L _{LM} (dBAI) (2 Impulses / hr)	Column 4: L _{LM} (dBAI) (3 Impulses / hr)	Column 5: L _{LM} (dBAI) (4 Impulses / hr)	Column 6: L _{LM} (dBAI) (5-6 Impulses / hr)	Column 7: L _{LM} (dBAI) (7-8 Impulses / hr)	Column 8: L _{LM} (dBAI) (9 or more Impulses / hr)
1.	Class 1 Area	75	70	65	60	55	50	45
2.	Class 2 Area	75	70	65	60	55	50	45
3.	Class 3	70	65	60	55	50	45	40
4.	Class 4 Area	85	80	75	70	65	60	55

Acoustic Assessment Part

Acoustic Assessment Report

8. (1) A noise report that indicates that the criteria set out in paragraph 8 iv or v of subsection 17 (1) of the Regulation are met shall contain the following information:

1. The primary NAICS code for the facility and any other applicable NAICS codes related to the facility.
2. A table entitled “Noise Source Summary Table” that sets out the type and number of sources of sound at the facility and, for each source, sets out the following information:
 - i. Column 1: Source Identifier: a unique identifier for each source of sound.
 - ii. Column 2: Source Description: a brief description of the source of sound.
 - iii. Column 3: Sound Power Level: a measurement in decibels of the acoustical power radiated by the source of sound with respect to the international reference of 10 -12Watts.
 - iv. Column 4: Sound Characteristics: the acoustical characteristics of the source of sound that affect the measurements, including tonal characteristics and whether the sound is steady, impulsive or quasi-steady impulsive.
 - v. Column 5: Source Location: an indication of whether the source of sound is located outside or inside a building
 - vi. Column 6: Noise Control Measures: an indication of measures and procedures used to control the noise emissions from the source of sound
3. The operating hours of the facility, including the start time and the stop time and, if there are multiple or intermittent source of sounds at the facility, the sequence of operation of the sources. The operational parameters that were assumed for the purpose of the assessment, including the maximum rates of production, process limits and parameters relating to equipment and infrastructure
4. A plan of the facility, drawn to scale, that shows the following items,
 - i. the property boundary of the site on which the facility is located,
 - ii. the location of each source identified in paragraph 2,
 - iii. for each source identified in paragraph 2 that is housed in a building, the size, location and orientation of each exterior opening in the building,
 - iv. the materials used to construct the exterior and interior of each building mentioned in subparagraph iii,
 - v. the location of each acoustical barrier used or proposed to be used with respect to each source of sound, and
 - vi. an indication of North.

5. A summary of the noise control measures and procedures used to prevent or minimize the discharge of sound from more than one source at the facility, for example berms or enclosures.

6. With respect to each noise control measure and procedure identified in subparagraph 2 vi and paragraph 5, the following information:

- i. If a source is silenced, enclosed or shielded by a barrier, the location, dimensions, structural details and material used for the noise control measure,
- ii. The specification of equipment and materials used in the noise control measure such as, transmission loss, insertion loss and noise reduction,
- iii. If the noise control measure uses standard catalogue items, an indication of the manufacturer's make and model number of the noise control measure.

7. A plan of the area surrounding the facility that meets the following criteria:

- i. The plan must set out the property boundary of the site on which the facility is located and a boundary that is at least 1000 metres from the property boundary at every point.
- ii. In the area between the property boundary and the boundary mentioned in subparagraph i, the plan must depict the following,
 - A. The land use zoning and permitted uses (e.g. a Land Use Zoning Designation Plan from the municipality),
 - B. The location of all highways and roadways,
 - C. The location of each affected point of noise reception determined in accordance with section 4, and the property boundaries associated with the affected point of noise reception, and
 - D. The location of each acoustical barrier used or proposed to be used in the area.
- iii. The plan must show the distance between each opening mentioned in subparagraph 4iii and each affected point of noise reception mentioned in sub-sub-paragraph C.
- iv. The plan must indicate North, be drawn to scale and include a zoning legend.

8. A table entitled "Point of noise reception Noise Impact Table" that sets out, for each source of sound identified in paragraph 2, the following information:

- i. Column 1: Source ID: the unique identifier mentioned in subparagraph 2 i.
- ii. Column 2: Point of noise reception ID: a unique identifier for each affected point of noise reception identified in sub-subparagraph 7 ii C.
- iii. Column 3: Distance to Point of noise reception: the distance in metres from the source of sound to each affected point of noise reception identified in subparagraph ii.

- iv. Column 4: Time of Day: For each affected point of noise reception identified in subparagraph ii, set out the time periods (day/evening/night) during which the sound level must be assessed in accordance with section 6 or 7.
- v. Column 5: Sound Level at Point of noise reception: For each time period identified in subparagraph iv, the predicted or measured sound level (Leq or LLM) identified as units of dBA or dBAI at each affected point of noise reception identified in subparagraph ii resulting from the source of sound.

9. A description of methods used to determine the predicted or measured sound levels mentioned in subparagraph 8 v, including calculations, measurement techniques and equipment used to measure noise.

10. Confirmation from the licensed engineering practitioner mentioned in paragraph 1 of subsection 17 (1) of the Regulation that the methods mentioned in paragraph 9 are adequate to accurately determine the sound level at each affected point of noise reception.

11. A table entitled “Acoustic Assessment Summary Table” that sets out, for each affected point of noise reception identified in sub-subparagraph 7 ii C, the following information:

- i. Column 1: Point of noise reception ID: the unique identifier mentioned in subparagraph 8 ii.
- ii. Column 2: Point of noise reception Description: A brief description of the affected point of noise reception.
- iii. Column 3: Time of Day: For each affected point of noise reception, set out the time periods (day/evening/night) during which the sound level must be assessed in accordance with section 6 or 7.
- iv. Column 4: Sound Level at Point of noise reception: For each time period identified in subparagraph iii, the predicted or measured sound level at the affected point of noise reception, in terms of Leq or LLM and reported in units of dBA or dBAI. Note that if there are multiple sources of sound at the facility, the sound level at the affected point of noise reception must account for the combined effect of all sources of sound.
- v. Column 5: Sound Level Limit: the applicable sound level limit set out in section 6 or 7.
- vi. Column 6: Compliance with Sound Level Limit: an indication of whether the predicted sound level at the affected point of noise reception is below the applicable sound level limit mentioned in subparagraph v.

12. A statement signed by the person engaging in the prescribed activity confirming that all information given to the licensed engineering practitioner in order to prepare the report was complete and accurate.

Chapter 4: Odour

Definitions

1. In this Chapter,

“Class 3 area” has the same meaning as in Chapter 3 (Noise);

“coating” means a product that forms a film when it is applied to a surface but does not include a water based product that has a volatile organic compound concentration that is 50 gram/litre or less;

“cooking or drying animal products” means an industrial process that includes the heating of or removing of moisture from animal products to create animal food or other animal products. This process does not include the manufacturing of food for human consumption;

“food frying” means an industrial process in which food for human consumption is fried using edible oils or fats.

“printing” means a printing process at a commercial printing facility and includes lithographic printing, flexographic printing, digital printing, rotogravure printing, and screen printing.

“printing ink” means an ink used in a printing process but does not include an ink that has a volatile organic compound concentration that is 50 gram/litre or less;

“process using phenolic resin” means a manufacturing process in which phenolic (PF) resin is used to complete the process but does not include the manufacturing of phenolic resin.

“scented product” means a non-edible product produced for purposes that includes the discharge of odour, such as candles;

“scented product manufacturing” means a manufacturing process in which scented products are produced or used in the process;

“spraying operation” means a process in which a coating is applied to a surface by way of spraying but does not include a printing process or a process that applies a coating using a spray can, electrostatic painting or electrophoretic painting or the application of a coating as part of routine maintenance at the facility;

“wastewater treatment” means an on-site process at the facility to treat wastewater from the facility;

Point of Odour Reception

2. For the purposes of the definition of “point of odour reception” in subsection 1 (1) of the Regulation, each of the following locations is a point of odour reception if the location is not on the same property as the facility from which the odour is or will be discharged:

1. A building or structure that contains one or more dwellings.
2. A building used for a commercial purpose that includes one or more habitable rooms used as sleeping facilities, such as a hotel or motel.
3. A building used for an institutional purpose, including an educational facility, a child care centre, a health care facility, a community centre.
4. A building used for a place of worship, other than a place of worship located on land that is zoned for commercial or industrial use.
5. A location on a vacant lot, other than an inaccessible vacant lot, that has been zoned to permit a building mentioned in paragraph 1, 2, 3 or 4.
6. A portion of a property used for recreational purposes, not including a portion used for a recreational trail.
7. A portion of a property that is used for as a campsite or campground at which overnight accommodation is provided by or on behalf of a public agency or as part of a commercial operation.

Tables

3. (1) The following are the tables referred to in section 24 of the Regulation.

Table 1- Odour – Activities and Setback Distances

Column 1: Item	Column 2: NAICS Code	Column 3: NAICS Code Description	Column 4: Design Capacity of Facility	Column 5: Setback Distance (m)
1.	311119	Other animal food manufacturing	N/A	500
2.	311214	Rice Milling and Malt Manufacturing	N/A	500
3.	311230	Breakfast cereal manufacturing	N/A	300
4.	311340	Non-chocolate confectionery manufacturing	N/A	300
5.	311351	Chocolate and chocolate confectionery manufacturing from cacao beans	N/A	500

Column 1: Item	Column 2: NAICS Code	Column 3: NAICS Code Description	Column 4: Design Capacity of Facility	Column 5: Setback Distance (m)
6.	311352	Confectionery manufacturing from purchased chocolate	N/A	300
7.	311420	Fruit and vegetable canning, pickling and drying	N/A	350
8.	311511	Fluid milk manufacturing	N/A	100
9.	311515	Butter, cheese, and dry and condensed dairy product manufacturing	N/A	100
10.	311520	Ice cream and frozen dessert manufacturing	N/A	300
11.	311710	Seafood product preparation and packaging	N/A	500
12.	311821	Cookie and cracker manufacturing	N/A	300
13.	311911	Roasted nut and peanut butter manufacturing	N/A	300
14.	311919	Other snack food manufacturing	N/A	300
15.	311920	Coffee and tea manufacturing	N/A	250
16.	311930	Flavouring syrup and concentrate manufacturing	N/A	300
17.	311940	Seasoning and dressing manufacturing	N/A	300
18.	311990	All other food manufacturing	N/A	300
19.	312120	Breweries	< 20 ML/yr annual production rate	250
20.	312140	Distilleries	N/A	500

Column 1: Item	Column 2: NAICS Code	Column 3: NAICS Code Description	Column 4: Design Capacity of Facility	Column 5: Setback Distance (m)
21.	316110	Leather and hide tanning and finishing	N/A	500
22.	321114	Wood preservation	N/A	500
23.	322220	Paper bag and coated and treated paper manufacturing	N/A	500
24.	326140	Polystyrene foam product manufacturing	N/A	500
25.	326196	Motor vehicle plastic parts manufacturing	N/A	500

Table 2 – Odour – Processes and Setback Distances

Column 1: Item	Column 2: Odorous Process	Column 3: Setback Distance (m)
1.	Spraying Operations (<10 L/hr)	100
2.	Wastewater Treatment – Covered Clarifiers	500
3.	Scented Products Manufacturing	500
4.	Printing (printing rates > 100 kg/hr, to ≤ 400 kg/hr)	100
5.	Plastic Extrusion or Melting	100
6.	Process using Phenolic Resin	250

(2) For the purposes of Table 2,

“printing (printing rates) >100 kg/ hr to ≤ 400 kg/hr” means a printing process engaged in at a facility at which the total of the maximum hourly application rates of all printing inks used in printing processes at the facility is greater than 100 kg/hr and not greater than 400 kg/hr;

“spraying operation (<10 L/hr)” means a spraying operation engaged in at a facility at which the total of the maximum hourly application rates of all coatings used in spraying operations at the facility is less than 10 litres/hr;

“wastewater treatment – covered clarifier” means a wastewater treatment process that uses a covered clarifier but does not use a lagoon, uncovered clarifier or sludge management.

Table 3 – Odour – Activities and Setback Distances

Column 1: Item	Column 2: NAICS Code	Column 3: NAICS Code Description	Column 4: Design Capacity of Facility	Column 5: Setback Distance (m)
1.	311111	Dog and Cat Food Manufacturing	N/A	500
2.	311310	Sugar manufacturing	N/A	500
3.	312120	Breweries	≥ 20 ML/yr annual production rate	500

Table 4 – Odour – Processes and Setback Distances

Column 1: Item	Column 2: Odorous Process	Column 3: Setback Distance (m)
1.	Spraying Operations (≥10 L/hr)	500
2.	Wastewater Treatment – Lagoons, Uncovered Clarifiers, Sludge Management	1000
3.	Food Frying	500
4.	Cooking or Drying Animal Products	500

Column 1: Item	Column 2: Odorous Process	Column 3: Setback Distance (m)
5.	Printing (printing rates > 400 kg/hr)	500

(3) For the purposes of Table 4,

“printing (printing rates) > 400 kg/hr” means a printing process engaged in at a facility at which the total of the maximum hourly application rates of all printing inks used in printing processes at the facility is greater than 400 kg/hr;

“spraying operation (≥ 10 L/hr)” means a spraying operation engaged in at a facility at which the total of the maximum hourly application rates of all coatings used in spraying operations at the facility is greater than or equal to 10 litres/hr;

“wastewater treatment – Lagoons, Uncovered Clarifiers, Sludge Management” means a wastewater treatment process that uses a covered clarifier but does not use a lagoon, uncovered clarifier or sludge management.

Measuring Distances

4. For the purposes of paragraphs 3 and 5 of section 24 of the Regulation, to determine the distance between a facility and the closest point of odour reception, the distance from the closest point of discharge of odour from the facility or outdoor odour source to the property line of the closest point of odour reception must be measured.

The distance shall be measured from Point A to Point B in accordance with the following:

1. Point A is,
 - i. the point that is located on the edge of the point of discharge of odour from a building at the facility and that is closest to the property boundary of the point of odour reception, or
 - ii. if there is an outdoor source of odour located closer to the property boundary of the point of odour reception than the point mentioned in subparagraph i, the point that is located on the edge of the outdoor source of odour and that is closest to the property boundary of the point of odour reception.
2. Point B is the point that is located on the property boundary of the point of odour reception and that is closest to Point A.

There is an exception to the measurement rule set out above. If the closest point of odour reception is a dwelling or a camping area that is located in a Class 3 area, a person may use Point C instead of Point B in the measurement rule set out above, where, Point C is

the point that is located 30 meters from the exterior wall of the dwelling or edge of the camping area and closest to Point A.

However, if the distance between Point A and Point C is less than the distance between Point A and Point B, Point A and Point B must be used in the measurement rule set out above.

Records

5. For the purpose of paragraph 9 of section 24 of the Regulation the following records shall be created and retained at the facility for a period of 20 years after the record is created:

1. A drawing that is to scale and that sets out the points used for any measurements performed for the purpose of paragraph 3 or 5 of section 24 of the Regulation.

Chapter 5: Small Wood-fired Combustors

Definitions

1. (1) In this Chapter,

“EN 303-5 (2012)” means the European Standard EN 303-5, published by the European Committee for Standardization in June, 2012 and entitled “Heating boilers for solid fuels, manually and automatically stoked, nominal load heat input capacity up to 500 kW – Terminology, requirements, testing and marking”;

“nominal load heat input capacity” means the design capacity of a small wood-fired combustor to combust a maximum amount of wood fuel based on the physical design of the small wood-fired combustor and is calculated by multiplying the mass flow rate of the wood fuel by the higher heating value of the wood fuel;

“nominal load heat output capacity” means the maximum continuous usable heat output as determined by the nominal load heat input capacity and design of the heat exchanger;

“oxygen lambda sensor” means a device that continuously measures the concentration of oxygen in the flue gas on a wet basis and uses the resulting measurement as an input to the oxygen trim system;

“oxygen trim system” means the components of a small wood-fired combustor that dynamically control the excess oxygen level in the flue gas through the use of an oxygen lambda sensor;

“partial load heat input capacity” means the design capacity of a small wood-fired combustor to combust a minimum amount of wood fuel based on the physical design of the small wood-fired combustor, for which air emissions can be reliably measured at steady state conditions, and is calculated by multiplying the mass flow rate of the wood fuel by the higher heating value of the wood fuel;

“partial load heat output capacity” means the minimum continuous usable heat output as determined by the partial load heat input capacity and design of the heat exchanger;

Wood fuel specifications

2. The following are the specifications referred to in subparagraph 3 iii of subsection 2 (2) of the Regulation with respect to the fuel used in a small wood-fired combustor.

1. Wood briquettes that are grade A1, A2 or B as set out in the standard CAN/CSA-ISO 17725-3:15, published by the Canada National Standard/Canadian Standards – International Organization for Standardization standard on March 1, 2015 and

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if the system is larger than 500 kW (up to 3 MW), the boiler must be tested using the test methodology in EN 303-5 (2012) by a third party certified testing company. report is to be submitted.

entitled “Solid biofuels – Fuel specifications and classes - Part 3: Graded Wood briquettes”.

2. Wood pellets that are:
 - i. grade A1, A2 or B as set out in the standard CAN/CSA-ISO 17725-2:15, published by the Canada National Standard/Canadian Standards – International Organization for Standardization standard on March 1, 2015 and entitled “Solid biofuels – Fuel specifications and classes - Part 2: Graded Wood pellets”; or
 - ii. premium or standard grade as set out in the document entitled “Pellet Fuels Institute Standard Specifications for Residential/Commercial Densified Fuel”, published by the Pellet Fuels Institute in July 2015.

3. Wood chips that,
 - i. have a moisture content, reported on a wet basis, that is not greater than 30 percent when used as fuel; and
 - ii. if the date is after January 31, 2027, are grade A1, A2, B or C, as set out in the standard 17225-4:15, published by the Canada National Standard/Canadian Standards – International Organization for Standardization in 2015 on March 1, 2015 and entitled “Solid Biofuels – Fuel specifications and classes – Part 4: Graded wood chips”.

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currently only limitation for wood chips fuel is moisture content

International Organization for Standardization for Solid Biofuels – Fuel

Automated wood fuel feed system

3. An automated wood fuel feed system mentioned in paragraph 1 of section 31 of the Regulation must meet the following criteria:

1. The automated wood fuel feed system must have a computerized control system that operates in conjunction with an oxygen trim system.
2. The automated wood fuel feed system must have start-up and shut-down procedures that control the timing sequence and amount of wood fuel fed into the combustor.

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automated wood fuel feed system should be a requirement for the RFP. this language can be used in the RFP

Wood fuel management

4. (1) A wood fuel management plan mentioned in paragraph 2 of section 31 of the Regulation must contain the following elements:

1. A list setting out, for each small wood-fired combustor at the facility, the quantity of wood fuel that is intended to be stored at the facility for use in that combustor and the specification described in section 2 that best describes the wood fuel.
2. A procedure to document the quantity of wood fuel purchased for use in each small wood-fired combustor at the facility, the date of the purchase and the source from which the fuel was purchased.

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this section is important from wood fuel management perspective

best describes the wood

for use in each small wood-fired combustor and the source from

3. If wood fuel is generated at the facility, a procedure to document each type of wood fuel generated at the facility in each calendar year for use in each small wood-fired combustor at the facility and the amount of each type of wood fuel generated during that period.
4. A procedure to ensure that each wood fuel, wood fuel storage area, and wood fuel handling and conveyance system used at the facility in relation to a small wood-fired combustor is inspected on a regular basis.
5. A procedure to ensure that wood fuel that is not considered acceptable for combustion at the facility is removed from the facility immediately or stored in a location that is separate from the wood fuel storage area until it can be removed from the facility in a timely manner. The quantity and type of wood fuel rejected as unacceptable for combustion and the reasons for the rejection must be documented.
6. A procedure setting out the steps that are to be taken to ascertain whether a wood fuel meets the applicable specifications set out in section 2 for the type of wood fuel. Such steps may include laboratory testing, requisition of documentation of third party certification provided to the wood fuel supplier, and on-site testing.
7. An indication of the maximum time that each type of wood fuel may be stored at the facility before it is used in a small wood-fired combustor. This maximum storage duration must be established in a manner that prevents degradation of the wood fuel before it is used as a fuel.
8. If a facility uses wood chips, a procedure to,
 - i. with respect to wood chip pile turn-over, ensure that the wood chips that have been at the facility for the longest are used first, and
 - ii. ensure that the wood chips fed into a small wood-fired combustor are delivered from either a heated indoor wood chip storage facility sufficient to store a minimum of one and a half days of wood chip fuel supply at nominal load heat input capacity or unheated indoor storage facility sufficient to store a minimum of three days of wood chip fuel supply at nominal load heat input capacity. The wood chips may be delivered either directly from the indoor storage facility to the combustor if both are housed in one structure, or indirectly from the storage facility into the combustor fuel hopper through a conveyance system if housed in separate structures.
9. If a facility uses wood pellets or wood briquettes, a procedure to ensure that the wood pellets and wood briquettes are covered by a weather proof enclosure.

(2) A person mentioned in section 31 of the Regulation must ensure that the wood fuel management plan is reviewed at least once every year and updated to reflect changes in wood fuel management at the facility, including any revisions required by the maximum time that each type of wood fuel may be stored at the facility before it is used as a fuel in a small wood-fired combustor.

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one of the responsibility of the operator
"ensuring and maintaining wood fuel
management plan"

Design criteria

5. (1) The design criteria mentioned in paragraph 3 of section 31 of the Regulation are the following:

1. Subject to subsection (2), a small wood-fired combustor must meet the following requirements:
 - i. Subject to subparagraphs ii and iii, the small wood-fired combustor must meet the requirements of EN 303-5 (2012).
 - ii. The combustor must be designed to meet Class 5 thermal efficiency and carbon monoxide as set out in EN 303-5 (2012) at nominal load and partial load heat output capacity operating conditions.
 - iii. The combustor must be designed, taking into account any air pollution control equipment specified by the manufacturer, to meet at least one of Class 3, 4 or 5 for dust (particulate matter) as set out in EN 303-5 (2012) at nominal load and partial load heat output capacity operating conditions.
2. A small wood-fired combustor must have a multi-zone air control process with a primary combustion zone designed to facilitate gasification of the wood fuel and to ensure that solid fixed carbon has minimal carry-over of particulate matter.
3. A small wood-fired combustor must have a multi-zone air control process with a secondary combustion zone designed to achieve complete combustion of the volatilized gases and any combustible particles that may be carried over from the primary combustion zone.
4. A small wood-fired combustor must have an automated bottom ash removal system.
5. A small wood-fired combustor must have an oxygen trim system including an oxygen lambda sensor to regulate the supply of combustion air to the primary, secondary, and, where applicable, tertiary combustion zones.
6. A small wood-fired combustor must use a variable speed electric fan as the induced draft fan to maintain a minimum negative static pressure in the combustion zones.
7. A small wood-fired combustor must have a monitor that measures the static pressure in the furnace or an alarm that signals when the static pressure in the furnace is positive.
8. If the small wood-fired combustor is designed to meet Class 3 dust (particulate matter) as set out in EN 303-5 (2012), the combustor must have, in addition to any air pollution control equipment specified by the manufacturer, additional air pollution control equipment that removes at least 50% of the particulate matter entering the additional air pollution control equipment.
9. If the small wood-fired combustor is designed to meet Class 4 or 5 for dust (particulate matter) as set out in EN 303-5 (2012), the combustor must be equipped with the air pollution control equipment specified by the manufacturer as required, if any, in order for the combustor to meet Class 4 or 5 for dust (particulate matter).

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all the requirements in this design criteria section could be included to the RFP language.

complete

ash removal

(2) A small wood-fired combustor that would meet the criteria set out in paragraph 1 of subsection (1) but for having a nominal heat load output capacity of more than 500 kW is deemed to meet the design criteria in paragraph 1 of subsection (1).

(3) The design criteria set out in paragraph 1 of subsection (1) of a small wood-fired combustor referred to in subsection (1) or (2) must be confirmed by a person who,

- (a) does not own, operate, sell or manufacture the small wood-fired combustor, and
- (b) meets the EN ISO/IEC 17025 requirements for testing as described in EN 303-5 (2012).

Operational parameters

6. (1) The operational parameters mentioned in paragraph 4 of section 31 of the Regulation are the following operational parameters specified by the manufacturer of the small wood-fired combustor at both nominal and partial load capacity:

- 1. The heat input capacity.
- 2. The heat output capacity.
- 3. The wood fuel feed rate.
- 4. The thermal efficiency.

(2) A person mentioned in section 31 of the Regulation must ensure of the partial load heat input and output capacity of each small wood-fired combustor as a percentage of the corresponding nominal load heat input and output capacity.

(3) A person mentioned in section 31 of the Regulation must ensure that a small wood-fired combustor only operates if,

- (a) the heat input is above the partial load heat input capacity mentioned in subsection (2);
- (b) the heat output is above the partial load heat output capacity mentioned in subsection (2);
- (c) the excess oxygen in the flue gas of the small wood-fired combustor is at least 5.5 percent by volume on a wet basis block-averaged over a one-hour period;
- (d) the static pressure in the small wood-fired combustor is negative; and
- (e) the air pollution control equipment mentioned in paragraphs 8 and 9 of subsection 5 (1) is operational.

Monitoring operational parameters

7. (1) For the purpose of paragraph 5 of section 31 of the Regulation, a person mentioned in that section must ensure that the following parameters are measured that the measurements are recorded as block-averages over every five

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Note the similarities between the parameters in this operational list (to comply with ON regulation) and the list being developed for the monitoring and verification protocol by the Project team.

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this should be another requirement in the RFP; the supplier should provide a way of recording the measurements according to the requirements stated here

1. The concentration of oxygen in the flue gas as measured by an oxygen lambda sensor, expressed as percent by volume on a wet basis.
2. An induced draft fan parameter, for example the fan speed or percent of maximum fan speed.
3. A fuel input or energy output parameter, for example, the percentage of the nominal input/output capacity at which the small wood-fired combustor is operating.
4. The flue gas temperature.

(2)) A person mentioned in section 31 of the Regulation must ensure that each piece of monitoring equipment used to measure the parameters set out in subsection (1) is properly maintained, inspected and calibrated in accordance the manufacturer's recommendations.

(3) The person must ensure that the records that are required by subsection (1) are retained for at least a 12-month period after the date the measurement was taken.

Installation test

8. (1) The statement mentioned in paragraph 6 of section 31 of the Regulation must confirm that the installation test was conducted in accordance with the

1. The test was performed no later than 90 days after the date the fired combustor is first used.
2. The test was performed by a technician trained by the manufacturer of the wood-fired combustor to observe the installation and commissioning of the wood-fired combustor to determine if any problems occur with the operation of the small wood-fired combustor.
3. The small wood-fired combustor was tested to confirm that it operates in accordance with the manufacturer's specifications and the test was performed for a minimum of three continuous hours at nominal load heat input and output capacity and for a minimum of three continuous hours at partial load heat input and output capacity, for each type of wood fuel that is intended to be used in the small wood-fired combustor.
4. The concentration of carbon monoxide and oxygen in the flue gas of the small wood-fired combustor was measured with a calibrated portable combustion gas analyser for each of the three-hour intervals described in paragraph 3.
5. Each piece of monitoring equipment mentioned in section 7 was assessed to determine that it functions correctly for each of the three-hour intervals described in paragraph 3.
6. Any necessary adjustments or repairs were made to ensure that the measurements obtained in accordance with paragraph 4 indicate the following concentrations:
 - i. the concentration of carbon monoxide averaged over each three-hour interval described in paragraph 3 is,

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this should be included to the RFP as part of the installation and commissioning requirements by the Supplier

the installation or

operates in

- A. less than 100 parts per million by volume (ppmv) corrected to 11 percent oxygen for nominal load heat input and output capacity, and
- B. less than 200 ppmv corrected to 11 percent oxygen for partial load heat input and output capacity; and
- ii. the concentration of oxygen averaged over each three-hour interval described in paragraph 3 is at least 5.5 percent by volume.

7. The results of the measurements obtained in accordance with paragraph 4, subject to any necessary adjustments or repairs identified in paragraph 6, were reviewed and correlated with the results of the measurements obtained in accordance with section 7 over the same period of time to determine if the small wood-fired combustor is performing well.

(2) The statement must set out the results of the test, including the five-minute block averages for each of the three hour intervals described in paragraph 3 of subsection (1) of the parameters set out in paragraph 4 of subsection (1) and section 7, a description of any problems that occurred with the installation or operation of the combustor during the test and any necessary adjustments or repairs made to address those problems and ensure that the small wood-fired combustor is operating in accordance with the manufacturer's recommendations and the requirement of the Regulation.

(3) The person mentioned in section 31 of the Regulation must ensure that a statement mentioned in paragraph 6 of section 31 of the Regulation must be retained for a period of 5-years after the date on which the small wood-fired combustor ceases to be used at the facility.

Routine Inspections or Remote Connection

9. (1) A person engaging in a prescribed activity that involves the use of a small wood-fired combustor must ensure that each small wood-fired combustor at

- (a) physically inspected at least once a week in accordance with the manufacturer's recommendations, if any, by a person who has received training for the purposes of conducting such inspections; or
- (b) equipped with a 24-hour per day remote connection to either a staff member or a service contractor.

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this is a section for the operator of the boiler
the manufacturer's
for the purposes of
designated facility

(2)) A remote connection referred to in clause (1) (b) must be capable of communicating error or fault alarms, messages and notifications from the facility in the event of a malfunction of the small wood-fired combustor to enable a response in a timely manner to trouble-shoot and correct the malfunction by either attending to the combustor in person or engaging in two-way communication remotely with the combustor.

(3) A person engaging in a prescribed activity that involves the use of a small wood-fired combustor must ensure that the following records are created and retained at the facility for a period of five years from the date of its creation:

1. A record each inspection, including the date of the inspection and any maintenance activities performed.
2. Each record of a communication mentioned in subsection (2).

Performance Assessment

10. (1) The performance assessment mentioned in paragraph 7 of section 7 of the Regulation must include the following actions:

1. Inspection of the following items while the small wood-fired combustor is operating,
 - i. fuel conveyance and handling equipment,
 - ii. indoor wood fuel storage area
 - iii. heat exchanger, air pollution control equipment, combustion air and flue gas ductwork,
 - iv. fans and dampers,
 - v. continuous monitoring devices,
 - vi. combustion chamber air injection nozzles, grates and refractory, and
 - vii. bottom ash and fly ash.
2. While the small wood-fired combustor is operating at or between nominal and partial heat load, measure the carbon monoxide and oxygen emission levels in the flue gas of the small wood-fired combustor over at least a 30-minute period using a calibrated portable combustion gas analyser and record the levels of those parameters.
3. Complete any necessary adjustments or repairs to ensure that the measurements obtained in accordance with paragraph 2 indicate the following concentrations:
 - i. the concentration of carbon monoxide averaged over the test period described in paragraph 2 is less than 100 parts per million by volume (ppmv) corrected to 11 percent oxygen and
 - ii. the concentration of oxygen averaged over the test period described in paragraph 2 is at least 5.5 percent by volume.
4. Determine if the small wood-fired combustor is performing well by reviewing:
 - i. the results of the measurements required by paragraph 2, subject to any necessary adjustments or repairs, and correlating those results with the results of the measurements obtained in accordance with section 7 over the same period;
 - ii. the maintenance, inspection and calibration records for each piece of continuous monitoring equipment mentioned in section 7.

(2) If the determination required by paragraph 4 of subsection (1) indicates that the small wood-fired combustor is not performing well, the person engaging in the activity must ensure that necessary adjustments or repairs are made in a manner that will ensure the small wood-fired combustor is operating in accordance with the manufacturer's recommendations and the requirements of the Regulation.

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this list is extensive and can be used as a list for identifying what to include to the acceptance sheet before taking the ownership of the boiler.

(3) For greater certainty, subsection (1) does not replace any inspection or preventative maintenance program recommended by the manufacturer and such recommendations must be implemented in addition to the requirements in subsection (1).

(4) The person engaging in the activity must ensure that a record of the results of each assessment is created and retained for a five-year period after the record is completed.

(5) A record created for the purpose of subsection (4) shall include the date on which the performance assessment is performed, the observed conditions of the items set out in paragraph 1 of subsection (1), the measurements made in accordance with paragraph 2 of subsection (1), a summary of the determination made in accordance with paragraph 4 of subsection (1) and a description of any adjustments or repairs made for the purpose of subsection (2).

Records

11. (1) For the purpose of paragraph 8 of section 31 of the Regulation mentioned in that section must, in respect of each small wood-fired combustor at the facility, retain a copy of the confirmation required by subsection 5(3) at the facility at all times while engaging in the activity indicating whether any air pollution control equipment is required in order for the small wood-fired combustor to meet the design criteria set out in paragraph 1 of subsection 5(1).

(2) For the purpose of paragraph 8 of section 31 of the Regulation, a person mentioned in that section must ensure that the following records are created and retained for the applicable time period:

1. A tabulated summary of the types and specifications of wood fuels that have been or are intended to be stored and intended for use in each small wood-fired combustor at the facility must be created, maintained and retained at the facility. The summary must be retained at the facility at all times while engaging in the activity.
2. A tabulated summary of the design (including air pollution control equipment and EN 303-5 (2012) dust classification rating of Class 3, 4 or 5), operating and continuous monitoring aspects of each small wood-fired combustor at the facility must be created and retained at the facility at all times while engaging in the activity.
3. A copy of the manufacturer's design specifications, guaranteed emission limits and operating recommendations for each small wood-fired combustor must be retained at the facility for a period of five years after the date on which the small wood-fired combustor ceases to be used at the facility.
4. A copy of the wood fuel management plan and updates to the plan, if any, must be retained at the facility for at least five years after the day the plan is no longer being implemented at the facility.

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this will be part of responsibility of the operator.
combustor that is used
5 (3) at the facility at
pollution control
meet the design

5. The following records created in accordance with a procedure set out in the wood fuel management plan must be retained at the facility for a period of five years after the date the record is created:
 - i. A record of the quantity and specification of each type of wood fuel purchased for use in each small wood-fired combustor at the facility, the date of the purchase, the date of the fuel delivery to the facility and the source from which the fuel was purchased.
 - ii. A record of the type and specification of each type of wood fuel generated at the facility in each calendar year for use in a small wood-fired combustor at the facility and the amount of each type of wood fuel generated during that period.
 - iii. A record of the amount and intended specification of each type of wood fuel rejected as unacceptable for combustion at the facility in each calendar year and the reasons for the rejection, the date the wood fuel was rejected and the date it was removed from the facility.
 - iv. A record of the steps taken to ascertain whether wood fuel meets the applicable specifications, including the wood fuel type, the date the steps were taken and the results of the steps.
 - v. A record of each inspection conducted for the purpose of paragraph 4 of subsection 4 (1), including the date of the inspection, observations made during inspections and any steps taken to address any problems observed.
6. A record of the maintenance, inspection and calibration records for each piece of continuous monitoring equipment used to measure the parameters set out in subsection 7(1) which shall be retained at the facility for at least 12 months after the record is created.

Appendix A: Record of Publications

Version 1.0 - Environmental Activity and Sector Registry - Limits and Other Requirements (December, 2016)

Tracking	Date	Publishing Ministry
Version 1.0 Environmental Activity and Sector Registry - Limits and Other Requirements	Created December, 2016	Environment and Climate Change

Guideline for the Control of Air Emissions from Small Wood-Fired Combustors (< 3 MW)

Guideline A-14

January 2017



TABLE OF CONTENTS

1.0 INTRODUCTION	2
2.0 DEFINITIONS AND ABBREVIATIONS	3
3.0 APPLICABILITY	6
4.0 WOOD FUEL PARAMETERS	7
5.0 COMBUSTOR DESIGN AND PERFORMANCE	9
6.0 INSTALLATION AND SOURCE TESTING	12
7.0 PERFORMANCE MONITORING	14
8.0 PERFORMANCE ASSESSMENT	16
9.0 DOCUMENTATION	18

LIST OF APPENDICES

- Appendix A: Tabulated Summary of Guideline A-14 Expectations**
- Appendix B: Tabulated Summary of Documentation Expectations**
- Appendix C: Emission Conversions and Calculations**
- Appendix D: Information Pertaining to Environmental Compliance Approvals Process**
- Appendix E: Additional Technical Information**
- Appendix F: Summary of Wood Fuel Specifications and NRCan Bulletins**

1.0 INTRODUCTION

The purpose of Guideline A-14: Guideline for the Control of Air Emissions from Small Wood-Fired Combustors (< 3 MW) is to establish the minimum expectations necessary to control air emissions from small wood-fired combustors with a nominal load heat input capacity of less than 3 megawatts (MW) in Ontario. This guideline complements Guideline A-13: Guideline for the Control of Air Emissions from Large Wood-Fired Combustors (≥ 3 MW). Together, these two air quality guidelines serve to replace the Interim Design and Review Guidelines for Wood Fired Combustors published by the Ministry in 1990.

The intended audience for this guideline includes persons applying for an environmental compliance approval (ECA) under section 20.2 of the *Environmental Protection Act*, R.S.O. 1990 (the “EPA”), persons that own or operate small wood-fired combustors, and manufacturers and distributors of small wood-fired combustors.

The intended audience for this guideline does not include a person engaging in the installation, use, operation, replacement or modification a small wood-fired combustor where that activity is a prescribed activity for the purposes of section 20.21 (1) of the EPA. Persons engaging in prescribed activities that involve the use of a small wood-fired combustor are referred to O. Reg. 01/17 “Registrations under Part II.2 of the Act – Activities Requiring Assessment of Air Emissions” made under the EPA and the EASR publication, in particular chapters 1 and 5 of the EASR publication.

During the review of an application for an ECA and when considering issuing an order, the Director¹ considers the requirements set out in relevant regulations as well as all applicable Ontario Ministry of the Environment and Climate Change (Ministry) guidelines and policies. To the extent that this document sets out that something is “required” or “shall” be done or sets out a “requirement” or “limit”, it does so only to identify minimum expectations, the application of which remain subject to the discretion of the Director. The expectations set out in this guideline are compulsory to the extent that they are contained in conditions of an ECA or other legally binding instrument, such as an order. Information pertaining to the ECA process is provided in Appendix D.

As a complement to the minimum expectations for small wood-fired combustors set out in this guideline, additional technical information is provided in Appendix E. This information could be considered before purchasing a small wood-fired combustor.

While every effort has been made to ensure the accuracy of the information contained in this guideline, it should not be construed as legal advice. In the event of a conflict with requirements of the EPA, O. Reg. 419/05 or any other regulation, the legislative requirements shall determine the appropriate approach.

¹ Reference to a Director in this guideline refers to a Director appointed under section 5 of the EPA for the purpose of a section authorizing the issuance of an order or ECA.

2.1 DEFINITIONS AND ABBREVIATIONS

The following definitions apply for the purposes of this guideline:

“air pollution control equipment” means equipment that is designed to decrease emissions to the air of one or more contaminants that are present in the flue gas stream;

“CAN/CSA-ISO 17225-2:15” means the standard CAN/CSA-ISO 17225-2:15, published by the Canada National Standard/Canadian Standards – International Organization for Standardization on March 1, 2015 and entitled “Solid biofuels – Fuel specifications and classes - Part 2: Graded Wood pellets”;

“CAN/CSA-ISO 17225-3:15” means the standard CAN/CSA-ISO 17225-3:15, published by the Canada National Standard/Canadian Standards – International Organization for Standardization on March 1, 2015 and entitled “Solid biofuels – Fuel specifications and classes - Part 3: Graded Wood briquettes”;

“CAN/CSA-ISO 17225-4:15” means the standard CAN/CSA-ISO 17225-4:15, published by the Canada National Standard/Canadian Standards – International Organization for Standardization on March 1, 2015 and entitled “Solid Biofuels – Fuel specifications and classes – Part 4: Graded wood chips”;

“certified small wood-fired combustor” means a small wood-fired combustor that meets the following criteria:

1. Subject to paragraphs 2 and 3, the combustor meets the requirements of EN 303-5 (2012).
2. The combustor is designed to meet the Class 5 thermal efficiency and carbon monoxide requirements set out in EN 303-5 (2012) at nominal load and partial load heat output capacity operating conditions.
3. The combustor is designed, taking into account any air pollution control equipment specified by the manufacturer, to meet at least one of Class 3, 4 or 5 for dust (particulate matter) as set out in EN 303-5 (2012) at nominal load and partial load heat output capacity operating conditions.
4. The criteria set out in paragraphs 1 to 3 must be confirmed by a person who,
 - i. does not own, operate, sell or manufacture the small wood-fired combustor, and
 - ii. meets the EN ISO/IEC 17025 requirements for testing as described in EN 303-5 (2012);

“combustor” means a device in which combustible material is oxidized resulting in release of heat and products of combustion;

“commissioning period” means the 90-day period following the first start-up of a small wood-fired combustor;

“cyclone” means a piece of air pollution control equipment that uses centrifugal force to separate particulate matter from the flue gas;

“ECA” means environmental compliance approval, as defined in subsection 1(1) of the *Environmental Protection Act*;

“EN 303-5 (2012)” means European Standard EN 303-5, published by the European Committee for Standardization in June, 2012 and entitled “Heating boilers – Part 5: Heating boilers for solid fuels, manually and automatically stoked, nominal heat output of up to 500 kW – Terminology, requirements, testing and marking”;

“existing small wood-fired combustor” means a non-reassessed small wood-fired combustor,

Guideline for the Control of Air Emissions from Small Wood-Fired Combustors (<3 MW)

- (a) that was installed on or before January 31, 2017, or
- (b) for which an application for an ECA was made on or before January 31, 2017;

“existing ECA” means an Environmental Compliance Approval issued by the Director for a small wood-fired combustor on or before January 31, 2017;

“flue gas” means a gas that is generated from a combustion process;

“furnace” means a part of a combustor where combustion takes place and may be comprised of primary, secondary and tertiary combustion chambers;

“Guideline A-13” means Guideline for the Control of Air Emissions from Large Wood-Fired Combustors (≥ 3 MW) published by the Ministry in January 2015 (as amended);

“higher heating value” means the amount of heat released during the complete combustion of a unit quantity of fuel and includes the latent heat of vapourization of the water vapour formed by the combustion;

“mg/Rm³” means milligrams per cubic metre at reference conditions;

“Minister” means the Minister of the Environment and Climate Change or such other member of the Executive Council as may be assigned the administration of the *Environmental Protection Act*, R.S.O. 1990 under the *Executive Council Act*;

“Ministry” means the ministry of the Minister;

“moisture content” means the total moisture content of a sample of wood fuel, as-fired, reported on a wet basis as a percentage;

“MW” means megawatt and is equal to 3,600 megaJoules per hour;

“new small wood-fired combustor” means a small wood-fired combustor, the installation of which began after January 31, 2017 and in respect of which, no application for an ECA was made on or before January 31, 2017;

“nominal load heat input capacity” means the design capacity of a small wood-fired combustor to combust a maximum amount of wood fuel based on the physical design of the small wood-fired combustor and is calculated by multiplying the mass flow rate of the wood fuel by the higher heating value of the wood fuel;

“nominal load heat output capacity” means the maximum continuous usable heat output as determined by the nominal load heat input capacity and design of the heat exchanger;

“oxygen lambda sensor” means a device that continuously measures the concentration of oxygen in the flue gas on a wet basis and uses the resulting measurement as an input to the oxygen trim system;

“oxygen trim system” means the components of a small wood-fired combustor that dynamically control the excess oxygen level in the flue gas through the use of an oxygen lambda sensor;

“partial load heat input capacity” means the design capacity of a small wood-fired combustor to combust a minimum amount of wood fuel based on the physical design of the small wood-fired combustor, for which air emissions can be reliably measured at steady state conditions, and is calculated by multiplying the mass flow rate of the wood fuel by the higher heating value of the wood fuel;

Guideline for the Control of Air Emissions from Small Wood-Fired Combustors (<3 MW)

“partial load heat output capacity” means the minimum continuous usable heat output as determined by the partial load heat input capacity and design of the heat exchanger;

“particulate matter” means particulate matter in the flue gas downstream of any air pollution control equipment, prior to discharge to the air, that has an aerodynamic diameter of less than 44 microns;

“reassessed small wood-fired combustor” means an existing small wood-fired combustor at a facility for which an application for an ECA in respect to an activity engaged in at the facility has been made after January 31, 2017;

“record” includes a written procedure, a measurement result, a written notification, a table, a report, a document, electronic data, a written practice, and an update to any of the preceding;

“reference conditions” mean conditions at which the temperature is 25 degrees Celsius and the pressure is 101.3 kilopascals;

“small wood-fired combustor” means a wood-fired combustor that has,

- (a) a nominal load heat input capacity of less than three megawatts, and
- (b) a nominal load heat output capacity of greater than 50 kilowatts;

“thermal efficiency” means the ratio of the delivered useful heat output to the heat input as derived from the wood fuel, expressed as a percentage;

“uncertified small wood-fired combustor” means a small wood-fired combustor that does not meet the requirements set out in the definition of a “certified small wood-fired combustor”;

“ungraded wood material” means woody biomass that has not been processed into a wood briquette, wood pellet or wood chip;

“wood briquette” means a densified wood fuel with a diameter of more than 25 millimetres produced by compressing woody biomass as defined by CAN/CSA-ISO 17225-3:15;

“wood chip” means a piece of wood within a defined size range, cut or chipped from a larger piece of wood as defined by CAN/CSA-ISO 17225-4:15;

“wood-fired combustor” means a combustion source designed to burn wood fuel and does not include a wood-fuel gasifier connected to an internal combustion engine;

“wood pellet” means a densified wood fuel made by compressing woody biomass into a cylindrical form as defined by CAN/CSA-ISO 17225-2:15.

3.1 APPLICABILITY

This guideline applies to small wood-fired combustors that are designed to burn wood fuel set out in this guideline (i.e., wood pellets, wood briquettes or wood chips²) rated to a nominal load heat input capacity of less than 3 MW and a nominal load heat output capacity of greater than 50 kW. This guideline does not apply to a combustor that burns ungraded wood fuel or fuel other than wood fuel (e.g. agricultural sourced biomass). Please refer to Guideline A-13 (Guideline for the Control of Air Emissions from Large Wood-Fired Combustors \geq 3 MW) for the Ministry's expectations regarding wood-fired combustors that use ungraded wood material or up to 7.5 percent municipal waste (that is predominantly wood) material as a fuel.

Certain expectations set out in this guideline vary according to whether the small wood-fired combustor is: (i) a new small wood-fired combustor; (ii) a reassessed small wood-fired combustor; or (iii) an existing small wood-fired combustor. Unless exempt from section 9 of the EPA, it is an offence under the EPA to operate a small wood-fired combustor without an ECA and an application for an ECA should be made forthwith. It should be noted that the following are the ministry's expectations with respect to such an ECA application:

1. If the operation of the small wood-fired combustor commenced before January 31, 2017, it is expected that the person will follow the expectations set out for a reassessed small wood-fired combustor.
2. If the operation of the small wood-fired combustor commenced after January 31, 2017, it is expected that the person will follow the expectations set out for a new small wood-fired combustor.

This guideline also distinguishes between small wood-fired combustors that are certified (i.e. have been independently tested and have documentation to demonstrate compliance with European Standard EN 303-5 (2012), including Class 5 for thermal efficiency and carbon monoxide emissions and either Class 3, 4 or 5 for dust) and those that are uncertified. A certified small wood-fired combustor will be considered uncertified if it is modified to be equipped with a direct contact heat exchanger (e.g., direct contact grain dryer).

The expectations set out in this guideline for certified small wood-fired combustors also apply to a small wood-fired combustor that meets the following criteria:

- If a small wood-fired combustor has a nominal load heat output capacity of more than 500 kW, it meets all four of the criteria of the definition of "certified small wood-fired combustor" other than having a nominal load heat output capacity of less than or equal to 500 kW (note that EN 303-5 (2012) is limited to nominal load heat output capacity of up to 500 kW), and
- If the small wood-fired combustor has a non-contact air-to-air heat exchanger, the small wood-fired combustor meets the criteria set out in paragraph 1 of the definition of "certified small wood-fired combustor" and meets the criteria set out in paragraph 2 with respect to carbon monoxide and meets the criteria set out in paragraphs 3 and 4 of that definition.

² Please note that at the time of the writing of this guideline, the ISO wood fuel quality standard for thermally treated and densified wood fuels, such as torrefied wood briquettes and pellets is under development. After the ISO fuel quality standard 17225-8 has been adopted by CSA Group, thermally treated and densified wood will be considered by the Ministry to be wood fuels and this guideline will be updated accordingly. In the interim, a small wood-fired combustor that uses thermally treated and densified wood is expected to meet the requirements of Guideline A-13.

4.0 WOOD FUEL PARAMETERS

A small wood-fired combustor is expected to use the wood fuel that the manufacturer designed it to use, subject to the specifications outlined below.

4.1 Wood Fuel Specifications

New and Reassessed Small Wood-Fired Combustors

A new or reassessed small wood-fired combustor is expected to use wood fuel that meets one or more of the following specifications:

Wood pellets:

- i. **CAN/CSA-ISO 17225-2:15:** Type A1, A2 or B graded wood pellets for commercial and residential applications (ISO 17225-2 has superseded EN 14961-2);
- ii. **Pellet Fuels Institute:** premium or standard grade as set out in the document entitled “Pellet Fuels Institute Standard Specifications for Residential/Commercial Densified Fuel”, published by the Pellet Fuels Institute in July 2015.

Wood chips:

- i. moisture content is 50 percent or less, and
- ii. **CAN/CSA-ISO 17225-4:15:** Type A1, A2, B1 or B2 graded wood chips (ISO 17225-4 has superseded EN 14961-4).

Wood briquettes:

- i. **CAN/CSA-ISO 17225-3:15:** Type A1, A2 or B

For wood chips, the expectation of the 50 percent or less moisture content will begin on January 31, 2017, but the specification set out in clause ii will be considered voluntary until January 31, 2027 after which compliance with the specification will be expected. Refer to Appendix F for more detailed descriptions of the above-noted wood fuel specifications.

Please note that a person responsible for a small wood-fired combustor that seeks to use a form of wood fuel other than wood briquettes, wood pellets or wood chips, when applying for an ECA on or after January 31, 2017, is expected to meet the requirements of Guideline A-13.

Existing Small Wood-Fired Combustors

For an existing small wood-fired combustor, it is considered good practice to use a wood fuel quality specification that optimizes combustion efficiency and minimizes air emissions. Using the wood fuel types described above is a recommended best practice.

4.2 Automated Wood Fuel Feed Systems for New and Reassessed Small Wood-Fired Combustors

An automated wood fuel feed system inserts wood fuel into a combustor furnace under the control of a computational algorithm that operates in conjunction with the oxygen trim system. Such a system is anticipated to assist in ensuring consistently effective combustion, as compared with manually fed systems.

Automated wood fuel feed systems have start-up and shut down procedures that control the timing sequence and amount of combustion air and wood fuel fed into the combustor. Having these procedures incorporated

into the system assists in minimizing air emissions by limiting the time for start-up and shut down as compared with manually operated systems.

Accordingly, new and reassessed small wood-fired combustors are expected to have an automated wood feed system that includes automated start-up and shutdown procedures.

4.3 Wood Fuel Management

Wood fuel quality is a critical parameter for ensuring efficient combustion and thereby minimizing air emissions. In order to ensure that each type of wood fuel being supplied to a small wood-fired combustor is of satisfactory quality and is managed in a manner that maintains the quality and characteristics of the fuel, it is expected that the person responsible for a small wood-fired combustor prepare, implement and maintain a Wood Fuel Management Plan.

New and Reassessed Small Wood-Fired Combustors

A Wood Fuel Management Plan for a new or reassessed small wood-fired combustor is expected to have the following elements:

- a) A list of the type of each wood fuel that may be stored at the facility with the intent to be burned in the small wood-fired combustor (e.g., wood briquettes, wood chips, wood pellets) and which specification in Chapter 4.1 best describes the wood fuel.
- b) A procedure to document the quantity of wood fuel purchased by the facility and the source from which it was purchased, and, if applicable, the quantity of wood fuel generated at the facility.
- c) A procedure to document how each wood fuel, wood fuel storage area and wood fuel handling and conveyance system at the facility is inspected on a regular basis.
- d) A procedure to ensure that wood fuel that is not considered acceptable for combustion at the facility is removed from the facility immediately or stored separately from the wood fuel storage until it can be removed from the facility in a timely manner. The quantity of wood fuel rejected and the reasons for the rejection should be documented.
- e) A procedure to document what steps have been taken to ascertain wood fuel quality. Such steps may include laboratory testing, documentation of third party certification provided to the wood fuel supplier, and on-site testing.
- f) An indication of the maximum time that each wood fuel may be stored at the facility. This maximum storage duration is intended to prevent degradation of the wood fuel before it is used as a fuel.
- g) If a facility uses wood chips, a procedure to,
 - i) document the wood chip pile turn-over to ensure that the wood chips that have been at the facility for the longest are used first, and
 - ii) ensure that the wood chips fed into the small wood-fired combustor are delivered from either a heated indoor wood chip storage facility sufficient to store a minimum of 1.5 days of wood chip fuel supply at nominal load heat input capacity or unheated indoor storage facility sufficient to store a minimum of three days of wood chip fuel supply at nominal load heat input capacity. The wood chips may be delivered either directly from the indoor storage facility to the combustor if both are housed in one structure, or indirectly from the storage facility into the combustor fuel hopper through a conveyance system if housed in separate structures.
- h) If a facility uses wood pellets or wood briquettes, a procedure to ensure that the wood pellets and wood briquettes are covered by a weather proof enclosure.

Existing Small Wood-Fired Combustors

The Ministry considers it a best practice for a Wood Fuel Management Plan pertaining to an existing small wood-fired combustor to have the elements described above.

5.0 COMBUSTOR DESIGN AND PERFORMANCE

This guideline distinguishes between small wood-fired combustors that are certified or uncertified. Note that the expectations set out in this guideline for certified small wood-fired combustors apply to a wood combustor that is described in Chapter 3.0 “Applicability”. Emission conversion and calculations are provided in Appendix C.

5.1 Design of New Small Wood-Fired Combustors

A new small wood-fired combustor is expected to have the following design elements:

- a) The small wood-fired combustor is to have a multi-zone air control combustion process that includes the following elements (optional elements are noted as “good practice”):
 - i) The multi-zone air control combustion process is to have a primary combustion zone with a fuel bed and is to introduce primary combustion air. The primary combustion zone is to be designed to facilitate the drying and gasification of the wood fuel. It is also to be designed to ensure that solid fixed carbon is combusted with minimal carry-over of particulate matter.
 - ii) The multi-zone air control combustion process is to have a secondary combustion zone and is to introduce secondary combustion air. The secondary combustion zone is to be designed to achieve complete combustion of the volatilized gases and any combustible particles that may be carried over from the primary combustion zone.
 - iii) The multi-zone air control combustion process is to have an automated bottom ash removal system.
 - iv) It is considered good practice for the multi-zone air control combustion process to have an automated fly ash removal system in the heat exchanger.
 - v) It is considered good practice for the multi-zone air control combustion process to have a tertiary combustion zone to introduce tertiary combustion air to complete the combustion of volatilized gases.
 - vi) It is considered good practice for the multi-zone air control combustion process to have a flue gas recirculation system that directs a portion of the flue gases from the outlet of the induced draft fan back into the combustion air injection points.
- b) The small wood-fired combustor is to have an oxygen trim system including an oxygen lambda sensor to regulate the supply of combustion air to the primary, secondary, and, where applicable, tertiary combustion zones.
- c) The small wood-fired combustor is to use a variable speed electric fan as the induced draft fan to maintain a minimum negative static pressure in the combustion zones.
- d) The small wood-fired combustor is to have a monitor that measures the static pressure in the furnace or an alarm that signals when the static pressure in the furnace is positive.
- e) The small wood-fired combustor is to be designed to operate in a manner that results in the concentration of particulate matter in the flue gas of the discharge stack of a small wood-fired combustor, downstream of any air pollution control equipment being less than 75 mg/Rm³ at 11% oxygen (dry basis). The person responsible for the small wood-fired combustor is expected to obtain documentation from the

Guideline for the Control of Air Emissions from Small Wood-Fired Combustors (<3 MW)

manufacturer confirming that the small wood-fired combustor (and its air pollution control equipment as described below) is capable of achieving this emission level.

- f) The small wood-fired combustor is expected to have the following air pollution control equipment:
- If the combustor is a certified³-small wood-fired combustor:
 - Where a certified small wood-fired combustor is certified to EN 303-5 (2012) Class 3 for dust,
 - if air pollution control equipment is not required to meet Class 3 dust emission level in EN 303-5 (2012), add air pollution control equipment capable of reducing the emissions of suspended particulate matter to the air by at least 50% when the small wood-fired combustor is operating at nominal load heat input capacity.
 - if air pollution control equipment is required to meet Class 3 dust emission level in EN 303-5 (2012), add an additional piece of air pollution control equipment capable of reducing the emissions of suspended particulate matter to the air by at least 50% when the small wood-fired combustor is operating at nominal load heat input capacity.
 - Where a certified small wood-fired combustor is certified to EN 303-5 (2012) Class 4 or 5 for dust, air pollution control equipment specified by the manufacturer, if necessary, to meet the Class 4 or 5 certification emission level for dust.
 - If the combustor is an uncertified small wood-fired combustor, air pollution control equipment capable of reducing the emissions of suspended particulate matter to the air by at least 50% when the small wood-fired combustor is operating at nominal load heat input capacity.
- g) The small wood-fired combustor is to be designed so that it is capable of measuring the process control parameters set out in Chapter 7.1.

5.2 Operation of New Small Wood-Fired Combustors

A new small wood-fired combustor is expected to operate at a load that is within an operating range specified by the manufacturer (i.e., at a load that is above the partial load and below the nominal load). Similarly a new small wood-fired combustor is expected to operate at wood fuel feed rates specified by the manufacturer and operate within the range of thermal efficiencies specified by the manufacturer. These three parameters are to be documented by the person responsible for the small wood-fired combustor, based on information received from the manufacturer.

For a certified⁴ new small wood-fired combustor the partial load heat output capacity is typically 30 percent of the nominal load heat output capacity, as described in EN 303-5 (2012), and third party certification emission testing for partial load is typically conducted at 30 percent of the nominal load heat output capacity.

However, for an uncertified new small wood-fired combustor, the person responsible for the small wood-fired combustor must document, based on information received from the manufacturer, the partial load heat input and output capacity as a percentage of the corresponding nominal load heat input and output capacity. The person responsible for the small wood-fired combustor is expected to have a written record of the partial load heat input and output capacity specifications.

³ This applies also to a wood combustor that is described in Chapter 3.0 “Applicability”.

⁴ This applies also to a wood combustor that is described in Chapter 3.0 “Applicability”.

It is important to note that a new small wood-fired combustor is not to operate “in idle mode” below the partial load heat input and output capacity - it is expected to operate at or above the partial load heat input and output capacity or otherwise be shut down.

As well, a new small wood-fired combustor is expected to operate in manner that ensures that the static pressure in the furnace is negative. Ensuring the furnace is drafting air and, therefore, is negatively pressurized will prevent the migration of flue gases into the structure housing the small wood-fired combustor.

It is expected that any air pollution control equipment required to be installed as a component of the small wood-fired combustor as described in Chapter 5.1 will operate at all times while the small wood-fired combustor is operational.

5.3 Flue Gas Concentration Limits⁵

New Small Wood-Fired Combustors

The concentration of carbon monoxide in the flue gas of a new small wood-fired combustor is expected to be less than 400 parts per million by volume (ppmv) at 11% oxygen on a dry basis and reference conditions averaged over a 24-hour calendar day. When calculating the daily average carbon monoxide concentration, a person may omit up to 120 non-consecutive minutes of carbon monoxide measurements while the small wood-fired combustor is operational. As well, a person may omit any carbon monoxide measurements taken after the induced draft fan shuts off following the shutdown of a small wood-fired combustor. Records of the measurements (including those that were omitted) are to be kept at the facility for a minimum of 12 months from the date the measurement was taken (see also Chapter 7).

The concentration of oxygen in the flue gas of a new small wood-fired combustor is expected to be at least six percent by volume on a dry basis at reference conditions block-averaged over a one-hour period. Note however, that the concentration of oxygen in the flue gas of a certified⁶ new small wood-fired combustor is expected to be at least 5.5 percent by volume on a wet basis averaged over a one-hour period as measured by the oxygen lambda sensor. Note that a dry oxygen measurement is not required because a continuous carbon monoxide monitor is not required for certified new small wood-fired combustors (See Chapter 7.2).

Reassessed and Existing Small Wood-Fired Combustors

It is expected that a person responsible for a reassessed or existing small wood-fired combustor will meet the flue gas carbon monoxide and oxygen limits set out in their ECA. Note that the ministry will have regard to the limits for carbon monoxide and oxygen set out above in issuing or amending ECAs after January 31, 2017. It is also expected that a person responsible for a reassessed or existing small wood-fired combustor will operate in a manner that results in the concentration of particulate matter in the flue gas of the discharge stack of a small wood-fired combustor, downstream of any air pollution control equipment meeting the limit set out in their ECA. Similarly, the ministry will have regard to a concentration limit of less than 90 mg/Rm³ at 11% oxygen (dry basis) for particulate matter with respect ECAs issued or amended after January 31, 2017.

⁵ Note that air standards in Ontario Regulation 419/05 are also applicable.

⁶ This applies also to a wood combustor that is described in Chapter 3.0 “Applicability”.

6.0 INSTALLATION AND SOURCE TESTING

6.1 Installation Test for New Small Wood-Fired Combustors

During the 90-day period following the first start-up of a new small wood-fired combustor it is expected that an installation test be performed to ensure the small wood-fired combustor was installed and is operating according to the manufacturer's design. As part of the installation test, the person responsible for the small wood-fired combustor is to ensure that a technician trained by the manufacturer inspects how the small wood-fired combustor was installed and observes the operation of the small wood-fired combustor to determine if any problems occur. The person responsible for the small wood-fired combustor is to ensure that the technician corrects any problems and is to document the work done by the technician upon successful completion of the installation test.

When performing the installation test, it is expected that the person responsible for the small wood-fired combustor ensures that the technician determines if the performance monitoring equipment (as described in Chapter 7) is functioning properly. The monitoring equipment is to be assessed for a minimum of three continuous hours at each of the following operating conditions: (i) at nominal load heat input and output capacity and (ii) at partial load heat input and output capacity. The data generated by the process monitoring devices described in Chapter 7.1 are expected to be recorded as part of the installation test. This test is intended to ensure the satisfactory performance of the performance monitoring equipment and to demonstrate that the equipment is ready to operate at steady state conditions for subsequent source testing as described in Chapter 6.2 below.

The installation test is to be performed for each type of wood fuel that is intended to be used in the small wood-fired combustor (i.e., wood pellets, wood chips and/or wood briquettes). For a small wood-fired combustor that may use wood pellets or wood briquettes, the installation test is to be performed using wood pellets or wood briquettes with the highest ash content that may be used in the small wood-fired combustor. For a small wood-fired combustor that may use wood chips, the installation test is to be performed using wood chips with the highest moisture content and ash content that may be used in the small wood-fired combustor.

As part of the installation test, the person responsible for the small wood-fired combustor must ensure that the technician uses a calibrated portable combustion gas analyzer to measure and record carbon monoxide and oxygen emission levels in the flue gas for each three-hour period concurrent with the assessment of the performance monitoring equipment at nominal load and partial load heat input and output capacity. As such, it is recommended that all new small wood-fired combustors have readily accessible emission testing ports to allow for the use of a calibrated portable combustion gas analyzer.

It is expected that the concentration of carbon monoxide measured during the installation testing be: (i) less than 100 ppmv at 11% oxygen for nominal load heat input and output capacity, and (ii) less than 200 ppmv at 11% oxygen for partial load heat input and output capacity. It is expected that the concentration of oxygen in the flue gas measured during installation testing be at least 5.5 percent by volume.

The person responsible for the small wood-fired combustor is to ensure that the technician compares the measurement results to the limits set out above and any other applicable limits (e.g. in an ECA). The person responsible for the small wood-fired combustor is to ensure that the technician makes any necessary adjustments or repairs to ensure that the measurement results are compliant with the limits set out above. If the small wood-fired combustor has a continuous carbon monoxide or oxygen monitor, the person responsible for the small wood-fired combustor must ensure that the technician compares the measurement results of the portable combustion gas analyzer to the measurements of the continuous monitor.

The person responsible for the small wood-fired combustor is to ensure that the technician reviews and correlates the results of the measurements described above from the process monitoring devices and combustion gas analyzer, subject to any adjustments or repairs, to determine if the small wood-fired combustor is performing well in accordance with the manufacturer's recommendations.

It is expected that the person responsible for the small wood-fired combustor will document the results of an installation test and that a report be prepared and retained at the facility for a period of five years after the date on which the small wood-fired combustor ceases to be used at the facility. The report shall include the calibration records of the portable combustion gas analyzer.

6.2 Source Testing for Small Wood-Fired Combustors

In this guideline, a source test generally means the measurement of carbon monoxide, oxygen and particulate matter in the flue gas of the discharge stack of a small wood-fired combustor, downstream of any air pollution control equipment.

A source test is to be performed for each type of wood fuel that is intended to be used in the small wood-fired combustor at the facility (i.e., wood pellets, wood chips and/or wood briquettes). For a small wood-fired combustor that may use wood pellets or wood briquettes, the source test is to be performed using wood pellets or wood briquettes with the highest ash content that may be used in the small wood-fired combustor. For a small wood-fired combustor that may use wood chips, the source test is to be performed using wood chips with the highest moisture content and ash content that may be used in the small wood-fired combustor.

The source test report is to include a summary of the process control monitoring data described in Chapter 7 that was measured during the source test.

New Small Wood-Fired Combustors

A source test is expected to be performed no later than six months after the completion of an installation test with respect to a new small wood-fired combustor.

The source test is to measure particulate matter, carbon monoxide and oxygen in the flue gas of the new small wood-fired combustor. These parameters are to be measured at both nominal load heat input and output capacity and partial load heat input and output capacity⁷; however, a certified new small wood-fired combustor need only measure carbon monoxide and oxygen at nominal load heat input and output capacity and partial load heat input and output capacity.

It is expected that the concentration of particulate matter, as measured in the flue gas after the air pollution control equipment during source testing, be less than 75 mg/Rm³ at 11% oxygen (dry basis) averaged over a period determined in accordance with the Ontario Source Testing Code.

It is expected that the concentration of carbon monoxide measured during source testing be: (i) less than 100 ppmv at 11% oxygen on a dry basis and reference conditions averaged over a one-hour period for nominal load heat input and output capacity, and (ii) less than 200 ppmv at 11% oxygen on a dry basis and reference conditions averaged over a one-hour period for partial load heat input and output capacity.

It is expected that the concentration of oxygen in the flue gas measured during source testing be at least six percent by volume on a dry basis and reference conditions averaged over a one-hour period. Note that measuring the concentration of oxygen on a dry basis enables the oxygen correction of the carbon monoxide

⁷ Chapter 5.2 sets out that the partial load heat input capacity is to be set out in a written record for uncertified small wood-fired combustors.

Guideline for the Control of Air Emissions from Small Wood-Fired Combustors (<3 MW)

measurements. The dry oxygen level determined during source testing must be measured separately from the wet oxygen level determined by the oxygen lambda sensor.

If a new small wood-fired combustor undergoes a significant modification, it is expected that the person responsible for the small wood-fired combustor would seek an amendment to the ECA, after which another source test will be completed according to the requirements set out in the ECA.

Reassessed and Existing Small Wood-Fired Combustors

Source testing at nominal load heat input and output capacity operating conditions is expected to be performed, in accordance with the terms and conditions of an ECA. Note that for ECAs issued or amended after January 31, 2017, the ministry will have regard to the following expectations:

- (i) if it has been five years (or more) since the last source test was conducted for the small wood-fired combustor at the time when it is reassessed, source testing may be required no later than six months after the issuance of an ECA pertaining to the reassessed combustor, or
- (ii) if the small wood-fired combustor has been modified in such a way that it no longer conforms to the existing ECA conditions and requires an amendment to the ECA (e.g., change induced draft fan size, flow or pressure ratings, change wood fuel type and associated feed system), source testing may be required no later than six months after the commissioning period of the modified combustor, or
- (iii) with respect to an application for an ECA with respect to an existing small wood-fired combustor that has been operating without an ECA, where one is required, source testing is expected to be performed no later than six months after the issuance of an ECA pertaining to the existing small wood-fired combustor.

It is expected that the concentration of particulate matter in the flue gas measured downstream of any air pollution control equipment during source testing be less than 90 mg/Rm³ at 11% oxygen (dry basis) averaged over a period determined in accordance with the Ontario Source Testing Code.

It is expected that the concentration of carbon monoxide measured during source testing be less than 100 ppmv at 11% oxygen on a dry basis and reference conditions averaged over a one-hour period.

It is expected that the concentration of oxygen in the flue gas measured during source testing be at least six percent by volume on a dry basis and reference conditions averaged over a one-hour period.

A summary of the source testing expectations are provided in Appendix A.

7.0 PERFORMANCE MONITORING

7.1 Process Control Monitoring for Small Wood-Fired Combustors

New Small Wood-Fired Combustors

The Ministry expects that certain process control parameters will be monitored and recorded while a new small wood-fired combustor is operating. For the purposes of data recording, the process control monitors should measure and record for a minimum of two hours after a shutdown procedure has commenced.

The Ministry expects the following parameters to be measured continuously and that the measurements be block-averaged over every five minute period:

Guideline for the Control of Air Emissions from Small Wood-Fired Combustors (<3 MW)

1. The concentration of oxygen in the flue gas as measured by the oxygen lambda sensor (percent by volume on a wet basis)
2. An induced draft fan parameter (e.g., fan speed or percent of maximum)
3. A fuel input or energy output parameter (e.g., percent of nominal load to ensure that the small wood-fired combustor does not operate below the partial load heat input capacity – see Chapter 5.2)
4. The flue gas temperature.

The Ministry expects that each measurement be recorded and retained at the facility for at least 12 months from the date the measurement was taken.

Reassessed and Existing Small Wood-Fired Combustors

The Ministry considers it a best practice for a reassessed or existing small wood-fired combustor to have process control monitoring as described above.

7.2 Flue Gas Monitoring for Small Wood-Fired Combustors

New Small Wood-Fired Combustors

A new small wood-fired combustor is to be equipped with a monitor that continuously measures and records the concentration of carbon monoxide and oxygen in the flue gas. **Note that such monitoring is not expected if the new small wood-fired combustor is certified.**

In particular, it is expected that the following parameters be measured continuously and that the measurements be block-averaged over every five minute period:

1. The undiluted concentration of carbon monoxide, reported on a dry basis and corrected to 11 percent oxygen and reference conditions, in the flue gas.
2. The undiluted percentage of oxygen by volume, reported on a dry basis and reference conditions, in the flue gas.

For new uncertified small wood-fired combustors, it is recommended that the measurements of oxygen and carbon monoxide are conducted at the same location and that the carbon monoxide monitor be configured as a dual range application with automatic range change capabilities to accurately measure emissions during both start-up and shut down operations as well as normal operations.

The process control monitoring data is intended to assist in interpreting this flue gas emission monitoring data. As such, it is expected that the times and dates for each monitor and data recording system (for both flue gas and process control monitors) be synchronized to within one minute of each other.

The Ministry expects that each carbon monoxide and oxygen measurement be recorded and retained at the facility for at least 12 months from the date the measurement was taken.

Prior to installing a new uncertified small wood-fired combustor, it is strongly recommended that a person submit a plan for the installation, operation and maintenance of the above-noted continuous flue gas monitoring devices to the Manager of Technology Standards Section, Standards Development Branch at the Ministry.

Reassessed and Existing Small Wood-Fired Combustors

The Ministry expects that a person responsible for a reassessed or existing small wood-fired combustor will comply with the terms and conditions of their ECA with regards to flue gas monitoring. Note that for ECAs issued or amended after January 31, 2017, the ministry will have regard to the expectation that a small wood-

fired combustor be equipped with a monitor that continuously measures and records the concentration of carbon monoxide, oxygen and temperature in the flue gas. The Ministry also expects that each carbon monoxide, oxygen and temperature measurement be recorded and retained at the facility for at least 12 months from the date the measurement was taken.

7.3 Routine Inspections or Remote Connection

New and Reassessed Small Wood-Fired Combustors

To minimize the potential for operational malfunction of a small wood-fired combustor and associated air emissions, it is expected that new and reassessed small wood-fired combustors be (i) inspected regularly or (ii) equipped with a remote connection.

If the small wood-fired combustor is to be inspected regularly, it is expected that the routine physical inspections be performed at least once per week in accordance with recommendations of the manufacturer by a person who has received training for the purposes of conducting such inspections. The Ministry expects the results of each inspection to be recorded and maintenance activities to be performed as needed.

If a small wood-fired combustor is to be equipped with a remote connection, it is expected that the small wood-fired combustor be equipped with a 24-hour per day remote connection to either a designated facility staff member or service contractor. The remote connection should communicate error or fault alarms, messages and notifications from the facility in the event of a malfunction to enable a response in a timely manner to trouble-shoot and correct the malfunction by either attending to the combustor in person or engaging in two-way communication remotely with the combustor. The Ministry expects the results of each remote communication to be recorded and maintenance activities to be performed as needed.

Existing Small Wood-Fired Combustors

The Ministry considers it a best practice to adopt a routine inspection program or remote connection as described above for existing small wood-fired combustors.

8.0 PERFORMANCE ASSESSMENT

New and Reassessed Small Wood-Fired Combustors

The Ministry expects that the person responsible for the small wood-fired combustor will ensure that a technician who is competent in heating, ventilation, and air conditioning (HVAC) technologies conducts a performance assessment at least once per year with respect to a new or reassessed small wood-fired combustor. The performance assessment is expected to include the following actions:

1. Inspection of the following items while the small wood-fired combustor is not operating,
 - i. fuel conveyance and handling equipment (e.g., is the wood fuel conveyance equipment visibly damaged?),
 - ii. indoor wood fuel storage area (e.g., is the indoor wood fuel storage area dry or is there evidence of water leaking in from the outdoors?),
 - iii. heat exchanger, air pollution control equipment, combustion air and flue gas ductwork (e.g., are the heat exchanger tubes free of corrosion and fly ash deposits, and is the ductwork free from leakage due to rust or holes?),
 - iv. fans and dampers (e.g., are any of the fans or dampers visibly damaged?),

Guideline for the Control of Air Emissions from Small Wood-Fired Combustors (<3 MW)

- v. continuous monitoring devices (e.g., is the oxygen lambda sensor installed correctly or has it been removed?),
 - vi. combustion chamber air injection nozzles, grates and refractory (e.g., is there surplus bottom ash on the grate that has not been removed in a timely manner?), and
 - vii. bottom ash and fly ash (e.g., does the bottom ash contain a significant amount of blackened fuel particles that still have a recognizable shape because they did not burn completely?).
2. While the small wood-fired combustor is operating at or between nominal and partial heat load, measure the carbon monoxide and oxygen emission levels in the flue gas of the small wood-fired combustor over at least a 30-minute period using a calibrated portable combustion gas analyser and record the levels of those parameters.
 3. Complete any necessary adjustments or repairs to ensure that the measurements obtained in accordance with paragraph 2 indicate the following concentrations:
 - i. the concentration of carbon monoxide averaged over the test period described in paragraph 2 is less than 100 parts per million by volume (ppmv) corrected to 11 percent oxygen, and
 - ii. the concentration of oxygen averaged over the test period described in paragraph 2 is at least 5.5 percent by volume.
 4. Determine if the small wood-fired combustor is performing well by reviewing:
 - i. the results of the measurements required by paragraph 2, subject to any necessary adjustments or repairs, and correlating those results with the results of the measurements obtained in accordance with Chapter 7.1 over the same period;
 - ii. the maintenance, inspection and calibration records for each piece of continuous monitoring equipment mentioned in Chapter 7.1.

If the determination described by paragraph 4 above indicates that the small wood-fired combustor is not performing well, the person responsible for the small wood-fired combustor must ensure that necessary adjustments or repairs are made in a manner that will ensure the small wood-fired combustor is operating in accordance with the manufacturer's recommendations and the requirements of any conditions of an ECA or other legally binding instrument.

For greater certainty, the actions described above do not replace any inspection or preventative maintenance program recommended by the manufacturer and such recommendations are expected to be implemented in addition to the actions described above. Also, the actions expected to be performed while the small wood-fired combustor is operating can be performed on a different day than the actions expected to be performed while the small wood-fired combustor is not operating, within the same year.

The person responsible for the small wood-fired combustor is expected to ensure that a record of the results of each performance assessment is created and retained for a five-year period after the record is completed. A record created is expected to include the date on which the performance assessment is performed, the observed conditions of the items to be inspected while the small wood-fired combustor is not operating, the measurements made while the small wood-fired combustor is operating, a summary of the determination made as to whether the small wood-fired combustor is performing well and a description of any adjustments or repairs made to correct the small wood-fired combustor so that it does perform well.

Existing Small Wood-Fired Combustors

The Ministry considers it a best practice to perform performance assessments for existing small wood-fired combustors as described above.

9.0 DOCUMENTATION

This chapter sets out the information that is expected to be submitted in an ECA application and, with respect to a new small wood-fired combustor, documented prior to the installation of a new small wood-fired combustor. The following information on wood fuel parameters, combustor design and performance will assist the Director in assessing whether the small wood-fired combustor meets the expectations set out in this guideline (where applicable):

- a) A tabulated summary of the types and specifications of wood fuels that are proposed to be stored and intended to be used at the facility (see expectations set out in Chapter 4.1).
- b) A tabulated summary of the design, operating and performance monitoring aspects of the small wood-fired combustor and air pollution control equipment (see expectations set out in Chapters 5 and 7).
- c) A side-sectional schematic of the combustor including an illustration of the automated method of introduction of wood fuel into the furnace that meets the expectations set out in Chapter 4.2; the combustion zones (e.g., primary, secondary) and identification of points of introduction of combustion air and, where applicable, flue gas recirculation air (see expectations set out in Chapter 5).
- d) A copy of the original equipment manufacturers combustor design and operating documentation⁸ that includes the following information (where available):
 - i) The make and model number and nominal load heat input and output capacity and other related design features such as the air pollution control equipment (e.g., cyclone).
 - ii) The partial load heat input and output capacity as a percent of the nominal load heat input and output capacity.
 - iii) The types of wood fuels capable of being used in the unit, including wood briquettes, pellets and/or chips with a provision for wood chip units that the maximum fuel moisture content is 50%.
 - iv) A description of the automated start-up and shutdown procedures.
 - v) A description of the combustion process control parameters outlined in Chapter 7.1, including the data acquisition system capabilities.
 - vi) Specifications for the oxygen lambda sensor.
 - vii) The design operating range for excess oxygen in the flue gas and how the oxygen trim system maintains the excess oxygen at the desired level.
 - viii) Recommendations for operator training, routine visual inspections, remote connections and monitoring, preventative maintenance plans, spare parts, trouble-shooting, operational adjustment either on-site or remotely and periodic combustor cleaning, maintenance and tune ups.
- e) A tabulated summary of the expected air emission performance of the small wood-fired combustor for both nominal load and partial load heat input and output operating conditions (see expectations set out in Chapters 5.2 and 5.3), that includes the following information:
 - i) Range of anticipated 1-hour block average oxygen concentrations (percent by volume, dry and wet basis) in the flue gas and typical set-point for each wood fuel proposed for use at the facility.
 - ii) Maximum anticipated 24-hour daily average carbon monoxide concentration (ppmv, dry basis at 11% oxygen and reference conditions) in the flue gas.
 - iii) Maximum anticipated flue gas concentration of particulate matter (mg/Rm³ at 11% oxygen, dry basis) measured at a point after any air pollution control equipment.

⁸ If the manufacturer's documentation is not available, a copy of the tender documents used to procure a small wood-fired combustor may be submitted instead.

Guideline for the Control of Air Emissions from Small Wood-Fired Combustors (<3 MW)

- f) Air emission documentation that validates the above-noted maximum anticipated outlet concentrations of carbon monoxide and particulate matter for the small wood-fired combustor and air pollution control equipment that is to be included in the application for ECA. In particular:
- i) For a certified⁹ small wood-fired combustor at least one of the following is considered acceptable if it identifies the emissions of dust (particulate matter) and demonstrates compliance with the requirements of EN 303-5 (2012) Class 5 for thermal efficiency and carbon monoxide as well as Class 3, 4 or 5 for dust at both nominal load and partial load heat input and output capacity operating conditions:
 - 1. the manufacturer's guaranteed emission limits,
 - 2. a copy of an independent testing agency's report.
 - ii) For an uncertified small wood-fired combustor, an air emission test report from an operating small wood-fired combustor in another jurisdiction that has been accepted by an environmental regulatory agency (e.g., an American State or Canadian Provincial regulator) is preferred over published emission factors. Emission data at nominal load heat input and output capacity is expected and emission data at partial load heat input and output capacity is also desired where available.
- g) Documentation summarizing the proposed continuous flue gas monitoring devices, installation location, operation and maintenance for uncertified small wood-fired combustors (see expectations set out in Chapter 7.3).

Refer to Table A-1 in Appendix A for a summary of the expectations for new and reassessed small wood-fired combustors. Table A-1 includes related notes to distinguish expectations based on certification status. Refer also to Table B-1 in Appendix B for an example of a format that would assist in providing the above-listed information.

⁹ This applies also to a wood combustor that is described in Chapter 3.0 "Applicability".

APPENDIX A

Tabulated Summary of Guideline A-14 Expectations

Guideline for the Control of Air Emissions from Small Wood-Fired Combustors (<3 MW)

Table A-1: Summary of Expectations for Small Wood-Fired Combustors

A person responsible for a small wood-fired combustor that has an ECA must meet the requirements set out in the ECA. For existing small wood-fired combustors that have an ECA the items listed in Table A-1 under the column entitled “Reassessed” are considered best practices. Please refer to the notes below Table A-1 with regards to distinguishing expectations for certified new small wood-fired combustors.

Parameter		Guideline A-14 Expectations	
		New	Reassessed
Wood Fuel			
1.	Select wood fuel specifications	Yes	Yes
2.	Develop wood fuel management plan	Yes	Yes
3.	Automated start-up, shut down and feed system	Yes	Yes
Design Parameters			
4.	Nominal load heat input capacity	<3 MW	<3 MW
5.	Partial load heat input capacity (% of nominal load)	As provided by the manufacturer ^A	N/A
6.	Air Pollution Control Equipment	Yes ^E	N/A
7.	Multi-zone air control with oxygen trim system	Yes	N/A
8.	Maximum particulate matter in the flue gas, downstream of any air pollution control equipment ^D	< 75 mg/Rm ³	< 90 mg/Rm ³ ^F
Flue Gas Limits			
9.	Minimum oxygen (1-hour block average)	> 6.0% dry basis ^B	> 6.0% dry basis
10.	Maximum carbon monoxide (daily average) ^D	< 400 ppmv	< 400 ppmv
11.	Installation Test	Yes	N/A
Source Testing Objectives			
12.	Particulate Matter – nominal load ^D	< 75 mg/Rm ³ ^C	< 90 mg/Rm ³
13.	Particulate Matter – partial load ^D	< 75 mg/Rm ³ ^C	N/A
14.	Carbon Monoxide – nominal load (1-hour average) ^D	< 100 ppmv	< 100 ppmv
15.	Carbon Monoxide – partial load (1-hour average) ^D	< 200 ppmv	N/A
16.	Minimum oxygen (1-hour average)	> 6.0% dry basis	> 6.0% dry basis
Performance Monitoring			
17.	Oxygen lambda sensor (% by volume, wet basis)	Yes	Best Practice
18.	Induced draft fan parameter	Yes	Best Practice
19.	Fuel input or energy output (% of nominal load)	Yes	Best Practice
20.	Flue gas temperature	Yes	Yes
21.	Carbon monoxide (ppmv) ^D	Yes ^C	Yes
22.	Oxygen (% by volume, dry basis)	Yes ^C	Yes
23.	Retain performance monitoring data for at least 12 months (maximum 5-minute block averaging)	Yes	Yes
Inspection and Maintenance			
24.	Routine inspection log and/or remote connection	Yes	Yes
25.	Performance assessment	Yes	Yes

Notes:

- ^A The partial load heat capacity for a new certified small wood-fired combustors is typically tested at **30%**.
- ^B The minimum excess oxygen (1-hour block average) for a new certified small wood-fired combustor may be **5.5% on a wet basis** as recorded by the oxygen lambda sensor.
- ^C Not applicable for a new certified small wood-fired combustor.
- ^D Corrected to 11% oxygen, dry basis, reference conditions.
- ^E Refer to Chapter 5.1 (f) for details of air pollution control equipment expectations, depending on the EN 303-5 (2012) Class 3, 4 or 5 rating for dust (particulate matter) and whether air pollution control equipment is required to meet the dust Class rating as specified by the manufacturer.
- ^F This limit for particulate matter is a flue gas limit for reassessed small wood-fired combustors, not a design parameter, but it is shown here for ease of comparison with new small wood-fired combustors.

APPENDIX B

Tabulated Summary of Documentation Expectations

Table B-1: Summary of Documentation Expectations regarding Combustor Design and Performance

1	Make and Model Number of Small Wood-Fired Combustor:	
2a	Certified¹⁰ to EN 303-5 (2012) Class 5 for Thermal Efficiency and Carbon Monoxide (Yes/No):	
2b	Certified to EN 303-5 (2012) Class 3, 4 or 5 for Dust (Yes/No, if Yes specify):	
3a	Identify whether Guideline A-13 or Guideline A-14 applies to the small wood-fired combustor:	
3b	If Guideline A-14 applies, identify whether the small wood-fired combustor is existing, reassessed or new:	
4	Wood Fuel Type(s) (Pellet, Briquette and/or Wood Chip):	
5	Wood Fuel Specification(s):	
6	Equivalent days of indoor storage for wood chips at nominal load (heated or unheated):	
7	Maximum Wood Fuel Moisture Content for each intended fuel type:(% by weight, wet basis):	
8	Maximum Wood Fuel Ash content according to specification for each intended fuel type (% by weight, if applicable):	
9	Maximum fuel flow at nominal load operating condition for each intended fuel type (kg/hr):	
10	Maximum fuel flow at partial load operating condition for each intended fuel type (kg/hr):	
11	Nominal Load Heat Input and Output Capacity (kW):	
12	Partial Load Heat Input and Output Capacity (% of Nominal Load):	
13a	Testing report/documentation compliant to	

¹⁰ This applies also to a wood combustor that is described in Chapter 3.0 “Applicability”.

Guideline for the Control of Air Emissions from Small Wood-Fired Combustors (<3 MW)

	EN 303-5 (2012) Class 5 for Thermal Efficiency and Carbon Monoxide (Yes/No):	
13b	Testing report/documentation compliant to EN 303-5 (2012) Class 5 for Carbon Monoxide, equipped with an air-to-air heat exchanger (Yes/No):	
13c	Testing report/documentation compliant to EN 303-5 (2012) Class 3, 4 or 5 for Dust (Yes/No, if Yes specify):	
14	Includes multi-zone air control (Yes/No):	
15	Includes oxygen trim system? (Yes/No):	
16	Includes tertiary combustion air (Yes/No):	
17	Includes flue gas recirculation (Yes/No):	
18	Side-sectional schematic of combustor included (Yes/No):	
19a	Oxygen lambda sensor type and operating range (% by volume – wet):	
19b	Induced draft fan parameter and operating range:	
19c	Fuel input or energy output parameter and operating range:	
19d	Flue gas temperature measurement operating range:	
20	Maximum anticipated suspended particulate matter outlet concentration (mg/Rm ³ @ 11% O ₂ -dry):	
21	Maximum anticipated carbon monoxide outlet concentration at nominal load, partial load and 24-hour daily average (ppm-v @ 11% O ₂ -dry):	
22	Includes air pollution control equipment specified by combustor manufacturer (Yes/No) if yes please describe:	
23	Includes other air pollution control equipment as described in Chapter 5.1 (f) (Yes/No) if yes please describe:	

Guideline for the Control of Air Emissions from Small Wood-Fired Combustors (<3 MW)

24	Supporting documentation included for
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Guideline for the Control of Air Emissions from Small Wood-Fired Combustors (<3 MW)

	anticipated outlet concentrations of particulate matter and carbon monoxide (Yes/No):	
25	Includes testing port(s) for particulate matter and carbon monoxide emission testing (Yes/No):	
26	Supporting documentation included for flue gas emission monitoring devices (where applicable) (Yes/No):	

Notes:

- i) mg/Rm³ @ 11% O₂-dry means milligrams per reference cubic metre corrected to 11% by volume (dry basis) oxygen content in the flue gas;
- ii) ppm-v @ 11% O₂-dry means ppmv corrected to 11% by volume (dry basis) oxygen content in the flue gas; and
- iii) reference conditions are 25 degrees Celsius and 101.3 kilopascals atmospheric pressure.

APPENDIX C

Emission Conversions and Calculations

Table C-1: Conversion Between Imperial and Metric Systems

From	To	Multiply by	References
Btu	J	1055.1	Perry's Chemical's Engineer Handbook (50 th Anniversary Edition, 1984) Table 1-6, pages 1-15 to 1-17.
Btu/hr	kJ/hr	1.0551	
Btu/hr	W	0.29307	
MM Btu/hr	MW	0.29307	
Pounds-mass	Kilograms	0.45359	

Notes:

- i) MM = 1 million in US customary units and Imperial British Units (e.g., 1 MM Btu = 1 million Btu).
- ii) M = 1 million in metric units (e.g., 1 MW = 1 megawatt or 1 million watts).
- iii) G = 1 billion in metric units (e.g., 1 GJ = 1 billion Joules).

Table C-2: Emission Conversions

a. Converting from parts per million by volume of a gaseous contaminant to milligrams per cubic metre at the same Conditions:

$$\text{Emission Concentration (mg/m}^3\text{)} = 21.9 \times [\text{ppmv}] \times \frac{\text{MW}}{(1.8 \times T + 492)}$$

T is the temperature, in °C, of the flue gases that corresponds to the (ppmv) measurement
 MW= Molecular weight of contaminant

Note: In the above-noted formula, the converted emission concentration (mg/m³) is on the same dry or wet basis and at the same flue gas conditions (e.g., % oxygen and/or % carbon dioxide) as the measured concentration (ppmv).

b. Converting from parts per million by volume of a gaseous contaminant to pounds per cubic foot at the same Conditions:

$$\text{Emission Concentration (pounds/ft}^3\text{)} = [\text{ppmv}] \times \frac{1.369 \times \text{MW}}{[1\text{E}6 \times (T+460)]}$$

T is the temperature, in °F, of the flue gases that corresponds to the (ppm-v) measurement
 MW= Molecular weight of contaminant

Note: In the above-noted formula, the converted emission concentration (pounds/ft³) is on the same dry or wet basis and at the same flue gas conditions (e.g., % oxygen and/or % carbon dioxide) as the measured concentration (ppmv).

c. Converting from pounds per standard cubic foot of a gaseous contaminant to milligrams per reference cubic metre at the same oxygen level and same wet/dry basis:

$$\text{Emission Concentration (mg/Rm}^3\text{)} = [\text{pounds/Scf}] \times (35.315/2.2046) \times (1\text{E}6) \times (20+273)/(25+273)$$

$$\text{Therefore, Emission Concentration (mg/Rm}^3\text{)} = [\text{pounds/Scf}] \times (1.575\text{E}7)$$

Notes:

- i) Standard conditions (with respect to "standard ft³" or Scf) are at 68 °F or 20 °C and reference conditions (with respect to Rm³) are at 25 °C.
- ii) In the above-noted formula, the converted emission concentration (mg/Rm³) is on the same dry or wet basis and at the same flue gas conditions (e.g., % oxygen and/or % carbon dioxide) as the measured concentration (pounds/Scf).

d. Converting a measured concentration from one level of volumetric percentage of oxygen-dry in flue gas to a different volumetric percentage of oxygen in flue gas:

$$\text{Emission Concentration}_B = [\text{Original Concentration}]_A \times \frac{(20.9 - \%O_{2B})}{(20.9 - \%O_{2A})}$$

$\%O_{2B}$ = percent, by volume-dry, oxygen at the new concentration

$\%O_{2A}$ = percent, by volume-dry, oxygen at the original concentration

Example: converting 80 ppmv (dry) at 3% oxygen-dry to a concentration at 11% oxygen-dry:

$$\text{Emission concentration at 11\% oxygen} = (80 \text{ ppmv-dry}) \times [(20.9-11)/(20.9-3)] = \underline{44 \text{ ppmv-dry}}$$

e. Converting a measured concentration from one level of volumetric percentage of carbon dioxide-dry in flue gas to a different volumetric percentage of carbon dioxide in flue gas:

$$\text{Emission Concentration}_B = [\text{Original Concentration}]_A \times \frac{(\%CO_{2B})}{(\%CO_{2A})}$$

$\%CO_{2B}$ = percent, by volume-dry, carbon dioxide at the new concentration

$\%CO_{2A}$ = percent, by volume-dry, carbon dioxide at the original concentration

Example: converting 100 ppmv-dry at 10% by volume-dry carbon dioxide to a concentration at 12% carbon dioxide:

$$\text{Emission concentration at 12\% carbon dioxide} = (100 \text{ ppmv-dry}) \times [(12)/(10)] = \underline{120 \text{ ppmv-dry}}$$

f. Converting a measured concentration (in mg/m³) from one flue gas temperature to another:

$$\text{Emission Concentration}_B = [\text{Original Concentration}]_A \times \frac{(T_A+273)}{(T_B+273)}$$

T_B = Temperature, in °C, at the new concentration

T_A = Temperature, in °C, at the original concentration

Example: converting 10 mg/m³ at 0 °C to a concentration at 25 °C

$$\text{Emission Concentration at 25 °C} = (10 \text{ mg/m}^3) \times [(0+273)/(25+273)] = \underline{9.2 \text{ mg/m}^3}$$

Note: There is no need for a temperature correction for a concentration in ppmv because both the numerator and denominator are volume-based.

g. Converting from pounds per million Btu (a common emission factor metric used in the United States) to milligrams per reference cubic metre

When measurements of contaminant concentration (F_d) and oxygen ($\%O_{2d}$) are both on a dry basis, then the following conversion formula can be used:

Note: This involves the following two step conversion process:

- i) First, converting from pounds per million Btu to pounds per standard cubic foot where standard conditions are defined as 68 °F (ie., 20 °C) and 760 mm Hg (ie., 101.3 kPa); and
- ii) Second converting pounds per standard cubic foot to milligrams per Reference cubic metre where, for the purposes of this document, reference temperature and pressure are defined as 25 °C and 101.3 kPa.

Step 1: Convert pounds per million Btu to pounds per standard cubic foot:

$$C_d = [\text{Emission Factor in pounds per million Btu}] \times \frac{(20.9 - \%O_{2d})}{(20.9 \times F_d)}$$

- C_d : contaminant concentration, dry basis, pounds per standard cubic foot
- $\%O_{2d}$: percent by volume oxygen, dry basis, that corresponds to the contaminant concentration, C_d
- F_d : Fuel factor (volumes of combustion components per unit heat content)

$$F_d = \frac{[1E6] \times [3.64x(\%H) + 1.53x(\%C) + 0.57x(\%S) + 0.14x(\%N) - 0.46x(\%O)]}{HHV}$$

- $\%H$: percent by weight hydrogen (as-fired, from ultimate analysis of fuel)
- $\%C$: percent by weight carbon (as fired, from ultimate analysis of fuel)
- $\%S$: percent by weight sulphur (as fired, from ultimate analysis of fuel)
- $\%N$: percent by weight nitrogen (as fired, from ultimate analysis of fuel)
- $\%O$: percent by weight oxygen (as fired, from ultimate analysis of fuel)
- HHV: Higher heating value of fuel, as fired, Btu/lb

Step 2: Convert pounds per standard cubic foot to milligrams per reference cubic metre

$$C_d \text{ in mg/Rm}^3 = [C_d \text{ in lb/Scf}] \times (35.315/2.2046) \times (1E6) \times (273+20)/(273+25)$$

$$C_d \text{ in mg/Rm}^3 = [C_d \text{ in lb/Scf}] \times (1.575E7)$$

Where, standard conditions (with respect to Scf) are at 68 °F or 20 °C and reference conditions (with respect to Rm³) are at 25 °C.

Table C-3: Summary Table of Typical Fuel Factors (F_d):

Fuel Type	F _d (dry standard cubic foot/million Btu heat input)
Coal:	
Anthracite:	10,100
Bituminous:	9,780
Lignite:	9,860
Oil:	9,190
Gas (natural gas, propane, butane):	8,710
Wood:	9,240
Wood Bark:	9,600
Municipal Solid Waste:	9,570

Note: The above fuel factors (F_d) are determined at standard conditions:
20 °C (68 °F) and 101.3 kPa (760 mm Hg)

Reference for Fuel Factor Conversion Information and Typical Fuel Factors:

- US EPA, Method 19 – Determination of Sulphur Dioxide Removal Efficiency and Particulate Matter, Sulfur Dioxide and Nitrogen Oxide Emission Rates
- See <http://www.epa.gov/ttn/emc/methods/method19.html>

Appendix D

Information Pertaining to Environmental Compliance Approvals Process

Guideline for the Control of Air Emissions from Small Wood-Fired Combustors (<3 MW)

The websites listed below may contain information that may assist proponents to develop a small wood-fired combustor project in Ontario.

Environmental Compliance Approval in Ontario

<https://www.ontario.ca/page/environmental-compliance-approval>

[Guide to applying for Environmental Compliance Approval](#)

<https://www.ontario.ca/document/guide-applying-environmental-compliance-approval>

Checklist of technical requirements for completing an Environmental Compliance Approval submission

<https://www.ontario.ca/document/checklist-technical-requirements-complete-environmental-compliance-approval-submission>

Guideline A-10: Procedure for preparing an Emission Summary and Dispersion Modelling (ESDM) report

<https://www.ontario.ca/document/guideline-10-procedure-preparing-emission-summary-and-dispersion-modelling-esdm-report>

[Guideline A-11: Air dispersion modelling guideline for Ontario](#)

<https://www.ontario.ca/document/guideline-11-air-dispersion-modelling-guideline-ontario>

Acoustic Assessment Report checklist

<https://www.ontario.ca/document/acoustic-assessment-report-checklist>

APPENDIX E
Additional Technical Information

Guideline for the Control of Air Emissions from Small Wood-Fired Combustors (<3 MW)

During the development of this guideline, a significant amount of technical information was reviewed that was not used to develop regulatory instruments but may improve project performance if considered before purchasing a small wood-fired combustor. The additional technical information is summarized below for information purposes and may assist a person considering the use of a small wood-fired combustor. The rationale document prepared to accompany this guideline also contains a significant amount of technical and jurisdictional information that may be informative.

1. Reference documents such as “Biomass Heating Project Analysis Chapter” (RetSCREEN®), “Biomass Heating” (CIBSE AM15:2014), “Emission Controls for Small Wood-Fired Boilers” (RSG Inc./BERC, May 2010) and “Particulate Matter Emissions-Control Options for Wood Boiler Systems” (BERC, 2011) are freely accessible on the internet.
2. Where available, wood fuel with independent, third-party certification is preferred. Retaining documentation from a wood fuel supplier demonstrating compliance with a fuel standard is one approach to complying with this guideline.
3. A project proponent should assess the availability of wood fuel and associated quantity and quality guarantees in their area. For example, having more than one wood fuel supplier within 100 km of a project site would be considered prudent if a facility does not produce its own wood fuel.
4. For facilities seeking to use wood chips as a fuel, it is recommended that an on-site testing capability be developed to measure the moisture content of the wood chips on a periodic basis. The purpose of developing this capability is based on the fact that wood fuel moisture can be lost during sample storage and transit before analysis at an off-site laboratory and the moisture content no longer represents the “as fired” reported basis. The most widely used approach in Europe consists of using an aluminum foil pan, small oven and scale. Retaining documentation of periodic on-site wood fuel moisture tests is one approach to complying with this guideline. Refer to Figure E1 below for a description of a procedure used to measure the moisture content of wood fuel prepared by FPIInnovation.
5. Wood chips that have been dried or “seasoned” to a moisture content of 25 to 35 percent typically have better combustion properties as compared with wet or “green” wood chips at 50 percent moisture content.
6. A small wood-fired combustor designed to burn 50 percent moisture content wood chips may be able to burn lower moisture content wood chips with high efficiency but a combustor designed to burn 35 percent moisture content wood chips may encounter operational difficulties if 50 percent moisture content wood chips are used as a fuel.
7. A combustor designed with automated continuous de-ashing is preferred, as compared with automated batch de-ashing designs, as they don’t require the combustor to temporarily cease operating to open the grate(s) to discharge the bottom ash. The automated batch de-ashing designs may emit increased levels of carbon monoxide when the grate(s) are open.
8. To accommodate the installation of appropriate emission testing port(s) the minimum exhaust stack inner diameter should be no less than 0.15 m and a minimum diameter of 0.20 m is preferred. The Ontario Source Testing Code (June 2010, as amended) contains information pertaining to the design configuration of emission testing ports as a component of an exhaust stack.
9. When performing a site acceptance test or tune-up, using a portable hand held combustion gas analyzer that has been designed for solid fuel burning devices is important due to the presence of particulate matter. An example of this type of analyzer is the Testo 380 that has been designed specifically to accommodate particulate matter in the flue gas.
10. Air emissions from small wood-fired combustors can increase at partial load operation and during start-up and shut down conditions. As such, it is desirable to maintain steady state operation at or near the nominal load heat input capacity as much of the time as possible. To achieve this objective, the heating system design of a facility should be considered beyond just the small wood-fired combustor. A heating system

design should include a description of how the integrated heating system components at the facility are designed to operate to meet the peak heat load as well as non-peak heat loads. This could be achieved by dividing the peak heat load into two small wood-fired combustors and/or using other devices that operate in conjunction with the small wood-fired combustor(s), such as a thermal storage tank, an auxiliary heating system and/or a peaking heating system. The description should include the estimated peak heat load served by the small wood-fired combustor(s) and the estimated monthly design heat loads to demonstrate how the small wood-fired combustor(s) is/are anticipated to modulate between nominal and partial loads or otherwise be shut down when the thermal storage tank is full or when the auxiliary heating system is operating.

11. Certified¹¹ small wood-fired combustors are tested at partial load, which typically represents 30% of the nominal load according to EN 303-5 (2012). This emission data is informative because small wood-fired combustors used for comfort heating in a building will typically experience variable heat load demand and should be able to modulate the heat input capacity between nominal and partial load without creating significant increases in air emissions.

¹¹ This applies also to a wood combustor that is described in Chapter 3.0 “Applicability”.

Analyzing the Moisture Content of Biomass Samples

Objective: to find the moisture content percentage mc (%) (% by weight, wet basis) of a biomass sample.

Work space: This procedure should be performed in laboratory conditions.

Materials and equipment:

- ❑ Digital scale with a capacity of at least 2000 g and accuracy of 0.1g (from \$350)
- ❑ Forced air convection oven (from \$700)
- ❑ Clean sample weighing tray, able to hold at least 300 g of biomass
- ❑ 6 L (>1 kg) of biomass sample (3 replicates of at least 300 g each)

Procedures:

Step 1

Follow the procedures for *Separating Biomass Samples* to separate 3 replicates of at least 300 g each from one sample of at least 1 kg of biomass.



Step 2

Weigh the empty sample tray and record its weight (*tare*) m_t .



Step 3

Load the material of a replicate into a weighing tray. Weigh the loaded tray and record the weight m_{wet} .



Step 4

Load the tray into the oven and set to 105°C. Keep the tray in the oven until constant mass is obtained¹.

Step 5

Weigh the loaded tray and record the weight of the dry material m_{dry} .

Step 6

Calculate moisture content mc (%) according to the following formula:
 $mc (\%) = [(m_{wet} - m_{dry}) / (m_{wet} - m_t)] \times 100$

Step 7

Analyze the 3 replicates and report the average.

¹ Mass constancy is obtained when the mass lost between two weights taken 60 minutes apart is not exceeding 0.2% of the total lost in mass (EN-TS 14774-1:2009). The drying time will depend on the particle size and the thickness of the sample in the tray, and may vary between 5 and 24 hours (overnight).

APPENDIX F

Summary of Wood Fuel Specifications and NRCan Bulletins

WOOD PELLETS

STANDARDS

CAN/CSA-ISO 17225-2:15, as amended

Solid biofuels – Fuel Specifications and classes – Part 2: Graded wood pellets – standard must be purchased.

This standard is a voluntary National Standard of Canada that is produced by the CSA Group. The standard was adopted without modification from the International Organization for Standardization's Standard 17225-2:2014, first edition 2014-05-01. It is intended to be used in conjunction with CAN/CSA-ISO 17225-1:15 (as amended), Solid biofuels - Fuel specifications and classes – Part 1: General requirements (adopted from ISO 17225-1:2014).

Accessed through the CSA Group's website: <http://shop.csa.ca/en/canada/fuel-burning-equipment/canca-iso-17225-215/inv/27038012015> (accessed November 2015).

United States Pellet Fuels Institute (PFI) Standards Program

PFI is a non-profit North American trade association that represents the densified biomass fuel industry. The PFI Standards Program is available for voluntary use in Canada. It is a third party accredited program that provides specifications for residential and commercial-grade fuel.

Documents that outline the PFI Standards Program can be accessed through the PFI website: <http://www.pelletheat.org/> (accessed November 2015)

CERTIFICATION SYSTEMS

The Wood Pellet Association of Canada (WPAC) is the Canadian Licensor for the ENplus wood pellet certification system. The CANplus wood pellet trademark is owned by WPAC and was launched in 2013. The CANplus system is to certify wood pellets developed in Canada. Third party certification is recognized in Canada, the United States and Europe.

Details of each certification system are summarized in handbooks which can be accessed through WPAC's website: <http://www.pellet.org> (accessed November 2015).

WOOD CHIPS

STANDARDS

CAN/CSA-ISO 17225-4:15, as amended

Solid biofuels - Fuel specifications and classes - Part 4: Graded wood chips – standard must be purchased.

This standard is a voluntary National Standard of Canada that is produced by the CSA Group. It is an adoption without modification of the identically titled International Organization for Standardization's Standard 17225-4, first edition, 2014-05-01. It is intended to be used in conjunction with CAN/CSA-ISO 17225-1:15 (as amended), Solid biofuels - Fuel specifications and classes – Part 1: General requirements (adopted from ISO 17225-1:2014).

Accessed through the CSA Group's website: <http://shop.csa.ca/en/canada/fuel-burning-equipment/canca-iso-17225-415/inv/27038032015> (accessed November 2015).

WOOD BRIQUETTES

STANDARD

CAN/CSA-ISO 17225-3:15, as amended

Solid biofuels - Fuel specifications and classes - Part 3: Graded wood briquettes – standard must be purchased.

This standard is a voluntary National Standard of Canada that is produced by the CSA Group. It is an adoption without modification of the identically titled International Organization for Standardization's Standard 17225-4, first edition, 2014-05-01. It is intended to be used in conjunction with CAN/CSA-ISO 17225-1:15 (as amended), Solid biofuels - Fuel specifications and classes – Part 1: General requirements (adopted from ISO 17225-1:2014). Requires payment.

Accessed through the CSA Group's website: <http://shop.csa.ca/en/canada/fuel-burning-equipment/canca-iso-17225-315/invt/27038022015> (accessed November 2015).

NATURAL RESOURCES CANADA SOLID BIOFUELS BULLETINS

The NRCan bulletins for wood pellets, wood chips and wood briquettes are included in the following pages of this appendix, and all seven bulletins are available through the NRCan website:

<https://www.nrcan.gc.ca/energy/renewable-electricity/bioenergy-systems/19069> (accessed October 2016)



Solid Biofuels Bulletin No. 4

GRADED WOOD PELLETS



This bulletin, fourth in a series of bulletins, introduces the different grades of wood pellets, their appropriate use and the important parameters that can affect the fuel characteristics. It provides information on the graded wood pellets as specified in the CAN/CSA-ISO 17225 Part 2: Graded wood pellets.

Wood pellets are a highly consistent biomass fuel allowing for easy handling and storage, as well as efficient energy conversion.

As a globally traded commodity, wood pellets are used for space heating in residential appliances, boilers, district heating plants and for electricity generation in large coal-burning power plants.

Wood pellets are small densified cylindrical granules produced by compression of sawdust. As a result, wood pellets are a consistent fuel that can easily be transported and suited to automated fuel handling systems.

Origins and Sources

Wood pellets are mainly produced from the by-products of traditional forest operations such as sawmills and finished wood products manufacturing. Harvest residues are also used as raw material though to a much lesser extent. The highest quality sources tend to come from mill and manufacturing residues with little or no bark or ash content.

The CAN/CSA-ISO 17225 Part 2 Standard¹ classifies several grades of wood pellets based on the origins and source of raw materials. Raw biomass used in the production of high grade wood pellets, Grades A1 and A2 (residential or commercial applications), primarily comes from mill residues including sawdust, shavings and cut-offs (classification 1.2.1) and stem wood (classification 1.1.3). In addition to the above sources, Grade A2 allows for the use of logging residues (classification 1.1.4) and whole trees without roots (classification 1.1.1)².

Sources of the raw biomass impacts fuel specifications. For example, A1 grade wood pellets contain low ash and nitrogen contents, while Grade A2 wood pellets have slightly higher ash and nitrogen content.

Grade B wood pellets are manufactured from more diverse sources, over and above those used for Grade A wood pellets, and can include bark (classification 1.1.6), residues from thinning, pruning, and arboriculture operations in city parks (classification 1.1.7), and chemically untreated used wood (classification 1.3.1).

Wood Pellets



The CAN/CSA-ISO 17225 Part 2 Standard also specifies Industrial Grade (I1, I2, I3) wood pellets based on origins, sources and properties, but these are outside the scope for this bulletin.

Both softwood and hardwood tree species can be sourced for wood pellets. It is anticipated that purposely grown woody crops such as poplar and willow grown on marginally productive land may be sourced for wood pellet production in the future. For further details on the origins and sources, refer to Natural Resources Canada Solid Biofuels Bulletin No.2 – Primer for Solid Biofuels².

Key Properties

The production of pellets starts with size reduction (if necessary) of the raw biomass source followed by drying. The material is then extruded under high pressure in pellet machines coming out as small cylinders typically with a 6 or 8 mm diameter, and a length of up to 40 mm. Small amounts of additives and binders can be blended with biomass material to improve the quality of wood pellets, but this is not common in Canada.

A buyer or user of graded wood pellets should consider several quality characteristics:

- **Diameter and Length (D and L)** – tested in the lab or production site. Two alternative diameters are produced: 6 mm and 8 mm (± 1 mm). The length of the individual wood pellets should be larger than 3.15 mm, and less than or equal to 40 mm ($3.15 < L \leq 40$ mm) with the maximum length not exceeding 45mm. The quantity of pellets longer than 40 mm can be 1% in weight. The quantity of pellets shorter than 10 mm (weight %) is stated by the producer.
- **Durability (DU) and Fines (F)** – determined in the lab by tumbling and screening the pellets. After tumbling, the quantity of pellets (in weight %) staying on the screening with the screen opening size greater than 3.15 mm determines the durability. The quantity of pellets passing through the screen with less than 3.15 mm opening size is defined as fines. Pellets handled in large quantities (bulk) experience some attrition, resulting in higher content of fines.
- **Bulk Density (BD)** – tested in the lab to provide guidance for sizing the storage space based on energy consumption needs. Minimum bulk density should be greater than or equal to 600 kg/m³. The actual bulk density of the pellets is often stated by the producer on the packaging. Rough estimates of bulk density can be made by weighing a known volume. When testing density, attempts should be made to minimize the void space between pellets by shaking and tapping pellets well.
- **Calorific value (Q) and Moisture Content (M)** – measured by lab testing. All grades of wood pellets must have moisture content less than 10% and a high calorific value greater than or equal to 18.6 MJ/kg (or low heating value of greater than or equal to 16.5 MJ/kg).
- **Ash Content (A)** – tested in the lab. For residential and commercial applications, ash content is low and increases from Grade A1 to A2 to B (Table 1). For residential stoves, furnaces and boilers, it is recommended to use wood pellets with low ash content.

TABLE 1. Key specifications of graded wood pellets based on the CAN/CSA-ISO 17225 Part 2 Standard

Property Class	Unit	Grade A1*	Grade A2*	Grade B*
Diameter, D	mm	6 ± 1 or 8 ± 1	6 ± 1 or 8 ± 1	6 ± 1 or 8 ± 1
Length**, L	mm	3.15 ≤ L ≤ 40	3.15 ≤ L ≤ 40	3.15 ≤ L ≤ 40
Moisture, M	% of weight	≤ 10	≤ 10	≤ 10
Ash, A	% of weight	≤ 0.7	≤ 1.2	≤ 2.0
Durability, DU	% of weight	≥ 97.5	≥ 97.5	≥ 96.5
Fines Content, F	% of weight	≤ 1	≤ 1	≤ 1
High Calorific Value, Q	MJ/kg	≥ 18.6	≥ 18.6	≥ 18.6
Bulk Density, BD	kg/m ³	600 ≤ BD ≤ 750	600 ≤ BD ≤ 750	600 ≤ BD ≤ 750

* Suitable for residential and commercial applications.

**Maximum length of wood pellets shall be ≤ 45 mm. Amount of pellets longer than 40 mm can be 5% weight.

Further restrictions may be stipulated by the supplier of the combustion equipment regarding ash characteristics of the pellets, such as ash melting temperature, to minimize damage to equipment.

Specifications of Properties for Graded Wood Pellets

Graded wood pellets conform to specific feedstock sources as well as the quality requirements as stipulated in the CAN/CSA-ISO 17225 Part 2 Standard. Table 1 shows various properties and specifications for Graded wood pellets as detailed in the CAN/CSA-ISO 17225 Part 2: Graded wood pellets. A family of CAN/CSA-ISO testing standards is available to confirm compliance of the wood pellets with the grade, see Bulletin No.7 – CAN/CSA-ISO Solid Biofuels Standards².

Certification of Wood Pellets

The European certification ENplus³ for wood pellets was adopted in Canada in 2013 under the acronym CANplus⁴. The ENplus and CANplus seals account for the whole wood pellet supply chain, from production to delivery to the final customer, to ensure high quality. Both ENplus and CANplus schemes define wood pellet quality classes following the ISO 17225 Part 2 Standard: A1, A2 and B. Examples of the two certification system logos are shown below:



Pellet Fuel Institute (PFI) in the USA has also developed standard specifications for residential and commercial grade wood pellets⁵. The PFI wood pellet standard forms the basis of a third party accredited certification program. The certification under ENplus and CANplus are currently voluntary in Europe and Canada, while the PFI certification is mandatory in the USA.

Safe Handling and Storage of Wood Pellets

Wood pellets require closed storage, such as silos or storage tanks to keep them dry. During storage, chemical, physical and biological processes can take place including water absorption, off-gassing, oxygen depletion and self heating. Off-gassing can lead to production of toxic gases including carbon monoxide (CO) which is a poisonous,

odorless, tasteless and non-irritating gas. As a result, bulk storage spaces need to be well ventilated with exhaust away from areas where people are present. As additional safety measure, CO detectors should be installed in and around the storage area. Personal protective equipment should be worn if entry into large storage areas is necessary.

Temperature measurements in large storage piles are recommended to monitor heat build up.

Dust can be generated while handling wood pellets. In large volumes dust may cause respiratory problems if inhaled, and constitutes a risk for fires and explosions. An extensive Safety Data Sheet (SDS) is available for wood pellets in bags and there is a separate SDS for wood pellets in bulk. SDS documents contain information on the potential hazards (health, fire reactivity and environmental) and how to work safely with wood pellets.

Standards and guidelines for safe handling and storage of wood pellets of all scales are currently under development by ISO/Technical Committee 238⁶.

References & Links

1. CSA Group - www.csagroup.org for the CAN/CSA-ISO 17225 Solid Biofuels-Fuel specifications and classes – Part 1 General Requirements and Part 2 Graded wood pellets.
2. Natural Resources Canada – www.nrcan.gc.ca for the Solid Biofuels Bulletins Series.
3. European Pellet Council <http://www.pelletcouncil.eu>
4. Wood Pellet Association of Canada <http://www.pellet.org>
5. Pellet Fuels Institute <http://www.pelletheat.org>
6. ISO Technical Committee 238 Solid Biofuels http://www.iso.org/iso/iso_technical_committee%3Fcommid%3D554401

Acknowledgement

This bulletin was prepared in collaboration with Canadian Institute of Forestry, FPIInnovations, Ontario Ministry of Natural Resources and Forestry, Pembina Institute, Wood Pellet Association of Canada, and Wood Waste to Rural Heat.





Solid Biofuels Bulletin No. 5

GRADED WOOD BRIQUETTES



This bulletin, fifth in a series of bulletins, introduces different grades of wood briquettes, their appropriate use and the important parameters that can affect the fuel characteristics. The information on the graded wood briquettes is based on the CAN/CSA-ISO 17225 Part 3: Graded wood briquettes.

Wood briquettes for heat generation have been used in residential space heaters, boilers and in district heating for several decades.

Wood briquettes come in a variety of dimensions depending on the manufacturer. In general, they can be found in two sizes: larger, such as bricks or logs, and smaller, such as pucks (which fit in your hand) or cubes. As a densified fuel product, briquettes are a consistent solid biomass fuel similar to wood pellets. In comparison to wood pellets, briquettes are less dense, constituent

particles are larger and typically require less drying leading to less power consumption in manufacturing and hence lower cost.

Origins and Sources

CAN/CSA-ISO 17225 Part 3 Standard¹ classifies three grades of wood briquettes based on origins and sources: Grades A1 and A2 are intended for heating of residential and commercial buildings; Grade B briquettes are for larger-scale combustors, such as district heating and electricity production.

Raw biomass used to produce Grade A2 briquettes include sources used for Grade A1 and residues left behind from logging operations (tree tops, branches and low grade small dimension logs—classification 1.1.4) and whole trees without roots (classification 1.1.1)². Raw biomass used to produce Grade A2 briquettes include sources used for Grade A1 and residues left behind from logging operations (such as tree tops and branches and low-grade small dimension logs—classification 1.1.4) and whole trees without roots (classification 1.1.1)². Grade A1 briquettes contain low ash and nitrogen levels, while Grade A2 have slightly higher ash and nitrogen content.

Grade B further expands the briquette source material² to include residues from tree thinnings, prunings and arboriculture operations in city parks (classification 1.1.7), bark (classification 1.1.6), and chemically untreated used wood (classification 1.3.1). Grade B also includes chemically treated wood by-products (classification 1.2.2), as long as they do not contain heavy metals or halogenated organic compounds from treatment with wood

Various shapes and sizes of wood briquettes



TABLE 1. Key specification of graded wood briquettes based on the CAN/CSA-ISO 17225 Part 3 Standard

Property Class	Unit	Grade A1	Grade A2	Grade B
Moisture, M	% of weight	≤ 12	≤ 15	≤ 15
High Calorific Value, Q	MJ/kg as received	≥ 17.5	≥ 17.3	≥ 16.8
Ash, A	% of weight	≤ 1.0	≤ 1.5	≤ 3.0
Particle Density, DE	g/cm ³ as received	≥ 1.0	≥ 0.9	≥ 0.9

preservatives or coatings. Sources are expected to be free of contaminants such as stones, glass, metal, sand, plastics and rubber.

Both softwood and hardwood species can be sourced for wood briquettes. It is anticipated that purposely grown woody crops, such as poplar and willow, grown on marginally productive land will be sourced for wood briquettes production in the future. For further details on the origins and sources, refer to Natural Resources Canada Solid Biofuels No.2 – Primer for Solid Biofuels².

Key Properties

The production of briquettes starts with size reduction of the raw feedstock and drying. Next, the material is compressed or extruded under high pressure in briquette machines before coming out in a variety of shapes and sizes as logs, bricks, cylinders, nuts or pucks. In Canada, additives and binders blended with biomass material to improve the quality of wood briquettes are not common.

Wood briquettes are distributed and transported in large plastic bags or stacked on pallets with plastic wrapping or cardboard packaging for distribution by truck or by shipping containers.

Wood briquettes, like wood pellets, are a highly consistent biomass fuel type which allows easy handling and storage, as well as efficient energy conversion.

A buyer of/user of wood briquettes should consider several quality characteristics, the most important of which are as follows (see Table 1):

- **Moisture content (M) and calorific value (Q)** – measured by lab testing.

- **Ash content (A)** – any restrictions regarding ash content and ash melting temperature as stipulated by the supplier of the combustion equipment need to be considered to minimize combustion equipment operational issues (clinker/slugging).
- **Particle density (DE)** – depending on the physical shape of the briquettes, particle density is used by some suppliers in lieu of bulk density to assist in estimating storage volume required.
- **Physical size of the briquettes** – recommended by the equipment supplier to avoid clogging the hoppers and augers that are used to feed the briquettes in automated systems.

Specifications of Properties for Graded Wood Briquettes

The term “graded” means that the feedstock as well as the quality of the briquettes have to comply with certain requirements as stipulated in the CAN/CSA-ISO 17225-3 Standard¹. Table 1 is an excerpt from the CAN/CSA-ISO 17225 Part 3: Graded wood briquettes. It provides standards for three graded property classes: A1, A2 and B. The source materials as well as the briquettes are tested for compliance in accordance with a family of CAN/CSA-ISO testing standards, see NRCan Solid Biofuels Bulletin No.3 – CAN/CSA-ISO Solid Biofuels Standards².

For example, a label stating wood briquettes’ specific of M9.0, A2.5 and Q17.0 indicates that the wood briquettes contain ≤ 9% moisture, ≤ 2.5 ash with a minimum calorific value of 17 MJ/kg. Based on these fuel property values, this wood briquettes is classified as Grade B.

Safe Handling and Storage of Wood Briquettes

Wood briquettes need to be kept dry during storage to maintain their mechanical integrity and fuel quality.

Bulk storage spaces should be well ventilated and away from areas where people are present.

Dust can be created during handling of large volumes of briquettes, which may cause respiratory problems if inhaled, and increase risk of fires and explosions. Wood briquettes piles may self-heat, and temperature measurements in large storage spaces are therefore recommended to monitor heat build up.

A Safety Data Sheet (SDS) for wood briquettes is available with information on the potential hazards (health, fire, reactivity and environmental) and how to work safely with wood briquettes.

References & Links

1. CSA Group - www.csagroup.org for CAN/CSA-ISO 17225 Solid Biofuels-Fuel specifications and classes – Part 1: General requirements, and, – Part 3: Graded wood briquettes.
2. Natural Resources Canada – www.nrcan.gc.ca for the Solid Biofuels Bulletins Series.

Acknowledgement

This bulletin was prepared in collaboration with Canadian Institute of Forestry, FPInnovations, Ontario Ministry of Natural Resources and Forestry, Pembina Institute, Wood Pellet Association of Canada, Wood Waste to Rural Heat.





Solid Biofuels Bulletin No. 6

GRADED WOOD CHIPS



This bulletin, sixth in a series of bulletins, introduces the different grades of wood chips, their appropriate use and the important parameters that can affect the fuel characteristics. It provides information on graded wood chips as specified in the *CAN/CSA-ISO 17225 Solid Biofuels—Fuel specifications and classes—Part 4 Graded Wood Chips*.

Wood chips have been widely used as fuel for space heating in buildings for several decades. As a locally available fuel with minimal processing, wood chips offer a less costly fuel option compared to wood briquettes or pellets.

Wood chips are typically produced by grinding or chipping operations followed by screening and air drying of the chips. Screening is necessary to produce the desired wood chip quality (particle size, ash and fines content).

Origins and Sources

The major sources for wood chips are by-products and residues from wood processing operations in the forest

sector (slabs, bark or shavings). The highest quality wood chip sources tend to be from milling and manufacturing operations. According to the *CAN/CSA-ISO 17225 Part 4 Standard*¹, classification is based on origins and sources and provides for four different grades of wood chips. Grade A (A1 and A2) are high quality wood chips that are sourced primarily from stem wood (classification 1.1.3) and by-products and residues from milling (classification 1.2.1) and logging operations (classification 1.1.4). A1 grade wood chips are dried and contain lower ash and no or little bark. A2 grade contains slightly higher ash and/or moisture content.

Sources for Grade B1 wood chips include materials from tree trimmings, prunings and arboriculture operations in city parks (classification 1.1.7).

In addition to the sources that are used for Grades A and B1, sources for Grade B2 wood chips include chemically treated by-products and residues from wood processing facilities (classification 1.2.2) and chemically untreated used wood (classification 1.3.1). B2 grade wood chips do not contain heavy metals or halogenated organic compounds from wood preservatives or coatings. For further details on classification by the origin and sources, refer to *Natural Resources Canada Solid Biofuels Bulletin No.2 – Primer for Solid Biofuels*².

Hog fuel – coarse and varying in size wood chips



High grade wood chips
(pulp chips)



Grade A classified wood chips are suitable for smaller bioenergy systems (assuming they meet the equipment's specifications) used in schools, public and commercial buildings. Larger bioenergy systems typical of industrial operations (such as sawmills, pulp mills, commercial greenhouses and large district energy systems) are able to use the lower quality Grade B1 and B2 wood chips.

Key Properties

While a number of different parameters are important for small-scale bioenergy systems, the most critical properties to consider when buying and using wood chips are moisture content (M), particle size (P), and ash content (A) (Tables 1 and 2)². Bark content, extraneous material (stones, sand, and dirt) and contamination (such as glass, metal, plastics) lead to an increase in ash content causing higher equipment maintenance costs. Particle size specifies both the acceptable size range for the diameter and length of wood chips and the minimum allowable amounts of acceptable sized material (main fraction in weight %). Each grade of wood chips also defines specific limits for the amounts of both undersize (fine fraction) and oversize materials (coarse fraction). Fines are defined as particles

less than 3.15 mm (less than 1/8 inch). Increased amount of fine and/or coarse fractions can have a significant impact on the fuel handling and operation (efficiency and emissions) of the bioenergy system.

It is highly recommended that the moisture, size and ash properties be tested on a regular basis to confirm contractual requirements for wood chips quality are met. This will also ensure that the biomass fuel is appropriate for efficient and economical operation of the heat or energy system.

It is possible to determine particle size using a sieve test. A hand-held moisture meter can be used to quickly measure moisture; however, an oven-dry analysis gives more accurate measurement and is preferred.

The standard test methods for determining moisture content and particle size distribution are provided in the CAN/CSA-ISO 18134-1 or -2 and CAN/CSA-ISO 17827-1, respectively. The detailed list of testing protocols is available in Natural Resources Canada Solid Biofuels No.3—CAN/CSA-ISO Standards for Solid Biofuels.

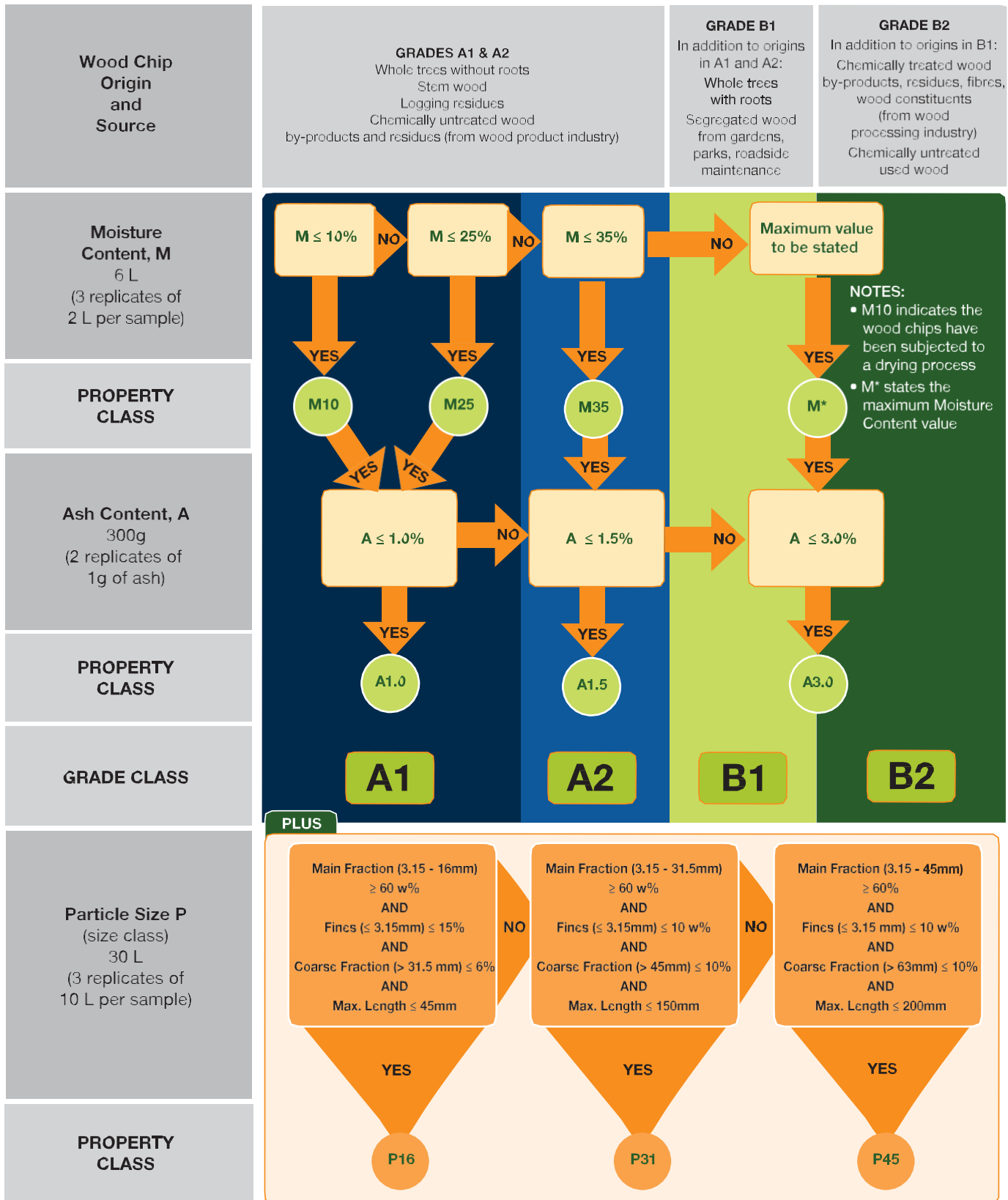
Table 1. Key specifications of properties for graded wood chips based on CAN/CSA-ISO 17225 Part 4

Property Class	Unit	Grade A1	Grade A2	Grade B1	Grade B2
Moisture (M)	weight %	M10 ≤10	M35 ≤35	Maximum value to be stated	Maximum value to be stated
Ash (A)	weight %, dry	A1.0 ≤1.0	A1.5 ≤1.5	A3.0 ≤3.0	A3.0 ≤3.0

Table 2. Classification of particle sizes for graded wood chips based on CAN/CSA-ISO 17225 Part 4*

Particle Size (P)	Main Fraction (min. 60 % weight)	Fine Fraction weight %, (≤ 3.15 mm)	Coarse Fraction weight % (length of particle)	Max. Length of Particle
P16S	3.15 mm to 16 mm	≤ 15 %	≤ 6 % (>31.5 mm)	≤ 45 mm
P31S	3.15 mm to 31.5 mm	≤ 10 %	≤ 6 % (> 45 mm)	≤ 150 mm
P45S	3.15 mm to 45 mm	≤ 10 %	≤ 10 % (> 63 mm)	≤ 200 mm

* Test method for determining particle size is ISO 17827-1 or -2



NOTES:

- This diagram highlights the most critical wood chip property classes. Other classes exist that were not included, such as: bulk density and chemical composition.
- A classification code may be generated using these classes, such as: A1-P16, B2-P31, etc.
- An appropriate wood chip sample amount should be separated from the wood chip lot (e.g., pile, chip van) for which the classification is done. The sample amount required for analysis depends on the attributes being tested, and indicated under each attribute title. For sample collection procedures, refer to ISO 17827-1 for Particle Size (P); ISO 18134-1, ISO 18134-2 for Moisture Content (M); and ISO 18122 for Ash Content (A).

Figure 1. Wood Chip Classifi Diagram, prepared by FPInnovations based on the CAN/CSA-ISO 177225 Part 4: Graded Wood Chips.



Figure 2. Covered storage for wood chip piles

Specifications of Properties for Graded Wood Chips

The use of common names (such as hog fuel, shavings) is neither quantitative nor sufficiently specific, and should not be used when developing biomass fuel supply agreements. CAN/CSA-ISO 17225 Part 4 provides measurable parameters for the sale of wood chips (Tables 1 and 2).¹ Current forestry by-products and residues commonly sold as wood chips may not meet grade specifications without further processing and may not be appropriate for a specific bioenergy application. Variability of wood chips should be minimized to ensure proper bioenergy system operation.

When sourcing wood chips, the nomenclature should include at minimum source class, particle size (P), moisture content (M) and ash content (A). For example, wood chips specification label would show:

Origin: Logging residues (1.1.4).

Properties: Dimensions P45S, Moisture M40, Ash A1.5.

This label states that the minimum 60% weight of the wood chips is sized between 3.15 mm and 45 mm, has moisture content of less than 40% and contains less than 1.5% ash. Figure 1 is a schematic diagram of specifications of properties for graded wood chips.

Safe Handling and Storage of Wood Chips

Protection of the wood chips pile from rain and snow with covered storage is critical to maintain fuel quality (Figure 2).

During storage of wood chips, chemical, physical and biological processes can occur. Microbial activities might be cultivated, dry fuel mass might degrade and the pile can heat up. In the worst case this can lead to self ignition. Particle size within a pile of wood chips affects rate of moisture absorption, heat build-up and heat dissipation. Large amounts of fines in a pile causes greater amounts of water to be absorbed, leading to faster heat up and even possibly spontaneous combustion. In contrast, large wood chunks heat up more slowly due to large void volumes between particles allowing more air flow. Microbial action also takes place at lower rates. To minimize the impact of these processes on the quality of the wood chips, it is highly recommended the storage period is kept to minimum.

The Ontario Office of the Fire Marshal has a technical guideline that recommends maximum sizes for outdoor piles of wet wood chips from storm debris⁴. For wood chips to be stored for more than three months, the recommended maximum height, width, and volume are 4 meters (13 feet), 8 meters (26 feet), and 1000 cubic meters (1,300 cubic yards), respectively. For periods less than three months, the recommended maximum height is 7.5 meters (25 feet).

Maintaining a low moisture and fines content in the wood chip pile will help minimize the risks of microbial activity, composting and self ignition. Storing low moisture pile under covered area is therefore a good practice.

To minimize the possibility of inadvertently transporting invasive species, care should also be taken when sourcing wood chips from other locations.

References & Links

1. CSA Group – www.csagroup.org for the CAN/CSA-ISO Standard 17225 Solid biofuels – Fuel specifications and classes Part 4: Graded wood chips, and, – Part 1: General requirements.
2. Natural Resources Canada – www.nrcan.gc.ca for the Solid Biofuels Bulletins Series.
3. FPInnovations, “Basic procedures for sampling and analyzing woody biomass”, Advantage report Vol. 15, No.5, 2015.
4. Ontario Office of Fire Marshal Technical Guideline for wood chips storage, www.mcscs.jus.gov.on.ca/english/firemarshal/legislation/technicalguidelinesandreports/TG-1998-03.html.

Acknowledgement

This bulletin was prepared in collaboration with Canadian Institute of Forestry, FPInnovations, Ontario Ministry of Natural Resources and Forestry, Pembina Institute, Wood Pellet Association of Canada, and Wood Waste to Rural Heat.



Wood Chip Fuel Specifications as per the CAN/CSA-ISO 17225 part 4 Graded Wood Chips

Table 1. Specifications for Fuel Particle Size Dimension

Dimensions (mm), ISO 17827-1				
Main fraction ^a (minimum 60 w-%), mm	Fines fraction, w- % (≤3,15 mm)	Coarse fraction, w- %, (length of particle, mm)	Max. length of particles ^b , mm	Max. cross sectional area of the coarse fraction ^c , cm ²
P31S	3,15 mm < P ≤ 31,5	≤ 10 %	≤ 6 % (>45 mm)	≤ 150 m ≤ 4 cm²
P45S	3,15 mm < P ≤ 45	≤ 10 %	≤ 10 % (>63 mm)	≤ 200 m ≤ 6 cm²
<p>^a The numerical values (P-class) for dimension refer to the particle sizes passing through the mentioned round hole sieve size (ISO 17827-1). The lowest possible class should be stated. Only one class shall be specified for wood chips.</p> <p>^b Length and cross sectional area only have to be determined for those particles, which are to be found in the coarse fraction.</p> <p>Maximum 2 pieces of about 10 l sample may exceed the maximum length, if the cross sectional area is < 0,5 cm².</p> <p>^c For measuring the cross sectional area it is recommended to use a transparent set square, place the particle orthogonally behind the set square and estimate the maximum cross sectional area of this particle with the help of the cm²-pattern.</p>				

Property Class Chips should minimum be B1, as per table below (ISO 17225-1)

Table 2. Property Class Chips (ISO 17225-1)

Property class, Analysis method	Unit	Grade B	
		1	2
Origin and source, ISO 17225-1		1.1 Forest, plantation and other virgin wood ^b 1.2.1 Chemically untreated wood residues	1.1 Forest, plantation and other virgin wood ^b 1.2. By-products and residues from wood processing industry 1.3.1. Chemically untreated used wood
Particle size, P ISO 17827-1	mm	P31S or P45S	
Moisture, M ^c , ISO 18134-1 ISO 18134-2	w-%	Maximum value to be stated, between 35 to 50%	
Ash, A ISO 18122	w-% dry	A3.0 ≤ 3.0	
Bulk density, BD ^d , ISO 17828	kg/loose m ³ as received	Minimum value to be stated	

Table 3. Specification of graded wood chips, Grade B1

Property class, Analysis method	Unit	Grade B	
		1	2
Nitrogen, N ISO 16948	w-% dry	N1.0 ≤ 1.0	
Sulfur, S ISO 16994	w-% dry	S0.1 ≤ 0,1	
Chlorine, Cl ISO 16994	w-% dry	Cl0.05 ≤ 0.05	
Arsenic, As ISO 16968	mg/kg dry	≤ 1	
Cadmium, Cd ISO 16968	mg/kg dry	≤ 2.0	
Chromium, Cr ISO 16968	mg/kg dry	≤ 10	
Copper, Cu ISO 16968	mg/kg dry	≤ 10	
Lead, Pb ISO 16968	mg/kg dry	≤ 10	
Mercury, Hg ISO 16968	mg/kg dry	≤ 0.1	
Nickel, Ni ISO 16968	mg/kg dry	≤ 10	
Zinc, Zn ISO 16968	mg/kg dry	≤ 100	



TP1 Amount Payable – General

1.1 Subject to any other provisions of the contract, Her Majesty shall pay the Contractor, at the times and in the manner hereinafter set out, the amount by which

1.1.1 the aggregate of the amounts described in TP2 exceeds

1.1.2 the aggregate of the amounts described in TP3

and the Contractor shall accept that amount as payment in full satisfaction for everything furnished and done by him in respect of the work to which the payment relates.

TP2 Amounts Payable to the Contractor

2.1 The amounts referred to in TP1.1.1 are the aggregate of

2.1.1 the amounts referred to in the Articles of Agreement, and

2.1.2 the amounts, if any, that are payable to the Contractor pursuant to the General Conditions.

TP3 Amounts Payable to Her Majesty

3.1 The amounts referred to in TP1.1.2 are the aggregate of the amounts, in any, that the Contractor is liable to pay Her Majesty pursuant to the contract.

3.2 When making any payments to the Contractor, the failure of Her Majesty to deduct an amount referred to in TP3.1 from an amount referred to in TP2 shall not constitute a waiver of the right to do so, or an admission of lack of entitlement to do so in any subsequent payment to the Contractor.

TP4 Time of Payment

4.1 In these Terms of Payment

4.1.1 The “payment period” means a period of 30 consecutive days or such other longer period as is agreed between the Contractor and the Departmental Representative.

4.1.2 An amount is “due and payable” when it is due and payable by Her Majesty to the Contractor according to TP4.4, TP4.7 or TP4.10.

4.1.3 An amount is overdue when it is unpaid on the first day following the day upon which it is due and payable.

4.1.4 The “date of payment” means the date of the negotiable instrument of an amount due and payable by the Receiver General for Canada and given for payment.

4.1.5 The “Bank Rate” means the discount rate of interest set by the Bank of Canada in effect at the opening of business on the date of payment.



- 4.2 The Contractor shall, on the expiration of a payment period, deliver to the Departmental Representative in respect of that payment period a written progress claim that fully describes any part of the work that has been completed, and any material that was delivered to the work site but not incorporated into the work during that payment period.
- 4.3 The Departmental Representative shall, not later than ten days after receipt by him of a progress claim referred to in TP4.2,
- 4.3.1 inspect the part of the work and the material described in the progress claim; and
- 4.3.2 issue a progress report, a copy of which the Departmental Representative will give to the Contractor, that indicates the value of the part of the work and the material described in the progress claim that, in the opinion of the Departmental Representative,
- 4.3.2.1 is in accordance with the contract, and
- 4.3.2.2 was not included in any other progress report relating to the contract.
- 4.4 Subject to TP1 and TP4.5 Her Majesty shall, not later than 30 days after receipt by the Departmental Representative of a progress claim referred to in TP4.2, pay the Contractor
- 4.4.1 an amount that is equal to 95% of the value that is indicated in the progress report referred to in TP4.3.2 if a labour and material payment bond has been furnished by the Contractor, or
- 4.4.2 an amount that is equal to 90% of the value that is indicated in the progress report referred to in TP4.3.2 if a labour and material payment bond has not been furnished by the Contractor.
- 4.5 It is a condition precedent to Her Majesty's obligation under TP4.4 that the Contractor has made and delivered to the Departmental Representative,
- 4.5.1 a statutory declaration described in TP4.6 in respect of a progress claim referred to in TP4.2,
- 4.5.2 in the case of the Contractor's first progress claim, a construction schedule in accordance with the relevant sections of the Specifications, and
- 4.5.3 if the requirement for a schedule is specified, an update of the said schedule at the times identified in the relevant sections of the Specifications.
- 4.6 A statutory declaration referred to in TP4.5 shall contain a deposition by the Contractor that
- 4.6.1 up to the date of the Contractor's progress claim, the Contractor has complied with all his lawful obligations with respect to the Labour Conditions; and
- 4.6.2 up to the date of the Contractor's immediately preceding progress claim, all lawful obligations of the Contractor to subcontractors and suppliers of material in respect of the



work under the contract have been fully discharged.

- 4.7 Subject to TP1 and TP4.8, Her Majesty shall, not later than 30 days after the date of issue of an Interim Certificate of Completion referred to in GC44.2, pay the Contractor the amount referred to in TP1 less the aggregate of
- 4.7.1 the sum of all payments that were made pursuant to TP4.4;
 - 4.7.2 an amount that is equal to the Departmental Representative's estimate of the cost to Her Majesty or rectifying defects described in the Interim Certificate of Completion; and
 - 4.7.3 an amount that is equal to the Departmental Representative's estimate of the cost to Her Majesty of completing the parts of the work described in the Interim Certificate of Completion other than the defects referred to in TP4.7.2.
- 4.8 It is a condition precedent to Her Majesty's obligation under TP4.7 that the Contractor has made and delivered to the Departmental Representative,
- 4.8.1 a statutory declaration described in TP4.9 in respect of an Interim Certificate of Completion referred to in GC44.2, and
 - 4.8.2 if so specified in the relevant sections of the Specifications, and update of the construction schedule referred to in TP4.5.2 and the updated schedule shall, in addition to the specified requirements, clearly show a detailed timetable that is acceptable to the Departmental Representative for the completion of any unfinished work and the correction of all defects.
- 4.9 A statutory declaration referred to in TP4.8 shall contain a deposition by the contractor that up to the date of the Interim Certificate of Completion the Contractor has
- 4.9.1 complied with all of the Contractor's lawful obligations with respect to the Labour Conditions;
 - 4.9.2 discharged all of the Contractor's lawful obligations to the subcontractors and suppliers of material in respect of the work under the contract; and
 - 4.9.3 discharged the Contractor's lawful obligations referred to in GC14.6.
- 4.10 Subject to TP1 and TP4.11, Her Majesty shall, not later than 60 days after the date of issue of a Final Certificate of Completion referred to in GC44.1, pay the Contractor the amount referred to in TP1 less the aggregate of
- 4.10.1 the sum of all payments that were made pursuant to TP4.4; and
 - 4.10.2 the sum of all payments that were made pursuant to TP4.7.
- 4.11 It is a condition precedent to Her Majesty's obligation under TP4.10 that the Contractor has made and delivered a statutory declaration described in TP4.12 to the Departmental Representative.



- 4.12 A statutory declaration referred to in TP4.11 shall, in addition to the depositions described in TP4.9, contain a deposition by the Contractor that all of the Contractor's lawful obligations and any lawful claims against the Contractor that arose out of the performance of the contract have been discharged and satisfied.

TP5 Progress Report and Payment Thereunder Not Binding on Her Majesty

- 5.1 Neither a progress report referred to in TP4.3 nor any payment made by Her Majesty pursuant to these Terms of Payment shall be construed as an admission by Her Majesty that the work, material or any part thereof is complete, is satisfactory or is in accordance with the contract.

TP6 Delay in Making Payment

- 6.1 Notwithstanding GC7 any delay by Her Majesty in making any payment when it is due pursuant to these Terms of Payment shall not be a breach of the contract by Her Majesty.
- 6.2 Her Majesty shall pay, without demand from the Contractor, simple interest at the Bank Rate plus 1 -1/4 per centum on any amount which is overdue pursuant to TP4.1.3, and the interest shall apply from and include the day such amount became overdue until the day prior to the date of payment except that
- 6.2.1 interest shall not be payable or paid unless the amount referred to in TP6.2 has been overdue for more than 15 days following
- 6.2.1.1 the date the said amount became due and payable, or
- 6.2.1.2 the receipt by the Departmental Representative of the Statutory Declaration referred to in TP4.5, TP4.8 or TP4.11,
- whichever is the later, and
- 6.6.2 interest shall not be payable or paid on overdue advance payments if any.

TP7 Right of Set-off

- 7.1 Without limiting any right of set-off or deduction given or implied by law or elsewhere in the contract, Her Majesty may set off any amount payable to Her Majesty by the Contractor under this contract or under any current contract against any amount payable to the Contractor under this contract.
- 7.2 For the purposes of TP7.1, "current contract" means a contract between Her Majesty and the Contractor
- 7.2.1 under which the Contractor has an undischarged obligation to perform or supply work, labour or material, or
- 7.2.2 in respect of which Her Majesty has, since the date of which the Articles of Agreement were made, exercised any right to take the work that is the subject of the contract out of the Contractor's hands.



TP8 Payment in Event of Termination

- 8.1 If the contract is terminated pursuant to GC41, Her Majesty shall pay the Contractor any amount that is lawfully due and payable to the Contractor as soon as is practicable under the circumstances.

TP9 Interest on Settled Claims

- 9.1 Her Majesty shall pay to the Contractor simple interest on the amount of a settled claim at an average Bank Rate plus 1 ¼ per centum from the date the settled claim was outstanding until the day prior to the date of payment.
- 9.2 For the purposes of TP9.1,
- 9.2.1 a claim is deemed to have been settled when an agreement in writing is signed by the Departmental Representative and the Contractor setting out the amount of the claim to be paid by Her Majesty and the items or work for which the said amount is to be paid.
- 9.2.2 an "average Bank Rate" means the discount rate of interest set by the Bank of Canada in effect at the end of each calendar month averaged over the period the settled claim was outstanding.
- 9.2.3 a settled claim is deemed to be outstanding from the day immediately following the date the said claim would have been due and payable under the contract had it not been disputed.
- 9.3 For the purposes of TP9 a claim means a disputed amount subject to negotiation between Her Majesty and the Contractor under the contract.



Section	Page	Heading
GC1	1	Interpretation
GC2	2	Successors and Assigns
GC3	2	Assignment of Contract
GC4	2	Subcontracting by Contractor
GC5	2	Amendments
GC6	3	No Implied Obligations
GC7	3	Time of Essence
GC8	3	Indemnification by Contractor
GC9	3	Indemnification by Her Majesty
GC10	3	Members of House of Commons Not to Benefit
GC11	4	Notices
GC12	4	Material, Plant and Real Property Supplied by Her Majesty
GC13	5	Material, Plant and Real Property Become Property of Her Majesty
GC14	5	Permits and Taxes Payable
GC15	6	Performance of Work under Direction of Departmental Representative
GC16	6	Cooperation with Other Contractors
GC17	7	Examination of Work
GC18	7	Clearing of Site
GC19	7	Contractor's Superintendent
GC20	8	National Security
GC21	8	Unsuitable Workers
GC22	8	Increased or Decreased Costs
GC23	9	Canadian Labour and Material
GC24	9	Protection of Work and Documents
GC25	10	Public Ceremonies and Signs
GC26	10	Precautions against Damage, Infringement of Rights, Fire, and Other Hazards
GC27	11	Insurance
GC28	11	Insurance Proceeds
GC29	12	Contract Security
GC30	12	Changes in the Work
GC31	13	Interpretation of Contract by Departmental Representative
GC32	14	Warranty and Rectification of Defects in Work
GC33	14	Non-Compliance by Contractor
GC34	14	Protesting Departmental Representative's Decisions
GC35	15	Changes in Soil Conditions and Neglect or Delay by Her Majesty
GC36	16	Extension of Time
GC37	16	Assessments and Damages for Late Completion
GC38	17	Taking the Work Out of the Contractor's Hands
GC39	18	Effect of Taking the Work Out of the Contractor's Hands
GC40	18	Suspension of Work by Minister
GC41	19	Termination of Contract
GC42	19	Claims Against and Obligations of the Contractor or Subcontractor
GC43	21	Security Deposit – Forfeiture or Return
GC44	22	Departmental Representative's Certificates
GC45	23	Return of Security Deposit
GC46	24	Clarification of Terms in GC47 to GC50
GC47	24	Additions or Amendments to Unit Price Table
GC48	24	Determination of Cost – Unit Price Table
GC49	25	Determination of Cost – Negotiation
GC50	25	Determination of Cost – Failing Negotiation
GC51	26	Records to be kept by Contractor
GC52	27	Conflict of Interest
GC53	27	Contractor Status



GC1 Interpretation

1.1 In the contract

- 1.1.1 where reference is made to a part of the contract by means of numbers preceded by letters, the reference shall be construed to be a reference to the particular part of the contract that is identified by that combination of letters and numbers and to any other part of the contract referred to therein;
- 1.1.2 “contract” means the contract document referred to in the Articles of Agreement;
- 1.1.3 “contract security” means any security given by the Contractor to Her Majesty in accordance with the contract;
- 1.1.4 “Departmental Representative” means the officer or employee of Her Majesty who is designated pursuant to the Articles of Agreement and includes a person specially authorized by him to perform, on his behalf, any of his functions under the contract and is so designated in writing to the Contractor;
- 1.1.5 “material” includes all commodities, articles and things required to be furnished by or for the Contractor under the contract for incorporation into the work;
- 1.1.6 “Minister” includes a person acting for, or if the office is vacant, in place of the Minister and his successors in the office, and his or their lawful deputy and any of his or their representatives appointed for the purposes of the contract;
- 1.1.7 “person” includes, unless the context otherwise requires, a partnership, proprietorship, firm, joint venture, consortium and a corporation;
- 1.1.8 “plant” includes all animals, tools, implements, machinery, vehicles, buildings, structures, equipment and commodities, articles and things other than material, that are necessary for the due performance of the contract;
- 1.1.9 “subcontractor” means a person to whom the Contractor has, subject to GC4, subcontracted the whole or any part of the work;
- 1.1.10 “superintendent” means the employee of the Contractor who is designated by the Contractor to act pursuant to GC19;
- 1.1.11 “work includes, subject only to any express stipulation in the contract to the contrary, everything that is necessary to be done, furnished or delivered by the Contractor to perform the contract.

1.2 The headings in the contract documents, other than in the Plans and Specifications, form no part of the contract but are inserted for convenience of reference only.

1.3 In interpreting the contract, in the event of discrepancies or conflicts between anything in the Plans and Specifications and the General Conditions, the General Conditions govern.



- 1.4 In interpreting the Plans and Specifications, in the event of discrepancies or conflicts between
- 1.4.1 the Plans and Specifications, the Specifications govern;
 - 1.4.2 the Plans, the Plans drawn with the largest scale govern; and
 - 1.4.3 figured dimensions and scaled dimensions, the figured dimensions govern.

GC2 Successors and Assigns

- 2.1 The contract shall inure to the benefit of and be binding upon the parties hereto and their lawful heirs, executors, administrators, successors and assigns.

GC3 Assignment of Contract

- 3.1 The contract may not be assigned by the Contractor, either in whole or in part, without the written consent of the Minister.

GC4 Subcontracting by Contractor

- 4.1 Subject to this General Condition, the Contractor may subcontract any part of the work.
- 4.2 The Contractor shall notify the Departmental Representative in writing of his intention to subcontract.
- 4.3 A notification referred to in GC4.2 shall identify the part of the work, and the subcontractor with whom it is intended to subcontract.
- 4.4 The Departmental Representative may object to the intended subcontracting by notifying the Contractor in writing within six days of receipt by the Departmental Representative of a notification referred to in GC4.2.
- 4.5 If the Departmental Representative objects to a subcontracting pursuant to GC4.4, the Contractor shall not enter into the intended subcontract.
- 4.6 The contractor shall not, without the written consent of the Departmental Representative, change a subcontractor who has been engaged by him in accordance with this General Condition.
- 4.7 Every subcontract entered into by the Contractor shall adopt all of the terms and conditions of this contract that are of general application.
- 4.8 Neither a subcontracting nor the Departmental Representative's consent to a subcontracting by the Contractor shall be construed to relieve the Contractor from any obligation under the contract or to impose any liability upon Her Majesty.

GC5 Amendments



- 5.1 No amendment or change in any of the provisions of the contract shall have any force or effect until it is reduced to writing.

GC6 No Implied Obligations

- 6.1 No implied terms or obligations of any kind by or on behalf of Her Majesty shall arise from anything in the contract and the express covenants and agreements therein contained and made by Her Majesty are the only covenants and agreements upon which any rights against Her Majesty are to be founded.
- 6.2 The contract supersedes all communications, negotiations and agreements, either written or oral, relating to the work that were made prior to the date of the contract.

GC7 Time of Essence

- 7.1 Time is of the essence of the contract.

GC8 Indemnification by Contractor

- 8.1 The Contractor shall indemnify and save Her Majesty harmless from and against all claims, demand, losses, costs, damages, actions, suits, or proceedings by whomever made, brought or prosecuted and in any manner based upon, arising out of, related to, occasioned by or attributable to the activities of the Contractor, his servants, agents, subcontractors and sub-subcontractors in performing the work including an infringement or an alleged infringement of a patent of invention or any other kind of intellectual property.
- 8.2 For the purpose of GC8.1, "activities" includes any act improperly carried out, any omission to carry out an act and any delay in carrying out an act.

GC9 Indemnification by Her Majesty

- 9.1 Her Majesty shall, subject to the Crown Liability Act, the Patent Act, and any other law that affects Her Majesty's rights, powers, privileges or obligations, indemnify and save the Contractor harmless from and against all claims, demands, losses, costs, damage, actions, suits or proceedings arising out of his activities under the contract that are directly attributable to
- 9.1.1 lack of or a defect in Her Majesty's title to the work site whether real or alleged; or
- 9.1.2 an infringement or an alleged infringement by the Contractor of any patent of invention or any other kind of intellectual property occurring while the Contractor was performing any act for the purposes of the contract employing a model, plan or design or any other thing related to the work that was supplied by Her Majesty to the Contractor.

GC10 Members of House of Commons Not to Benefit



- 10.1 As required by the Parliament of Canada Act, it is an express condition of the contract that no member of the House of Commons shall be admitted to any share of part of the contract or to any benefit arising therefrom.

GC11 Notices

- 11.1 Any notice, consent, order, decision, direction or other communication, other than a notice referred to in GC11.4, that may be given to the Contractor pursuant to the contract may be given in any manner.
- 11.2 Any notice, consent, order, decision, direction or other communication required to be given in writing, to any party pursuant to the contract shall, subject to GC11.4, be deemed to have been effectively given
- 11.2.1 to the Contractor, if delivered personally to the Contractor or the Contractor's superintendent, or forwarded by mail, telex or facsimile to the Contractor at the address set out in A4.1, or
- 11.2.2 to Her Majesty, if delivered personally to the Departmental Representative, or forwarded by mail, telex or facsimile to the Departmental Representative at the address set out in A1.2.1.
- 11.3 Any such notice, consent, order, decision, direction or other communication given in accordance with GC11.2 shall be deemed to have been received by either party
- 11.3.1 if delivered personally, on the day that it was delivered,
- 11.3.2 if forwarded by mail, on the earlier of the day it was received and the sixth day after it was mailed, and
- 11.3.3 if forwarded by telex or facsimile, 24 hours after it was transmitted.
- 11.4 A notice given under GC38.1.1, GC40 and GC41, if delivered personally, shall be delivered to the Contractor if the Contractor is doing business as sole proprietor or, if the Contractor is a partnership or corporation, to an officer thereof.

GC12 Material, Plant and Real Property Supplied by Her Majesty

- 12.1 Subject to GC12.2, the Contractor is liable to Her Majesty for any loss of or damage to material, plant or real property that is supplied or placed in the care, custody and control of the Contractor by Her Majesty for use in connection with the contract, whether or not that loss or damage is attributable to causes beyond the Contractor's control.
- 12.2 The Contractor is not liable to Her Majesty for any loss or damage to material, plant or real property referred to in GC12.1 if that loss or damage results from and is directly attributable to reasonable wear and tear.
- 12.3 The Contractor shall not use any material, plant or real property referred to in GC12.1 except for



the purpose of performing this contract.

- 12.4 When the Contractor fails to make good any loss or damage for which he is liable under GC12.1 within a reasonable time after being required to do so by the Departmental Representative, the Departmental Representative may cause the loss or damage to be made good at the Contractor's expense, and the Contractor shall thereupon be liable to Her Majesty for the cost thereof and shall, on demand, pay to Her Majesty an amount equal to that cost.
- 12.5 The Contractor shall keep such records of all material, plant and real property referred to in GC12.1 as the Departmental Representative from time to time requires and shall satisfy the Departmental Representative, when requested, that such material, plant and real property are at the place and in the condition which they ought to be.

GC13 Material, Plant and Real Property Become Property of Her Majesty

- 13.1 Subject to GC14.7 all material and plant and the interest of the Contractor in all real property, licenses, powers and privileges purchased, used or consumed by the Contractor for the contract shall, after the time of their purchase, use or consumption be the property of Her Majesty for the purposes of the work and they shall continue to be the property of Her Majesty.
- 13.1.1 in the case of material, until the Departmental Representative indicates that he is satisfied that it will not be required for the work, and
- 13.1.2 in the case of plant, real property, licenses, powers and privileges, until the Departmental Representative indicates that he is satisfied that the interest vested in Her Majesty therein is no longer required for the purposes of the work.
- 13.2 Material or plant that is the property of Her Majesty by virtue of GC13.1 shall not be taken away from the work site or used or disposed of except for the purposes of the work without the written consent of the Departmental Representative.
- 13.3 Her Majesty is not liable for loss of or damage from any cause to the material or plant referred to in GC13.1 and the Contractor is liable for such loss or damage notwithstanding that the material or plant is the property of Her Majesty.

GC14 Permits and Taxes Payable

- 14.1 The Contractor shall, within 30 days after the date of the contract, tender to a municipal authority an amount equal to all fees and charges that would be lawfully payable to that municipal authority in respect of building permits as if the work were being performed for a person other than Her Majesty.
- 14.2 Within 10 days of making a tender pursuant to GC14.1, the Contractor shall notify the Departmental Representative of his action and of the amount tendered and whether or not the municipal authority has accepted that amount.
- 14.3 If the municipal authority does not accept the amount tendered pursuant to GC14.1 the Contractor shall pay that amount to Her Majesty within 6 days after the time stipulated in GC14.2.



- 14.4 For the purposes of GC14.1 to GC14.3 “municipal authority” means any authority that would have jurisdiction respecting permission to perform the work if the owner were not Her Majesty.
- 14.5 Notwithstanding the residency of the Contractor, the Contractor shall pay any applicable tax arising from or related to the performance of the work under the contract.
- 14.6 In accordance with the Statutory Declaration referred to in TP4.9, a Contractor who has neither residence nor place of business in the province in which work under the contract is being performed shall provide Her Majesty with proof of registration with the provincial sales tax authorities in the said province.
- 14.7 For the purpose of the payment of any applicable tax or the furnishing of security for the payment of any applicable tax arising from or related to the performance of the work under the contract, the Contractor shall, notwithstanding the fact that all material, plant and interest of the Contractor in all real property, licenses, powers and privileges, have become the property of Her Majesty after the time of purchase, be liable, as a user or consumer, for the payment or for the furnishing of security for the payment of any applicable tax payable, at the time of the use or consumption of that material, plant or interest of the Contractor in accordance with the relevant legislation.

GC15 Performance of Work under Direction of Departmental Representative

- 15.1 The Contractor shall
- 15.1.1 permit the Departmental Representative to have access to the work and its site at all times during the performance of the contract;
 - 15.1.2 furnish the Departmental Representative with such information respecting the performance of the contract as he may require; and
 - 15.1.3 give the Departmental Representative every possible assistance to enable the Departmental Representative to carry out his duty to see that the work is performed in accordance with the contract and to carry out any other duties and exercise any powers specially imposed or conferred on the Departmental Representative under the contract.

CG16 Cooperation with Other Contractors

- 16.1 Where, in the opinion of the Departmental Representative, it is necessary that other contractors or workers with or without plant and material, be sent onto the work or its site, the Contractor shall, to the satisfaction of the Departmental Representative, allow them access and cooperate with them in the carrying out of their duties and obligation.
- 16.2 If
- 16.2.1 the sending onto the work or its site of other contractors or workers pursuant to GC16.1 could not have been reasonably foreseen or anticipated by the Contractor when entering into the contract, and



16.2.2 the Contractor incurs, in the opinion of the Departmental Representative, extra expense in complying with GC16.1, and

16.2.3 The Contractor has given the Departmental Representative written notice of his claim for the extra expense referred to in GC16.2.2 within 30 days of the date that the other contractors or workers were sent onto the work or its site,

Her Majesty shall pay the Contractor the cost, calculated in accordance with GC48 to GC50, of the extra labour, plant and material that was necessarily incurred.

GC17 Examination of Work

17.1 If, at any time after the commencement of the work but prior to the expiry of the warranty or guarantee period, the Departmental Representative has reason to believe that the work or any part thereof has not been performed in accordance with the contract, the Departmental Representative may have that work examined by an expert of his choice.

17.2 If, as a result of an examination of the work referred to in GC17.1, it is established that the work was not performed in accordance with the contract, then, in addition to and without limiting or otherwise affecting any of Her Majesty's rights and remedies under the contract either at law or in equity, the Contractor shall pay Her Majesty, on demand, all reasonable costs and expenses that were incurred by Her Majesty in having that examination performed.

GC18 Clearing of Site

18.1 The Contractor shall maintain the work and its site in a tidy condition and free from the accumulation of waste material and debris, in accordance with any directions of the Departmental Representative.

18.2 Before the issue of an interim certificate referred to in GC44.2, the Contractor shall remove all the plant and material not required for the performance of the remaining work, and all waste material and other debris, and shall cause the work and its site to be clean and suitable for occupancy by Her Majesty's servants, unless otherwise stipulated in the contract.

18.3 Before the issue of a final certificate referred to in GC44.1, the Contractor, shall remove from the work and its site all of the surplus plant and material and any waste material and other debris.

18.4 The Contractor's obligations described in GC18.1 to GC18.3 do not extend to waste material and other debris caused by Her Majesty's servants or contractors and workers referred to in GC16.1.

GC19 Contractor's Superintendent

19.1 The Contractor shall, forthwith upon the award of the contract, designate a superintendent.

19.2 The Contractor shall forthwith notify the Departmental Representative of the name, address and telephone number of a superintendent designate pursuant to GC19.1.



- 19.3 A superintendent designated pursuant to GC19.1 shall be in full charge of the operations of the Contractor in the performance of the work and is authorized to accept any notice, consent, order, direction, decision or other communication on behalf of the Contractor that may be given to the superintendent under the contract.
- 19.4 The Contractor shall, until the work has been completed, keep a competent superintendent at the work site during working hours.
- 19.5 The Contractor shall, upon the request of the Departmental Representative, remove any superintendent who, in the opinion of the Departmental Representative, is incompetent or has been conducting himself improperly and shall forthwith designate another superintendent who is acceptable to the Departmental Representative.
- 19.6 Subject to GC19.5, the Contractor shall not substitute a superintendent without the written consent of the Departmental Representative.
- 19.7 A breach by the Contractor of GC19.6 entitles the Departmental Representative to refuse to issue any certificate referred to in GC44 until the superintendent has returned to the work site or another superintendent who is acceptable to the Departmental Representative has been substituted.

GC20 National Security

- 20.1 If the Minister is of the opinion that the work is of a class or kind that involves the national security, he may order the Contractor
- 20.1.1 to provide him with any information concerning persons employed or to be employed by him for purposes of the contract; and
 - 20.1.2 to remove any person from the work and its site if, in the opinion of the Minister, that person may be a risk to the national security.
- 20.2 The Contractor shall, in all contracts with persons who are to be employed in the performance of the contract, make provision for his performance of any obligation that may be imposed upon him under GC19 to GC21.
- 20.3 The Contractor shall comply with an order of the Minister under GC20.1

GC21 Unsuitable Workers

- 21.1 The Contractor shall, upon the request of the Departmental Representative, remove any person employed by him for purposes of the contract who, in the opinion of the Departmental Representative, is incompetent or has conducted himself improperly, and the Contractor shall not permit a person who has been removed to return to the work site.

GC22 Increased or Decreased Costs



- 22.1 The amount set out in the Articles of Agreement shall not be increased or decreased by reason of any increase or decrease in the cost of the work that is brought about by an increase or decrease in the cost of labour, plant or material or any wage adjustment arising pursuant to the Labour Conditions.
- 22.2 Notwithstanding GC22.1 and GC35, an amount set out in the Articles of Agreement shall be adjusted in the manner provided in GC22.3, if any change in a tax imposed under the Excise Act, the Excise Tax Act, the Old Age Security Act, the Customs Act, the Customs Tariff or any provincial sales tax legislation imposing a retail sales tax on the purchase of tangible personal property incorporated into Real Property
- 22.2.1 occurs after the date of the submission by the Contractor of his tender for the contract,
- 22.2.2 applies to material, and
- 22.2.3 affects the cost to the Contractor of that material.
- 22.3 If a change referred to in GC22.2 occurs, the appropriate amount set out in the Articles of Agreement shall be increased or decreased by an amount equal to the amount that is established by an examination of the relevant records of the Contractor referred to in GC51 to be the increase or decrease in the cost incurred that is directly attributable to that change.
- 22.4 For the purpose of GC22.2, where a tax is changed after the date of submission of the tender but public notice of the change has been given by the Minister of Finance before that date, the change shall be deemed to have occurred before the date of submission of the tender.

GC23 Canadian Labour and Material

- 23.1 The Contractor shall use Canadian labour and material in the performance of the work to the full extent to which they are procurable, consistent with proper economy and expeditious carrying out of the work.
- 23.2 Subject to GC23.1, the Contractor shall, in the performance of the work, employ labour from the locality where the work is being performed to the extent to which it is available, and shall use the offices of the Canada Employment Centres for the recruitment of workers wherever practicable.
- 23.3 Subject to GC23.1 and GC23.2, the Contractor shall, in the performance of the work, employ a reasonable proportion of persons who have been on active service with the armed forces of Canada and have been honourably discharged therefrom.

GC24 Protection of Work and Documents

- 24.1 The Contractor shall guard or otherwise protect the work and its site, and protect the contract, specifications, plans, drawings, information, material, plant and real property, whether or not they are supplied by Her Majesty to the Contractor, against loss or damage from any cause, and he shall not use, issue, disclose or dispose of them without the written consent of the Minister, except as may be essential for the performance of the work.



- 24.2 If any document or information given or disclosed to the Contractor is assigned a security rating by the person who gave or disclosed it, the Contractor shall take all measures directed by the Departmental Representative to be taken to ensure the maintenance of the degree of security that is ascribed to that rating.
- 24.3 The Contractor shall provide all facilities necessary for the purpose of maintaining security, and shall assist any person authorized by the Minister to inspect or to take security measures in respect of the work and its site.
- 24.4 The Departmental Representative may direct the Contractor to do such things and to perform such additional work as the Departmental Representative considers reasonable and necessary to ensure compliance with or to remedy a breach of GC24.1 to GC24.3.

GC25 Public Ceremonies and Signs

- 25.1 The Contractor shall not permit any public ceremony in connection with the work without the prior consent of the Minister.
- 25.2 The Contractor shall not erect or permit the erection of any sign or advertising on the work or its site without the prior consent of the Departmental Representative.

GC26 Precautions against Damage, Infringement of Rights, Fire, and Other Hazards

- 26.1 The Contractor shall, at his own expense, do whatever is necessary to ensure that
- 26.1.1 no person, property, right, easement or privilege is injured, damaged or infringed by reasons of the Contractor's activities in performing the contract;
 - 26.1.2 pedestrian and other traffic on any public or private road or waterway is not unduly impeded, interrupted or endangered by the performance or existence of the work or plant;
 - 26.1.3 fire hazards in or about the work or its site are eliminated and, subject to any direction that may be given by the Departmental Representative, any fire is promptly extinguished;
 - 26.1.4 the health and safety of all persons employed in the performance of the work is not endangered by the method or means of its performance;
 - 26.1.5 adequate medical services are available to all persons employed on the work or its site at all times during the performance of the work;
 - 26.1.6 adequate sanitation measures are taken in respect of the work and its site; and
 - 26.1.7 all stakes, buoys and marks placed on the work or its site by or under the authority of the Departmental Representative are protected and are not removed, defaced, altered or destroyed.
- 26.2 The Departmental Representative may direct the Contractor to do such things and to perform such additional work as the Departmental Representative considers reasonable and necessary to ensure



compliance with or to remedy a breach of GC26.1.

- 26.3 The Contractor shall, at his own expense, comply with a direction of the Departmental Representative made under GC26.2.

GC27 Insurance

- 27.1 The Contractor shall, at his own expense, obtain and maintain insurance contracts in respect of the work and shall provide evidence thereof to the Departmental Representative in accordance with the requirements of the Insurance Conditions "E".

- 27.2 The insurance contracts referred to in GC27.1 shall

27.2.1 be in a form, of the nature, in the amounts, for the periods and containing the terms and conditions specified in Insurance Conditions "E", and

27.2.2 provide for the payment of claims under such insurance contracts in accordance with GC28.

GC28 Insurance Proceeds

- 28.1 In the case of a claim payable under a Builders Risk/Installation (All Risks) insurance contract maintained by the Contractor pursuant to GC27, the proceeds of the claim shall be paid directly to Her Majesty, and

28.1.1 the monies so paid shall be held by Her Majesty for the purposes of the contract, or

28.1.2 if Her Majesty elects, shall be retained by Her Majesty, in which event they vest in Her Majesty absolutely.

- 28.2 In the case of a claim payable under a General Liability insurance contract maintained by the Contractor pursuant to GC27, the proceeds of the claim shall be paid by the insurer directly to the claimant.

- 28.3 If an election is made pursuant to GC28.1, the Minister may cause an audit to be made of the accounts of the Contractor and of Her Majesty in respect of the part of the work that was lost, damaged or destroyed for the purpose of establishing the difference, if any, between

28.3.1 the aggregate of the amount of the loss or damage suffered or sustained by Her Majesty, including any cost incurred in respect of the clearing and cleaning of the work and its site and any other amount that is payable by the Contractor to Her Majesty under the contract, minus any monies retained pursuant to GC28.12, and

28.3.2 the aggregate of the amounts payable by Her Majesty to the Contractor pursuant to the contract up to the date of the loss or damage.

- 28.4 A difference that is established pursuant to GC28.3 shall be paid forthwith by the party who is determined by the audit to be the debtor to the party who is determined by the audit to be the



creditor.

- 28.5 When payment of a deficiency has been made pursuant to GC28.4, all rights and obligations of Her Majesty and the Contractor under the contract shall, with respect only to the part of the work that was the subject of the audit referred to in GC28.3, be deemed to have been expended and discharged.
- 28.6 If an election is not made pursuant to GC28.1.2 the Contractor shall, subject to GC28.7, clear and clean the work and its site and restore and replace the part of the work that was lost, damaged or destroyed at his own expense as if that part of the work had not yet been performed.
- 28.7 When the Contractor clears and cleans the work and its site and restores and replaces the work referred to in GC 28.6, Her Majesty shall pay him out of the monies referred to in GC28.1 so far as they will thereunto extend.
- 28.8 Subject to GC28.7, payment by Her Majesty pursuant to GC28.7 shall be made in accordance with the contract but the amount of each payment shall be 100% of the amount claimed notwithstanding TP4.4.1 and TP4.4.2.

GC29 Contract Security

- 29.1 The Contractor shall obtain and deliver contract security to the Departmental Representative in accordance with the provisions of the Contract Security Conditions.
- 29.2 If the whole or a part of the contract security referred to in GC29.1 is in the form of a security deposit, it shall be held and disposed of in accordance with GC43 and GC45.
- 29.3 If a part of the contract security referred to in GC29.1 is in the form of a labour and material payment bond, the Contractor shall post a copy of that bond on the work site.

GC30 Changes in the Work

- 30.1 Subject to GC5, the Departmental Representative may, at any time before he issues his Final Certificate of Completion,
- 30.1.1 order work or material in addition to that provided for in the Plans and Specifications;
and
- 30.1.2 delete or change the dimensions, character, quantity, quality, description, location or position of the whole or any part of the work or material provided for in the Plans and Specifications or in any order made pursuant to GC30.1.1,
- if that additional work or material, deletion, or change is, in his opinion, consistent with the general intent of the original contract.
- 30.2 The Contractor shall perform the work in accordance with such orders, deletions and changes that are made by the Departmental Representative pursuant to GC30.1 from time to time as if they had appeared in and been part of the Plans and Specifications.



- 30.3 The Departmental Representative shall determine whether or not anything done or omitted by the Contractor pursuant to an order, deletion or change referred to in GC30.1 increased or decreased the cost of the work to the Contractor.
- 30.4 If the Departmental Representative determines pursuant to GC30.3 that the cost of the work to the Contractor has been increased, Her Majesty shall pay the Contractor the increased cost that the Contractor necessarily incurred for the additional work calculated in accordance with GC49 or GC50.
- 30.5 If the Departmental Representative determines pursuant to GC30.3 that the cost of the work to the Contractor has been decreased, Her Majesty shall reduce the amount payable to the Contractor under the contract by an amount equal to the decrease in the cost caused by the deletion or change referred to in GC30.1.2 and calculated in accordance with GC49.
- 30.6 GC30.3 to GC30.5 are applicable only to a contract or a portion of a contract for which a Fixed Price Arrangement is stipulated in the contract.
- 30.7 An order, deletion or change referred to in GC30.1 shall be in writing, signed by the Departmental Representative and given to the Contractor in accordance with GC11.

GC31 Interpretation of Contract by Departmental Representative

- 31.1 If, at any time before the Departmental Representative has issued a Final Certificate of Completion referred to in GC44.1, any question arises between the parties about whether anything has been done as required by the contract or about what the Contractor is required by the contract to do, and, in particular but without limiting the generality of the foregoing, about
- 31.1.1 the meaning of anything in the Plans and Specification,
 - 31.1.2 the meaning to be given to the Plans and Specifications in case of any error therein, omission therefrom, or obscurity or discrepancy in their working or intention,
 - 31.1.3 whether or not the quality or quantity of any material or workmanship supplied or proposed to be supplied by the Contractor meets the requirements of the contract,
 - 31.1.4 whether or not the labour, plant or material provided by the Contractor for performing the work and carrying out the contract are adequate to ensure that the work will be performed in accordance with the contract and that the contract will be carried out in accordance with its terms,
 - 31.1.5 what quantity of any kind of work has been completed by the Contractor, or
 - 31.1.6 the timing and scheduling of the various phases of the performance of the work,
- the question shall be decided by the Departmental Representative whose decision shall be final and conclusive in respect of the work.
- 31.2 The Contractor shall perform the work in accordance with any decisions of the Departmental



Representative that are made under GC31.1 and in accordance with any consequential directions given by the Departmental Representative.

GC32 Warranty and Rectification of Defects in Work

- 32.1 Without restricting any warranty or guarantee implied or imposed by law or contained in the contract documents, the Contractor shall, at his own expense,
- 32.1.1 rectify and make good any defect or fault that appears in the work or comes to the attention of the Minister with respect to those parts of the work accepted in connection with the Interim Certificate of Completion referred to GC44.2 within 12 months from the date of the Interim Certificate of Completion;
- 32.1.2 rectify and make good any defect or fault that appears in or comes to the attention of the Minister in connection with those parts of the work described in the Interim Certificate of Completion referred to in GC44.2 within 12 months from the date of the Final Certificate of Completion referred to in GC44.1.
- 32.2 The Departmental Representative may direct the Contractor to rectify and make good any defect or fault referred to in GC32.1 or covered by any other expressed or implied warranty or guarantee.
- 32.3 A direction referred to in GC32.2 shall be in writing, may include a stipulation in respect of the time within which a defect or fault is required to be rectified and made good by the Contractor, and shall be given to the Contractor in accordance with GC11.
- 32.4 The Contractor shall rectify and make good any defect or fault described in a direction given pursuant to GC32.2 within the time stipulated therein.

GC33 Non-Compliance by Contractor

- 33.1 If the Contractor fails to comply with any decision or direction given by the Departmental Representative pursuant to GC18, GC24, GC26, GC31 or GC32, the Departmental Representative may employ such methods as he deems advisable to do that which the Contractor failed to do.
- 33.2 The Contractor shall, on demand, pay Her Majesty an amount that is equal to the aggregate of all cost, expenses and damage incurred or sustained by Her Majesty by reason of the Contractor's failure to comply with any decision or direction referred to in GC33.1, including the cost of any methods employed by the Departmental Representative pursuant to GC33.1.

GC34 Protesting Departmental Representative's Decisions

- 34.1 The Contractor may, within ten days after the communication to him of any decision or direction referred to in GC30.3 or GC33.1, protest that decision or direction.
- 34.2 A protest referred to in GC34.1 shall be in writing, contain full reasons for the protest, be signed



by the Contractor and be given to Her Majesty by delivery to the Departmental Representative.

- 34.3 If the Contractor gives a protest pursuant to GC34.2, any compliance by the Contractor with the decision or direction that was protested shall not be construed as an admission by the Contractor of the correctness of that decision or direction, or prevent the Contractor from taking whatever action he considers appropriate in the circumstances.
- 34.4 The giving of a protest by the Contractor pursuant to GC34.2 shall not relieve him from complying with the decision or direction that is the subject of the protest.
- 34.5 Subject to GC34.6, the Contractor shall take any action referred to in GC34.3 within three months after the date that a Final Certificate of Completion is issued under GC44.1 and not afterwards.
- 34.6 The Contractor shall take any action referred to in GC34.3 resulting from a direction under GC32 within three months after the expiry of a warranty or guarantee period and not afterwards.
- 34.7 Subject to GC34.8, if Her Majesty determines that the Contractor's protest is justified, Her Majesty shall pay the Contractor the cost of the additional labour, plant and material necessarily incurred by the Contractor in carrying out the protested decision or direction.
- 34.8 Costs referred to in GC34.7 shall be calculated in accordance with GC48 to GC50.

GC35 Changes in Soil Conditions and Neglect or Delay by Her Majesty

- 35.1 Subject to GC35.2 no payment, other than a payment that is expressly stipulated in the contract, shall be made by Her Majesty to the Contractor for any extra expense or any loss or damage incurred or sustained by the Contractor.
- 35.2 If the Contractor incurs or sustains any extra expense or any loss or damage that is directly attributable to
- 35.2.1 a substantial difference between the information relating to soil conditions at the work site that is contained in the Plans and Specifications or other documents supplied to the Contractor for his use in preparing his tender or a reasonable assumption of fact based thereon made by the Contractor, and the actual soil conditions encountered by the Contractor at the work site during the performance of the contract, or
- 35.2.2 any neglect or delay that occurs after the date of the contract on the part of Her Majesty in providing any information or in doing any act that the contract either expressly requires Her Majesty to do or that would ordinarily be done by an owner in accordance with the usage of the trade,

he shall, within ten days of the date the actual soil conditions described in GC35.2.1 were encountered or the neglect or delay described in GC35.2.2 occurred, give the Departmental Representative written notice of his intention to claim for that extra expense or that loss or damage.

- 35.3 When the Contractor has given a notice referred to in GC35.2, he shall give the Departmental Representative a written claim for extra expense or loss or damage within 30 days of the date that



a Final Certificate of Completion referred to in GC44.1 is issued and not afterwards.

- 35.4 A written claim referred to in GC35.3 shall contain a sufficient description of the facts and circumstances of the occurrence that is the subject of the claim to enable the Departmental Representative to determine whether or not the claim is justified and the Contractor shall supply such further and other information for that purpose as the Departmental Representative requires from time to time.
- 35.5 If the Departmental Representative determines that a claim referred to in GC35.3 is justified, Her Majesty shall make an extra payment to the Contractor in an amount that is calculated in accordance with GC47 to GC50.
- 35.6 If, in the opinion of the Departmental Representative, an occurrence described in GC35.2.1 results in a savings of expenditure by the Contractor in performing the contract, the amount set out in the Articles of Agreement shall, subject to GC35.7, be reduced by an amount that is equal to the saving.
- 35.7 The amount of the saving referred to in GC35.6 shall be determined in accordance with GC47 to GC49.
- 35.8 If the Contractor fails to give a notice referred to in GC35.2 and a claim referred to in GC35.3 within the times stipulated, an extra payment shall not be made to him in respect of the occurrence.

GC36 Extension of Time

- 36.1 Subject to GC36.2, the Departmental Representative may, on the application of the Contractor made before the day fixed by the Articles of Agreement for completion of the work or before any other date previously fixed under this General Condition, extend the time for its completion by fixing a new date if, in the opinion of the Departmental Representative, causes beyond the control of the Contractor have delayed its completion.
- 36.2 An application referred to in GC36.1 shall be accompanied by the written consent of the bonding company whose bond forms part of the contract security.

GC37 Assessments and Damages for Late Completion

- 37.1 For the purposes of this General Condition
- 37.1.1 the work shall be deemed to be completed on the date that an Interim Certificate of Completion referred to in GC44.2 is issued, and
- 37.1.2 "period of delay" means the number of days commencing on the day fixed by the Articles of Agreement for completion of the work and ending on the day immediately preceding the day on which the work is completed but does not include any day within a period of extension granted pursuant to GC36.1, and any other day on which, in the opinion of the Departmental Representative, completion of the work was delayed for reasons beyond the control of the Contractor.



- 37.2 If the Contractor does not complete the work by the day fixed for its completion by the Articles of Agreement but completes it thereafter, the Contractor shall pay Her Majesty an amount equal to the aggregate of
- 37.2.1 all salaries, wages and travelling expenses incurred by Her Majesty in respect of persons overseeing the performance of the work during the period of delay;
 - 37.2.2 the cost incurred by Her Majesty as a result of the inability to use the completed work for the period of delay; and
 - 37.2.3 all other expenses and damages incurred or sustained by Her Majesty during the period of delay as a result of the work not being completed by the day fixed for its completion.
- 37.3 The Minister may waive the right of Her Majesty to the whole or any part of the amount payable by the Contractor pursuant to GC37.2 I, in the opinion of the Minister, it is in the public interest to do so.

GC38 Taking the Work Out of the Contractor's Hands

- 38.1 The Minister may, at his sole discretion, by giving a notice in writing to the Contractor in accordance with GC11, take all or any part of the work out of the Contractor's hands, and may employ such means as he sees fit to have the work completed if the Contractor
- 38.1.1 Has not, within six days of the Minister or the Departmental Representative giving notice to the Contractor in writing in accordance with GC11, remedied any delay in the commencement or any default in the diligent performance of the work to the satisfaction of the Departmental Representative;
 - 38.1.2 has defaulted in the completion of any part of the work within the time fixed for its completion by the contract;
 - 38.1.3 has become insolvent;
 - 38.1.4 has committed an act of bankruptcy;
 - 38.1.5 has abandoned the work;
 - 38.1.6 has made an assignment of the contract without the consent required by GC3.1; or
 - 38.1.7 has otherwise failed to observe or perform any of the provisions of the contract.
- 38.2 If the whole or any part of the work is taken out of the Contractor's hands pursuant to GC38.1,
- 38.2.1 the Contractor's right to any further payment that is due or accruing due under the contract is, subject only to GC38.4, extinguished, and
 - 38.2.2 the Contractor is liable to pay Her Majesty, upon demand, an amount that is equal to the amount of all loss and damage incurred or sustained by Her Majesty in respect of the



Contractor's failure to complete the work.

- 38.3 If the whole or any part of the work that is taken out of the Contractor's hands pursuant to GC38.1 is completed by Her Majesty, the Departmental Representative shall determine the amount, if any, of the holdback or a progress claim that had accrued and was due prior to the date on which the work was taken out of the Contractor's hands and that is not required for the purposes of having the work performed or of compensating Her Majesty for any other loss or damage incurred or sustained by reason of the Contractor's default.
- 38.4 Her Majesty may pay the Contractor the amount determined not to be required pursuant to GC38.3.

GC39 Effect of Taking the Work Out of the Contractor's Hands

- 39.1 The taking of the work or any part thereof out of the Contractor's hands pursuant to GC38 does not operate so as to relieve or discharge him from any obligation under the contract or imposed upon him by law except the obligation to complete the performance of that part of the work that was taken out of his hands.
- 39.2 If the work or any part thereof is taken out of the Contractor's hands pursuant to GC38, all plant and material and the interest of the Contractor is all real property, licenses, powers and privileges acquired, used or provided by the Contractor under the contract shall continue to be the property of Her Majesty without compensation to the Contractor.
- 39.3 When the Departmental Representative certifies that any plant, material, or any interest of the Contractor referred to in GC39.2 is no longer required for the purposes of the work, or that it is not in the interest of Her Majesty to retain that plant, material or interest, it shall revert to the Contractor.

G40 Suspension of Work by Minister

- 40.1 The Minister may, when in his opinion it is in the public interest to do so, require the Contractor to suspend performance of the work either for a specified or an unspecified period by giving a notice of suspension in writing to the Contractor in accordance with GC11.
- 40.2 When a notice referred to in GC40.1 is received by the Contractor in accordance with GC11, he shall suspend all operations in respect of the work except those that, in the opinion of the Departmental Representative, are necessary for the care and preservation of the work, plant and material.
- 40.3 The Contractor shall not, during a period of suspension, remove any part of the work, plant or material from its site without the consent of the Departmental Representative.
- 40.4 If a period of suspension is 30 days or less, the Contractor shall, upon the expiration of that period, resume the performance of the work and he is entitled to be paid the extra cost, calculated in accordance with GC48 to GC50, of any labour, plant and material necessarily incurred by him as a result of the suspension.



- 40.5 If, upon the expiration of a period of suspension of more than 30 days, the Minister and the Contractor agree that the performance of the work will be continued by the Contractor, the Contractor shall resume performance of the work subject to any terms and conditions agreed upon by the Minister and the Contractor.
- 40.6 If, upon the expiration of a period of suspension of more than 30 days, the Minister and the Contractor do not agree that performance of the work will be continued by the Contractor or upon the terms and conditions under which the Contractor will continue the work, the notice of suspension shall be deemed to be a notice of termination pursuant to GC41.

GC41 Termination of Contract

- 41.1 The Minister may terminate the contract at any time by giving a notice of termination in writing to the Contractor in accordance with GC11.
- 41.2 When a notice referred to in GC41.1 is received by the Contractor in accordance with GC11, he shall, subject to any conditions stipulated in the notice, forthwith cease all operations in performance of the contract.
- 41.3 If the contract is terminated pursuant to GC41.1, Her Majesty shall pay the Contractor, subject to GC41.4, an amount equal to
- 41.3.1 the cost to the contractor of all labour, plant and material supplied by him under the contract up to the date of termination in respect of a contract or part thereof for which a Unit Price Arrangement is stipulated in the contract, or
 - 41.3.2 the lesser of
 - 41.3.2.1 an amount, calculated in accordance with the Terms and Payment, that would have been payable to the Contractor had he completed the work, and
 - 41.3.2.2 an amount that is determined to be due to the Contractor pursuant to GC49 in respect of a contract or part thereof for which a Fixed Price Arrangement is stipulated in the contract
- less the aggregate of all amounts that were paid to the Contractor by Her Majesty and all amounts that are due to Her Majesty from the Contractor pursuant to the contract.
- 41.4 If Her Majesty and the Contractor are unable to agree about an amount referred to in GC41.3 that amount shall be determined by the method referred to in GC50.

GC42 Claims Against and Obligations of the Contractor or Subcontractor

- 42.1 Her Majesty may, in order to discharge lawful obligations of and satisfy claims against the Contractor or a subcontractor arising out of the performance of the contract, pay any amount that is due and payable to the Contractor pursuant to the contract directly to the obligees of and the claimants against the Contractor or the subcontractor but such amount if any, as is paid by Her Majesty, shall not exceed that amount which the Contractor would have been obliged to pay to



such claimant had the provisions of the Provincial or Territorial lien legislation, or, in the Province of Quebec, the law relating to privileges, been applicable to the work. Any such claimant need not comply with the provisions of such legislation setting out the steps by way of notice, registration or otherwise as might have been necessary to preserve or perfect any claim for lien or privilege which claimant might have had;

- 42.2 Her Majesty will not make any payment as described in GC42.1 unless and until that claimant shall have delivered to Her Majesty:
- 42.2.1 a binding and enforceable Judgment or Order of a court of competent jurisdiction setting forth such amount as would have been payable by the Contractor to the claimant pursuant to the provisions of the applicable Provincial or Territorial lien legislation, or, in the Province of Quebec, the law relating to privileges, had such legislation been applicable to the work; or
 - 42.2.2 a final and enforceable award of an arbitrator setting forth such amount as would have been payable by the Contractor to the claimant pursuant to the provisions of the applicable Provincial or Territorial lien legislation, or, in the Province of Quebec, the law relating to privileges, had such legislation been applicable to the work; or
 - 42.2.3 the consent of the Contractor authorizing a payment.
- For the purposes of determining the entitlement of a claimant pursuant to GC42.2.1 and GC42.2.2, the notice required by GC42.8 shall be deemed to replace the registration or provision of notice after the performance of work as required by any applicable legislation and no claim shall be deemed to have expired, become void or unenforceable by reason of the claimant not commencing any action within the time prescribed by any applicable legislation.
- 42.3 The Contractor shall, by the execution of his contract, be deemed to have consented to submit to binding arbitration at the request of any claimant those questions that need be answered to establish the entitlement of the claimant to payment pursuant to the provisions of GC42.1 and such arbitration shall have as parties to it any subcontractor to whom the claimant supplied material, performed work or rented equipment should such subcontractor wish to be adjoined and the Crown shall not be a party to such arbitration and, subject to any agreement between the Contractor and the claimant to the contrary, the arbitration shall be conducted in accordance with the Provincial or Territorial legislation governing arbitration applicable in the Province or Territory in which the work is located.
- 42.4 A payment made pursuant to GC42.1 is, to the extent of the payment, a discharge of Her Majesty's liability to the Contractor under the contract and may be deducted from any amount payable to the Contractor under the contract.
- 42.5 To the extent that the circumstances of the work being performed for Her Majesty permit, the Contractor shall comply with all laws in force in the Province or Territory where the work is being performed relating to payment period, mandatory holdbacks, and creation and enforcement of mechanics' liens, builders' liens or similar legislation or in the Province of Quebec, the law relating to privileges.
- 42.6 The Contractor shall discharge all his lawful obligations and shall satisfy all lawful claims against him arising out of the performance of the work at least as often as the contract requires Her



Majesty to pay the Contractor.

- 42.7 The Contractor shall, whenever requested to do so by the Departmental Representative, make a statutory declaration deposing to the existence and condition of any obligations and claims referred to in GC42.6.
- 42.8 GC42.1 shall only apply to claims and obligations
- 42.8.1 the notification of which has been received by the Departmental Representative in writing before payment is made to the Contractor pursuant to TP4.10 and within 120 days of the date on which the claimant
- 42.8.1.1 should have been paid in full under the claimant's contract with the Contractor or subcontractor where the claim is for money that was lawfully required to be held back from the claimant; or
- 42.8.1.2 performed the last of the services, work or labour, or furnished the last of the material pursuant to the claimant's contract with the Contractor or subcontractor where the claim is not for money referred to in GC42.8.1.1, and
- 42.8.2 the proceedings to determine the right to payment of which, pursuant to GC42.2. shall have commenced within one year from the date that the notice referred to in GC42.8.1 was received by the Departmental Representative, and
- the notification required by GC42.8.1 shall set forth the amount claimed to be owing and the person who by contract is primarily liable.
- 42.9 Her Majesty may, upon receipt of a notice of claim under GC42.8.1, withhold from any amount that is due and payable to the Contractor pursuant to the contract the full amount of the claim or any portion thereof.
- 42.10 The Departmental Representative shall notify the Contractor in writing of receipt of any claim referred to in GC42.8.1 and of the intention of Her Majesty to withhold funds pursuant to GC42.9 and the Contractor may, at any time thereafter and until payment is made to the claimant, be entitled to post, with Her Majesty, security in a form acceptable to Her Majesty in an amount equal to the value of the claim, the notice of which is received by the Departmental Representative and upon receipt of such security Her Majesty shall release to the Contractor any funds which would be otherwise payable to the Contractor, that were withheld pursuant to the provisions of GC42.9 in respect of the claim of any claimant for whom the security stands.

GC43 Security Deposit – Forfeiture or Return

- 43.1 If
- 43.1.1 the work is taken out of the Contractor's hands pursuant to GC38,
- 43.1.2 the contract is terminated pursuant to GC41, or
- 43.1.3 the Contractor is in breach of or in default under the contract,



Her Majesty may convert the security deposit, if any, to Her own use.

- 43.2 If Her Majesty converts the contract security pursuant to GC43.1, the amount realized shall be deemed to be an amount due from Her Majesty to the Contractor under the contract.
- 43.3 Any balance of an amount referred to in GC43.2 that remains after payment of all losses, damage and claims of Her Majesty and others shall be paid by Her Majesty to the Contractor if, in the opinion of the Departmental Representative, it is not required for the purposes of the contract.

GC44 Departmental Representative's Certificates

44.1 On the date that

44.1.1 the work has been completed, and

44.1.2 the Contractor has complied with the contract and all orders and directions made pursuant thereto,

both to the satisfaction of the Departmental Representative, the Departmental Representative shall issue a Final Certificate of Completion to the Contractor.

44.2 If the Departmental Representative is satisfied that the work is substantially complete he shall, at any time before he issues a certificate referred to in GC44.1, issue an Interim Certificate of Completion to the Contractor, and

44.2.1 for the purposes of GC44.2 the work will be considered to be substantially complete,

44.2.1.1 when the work under the contract or a substantial part thereof is, in the opinion of the Departmental Representative, ready for use by Her Majesty or is being used for the purpose intended; and

44.2.1.2 when the work remaining to be done under the contract is, in the opinion of the Departmental Representative, capable of completion or correction at accost of not more than

44.2.1.2.1 -3% of the first \$500,000, and

44.2.1.2.2 -2% of the next \$500,000, and

44.2.1.2.3 -1% of the balance

of the value of the contract at the time this cost is calculated.

44.3 For the sole purpose of GC44.2.1.2, where the work or a substantial part thereof is ready for use or is being used for the purposes intended and the remainder of the work or a part thereof cannot be completed by the time specified in A2.1, or as amended pursuant to GC36, for reasons beyond the control of the Contractor or where the Departmental Representative and the Contractor agree not to complete a part of the work within the specified time, the cost of that part of the work



which was either beyond the control of the Contractor to complete or the Departmental Representative and the Contractor have agreed not to complete by the time specified shall be deducted from the value of the contract referred to GC44.2.1.2 and the said cost shall not form part of the cost of the work remaining to be done in determining substantial completion.

44.4 An Interim Certificate of Completion referred to in GC44.2 shall describe the parts of the work not completed to the satisfaction of the Departmental Representative and all things that must be done by the Contractor

44.4.1 before a Final Certificate of Completion referred to in GC44.1 will be issued, and

44.4.2 before the 12-month period referred to in GC32.1.2 shall commence for the said parts and all the said things.

44.5 The Departmental Representative may, in addition to the parts of the work described in an Interim Certificate of Completion referred to in GC44.2, require the Contractor to rectify any other parts of the work not completed to his satisfaction and to do any other things that are necessary for the satisfactory completion of the work.

44.6 If the contract or a part thereof is subject to a Unit Price Arrangement, the Departmental Representative shall measure and record the quantities of labour, plant and material, performed, used and supplied by the Contractor in performing the work and shall, at the request of the Contractor, inform him of those measurements.

44.7 The Contractor shall assist and co-operate with the Departmental Representative in the performance of his duties referred to in GC44.6 and shall be entitled to inspect any record made by the Departmental Representative pursuant to GC44.6.

44.8 After the Departmental Representative has issued a Final Certificate of Completion referred to in GC44.1, he shall, if GC44.6 applies, issue a Final Certificate of Measurement.

44.9 A Final Certificate of Measurement referred to in GC44.8 shall

44.9.1 contain the aggregate of all measurements of quantities referred to in GC44.6, and

44.9.2 be binding upon and conclusive between Her Majesty and the Contractor as to the quantities referred to therein.

GC45 Return of Security Deposit

45.1 After an Interim Certificate of Completion referred to in GC44.2 has been issued, Her Majesty shall, if the Contractor is not in breach of or in default under the contract, return to the Contractor all or any part of the security deposit that, in the opinion of the Departmental Representative, is not required for the purposes of the contract.

45.2 After a Final Certificate of Completion referred to in GC44.1 has been issued, Her Majesty shall return to the Contractor the remainder of any security deposit unless the contract stipulates otherwise.



- 45.3 If the security deposit was paid into the Consolidated Revenue Fund of Canada, Her Majesty shall pay interest thereon to the Contractor at a rate established from time to time pursuant to section 21(2) of the Financial Administration Act.

GC46 Clarification of Terms in GC47 to GC50

- 46.1 For the purposes of GC47 to GC50,
- 46.1.1 "Unit Price Table" means the table set out in the Articles of Agreement, and
- 46.1.2 "plant" does not include tools customarily provided by a tradesman in practicing his trade.

GC47 Additions or Amendments to Unit Price Table

- 47.1 Where a Unit Price Arrangement applies to the contract or a part thereof the Departmental Representative and the Contractor may, by an agreement in writing,
- 47.1.1 add classes of labour or material, and units of measurement, prices per unit and estimated quantities to the Unit Price Table if any labour, plant or material that is to be included in the Final Certificate of Measurement referred to in GC44.8 is not included in any class of labour, plant or material set out in the Unit Price Table; or
- 47.1.2 subject to GC47.2 and GC47.3, amend a price set out in the Unit Price Table for any class of labour, plant or material included therein if the Final Certificate of Measurement referred to in GC44.8 shows or is expected to show that the total quantity of that class of labour, plant or material actually performed, used or supplied by the Contractor in performing the work is
- 47.1.2.1 less than 85% of that estimated total quantity, or
- 47.1.2.2 in excess of 115% of that estimated total quantity.
- 47.2 In no event shall the total cost of an item set out in the Unit Price Table that has been amended pursuant to GC47.1.2.1 exceed the amount that would have been payable to the Contractor had the estimated total quantity actually been performed, used or supplied.
- 47.3 An amendment that is made necessary by GC47.1.2.2 shall apply only to the quantities that are in excess of 115%.
- 47.4 If the Departmental Representative and the Contractor do not agree as contemplated in GC47.1, the Departmental Representative shall determine the class and the unit of measurement of the labour, plant or material and, subject to GC47.2 and GC47.3, the price per unit therefore shall be determined in accordance with GC50.

GC48 Determination of Cost – Unit Price Table



- 48.1 Whenever, for the purposes of the contract, it is necessary to determine the cost of labour, plant or material, it shall be determined by multiplying the quantity of that labour, plant or material expressed in the unit set out in column 3 of the Unit Price Table by the price of that unit set out in column 5 of the Unit Price Table.

GC49 Determination of Cost – Negotiation

- 49.1 If the method described in GC48 cannot be used because the labour, plant or material is of a kind or class that is not set out in the Unit Price Table, the cost of that labour, plant or material for the purposes of the contract shall be the amount agreed upon from time to time by the Contractor and the Departmental Representative.
- 49.2 For the purposes of GC49.1, the Contractor shall submit to the Departmental Representative any necessary cost information requested by the Departmental Representative in respect of the labour, plant and material referred to in GC49.1

GC50 Determination of Cost – Failing Negotiation

- 50.1 If the methods described in GC47, GC48 or GC49 fail for any reason to achieve a determination of the cost of labour, plant and material for the purposes referred to therein, that cost shall be equal to the aggregate of
- 50.1.1 all reasonable and proper amounts actually expended or legally payable by the Contractor in respect of the labour, plant and material that falls within one of the classes of expenditure described in GC50.2 that are directly attributable to the performance of the contract,
 - 50.1.2 an allowance for profit and all other expenditures or costs, including overhead, general administration cost, financing and interest charges, and every other cost, charge and expenses, but not including those referred to in GC50.1.1 or GC50.1.3 or a class referred to in GC50.2, in an amount that is equal to 10% of the sum of the expenses referred to in GC50.1.1, and
 - 50.1.3 interest on the cost determined under GC50.1.1 and GC50.1.2, which interest shall be calculated in accordance with TP9,

provide that the total cost of an item set out in the Unit Price Table that is subject to the provisions of GC47.1.2.1 does not exceed the amount that would have been payable to the Contractor had the estimated total quantity of the said item actually be performed, used or supplied.

- 50.2 For purposes of GC50.1.1 the classes of expenditure that may be taken into account in determining the cost of labour, plant and material are,
- 50.2.1 payments to subcontractors;
 - 50.2.2 wages, salaries and travelling expenses of employees of the Contractor while they are actually and properly engaged on the work, other than wages, salaries, bonuses, living



and travelling expenses of personnel of the Contractor generally employed at the head office or at a general office of the Contractor unless they are engaged at the work site with the approval of the Departmental Representative,

- 50.2.3 assessments payable under any statutory authority relating to workmen's compensation, unemployment insurance, pension plan or holidays with pay;
- 50.2.4 rent that is paid for plant or an amount equivalent of the said rent if the plant is owned by the Contractor that is necessary for and used in the performance of the work, if the rent of the equivalent amount is reasonable and use of that plant has been approved by the Departmental Representative;
- 50.2.5 payments for maintaining and operating plant necessary for and used in the performance of the work, and payments for effecting such repairs thereto as, in the opinion of the Departmental Representative, are necessary to the proper performance of the contract other than payments for any repairs to the plant arising out of defects existing before its allocation to the work;
- 50.2.6 payments for material that is necessary for and incorporated in the work, or that is necessary for and consumed in the performance of the contract;
- 50.2.7 payments for preparation, delivery, handling, erection, installation, inspection protection and removal of the plant and material necessary for and used in the performance of the contract; and
- 50.2.8 any other payments made by the Contractor with the approval of the Departmental Representative that are necessary for the performance of the contract.

GC51 Records to be kept by Contractor

51.1 The Contractor shall

- 51.1.1 maintain full records of his estimated and actual cost of the work together with all tender calls, quotations, contracts, correspondence, invoices, receipts and vouchers relating thereto.
- 51.1.2 make all records and material referred to in GC5.1.1 available to audit and inspection by the Minister and the Deputy Receiver General for Canada or by persons acting on behalf of either of both of them, when requested;
- 51.1.3 allow any of the person referred to in GC51.1.2 to make copies of and to take extracts from any of the records and material referred to in GC51.1.1; and
- 51.1.4 furnish any person referred to in GC51.1.2 with any information he may require from time to time in connection with such records and material.

- 51.2 The records maintained by the Contractor pursuant to GC51.1.1 shall be kept intact by the Contractor until the expiration of two years after the date that a Final Certificate of Completion referred to in GC44.1 was issued or until the expiration of such other period of time as the



Minister may direct.

- 51.3 The Contractor shall cause all subcontractors and all other persons directly or indirectly controlled by or affiliated with the Contractor and all persons directly or indirectly having control of the Contractor to comply with GC51.1 and GC51.2 as if they were the Contractor.

GC52 Conflict of Interest

- 52.1 It is a term of this contract that no former public office holder who is not in compliance with the Conflict of Interest and Post-Employment Code for Public Office Holders shall derive a direct benefit from this contract.

GC53 Contractor Status

- 53.1 The Contractor shall be engaged under the contract as an independent contractor.
- 53.2 The Contractor and any employee of the said Contractor is not engaged by the contract as an employee, servant or agent of Her Majesty.
- 53.3 For the purposes of GC53.1 and GC53.2 the Contractor shall be solely responsible for any and all payments and deductions required to be made by law including those required for Canada or Quebec Pension Plans, Unemployment Insurance, Worker's Compensation or Income Tax.



GENERAL CONDITONS

- IC 1 Proof of Insurance**
- IC 2 Risk Management**
- IC 3 Payment of Deductible**
- IC 4 Insurance Coverage**

GENERAL INSUANCE COVERAGES

- GCI 1 Insured**
- GIC 2 Period of Insurance**
- GIC 3 Proof of Insurance**
- GIC 4 Notification**

COMMERCIAL GENERAL LIABILITY

- CGL 1 Scope of Policy**
- CGL 2 Coverages/Provisions**
- CGL 3 Additional Exposures**
- CGL 4 Insurance Proceeds**
- CGL 5 Deductible**

BUILDER'S RISK – INSTALLATION FLOATER – ALL RISKS

- BR 1 Scope of Policy**
- BR 2 Property Insured**
- BR 3 Insurance Proceeds**
- BR 4 Amount of Insurance**
- BR 5 Deductible**
- BR 6 Subrogation**
- BR 7 Exclusion Qualifications**

INSURER'S CERTIFICATE OF INSURANCE



General Conditions

IC 1 Proof of Insurance (02/12/03)

Within thirty (30) days after acceptance of the Contractor's tender, the Contractor shall, unless otherwise directed in writing by the Contracting Officer, deposit with the Contracting Officer an Insurer's Certificate of Insurance in the form displayed in this document and, if requested by the Contracting Officer, the originals or certified true copies of all contracts of insurance maintained by the Contractor pursuant to the Insurance Coverage Requirements shown hereunder.

IC 2 Risk Management (01/10/94)

The provisions of the Insurance Coverage Requirements contained hereunder are not intended to cover all of the Contractor's obligations under GC8 of the General Conditions "C" of the contract. Any additional risk management measures or additional insurance coverages the Contractor may deem necessary to fulfill its obligations under GC8 shall be at its own discretion and expense.

IC 3 Payment of Deductible (01/10/94)

The payment of monies up to the deductible amount made in satisfaction of a claim shall be borne by the Contractor.

IC 4 Insurance Coverage (02/12/03)

The Contractor has represented that it has in place and effect the appropriate and usual liability insurance coverage as required by these Insurance Conditions and the Contractor has warranted that it shall obtain, in a timely manner and prior to commencement of the Work, the appropriate and usual property insurance coverage as required by these Insurance Conditions and, further, that it shall maintain all required insurance policies in place and effect as required by these Insurance Conditions.



INSURANCE COVERAGE REQUIREMENTS

PART I GENERAL INSURANCE COVERAGES (GIC)

GCI 1 Insured (02/12/03)

Each insurance policy shall insure the Contractor, and shall include, as an Additional Named Insured, Her Majesty the Queen in right of Canada, represented by the National Research Council Canada.

GIC 2 Period of Insurance (02/12/03)

Unless otherwise directed in writing by the Contracting Officer or otherwise stipulated elsewhere in these Insurance Conditions, the policies required hereunder shall be in force and be maintained from the date of the contract award until the day of issue of the Departmental Representative's Final Certificate of Completion.

GIC 3 Proof of Insurance (01/10/94)

Within twenty five (25) days after acceptance of the Contractor's tender, the Insurer shall, unless otherwise directed by the Contractor, deposit with the Contractor an Insurer's Certificate of Insurance in the form displayed in the document and, if requested, the originals or certified true copies of all contracts of insurance maintained by the Contractor pursuant to the requirements of these Insurance Coverages.

GIC 4 Notification (01/10/94)

Each Insurance policy shall contain a provision that (30) days prior written notice shall be given by the Insurer to Her Majesty in the event of any material change in or cancellation of coverage. Any such notice received by the Contractor shall be transmitted forthwith to Her Majesty.

PART II COMMERCIAL GENERAL LIABILITY

CGL 1 Scope of Policy (01/10/94)

The policy shall be written on a form similar to that known and referred to in the insurance industry as IBC 2100 – Commercial General Liability policy (Occurrence form) and shall provide for limit of liability of not less than \$2,000,000 inclusive for Bodily Injury and Property Damage for any one occurrence or series of occurrences arising out of one cause. Legal or defence cost incurred in respect of a claim or claims shall not operate to decrease the limit of liability.

CGL 2 Coverages/Provisions (01/10/94)



The policy shall include but not necessarily be limited to the following coverages/provisions.

- 2.1 Liability arising out of or resulting from the ownership, existence, maintenance or use of premises by the Contractor and operations necessary or incidental to the performance of this contract.
- 2.2 "Broad Form" Property Damage including the loss of use of property.
- 2.3 Removal or weakening of support of any building or land whether such support be natural or otherwise.
- 2.4 Elevator liability (including escalators, hoists and similar devices).
- 2.5 Contractor's Protective Liability
- 2.6 Contractual and Assumed Liabilities un this contact.
- 2.7 Completed Operations Liability – The insurance, including all aspects of this Part II of these Insurance Conditions shall continue for a period of at least one (1) year beyond the date of the Departmental Representative's Final Certificate of Completion for the Completed Operations.
- 2.8 Cross Liability – The Clause shall be written as follows:

Cross Liability – The insurance as is afforded by this policy shall apply in respect to any claim or action brought against any one Insured by any other Insured. The coverage shall apply in the same manner and to the same extent as though a separate policy had been issued to each Insured. The inclusion herein of more than one Insured shall not increase the limit of the Insurer's liability.

- 2.9 Severability of Interests – The Clause shall be written as follows:

Severability of Interests – This policy, subject to the limits of liability stated herein, shall apply separately to each Insured in the same manner and to the same extent as if a separate policy had been issued to each. The inclusion herein of more than one insured shall not increase the limit of the Insurer's liability.

CGL 3 Additional Exposures (02/12/03)

The policy shall either include or be endorsed to include the following exposures of hazards if the Work is subject thereto:

- 3.1 Blasting
- 3.2 Pile driving and calsson work
- 3.3 Underpinning
- 3.4 Risks associated with the activities of the Contractor on an active airport



- 3.5 Radioactive contamination resulting from the use of commercial isotopes
- 3.6 Damage to the portion of an existing building beyond that directly associated with an addition, renovation or installation contract.
- 3.7 Marine risks associated with the contraction of piers, wharves and docks.

**CGL 4 Insurance Proceeds
(01/10/94)**

Insurance Proceeds from this policy are usually payable directly to a Claimant/Third Party.

**CGL 5 Deductible
(02/12/03)**

This policy shall be issued with a deductible amount of not more than \$10,000 per occurrence applying to Property Damage claims only.

**PART III
BUILDER'S RISK – INSTALLATION FLOATER – ALL RISKS**

**BR 1 Scope of Policy
(01/10/94)**

The policy shall be written on an "All Risks" basis granting coverages similar to those provided by the forms known and referred to in the insurance industry as "Builder's Risk Comprehensive Form" or "Installation Floater – All Risks".

**BR 2 Property Insured
(01/10/94)**

The property insured shall include:

- 2.1 The Work and all property, equipment and materials intended to become part of the finished Work at the site of the project while awaiting, during and after installation, erection or construction including testing.
- 2.2 Expenses incurred in the removal from the construction site of debris of the property insured, including demolition of damaged property, de-icing and dewatering, occasioned by loss, destruction or damage to such property and in respect of which insurance is provided by this policy.

**BR 3 Insurance Proceeds
(01/10/94)**

- 3.1 Insurance proceeds from this policy are payable in accordance with GC28 of the General Conditions "C" of the contract.
- 3.2 This policy shall provide that the proceeds thereof are payable to Her Majesty or as the Minister may direct.



- 3.3 The Contractor shall do such things and execute such documents as are necessary to effect payment of the proceeds.

BR 4 Amount of Insurance
(01/10/94)

The amount of insurance shall not be less than the sum of the contract value plus the declared value (if any) set forth in the contract documents of all material and equipment supplied by Her Majesty at the site of the project to be incorporated into and form part of the finished Work.

BR 5 Deductible
(02/12/03)

The Policy shall be issued with a deductible amount of not more than \$10,000.

BR 6 Subrogation
(01/10/94)

The following Clause shall be included in the policy:

"All rights of subrogation or transfer of rights are hereby waived against any corporation, firm, individual or other interest, with respect to which, insurance is provided by this policy".

BR 7 Exclusion Qualifications
(01/10/94)

The policy may be subject to the standard exclusions but the following qualifications shall apply:

- 7.1 Faulty materials, workmanship or design may be excluded only to the extent of the cost of making good thereof and shall not apply to loss or damage resulting therefrom.
- 7.2 Loss or damage caused by contamination by radioactive material may be excluded except for loss or damage resulting from commercial isotopes used for industrial measurements, inspection, quality control radiographic or photographic use.
- 7.3 Use and occupancy of the project or any part of section thereof shall be permitted where such use and occupancy is for the purpose for which the project is intended upon completion.



INSURER'S CERTIFICATE OF INSURANCE

(TO BE COMPLETED BY INSURER (NOT BOKER) AND DELIVERD TO NATIONAL RESEARCH COUNCIL CANADA WITH 30 DAYS FOLLOWING ACCEPTANCE OF TENDER)

CONTRACT

DESCRIPTION OF WORK	CONTRACT NUMBER	AWARD DATE
LOCATION		

INSURER

NAME
ADDRESS

BROKER

NAME
ADDRESS

INSURED

NAME OF CONTRACTOR
ADDRESS

ADDITIONAL INSURED

HER MAJESTY THE QUEEN IN RIGHT OF CANADA AS REPRESENTED BY THE NATIONAL RESEARCH COUNCIL CANADA

THIS DOCUENT CERTIFIES THAT THE FOLLOWING POLICES OF INSURANCE ARE AT PRESENT IN FORCE COVERING ALL OPERATIONS OF THE INSURE IN CONNECTION WITH THE CONTRACT MADE BETWEEN THE NAMED INSURED AND THE NATIONAL RESEARCH COUNCIL CANADA AND IN ACCORDANCE WITH THE INSURANCE CONDITIONS "E"

POLICY					
TYPE	NUMBER	INCEPTION DATE	EXPIRY DATE	LIMITS OF LIABILITY	DEDUCTIBLE
COMMERCIAL GENERAL LIABILITY					
BUILDERS RISK "AL RISKS"					
INSTALLATION FLOATER "ALL RISKS"					

THE INSURER AGREES TO NOTIFY THE NATIONAL RESEARCH COUNCIL CANADA IN WRITING 30 DAYS PRIOR TO ANY MATERIAL CHANGE IN OR CANCELLATION OF ANY POLICY OR COVERAGE SPECIFICALLY RELATED TO THE CONTRACT

NAME OF INSURER'S OFFICER OR AUTHORIZED EMPLOYEE	SIGNATURE	DATE:
		TELEPHONE NUMBER:

ISSUANCE OF THIS CERTIFIATE SHALL NOT LIMIT OR RESTRICT THE RIGHT OF THE NATIONAL RESEARCH COUNCIL CANADA TO REQUEST AT ANY TIME DUPLICATE COPIES OF SAID INSURANCE POLICIES



CS1 Obligation to provide Contract Security

- 1.1 The Contractor shall, at the Contractor's own expense, provide one or more of the forms of contract security prescribed in CS2.
- 1.2 The Contractor shall deliver to the Departmental Representative the contract security referred to in CS1.1 within 14 days after the date that the Contractor receives notice that the Contractor's tender or offer was accepted by Her Majesty.

CS2 Prescribed Types and Amounts of Contract Security

- 2.1 The Contractor shall deliver to the Departmental Representative pursuant to CS1
 - 2.1.1 a performance bond and a labour and material payment bond each in an amount that is equal to not less than 50% of the contract amount referred to in the Articles of Agreement, or
 - 2.1.2 a labour and material payment bond in an amount that is equal to not less than 50% of the contract amount referred to in the Articles of Agreement, and a security deposit in an amount that is equal to
 - 2.1.2.1 not less than 10% of the contract amount referred to in the Articles of Agreement where that amount does not exceed \$250,000, or
 - 2.1.2.2 \$25,000 plus 5% of the part of the contract amount referred to in the Articles of Agreement that exceeds \$250,000, or
 - 2.1.3 a security deposit in an amount prescribed by CS2.12 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 at least one of the categories referred to in CS2.5.3
- 2.5.3 an approved financial institution is
 - 2.5.3.1 any corporation or institution that is a member of the Canadian Payments Association,
 - 2.5.3.2 a corporation that accepts deposits that are insured by the Canada Deposit Insurance Corporation or the Régie de l'assurance-dépôts du Québec to the maximum permitted by law,
 - 2.5.3.3 a credit union as defined in paragraph 137(6)(b) of the *Income Tax Act*,
 - 2.5.3.4 a corporation that accepts deposits from the public, if repayment of the deposit is guaranteed by Her Majesty in right of a province, or
 - 2.5.3.5 The Canada Post Corporation.
- 2.5.4 the bonds referred to in CS2.4.2 shall be
 - 2.5.4.1 made payable to bearer, or
 - 2.5.4.2 accompanied by a duly executed instrument of transfer of the bonds to the Receiver General for Canada in the form prescribed by the Domestic Bonds of Canada Regulations, or
 - 2.5.4.3 registered, as to principal or as to principal and interest in the name of the Receiver General for Canada pursuant to the Domestic Bonds of Canada Regulations, and
 - 2.5.4.4 provided on the basis of their market value current at the date of the contract.



Contract Number / Numéro du contrat A1-011349-01
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 Construction
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3. a) Subcontract Number / Numéro du contrat de sous-traitance	3. b) Name and Address of Subcontractor / Nom et adresse du sous-traitant
--	---

4. Brief Description of Work / Brève description du travail
Supply and install a renewable fuel boiler plant (biomass, wood chip fired) at the PSPC Confederation Heights CHCP located at 501 Heron Road, Ottawa.

5. a) Will the supplier require access to Controlled Goods? / Le fournisseur aura-t-il accès à des marchandises contrôlées?
 No / Non Yes / Oui

5. b) Will the supplier require access to unclassified military technical data subject to the provisions of the Technical Data Control Regulations? / Le fournisseur aura-t-il accès à des données techniques militaires non classifiées qui sont assujetties aux dispositions du Règlement sur le contrôle des données techniques?
 No / Non Yes / Oui

6. Indicate the type of access required / Indiquer le type d'accès requis

6. a) Will the supplier and its employees require access to PROTECTED and/or CLASSIFIED information or assets? / Le fournisseur ainsi que les employés auront-ils accès à des renseignements ou à des biens PROTÉGÉS et/ou CLASSIFIÉS?
(Specify the level of access using the chart in Question 7. c) / (Préciser le niveau d'accès en utilisant le tableau qui se trouve à la question 7. c)
 No / Non Yes / Oui

6. b) Will the supplier and its employees (e.g. cleaners, maintenance personnel) require access to restricted access areas? No access to PROTECTED and/or CLASSIFIED information or assets is permitted. / Le fournisseur et ses employés (p. ex. nettoyeurs, personnel d'entretien) auront-ils accès à des zones d'accès restreintes? L'accès à des renseignements ou à des biens PROTÉGÉS et/ou CLASSIFIÉS n'est pas autorisé.
 No / Non Yes / Oui

6. c) Is this a commercial courier or delivery requirement with no overnight storage? / S'agit-il d'un contrat de messagerie ou de livraison commerciale sans entreposage de nuit?
 No / Non Yes / Oui

7. a) Indicate the type of information that the supplier will be required to access / Indiquer le type d'information auquel le fournisseur devra avoir accès

Canada <input checked="" type="checkbox"/>	NATO / OTAN <input type="checkbox"/>	Foreign / Étranger <input type="checkbox"/>
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7. b) Release restrictions / Restrictions relatives à la diffusion

No release restrictions / Aucune restriction relative à la diffusion <input checked="" type="checkbox"/>	All NATO countries / Tous les pays de l'OTAN <input type="checkbox"/>	No release restrictions / Aucune restriction relative à la diffusion <input type="checkbox"/>
Not releasable / À ne pas diffuser <input type="checkbox"/>		
Restricted to: / Limité à: <input type="checkbox"/>	Restricted to: / Limité à: <input type="checkbox"/>	Restricted to: / Limité à: <input type="checkbox"/>
Specify country(ies): / Préciser le(s) pays:	Specify country(ies): / Préciser le(s) pays:	Specify country(ies): / Préciser le(s) pays:

7. c) Level of information / Niveau d'information

PROTECTED A / PROTÉGÉ A <input type="checkbox"/>	NATO UNCLASSIFIED <input type="checkbox"/>	PROTECTED A / PROTÉGÉ A <input type="checkbox"/>
PROTECTED B / PROTÉGÉ B <input type="checkbox"/>	NATO NON CLASSIFIÉ <input type="checkbox"/>	PROTECTED B / PROTÉGÉ B <input type="checkbox"/>
PROTECTED C / PROTÉGÉ C <input type="checkbox"/>	NATO RESTRICTED / NATO DIFFUSION RESTREINTE <input type="checkbox"/>	PROTECTED C / PROTÉGÉ C <input type="checkbox"/>
CONFIDENTIAL / CONFIDENTIEL <input type="checkbox"/>	NATO CONFIDENTIAL / NATO CONFIDENTIEL <input type="checkbox"/>	CONFIDENTIAL / CONFIDENTIEL <input type="checkbox"/>
SECRET / SECRET <input type="checkbox"/>	NATO SECRET <input type="checkbox"/>	SECRET / SECRET <input type="checkbox"/>
TOP SECRET / TRÈS SECRET <input type="checkbox"/>	COSMIC TOP SECRET / COSMIC TRÈS SECRET <input type="checkbox"/>	TOP SECRET / TRÈS SECRET <input type="checkbox"/>
TOP SECRET (SIGINT) / TRÈS SECRET (SIGINT) <input type="checkbox"/>		TOP SECRET (SIGINT) / TRÈS SECRET (SIGINT) <input type="checkbox"/>



PART A (continued) / PARTIE A (suite)

8. Will the supplier require access to PROTECTED and/or CLASSIFIED COMSEC information or assets?
 Le fournisseur aura-t-il accès à des renseignements ou à des biens COMSEC désignés PROTÉGÉS et/ou CLASSIFIÉS?
 If Yes, indicate the level of sensitivity:
 Dans l'affirmative, indiquer le niveau de sensibilité :

No / Non Yes / Oui

9. Will the supplier require access to extremely sensitive INFOSEC information or assets?
 Le fournisseur aura-t-il accès à des renseignements ou à des biens INFOSEC de nature extrêmement délicate?

No / Non Yes / Oui

Short Title(s) of material / Titre(s) abrégé(s) du matériel :
 Document Number / Numéro du document :

PART B - PERSONNEL (SUPPLIER) / PARTIE B - PERSONNEL (FOURNISSEUR)

10. a) Personnel security screening level required / Niveau de contrôle de la sécurité du personnel requis

- | | | | |
|---|---|---|--|
| <input checked="" type="checkbox"/> RELIABILITY STATUS
COTE DE FIABILITÉ | <input type="checkbox"/> CONFIDENTIAL
CONFIDENTIEL | <input type="checkbox"/> SECRET
SECRET | <input type="checkbox"/> TOP SECRET
TRÈS SECRET |
| <input type="checkbox"/> TOP SECRET- SIGINT
TRÈS SECRET - SIGINT | <input type="checkbox"/> NATO CONFIDENTIAL
NATO CONFIDENTIEL | <input type="checkbox"/> NATO SECRET
NATO SECRET | <input type="checkbox"/> COSMIC TOP SECRET
COSMIC TRÈS SECRET |
| <input type="checkbox"/> SITE ACCESS
ACCÈS AUX EMPLACEMENTS | | | |

Special comments:

Commentaires spéciaux :

NOTE: If multiple levels of screening are identified, a Security Classification Guide must be provided.

REMARQUE : Si plusieurs niveaux de contrôle de sécurité sont requis, un guide de classification de la sécurité doit être fourni.

10. b) May unscreened personnel be used for portions of the work?
 Du personnel sans autorisation sécuritaire peut-il se voir confier des parties du travail?

No / Non Yes / Oui

If Yes, will unscreened personnel be escorted?
 Dans l'affirmative, le personnel en question sera-t-il escorté?

No / Non Yes / Oui

PART C - SAFEGUARDS (SUPPLIER) / PARTIE C - MESURES DE PROTECTION (FOURNISSEUR)

INFORMATION / ASSETS / RENSEIGNEMENTS / BIENS

11. a) Will the supplier be required to receive and store PROTECTED and/or CLASSIFIED information or assets on its site or premises?
 Le fournisseur sera-t-il tenu de recevoir et d'entreposer sur place des renseignements ou des biens PROTÉGÉS et/ou CLASSIFIÉS?

No / Non Yes / Oui

11. b) Will the supplier be required to safeguard COMSEC information or assets?
 Le fournisseur sera-t-il tenu de protéger des renseignements ou des biens COMSEC?

No / Non Yes / Oui

PRODUCTION

11. c) Will the production (manufacture, and/or repair and/or modification) of PROTECTED and/or CLASSIFIED material or equipment occur at the supplier's site or premises?
 Les installations du fournisseur serviront-elles à la production (fabrication et/ou réparation et/ou modification) de matériel PROTÉGÉ et/ou CLASSIFIÉ?

No / Non Yes / Oui

INFORMATION TECHNOLOGY (IT) MEDIA / SUPPORT RELATIF À LA TECHNOLOGIE DE L'INFORMATION (TI)

11. d) Will the supplier be required to use its IT systems to electronically process, produce or store PROTECTED and/or CLASSIFIED information or data?
 Le fournisseur sera-t-il tenu d'utiliser ses propres systèmes informatiques pour traiter, produire ou stocker électroniquement des renseignements ou des données PROTÉGÉS et/ou CLASSIFIÉS?

No / Non Yes / Oui

11. e) Will there be an electronic link between the supplier's IT systems and the government department or agency?
 Disposera-t-on d'un lien électronique entre le système informatique du fournisseur et celui du ministère ou de l'agence gouvernementale?

No / Non Yes / Oui



Contract Number / Numéro du contrat A1 - 011349-01
Security Classification / Classification de sécurité UNCLASSIFIED

PART C - (continued) / PARTIE C - (suite)

For users completing the form manually use the summary chart below to indicate the category(ies) and level(s) of safeguarding required at the supplier's site(s) or premises.
Les utilisateurs qui remplissent le formulaire manuellement doivent utiliser le tableau récapitulatif ci-dessous pour indiquer, pour chaque catégorie, les niveaux de sauvegarde requis aux installations du fournisseur.

For users completing the form online (via the Internet), the summary chart is automatically populated by your responses to previous questions.
Dans le cas des utilisateurs qui remplissent le formulaire en ligne (par Internet), les réponses aux questions précédentes sont automatiquement saisies dans le tableau récapitulatif.

SUMMARY CHART / TABLEAU RÉCAPITULATIF

Category / Catégorie	PROTECTED / PROTÉGÉ			CLASSIFIED / CLASSIFIÉ			NATO				COMSEC					
	A	B	C	CONFIDENTIAL / CONFIDENTIEL	SECRET	TOP SECRET / TRÈS SECRET	NATO RESTRICTED / NATO DIFFUSION RESTREINTE	NATO CONFIDENTIAL / NATO CONFIDENTIEL	NATO SECRET	COSMIC TOP SECRET / COSMIC TRÈS SECRET	PROTECTED / PROTÉGÉ			CONFIDENTIAL / CONFIDENTIEL	SECRET	TOP SECRET / TRÈS SECRET
											A	B	C			
Information / Assets / Renseignements / Biens																
Production																
IT Media / Support TI																
IT Link / Lien électronique																

12. a) Is the description of the work contained within this SRCL PROTECTED and/or CLASSIFIED?
La description du travail visé par la présente LVERS est-elle de nature PROTÉGÉE et/ou CLASSIFIÉE? No / Non Yes / Oui
- If Yes, classify this form by annotating the top and bottom in the area entitled "Security Classification".
Dans l'affirmative, classifiez le présent formulaire en indiquant le niveau de sécurité dans la case intitulée « Classification de sécurité » au haut et au bas du formulaire.
12. b) Will the documentation attached to this SRCL be PROTECTED and/or CLASSIFIED?
La documentation associée à la présente LVERS sera-t-elle PROTÉGÉE et/ou CLASSIFIÉE? No / Non Yes / Oui
- If Yes, classify this form by annotating the top and bottom in the area entitled "Security Classification" and indicate with attachments (e.g. SECRET with Attachments).
Dans l'affirmative, classifiez le présent formulaire en indiquant le niveau de sécurité dans la case intitulée « Classification de sécurité » au haut et au bas du formulaire et indiquez qu'il y a des pièces jointes (p. ex. SECRET avec des pièces jointes).



Contract Number / Numéro du contrat A1-011349-01
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) Lisa Paterick	Title - Titre Research Council Officer	Signature
Telephone No. - N° de téléphone 613-990-0460	Facsimile No. - N° de télécopieur	E-mail address - Adresse courriel Lisa.Paterick@nrc-cnrc.gc.ca
		Date 6 June 17

14. Organization Security Authority / Responsable de la sécurité de l'organisme

Name (print) - Nom (en lettres moulées) Richard Bramucci	Title - Titre Analyst, Security in Contracting / Analyste, sécurité dans les marchés	Signature
Telephone No. - N° de téléphone 613-991-1093	Facsimile No. - N° de télécopieur	E-mail address - Adresse courriel BRAMUCCI@NRC.CA
		Date JUN 06 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) Collin Long	Title - Titre Procurement officer	Signature
Telephone No. - N° de téléphone 613-993-0431	Facsimile No. - N° de télécopieur 613-991-3297	E-mail address - Adresse courriel collin.long@nrc-cnrc.gc.ca
		Date June 15, 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